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Lotika Varadarajan

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ODAM – THE QUINTESSENTIAL SEWN BOAT OF INDIA

Lotika VARADARAJAN

Abstract

The article opens with a preliminary introduction to the trade routes that existed in antiquity and the role of Indian trade as regards these routes. India could have played a passive role and allowed foreign merchants to handle her commerce. This did not happen as the sub-continent had the wherewithal to play an effective role. This article will concentrate on the ships that handled this trade. Mariners are more open to innovation than settled communities and there was a corpus of Indian Ocean maritime tradition built on mutual adaptation and absorption in which the Arabs and Chinese played a role. India's achievements in astronomy and mathematics were reflected in some of the maritime devices that made seafaring a pragmatic enterprise with unacknowledged theoretical underpinnings. This is mirrored in the Lakshadweep *odam*, which undertook seafaring voyages until the 1970s. The *odam* was a sewn boat and its features will be delineated against a backdrop of the community that brought it into being.

Keywords

India, Indian Ocean, Nautical Ethnography, Odam, Sewn boat

ODAM – L'ESSENCE DU BATEAU COUSU DE L'INDE

Résumé

L'article s'ouvre sur une introduction relative aux routes commerciales de l'Antiquité et sur le rôle tenu par le commerce indien au sein de ces routes. L'Inde aurait pu jouer un rôle passif et ainsi permettre aux commerçants étrangers de gérer son commerce. Cela ne s'est pas produit car le sous-continent avait les moyens de jouer un rôle de premier plan. Cet article se concentre sur les navires impliqués dans ce commerce. Les marins, plus ouverts à l'innovation que les communautés sédentaires, ont conçu un corpus de traditions maritimes propres à l'Océan Indien qui s'est construit sur la base de phénomènes d'adaptation mutuelle et à travers l'assimilation de traditions exogènes. Le rôle des Arabes et des Chinois fut primordial dans ce processus. Les acquis de l'Inde en astronomie et en mathématiques trouvent un reflet dans des dispositifs nautiques qui ont fait de la navigation indienne une entreprise pragmatique aux fondements théoriques peu connus. Le Lakshadweep *odam*, un bateau cousu des îles Laquedives utilisé dans le cadre de voyages maritimes jusqu'aux années 1970, est un témoin de ces pratiques. Ce sont donc les caractéristiques architecturales de l'*odam* ainsi que les spécificités de la communauté qui l'a conçu qui constituent le sujet de cet article.

Mots-clés

Bateau cousu, Ethnographie navale, Inde, Océan Indien, Odam

Evidence regarding sewn boats in India has to be carefully sifted. Archaeological testimony is at best fragmentary and, in its absence, literary evidence has to be judiciously weighed. The ethnological base, on the other hand, is rich and James Hornell dealt extensively with this corpus of material¹. Professor G. Victor Rajamanickam has added contemporary data to this collection². Michael Flecker refers to a 9th century shipwreck found north of Tanjung Panday, the main town and port of Belitung island situated between Sumatra and Borneo. There is evidence of fastening of planks through sewing. The author says the wreck may have been either Indian or Arab³. Several authors have described sewn boat traditions in Asia and Africa⁴. Apart from Roman trade linkages, India also had extensive trade with West Asia, Southeast Asia and East Asia⁵. India was by no means a

passive participant and took advantage of both land as well as sea routes. Nor did the belief in *kalivarjya*, a proscription to sea travel, serve as a serious disincentive to trade⁶. The question then arises as to whether India had developed the technical know-how to enable it to directly participate in this trade or whether it depended on carrier vessels. Ethnological evidence provides a strong case for the ability of India to send its own vessels and merchants to carry on trade within the circuit of the East African to East Asian shores⁷. In this context it is important to emphasise the existence of an Indian Ocean knowledge system pertaining to the seas prior to the coming of the Europeans⁸. This body of knowledge continued to grow even after the coming of the Europeans and has come to an end in India with the introduction of fibreglass into the Indian boat building traditions. This body of information strengthens the view that India not only participated in the trade routes to which it was exposed but also possessed a maritime tradition, although today this can only be reconstructed through fishing boats. The Lakshadweep islands, however, possess a more resilient heritage and this article will be

1. Hornell 1920, p. 139-246, 1946.

2. Rajamanickam 2004, p. 7-32.

3. See Flecker 2000, p.199-200.

4. Hornell 1920, p. 14, 1942, p. 14, 29; Chittick 1980, p. 297, 299, 304; Deguchi 1991, p. 203-204; Manguin 1993, p. 256-264 (for the lashed lug tradition), p. 253-280 (for the development of lashed lug to the *jong* tradition). See also Romero-Frias 2014.

5. Casson 1986, p. 73; Varadarajan 1987, p. 90-95, 1991a, p. 425-433; Sridhar 2005; De Romanis 2012, p. 75-101. See also the following articles: Sharma 1999, p. 1-10; Basa 1999, p. 29-71.

6. Varadarajan 1983, p. 1-8.

7. See Varadarajan 1983, p. 349, 1987, p. 95-105, 1991b, p. 6-8; Sarma 2015.

8. See Varadarajan 1983; Arunachalam 2002, p. 29-65.

based on the sewn vessels of these islands as against the totality of the rich Indian heritage.

Reflecting the ecological diversity of the country, the coastal sailing craft falls into the following categories:

- i) Rabbeted, planked and sewn boats and their variations;
- ii) Tree-nailed or pegged;
- iii) Outriggers and other balance board crafts;
- iv) Catamarans;
- v) Stapled boats of West Bengal;
- vi) *Pāṭiā*, the reverse clinker boat on the border of West Bengal-Orissa.

These vessels may reflect a larger picture of the past but it is more meaningful to deal with the *odam*, the sewn boat of the erstwhile Amindivi and Laccadives group of islands⁹. At the outset it needs to be stated that since this article is based predominantly on oral information the informants will be cited as described in the note¹⁰.

The data was collected in the 1980s, when erstwhile participants could still vividly recall memories of high sea sailings by Lakshadweep vessels. Local rutters, *Rahmanis*, such as that framed by Kunhikunhi Malmi of Kavaratti, contain vestiges of sailing routes stretching from the holy cities of Arabia in the northwest to Burma and Malacca to the east. However, the areas worked out in depth comprised the pattern of sailings between Lakshadweep and ports along the coast of southern Karnataka and Kerala¹¹. Once the southwest monsoon had abated there were about four sailings from Lakshadweep to Karnataka, to ports such as Mangalore and Kerala and to destinations, which included Calicut, Cochin and Quilon. The first sailing in mid-September carried small coconuts used in rituals. The second, in November, was laden with larger coconuts valued for their water content. The third, in February, brought in oil-bearing copra. The cargo of the last, in late April, comprised coconut fibre as well as coir. The return cargos included rice, food necessities, textiles, timber and other requirements¹².

The lagoons have always offered a calm and protected environment for anchorage but the depth particularly at the entrance varies according to the tidal flow. This has served to control the size of the local craft, particularly those of larger size. Local mariners have a deep knowledge of the changing nature of seasonal tidal currents both in the open sea as well as their manifestations in the immediate vicinities of the islands. Sailings to mainland destinations were usually avoided during periods of cyclonic weather associated with the months of October to early November and December to January¹³.

Existing terminology points to the profound understanding of their marine environment by the islanders. *Valivu* and *neer* both refer to the term current. When the sea is very still the term used is *kaemal* or *kulappam*. When pockets of small waves are generated in an otherwise still sea, these are called *kattuthari* and signify that a wind is about to rise. *Thulabada* refers to a strong wind from a south-westerly direction. The

north-western wind in the month of *Makaranhar*, Malayalam *Makaram*, approximately mid-January to mid-February, is called *kacham*, meaning speedy. The wind coming from an easterly direction in the month of *Vrchianhar*, Malayalam *Vrichikam*, approximately mid-November to mid-December, is called *karakkatt*. The term for cyclone is *kolum kunakkedum*. Inclement weather is known as *kunakked* and if there is a spell of bad weather the expression *ennam* is used.

There are several kinds of marine watercraft in Lakshadweep. There is an island variant of the south Indian catamaran, today virtually extinct, the *terrapam*, earlier used for subsistence fishing within the lagoon waters¹⁴. In the past users would make their own *terrapam*. These are a variant of the Tamil *catamaran*. A light wood, *muraka* (*Erythrina variegata* L.), was used in its construction. In earlier times *terrapam* could measure 19' 8" in length and 6' 7" in width and could be manipulated by two persons. It could carry a load of about 100 kg. It would comprise about ten logs and would last about 30 years. In the 1990s the size had shrunk to half the earlier one. After the introduction of mechanisation in the 1960s, the *terrapam* tended to be used for fishing within reef waters and for carrying stones¹⁵.

The smallest craft in the sewn plank category is the two-oared fishing boat. The designation varies from island to island. The term in Amini is *odi*, in Andrott *toni*, while in Kadmat, Kiltan, Agatti, Kavaratti and Chetlat it is known as *cheriyath*¹⁶. Next in order of size are the larger oared boats. These are usually two-oared, *rendu valikkindad*¹⁷. Other crafts can be referred to as *nalu valikkindad*, four-oared, the *aru valikkindad*, six-oared and *ettu valikkindad*, eight-oared also called *velikonda*¹⁸. It is to the last two categories of *aru* and *ettu valikkindad* that attention will now be turned in terms of boat typology.

Prior to the year 1960 there was a category of two-masted boats called *kondalam* in Kavaratti rowed by six or seven pairs of oarsmen. They were mainly used by Thangals (religious leaders) for inter-island traffic. The next development is

14. Varadarajan 1998, p. 40.

15. HV, Kavaratti, February, '92.

16. TK, Amini, March, '95.

17. It is to be recalled that whereas the Andaman and Nicobar Islands in the Bay of Bengal fall into the Southeast Asian-Pacific arena of the paddled boat, Lakshadweep exists within the realm of the oared vessels.

18. Ouseph *et al.* 1988, p. 29. Fishing was an important activity in these waters in earlier times. Harpooning, an essential component in fishing, was an efficient response to the environment. The tool was made from local material, and iron, which had replaced sting of a ray fish, was only required at the tip. There were many varieties of shark on the high seas, which could be easily salted. The dorsal, caudal and pectoral fins are cut and dried and enjoy a ready market in East Asia. In the case of the green turtle (*Chelonia mydas*), there is a greenish jelly-like oil layer below the upper surface of the carapace. This is scraped, stored and utilised in *odam* construction. The shell of the hawksbill turtle (*Eretmochelys imbricate*) can be used for making spectacle frames and combs. The sperm whale (*Physeter catadon*) is also to be found in these waters. If after a contest, a whale swallows a whole squid the beak cannot be digested and causes discomfort in the intestines. A jelly like substance, *spermaceti*, is secreted and this accumulates around the beak. When this is ejected from the body it becomes ambergris and is much prized in the perfumery industry (Panicker, Chetlat, Feb. 1989). Another method employed in harpooning into present times is that a dummy wooden fish, the *ovu*, is dropped into the water from the stem to attract fish. The fishermen on the boat manipulate it in such a manner that its movements emulate those of the flying fish. The harpoon is deployed to catch the fish attracted to this bait. For smaller and medium fish the length of rope can be 25 metres. When harpoon fishing is involved for fish such as devil ray, tiger shark and marlin, more than 100 meters of rope may be required (SK, Chetlat, February, 1989).

9. Amindivi comprises modern Amini, Kadmat, Chetlat, Kiltan and Bitra, while Laccadives includes Kavaratti, Agatti, Kalpeni and Andrott. The island of Minicoy falls within the sphere of Maldivian or Southeast Asian tradition of the *Jong* mentioned by Manguin (1993).

10. For example, if the information has been obtained from M.N. Koyamhahaji at Andrott in February 1992, the reference will read: MNK, Andrott, February, '92. A list of Resource Persons and Informants is added to this contribution.

11. Varadarajan 2004, p. 144-148, 2006, p. 471.

12. Arunachalam *et al.* 1990, p. 104-105.

13. Arunachalam *et al.* 1990, p. 36-43, 106.

traced in Amini where it was difficult for larger *odam* to approach too close to the island because of the nature of the lagoon. The existing craft in Amini for ship to shore operations was a craft called the *valikonda odam*, which also engaged in inter-island sailings. The Amini *valikonda odam* came in two sizes. Those with a keel length of 6 *kol* (1 *kol* = 2½) had ten rowers, while 12 rowers manned crafts with a keel length of 8 *kol*. After 1 November 1956 when Lakshadweep became a part of the Indian Union, traffic began to increase and there was a rise in ship to shore activities. Saraichetta Mohammed, who was involved in loading and unloading operations in Amini now directed the carpenter Koormael Kader to modify the Kavaratti *kondalam* so that it could be adapted to serve his needs¹⁹. Whereas the Kavaratti *kondalam* had a straight stem set at an oblique angle to the keel, the adapted model, more commonly called the *aru valikkindad* or *ar velikonda* (6 *valikonda*), had a more rounded stem area. The angle between the keel and the sternpost was also readjusted to an angle of approximately 110° rather than the earlier *kondalam* sternpost positioned at an angle of about 100°. This offered more cargo space²⁰. The term *aru valikonda*, restricted to the island of Amini, can no longer be taken as referring to the size of keel or number of rowers but to any boat of this typology irrespective of the number of rowers or size of keel. In the other islands the term used is *ettu valikkindad* or *et* (8) *valikonda* irrespective of the number of oarsmen on board²¹.

The largest crafts in this range of planked sewn boats are the *valiya odam* used on the open sea²². As has already been stated, the nature of the reef requires the vessel to be one of shallow draft. The building of such a craft was a big venture and the costs would usually take five years to recover²³. The mean capacity of the *valiya odam* was 60 to 70 *param*, equal to 15 to 18 tons²⁴ in the table:

- 1 *thulam* = 28 lbs = 1 quarter;
- 20 *thulam* = 1 *param* = 5 cwt;
- 80 *thulam* = 4 *param* = 1 ton²⁵.

The small *odam* were engaged in fishing at Cheriyanani, Beliapani, Parimal Par and Manjal Par. Circa 1995 a *valiya odam* with a keel size of 15 to 16 *kol* would have a hull comprising 10-15 rows of planks. One with a keel length of 18 *kol* would have about 20 rows²⁶. In earlier times the only seasoning was the application of neem (*Azadirachta indica*) oil on the planks. A trench would be made and the waste wood would be used as fuel. The planks would then be aligned above this²⁷. Shark oil would be applied every two months to maintain suppleness in the wood²⁸. Steering oars rather than the rudder would be used inside the lagoon. The crew would comprise the

captain who could also be the *malmi*, steersman and navigator, the *tindel*, manager (could be the owner or his representative and was responsible for commercial transactions), a *bhandari* or cook and eight to ten *kilassi* for other tasks²⁹.

The method of carpentry and assemblage is uniform in all these planked wooden sea-going vessels and all can be accommodated within the sewn boat category³⁰. Much of the structural strength of the *mtepe*, now extinct, used along the East African littoral as noted by Robert M. Adams³¹ can also be said to be applicable to the Lakshadweep sewn boats particularly in relation to the inherent flexibility of the structure.

CONSTRUCTION OF THE VALIYA ODAM

All the sewn planked boats irrespective of specific nomenclature have a basic homogeneity in method of construction. This being so, while primacy will be given to the construction of the largest in this series, the *valiya odam*, information drawn from construction of the *cheriyath* and *kondalam*, where applicable will also be included in description of carpentry usage. To complete the picture, minor deviations in the *cheriyath* and *kondalam*, the latter subsuming the *aru* and *ettu valikkindad*, will also be noted. Where applicable international terminology for local vernacular terms will be provided, but this may not be feasible at all times.

The author has had the unique advantage of not only viewing a newly reconstructed *valiya odam*, the *Chetlat* (fig. 1), but was also able to meet the team involved in making the replica and to obtain valuable information from the chief carpenter, Yusuf Rapiapura of Chetlat Island where the *Chetlat* had been built.

It is of interest to trace the rise of Chetlat as a primary centre of shipbuilding on the islands. Society on the clusters earlier known as Laccadives and Amindivi was divided into three hierarchical strata comprising Koya, Malmi and Melacheri. The Koyas were the privileged group enjoying sole rights of ownership of the *odam*. The Malmis wrested the rights of ownership in the 1860s, while Melacheris succeeded in 1933 in Amini and in about 1940 in the other islands³². Chetlat, which had been earlier settled by Melacheris, was free of the tensions caused by possession of privilege prevailing in most of the other islands. Blessed by access to wood and enjoying a societal cohesion absent elsewhere, whenever an *odam* had to be constructed all the villages cooperated in the task. It was for this reason that members of other islands who needed *odams* began to be attracted to Chetlat because of the efficiency and speed with which such tasks could be completed³³. This trend has continued and it was for this reason that the *Chetlat* was constructed on the island bearing its name³⁴.

19. TK, Amini, March, '95.

20. AM, Kavaratti, April, '95.

21. TK, Amini, October, '86.

22. With the onset of mechanisation and with the introduction of ships commissioned by the Union Government and Lakshadweep Administration, the *valiya odam* was slowly squeezed to death. The last *odam* was built in 1965 by Atta Koya, Puthiyapura and Nalla Koya, Akkara. The life of an *odam* was approximately 50 years. All the wood including the keel would be reused (KPP, Kalpeni, March, '95).

23. AH, Kadmat, March, '95

24. KM, Kavaratti, '87.

25. TK, Amini, March, '95.

26. MKKK, Kalpeni, March, '95.

27. KMH, Kavaratti, January, '95.

28. KKH, Kavaratti, October, '86.

29. TK, Amini, March, '95.

30. The method of carpentry has been documented in Ouseph *et al.* 1988, p. 26-36. Tim Severin (1985, p. 279-287) used the same technique to build the *Sohar* on which he attempted recreate the voyage of Sinbad. For the sewn tradition in Southeast Asia see Manguin 1985, p. 319-343. For the sewn boat in a Mediterranean context, see Pomey 1981, p. 230-244.

31. See Adams 1988, p. 289-302.

32. George 1993, p. 146-147.

33. AMB, Kavaratti, November, '08.

34. See Census of India, 1961.

Fig. 1: The Chetlat, a reconstructed valiya odam. Note the system of stays and rigging: the lower white line on the hull marks the waterline.

TABLE OF CARPENTRY MEASUREMENTS

1 *mushti* = 6", 1 double *mushti* = 1', 5 single *mushti* = 1 *kol*
= 2½³⁵

DIMENSIONS OF THE CHETLAT

From end to end

Length of *pandi* / keel 12 *kol* / 31½'
Length, stem to stern 16 *kol* / 40'

Length

Stempost 2½ *kol* / 6¼'
Sternpost 1½ *kol* / 3¾'

For total length of stem and stern 4 *kol* / 10' is added to the above.

Depth

Quarter way from stem 4¼ *kol* / 12'
Quarter way from stern 4¾ *kol* / 11½'

Water mark

Height on hull 1¼ *kol* / 4½'

Vessels would not be loaded above the watermark (fig. 1). However, a highly skilled sailor could load a little above this line as the *odam* could rise about 6" with a good wind.

Curvature

Length measured along outer hull at stem (*anyatha chella*)
16½ *kol* / 41¼'

Corresponding length at stern (*amartha chella*) is less by 1½
kol / 3¾'

Masts

Main mast / Valia kumb

The height is equal to that of the keel i.e. 12 *kol* / 31½'
Set at an angle of 105°. This is done to provide additional lift to the sail

Length of *peruman* is 45', equal to length mid-sternpost to mid-stempost

The *valia kumb*, main mast is positioned through the mast cross plank, the *valiya kariya* to reach the mast step, *pooacham* positioned at the *adi thulu*. The section of the mast between the *valiya kariya* and *poocham* is called *eapalaka*.

Aft mast / Amara kumb

Height 20', length of *peruman* 30'

35. Varadarajan 2004, p. 228-229.

Fig. 2: Nomenclature of masts, sails, rigging and accessories: 1. valiya kumb, main mast; 2. amara kumb, mizzen mast; 3. peruman, yard; 4. lasoor, toggle, tholepin; 5. chillakkol or chillakumb, jib boom; 6. chillapaya, jib sail; 7. valiya paya, sail; 8. merk, sheet; 9. manthela, lift; 10. kalancha, halyard; 11. mukilancha, plays a role in lifting up the sail, supports the peruman/yard when it turns according to wind pressure and facilitates shifting the sail from one side of the mast to the other; 12. labram, shrouds; 13. sava, shrouds; 14. labram, shrouds; 15. churth, truss; 16. sava, shrouds; 17. chilla alath, fore stay; 18. chukkan, rudder; 19. choli, toilet; 20. puranada, aft gangway.

Jib mast / Chilla kumb 20'³⁶

Sails

Main sail / Valiya pa

Length of side tied to *peruman*, yard / *peruman puram* is 18 kol / 45'

Length of lower edge, *kelayasin* is $\frac{2}{3}$ *peruman puram* = 12 kol / 30'

Edge of sail, the *kada*, stretching between upper tip, *kodithala*, and *thammam* below, is 1 kol / $2\frac{1}{2}$ ' less than the *peruman puram*, equal to 17 kol / 42 $\frac{1}{2}$ '

The *koshnada*, the section between the end of the *peruman* and the *koshunthala*, is equal to $\frac{1}{5}$ *peruman* = 9'.

Aft sail / Amara pa

Length of side tied to *peruman* / *peruman puram* is 12 kol / 30' (length of sail is equal to length of *peruman*)

Length of lower edge, *kelayasin*, is $\frac{2}{3}$ *peruman puram* equal to 8 kol / 20'

Edge of sail, the *kada*, stretching between upper tip, *kodi thala*, and corresponding tip on *thammam* below, is 1 kol / $2\frac{1}{2}$ ' less than the *peruman puram*, equal to 10 $\frac{1}{2}$ kol / 26 $\frac{1}{4}$ '

Koshnada, the edge of the sail between the end of the *peruman* and the *koshunthala*, is equal to $\frac{1}{5}$ *peruman* = 2 $\frac{2}{5}$ kol / 6'

Jib sail / Chilla Pa (a lateen sail)

Length of side tied to *peruman* / *peruman puram* 8 kol / 20'

Length of lower edge, *kelayasin* is $\frac{2}{3}$ *peruman puram* equal to 5 $\frac{3}{10}$ kol / 13 $\frac{1}{4}$ '

Length of third side = 6 $\frac{1}{2}$ kol / 16 $\frac{1}{2}$ '

Fourth sail / Choli pa

If the keel size is more than 16 kol / 40', a fourth sail, the *choli pa*, is raised near the latrine area at the stern (fig. 2). During cyclonic weather jute sails, *maduthamta*, are hoisted. Additionally, to assess wind direction a small flag, *babus stad*, may be hoisted by the helmsman³⁷. It is of interest that while the number of stays as depicted in Figure 2 has individual nomenclature, contemporary European usage tends to

36. In earlier times if there were three masts, the main mast would be set slightly to the rear of mid-ships, while the foremast would be positioned at quarter point in line with the stem head (HC, Amini, October, '86). A rough and ready set of proportions used were that the foremast would measure half that of the main mast and the aft mast would be three quarters of the length of the foremast.

37. PMK, Kavaratti, October, '87.

Fig. 3: Nomenclature of different edges of the settee sail on the Chetlat: 1. kodithala, juncture between peruman/yard and point above thamman; 2. peruman, yard; 3. koshnada, rectangular edge of sail (luff); 4. koshumthala, point on lower edge of sail opposite thamman (tack clew); 5. thamman lower point of sail opposite koshumthala (sheet clew).

accommodate all under the category of either fore or side stay or guy³⁸.

Stitching of two settee sails

The cutting and stitching of sails is a specialised activity and would involve the participation of the *malmi*, the navigator³⁹. The sailcloth, *kittam*⁴⁰, is marked into three equal sections. In the first section the ropes will be laid and stitched in parallel lines and both the top and bottom edges will be equal. In the middle section the upper edge will be 1" broader than the lower one. In the third section the ropes will be laid and stitched in parallel lines once again. The rope, which is stitched into the body of the cloth, is called *naremp*. The height of the main mast is equivalent to the length of the keel. The length of the *peruman* would be equal to the length mid-sternpost to mid-stempost measured end to end along the upper rim of the hull. The length of the *kelayasin* between the *koshumthala* and *thamman* would measure two thirds of the *peruman*. The length the *kada*, extending between the *kodithala* and the *thamman* would be 1 *kol* less than the *peruman*. The *koshnada* extending between the end of

the *peruman* and *koshumthala* would be one-fifth the length of the *peruman*. The sail section abutting onto the *peruman* is called *peruman puram* (fig. 3)⁴¹.

STAGES IN THE CONSTRUCTION OF THE VALIYA ODAM⁴²

STAGE ONE

The required wood would be gathered. This would include *aini* (*Artocarpus hirsutus*) or *marathu*, which is the preferred wood for all planking, as also for the *pandi*: teak (*Tectona grandis*) for *valiya kumb* and *amara kumb*; *punna* for *peruman* and *chillakkol*; local wood including *punna*, *cheerani*, *chakka*, *seema*, coconut and mango for *aniyatha kumb*, *kai kol*, *ada* or *param*. According to Abdul Kader Kunhacha of Amini, the stem and sternpost were not to be made from neem (*Azadirachta*

38. AP, New Delhi.

39. KPP, Kalpeni, March, '95.

40. PH, Chetlat, November, '08.

41. YR Chetlat, November, '08; AMB, Kavaratti, November, '08.

42. The capacity could be defined in different ways. It was determined according MNK to the number of *kete*, bundles of coir, but later there was shift 25 *kete* being equivalent to one ton (PAH, Kadmat, March, '95). It could also be assessed in terms of the load of rice it could carry (KPP, Kalpeni, March, '95).

Fig. 4: Note the positioning on left of the *thirukk* and *thirrukk kol* for clamping the planks for sewing. Also shown is the coir sewing over the seam between two planks padded with coconut husk. The master carpenter is preparing to take *kan nottam*. The boat shown is a *kondalam*.

indica). The chief carpenter (*tala bandai*) chooses naturally shaped timber where required and supervises the cutting into planks.

The coir requirements are also projected as not only is the husk used but also rope of which this is the raw material. The amount of coir required is taken as being equal to the length of the keel in terms of the weight measurement of *thulam*. Preparation of coconut husk, which will be laid across plank seams during sewing, will be taken in hand. In Chetlat this is called *chup*. The green covering of the coconut is removed and the husk is sun dried. This forms the padding over which stitching is done to hold two parallel edges together. In Amini, individual husks are placed in position and sewn, whereas in Chelat the husks are placed in a row (*chup kettle*) and then bound together with *balga* to constitute a continuous line. *Balga* is a twine made by knotting together the shredded fibres of the main spine of the coconut leaf⁴³. The second usage of coir is in the rope, which is used in sewing as well as in the rigging (fig. 4).

43. PH, Chetlat, November, '08.

PREPARATION OF ROPE, *THUTHAR*

Rope made from sea-retted coir is called *thuthar* and is exclusively used in sea craft construction. Ordinary rope also utilised in boat building is called *shabari*. For making *thuthar*, green husks, chosen for long fibre, would be placed within the reef during low tide. Big stones would be interspersed with smaller ones so that neither the stones nor the husks are displaced during tidal movements. The process of decomposition took about six months. The husks were then taken to the homes and pounded with a wooden mallet to separate the pith. The fibres would then be sorted according to length. The men would then wash the fibres in the sea and spread them on the sand for sun drying. The material would be lightly weighted down by sand to prevent any displacement and would dry within a day. It would be shaken out and brought back. The fibre would now be twisted into a single ply and converted into hanks. The initial twisting of this primary yarn was very important, as it had to sustain the tension of subsequent doubling in further plying. Subsequent plying was accomplished by drawing the fibre through the eye of a coconut shell and then rotating it in opposite directions. Both parties involved

Fig. 5: 1. The kayyadi, double sheet bend knot, is used in the kalancha, the lower segment of the mukilancha, and at the juncture between the mukilancha and the peruman/yard. The thickest rope is used for the mukilancha, as it has to bear the full weight of the sail when it is hoisted or lowered; 2. The kayyadi, overhand knot, is employed on thick rope, kaalbayil, used for anchoring, pulling the odam ashore and also launching; 3. The kumb kulachil, clove hitch knotting, which can be undone. This is strengthened as and when required by the knot above, the cherukayar kett. The kumb kulachil is used when the anchor is being let down; 4. The barichil, rolling hitch knot, is used when there has to be a series of knots on a given length of thuthar as when additional freehold space has to be created on the hull. When the balu ketti is lowered and set afloat the barichil knot is used on the rope leading out from the odam; 5. The kumb kulachil, clove hitch without the knot above as in fig. 5.3 above. This knot used to tie sail to lasoor; 6. The kappal kett, bowline knot. When the balu ketti is let down into the sea the kappal kett is used to secure the boat by the rope eased out from the odam; 7. The kulachil, slip knot. This knot is without any strengthening element; 8. Kett, bowline on the bite, is the general term for knot.

would utilise the appropriate half coconut shell. In earlier times a wooden implement called a *shonk*, which had four holes, was used to accomplish four-ply twisting. Four-ply yarn is used for sewing while for rigging eight to 16 ply can be used⁴⁴. In 1986 coir rope was preferred to nylon rope in rigging, as the latter tended to slip on the pulley. Synthetic rope was reserved for the anchor. In present times synthetic rope is used in sewing but this can have deleterious consequences as it reduces flexibility. *Thuthar* lasted for about fifty years. A variety of knots are used in rigging, anchoring and for other assorted requirements (fig. 5).

ASSOCIATED RITUAL

Certain significant stages in boat building are linked with the performance of an associated ritual. The performance of these was believed to be essential for the enhancement of safety and to ensure good fortune for the vessel, the owner and the crew. The ritual was a simple one of prayer, which could be officiated by the *Kazi*, the *Mukri* (religious at the local level), or the chief carpenter. The stages for the performance of these comprised:

1. *pandi vaikkal*, keel laying.
2. Honouring of the chief carpenter.
3. *adithulu kettal*, placing of the third plank up from the keel. This plank has to be a little thicker as it has to support the mast step. This is an important stage as the carrying capacity of the craft is defined at this stage.
4. *thathivekkal*, when the hull is sufficiently advanced it is taken off the frame and positioned on the ground with props on either side.
5. *Thulukettal*, placing of the *thulu*. This plank has to be thicker as the *kariya* are positioned on it.

6. *Odam kanal*, on completion of the *odam* the community gathers together to celebrate.

7. *Bandavikalavidal*, all those involved in the building activity are brought together and honoured.

8. *Odam chaimaikkal*, decoration of the *odam*.

9. *Odam chuttal*, throwing of rice and circumambulation of the *odam*.

10. *Odam irrakal*, launching of the *odam*.

11. *Nalappa ottam*, trial sailing

On completion of all these stages the owner, in consultation with the *Kazi*, *Amin*, village headman, and respected elders, would decide on the date and time of launching. The vessel would be decorated and the entire community would assemble to celebrate the launching and special songs would be sung, while the children would also be drawn into the festivities. Coconuts would be broken at the stem. Prayers for good fortune would be offered to Allah. Starting from the right side of the stern seven boys aged 10 to 11 years would go around the boat seven times carrying covered pots containing cooked rice and coins. The rice would be distributed but the boys would keep the coins. Mechanised boats began to make increasing inroads and the construction of *odams* came to an end after 1975⁴⁵. The living memory, however, continued and this made the reconstruction of the *Chetlat* as an authentic model possible. Moreover, since the same technical processes and procedures have continued into present times, it would be correct to postulate that there is still a tradition of the sewn boat in Lakshadweep. In earlier times there were special songs for embarkation, disembarkation, to greet a visiting dignitary, when the craft was being shifted on rollers and at times of storm at sea. In Kilton and Chetlat if it was felt there was no wind movement the women would assemble on the beach and sing so that the calm at sea would cease⁴⁶.

44. KKH, Kavaratti, October, '86; PAH, Amini, February, '92; TK, Amini, October, '86; SMKK, Andrott, March, '95.

45. Ouseph *et al.* 1988, p. 5. However, K.P. Pookoya opined that Atta Koya, Puthiyapura and Nalla Koya, Akkara built the last *valiya odam* in 1965. KPP, Kalpeni, March, '95.

46. HC, Amini, October, '86.

Fig. 6: 1. *Pandi*, the keel; 2-3. *tanni palaka*, first plank and second plank; 4. *adi thulu*, 3rd plank; 5. 4th plank; 6. 5th plank; 7. 6th plank; 8. *thulu*, 7th plank; 9. 8th plank; 10. *mel palaka* or *dhellees*; 11. *chukkan*, rudder; 12. *choli*, toilet; 13. *chathri* cabin; 14. *chuduthampura*, kitchen.

CARPENTRY PROCEDURES

Although for purposes of clarity the processes of boat building will be traced through different stages, in fact many activities take place simultaneously. The covered area under which boat building takes place is called *pandiyala*⁴⁷. The important factor here is that all members not only engage in carpentry but are also sailors. This imparts a very precious input as they can foresee how the different elements in carpentry will behave under stress at sea. Figure 6 provides the nomenclature of the hull planking along with some other nomenclatures. The process of plank laying along the hull will now be described.

The *pandi*, keel, is the first timber to be laid. *Aini* or *maruthu* wood is preferred. A scarf joint or even a keyed scarf would be used to extend the *pandi* to the desired length. To ensure a perfect fit, the lower plank is smeared with a colouring material such as Robin Blue, a powder used in domestic laundry operations. When the upper surface is pressed down any uneven surface points would emerge marked in blue⁴⁸. These would be planed. The operation would be repeated until there was a perfect fit. This procedure is followed in all plank alignments. The *aniyatha kumb* and *amaratha kumb*, stem and sternposts, fashioned from a naturally curving log, would then be joined by scarf jointing. The *aniyam* generally would be $\frac{1}{3}$ the length of the *pandi* and the *amaram* would measure $\frac{1}{2}$ that of the *aniyam*⁴⁹. The entire length, called *thalakootuvakkal*, is uniform in grain and width. The stem and sternposts would then be shaped. Thereafter, the carpenters mark these planks according to their positioning in the hull: this process being called *erich*⁵⁰. In earlier times the structure would at this point be moved to the *pandiyala* where it would be placed on a support base. Since

this is a significant stage, it would be marked by a brief religious observance. The central line has next to be defined and marked along this length. A coconut leaf is taken and cut to the same width as the plank, after which it is folded in half. This strip is then aligned at four points, which are then marked with an *uli*⁵¹. The line, which is outlined connecting these points, would define the *nadu nool*, central line, of the boat.

The garboard planks will then be aligned in an angular fashion. To define the placement of the garboard planks a coconut leaf will again be used. The folded leaf, which had defined the half section of the keel, would then be folded again. As in the case of the keel, four points will be defined by the *uli* and a line will again be drawn. This demarcates the area that will have to be prepared for the lap joint between the keel and the *onnam palaka*, garboard planks. Four fingers are then raised vertically upwards on the central line. The angle at which the garboard planks are to be positioned will be such that the outer rim of the garboard plank will run parallel to the four fingers height. Four inches are left free at each end of the garboard joinery to the keel⁵². The proportion of the central line to that of the lap joint is $10 : 2\frac{1}{2}$ ⁵³. The process of joining the garboard to the keel by means of the lap joint is called *kaineer nool*. While the general term for joinery is *thatha koot* or *koot*, there is no specific term for the scarf joint, the term *cheep* referring to the key used in the scarf joint. The scarf is used in lengthening the fourth plank, the *adi thulu*, and the eighth plank, the *thulu*, both of which have to be thicker than the other planks on the hull. The *adi thulu* has to support the weight of the mast step, the *pooacham*, while the *thulu* constitutes the base for the cross planks, the *kariya*. A tongue in groove joint, *naram patti*, is used for lengthening other planks on the hull.

The angular placement of planks inclusive of those comprising the *tanni palaka* (fig. 6) until the mid-hull level is done by visual estimate, *kan* (eye) *nottam* (sight). The same process can also be used for the laying of the garboard plank, *onnam palaka*. At the first stage of *kan nottam*, one end of a string is tied at the midpoint on both sides of the hull. The two other

47. KS, Chetlat, February, '92.

48. The spathe of the coconut flower was burnt and powdered in earlier times. This would be smeared on thread. This thread called *karinool* would then be used in carpentry markings. The powder would also be mixed with water and smeared on the surface of planks to assess smoothness in planning of the surface (KPP, Kalpeni, March, '95; KS, Chetlat, February, '92).

49. Ouseph *et al.* 1988, p. 32

50. Koya Haji 2007, p. 19.

51. For further information on tools used, see Koya Haji 2007, p. 20.

52. YR, Chetlat, November, '08.

53. BP, Kadmat, November, '08.

Fig. 7: Method of application of kataranam and placement of cloth.

ends are then tied to midpoint of stem and stern. Taking up a position at one end of the boat, the master carpenter determines the angularity of the planks to be positioned. The planking used mid-hull, which is straighter in profile, is of lesser thickness than those used for areas of curvature at stem and stern. The master carpenter marks out the desired width to be incised in these sections and the extra wood is chiselled out with the *ba uli*. The maximum curvature is located at the point of juncture between the hull planks and stem and sternposts. This area is called *kith*. The planks encompassing the *kith* area are called *chayal kandan*. There are specific terms for this area of *kith* in relation to the inner and outer sections of hull. The terms used are respectively *anyatha kalli* and *anyatha chella* in the case of the stem, and *amaratha kalli* and *amaratha chella* for the stern. The area of curvature outboard is referred to as *chella*.

Once the planks have been aligned along a particular row, sewing operations will commence segment by segment⁵⁴ until the whole row has been brought together. The edges between the upper and lower planks have to attain a perfect fit. In order to facilitate this, holes will be drilled and chiselled on both surfaces and a trial peg will be positioned on the lower plank. The preferred wood for making pegs is *charuthelum*⁵⁵. After a proper fit has been assured, *kataranam* is applied with a brush made from coconut husk. *Kataranam* is the island synonym for the natural gum substance, *pantham*, procured from the mainland. The *kataranam* is powdered. Three parts of *kataranam* to one part of lime is boiled with shark liver or coconut oil until it is reduced to a gummy substance⁵⁶. The elasticity is tested before it is used. This process was demonstrated by P. Hamza at Chetlat Island. The pegs are placed and a strip of cloth split down the middle is then pressed onto the *kataranam* (fig. 7). The planks are compressed by the

thirrukk kol, the stick for tightening the *thirukk* (clamp), which have been positioned into place. In 1992 it was recorded that the team of carpenters were responsible for the preparation of planks, jointing procedures, laying of planks, drilling of holes and chiselling recesses for sewing processes. The actual sewing would be handled by another team. Yet another group would plug holes⁵⁷. In present times this specialisation has vanished. In the case of the *Chetlat* the master carpenter has assumed total responsibility for all functions, including that of sailing the craft on completion of construction.

The sewing operations commence with the attachment of the garboard planks. The needle, *aranam*, is made from the spine of the coconut frond. One end of the spine is pounded until it separates into strands. The four-ply *thuthar* is untwisted and the yarn is separated into two strands, one strand being thicker than the other. The thinner segment is again divided into two. The needle is introduced between these two strands. It is hand twisted into position made secure by a knot. The thicker strand is twisted, pushed through the separated plies of the thinner yarn and secured by another knot. The stitching process is called *avali panni*. *Chup kettle*, a layer of husk⁵⁸, is lined along the seam to be stitched and is held in place by several strands of rope⁵⁹, *sheli kair*⁶⁰. The first stitch is positioned with a peg to facilitate tightening. The master sewer who functions inboard is called *avali pannikar*, while his helper, called *purathvalikkunnon*, functions outboard⁶¹. The stitching is in a crisscross pattern inboard and vertical lines outboard (fig. 4). Crevices inboard after completion of stitching are plugged by the insertion of *chup* (coconut husk inclusive of pith), the person performing this task being called *chuppukaran*.

The sewing of the hull continues until the level of the *thulu* on which the cross planks, *kariya*, for which *cheerani* may be used, will now be fixed (fig. 4). Cross planks at stem and stern are respectively called *thalakkariya* and *kaddakkariya*. Thwarts are provided only if the planking is considered too thin⁶². The upper width of the *thulu* will be the same as the *dhellees* or *melpalaka* by which it is surmounted. Prior to this, the floor timber, *kaal* or *thalakoot*, with limber holes are sewn into position. This task is assigned to expert sewers. If required, *thalakoot* can be further extended by positioning *pilla kaal* or *tharacheera*. The *dhellees* is always nailed into place. The *amar* or *agabari*, stringer, is riveted onto the inner side of the *dhellees*. *Amanda*, the fender, is positioned on the outer hull on which the lower white band indicates the *dell*, the water line (fig. 8). The counterpart to *dell* on the outer hull is *akavari* in the inner hull.

The hull has now been built and the superstructures are now added. Wooden boards, *ada*, are positioned at stem and stern to form decks in triangular shape, *mekk*, oar post and *utheen*, post for towing, are put into place. These items, being above the

54. The entire length is divided into three segments and work is commenced from aft to fore on the right side and then repeated on the left side (Ouseph *et al.* 1988, p. 32-33).

55. *Charuthelum*, *Pemphi acidula*, is the hardest locally available wood. Not only is it resistant to termite attack but can also be shaped without too much effort (KAK, Andrott, February, '89). Pegs could also be made from *cheerani*, also a hard wood (PBH, Kadmat, February, '89). Smaller craft use *ani*, treenails, while oblong pegs, *cheep*, are used in larger vessels.

56. According to Kunhi Seethi Koya, Andrott, shark liver oil could be substituted by the oil of *kotar* (*Manta birostris* Donndoeff) or *moron* (*Nebrius ferrugineus* Lesson) in the making of *kataranam* (KSK, Andrott, February, '89).

57. KS, Chetlat, Februar, '92.

58. In Chetlat the husks are bound together with *balga*, shredded fibre from the main spine of the coconut leaf, which is then tied to form a continuous twine. In Amini individual husks are positioned (PH, Chetlat, November, '09).

59. This is a second quality rope called *sheli kair*. *Sheli kair* could be doubled as many as thirteen to fourteen times to constitute the layer above the *chup kettle*.

60. Varadarajan 1998, fig. 81.

61. For further details about the sewing process, see Varadarajan 1998, p. 70-79.

62. AKT, Amini, November, '09.

Fig. 8: See the amanda, fender, the upper line marked in white and the dell, the water line is indicated by the lower white band. Also to be noted are the mekk, oar post, utheen, post for towing, chadumpara, kitchen shed, choli, toilet, chukkan, rudder, chathri, cabin at stern, anayatha kumb, stem head, puranada, planks on outer side of the cabin for access to the rudder or toilet.

water line, can be made of local wood. *Chathiri*, the cabin at the stern is put up, the *kariya* in front of it being called *anchasari*. The trunk of *Artocarpus altilis*, the breadfruit tree, was used for the *charithiri*. *Puranada*, the planks on either side on the outer hull, provide access to the rudder and the toilet. The *chuduthampura*, kitchen shed, is also set up (fig. 8). Cooking was undertaken in a sand-filled *chudutham*, cooking box. Three stones are placed in the sand and this constitutes the hearth. The fuel used is dry coconut leaf, which leaves minimal ash. The hearth was cleaned only on the conclusion of the voyage. Water was stored in three jars of copper, clay or glazed ceramic, such as Martabani. Each would be of 270 to 300 litres capacity. This was for drinking and cooking and would be stored in the kitchen area⁶³. The stem and sternposts are fitted. The stempost head also serves as a mark of identity and they have different names (fig. 9⁶⁴). These are fitted by lap jointing onto the inner surface of the stempost and are then tied into position⁶⁵. The tying is also entirely accomplished from the interior and is not visible from the outside. The outer surface of the hull is now planed with the use of the *bashi*. Only the most skilled workers do this. A wooden mallet is used to compact the stitches on the outer hull.

The vessel is now moved out of the work shed. The rudder, *chukkan*, is made and kept at hand to be placed after the vessel is at a sufficient depth to allow its use. All the crevices in the inner hull are plugged and *kataranam* is applied. Fish oil is liberally smeared onto the inner hull and the craft is left in the sun to dry and for the oil to be absorbed. The outer hull is then dealt with. Two ingredients are used, *kataranam* and quicklime. The quicklime is beaten to a powder. Some dried coconut husk is then burnt to ash and mixed with the quicklime. *Kataranam* is then gradually added and mixed by hand. When the mix has the desired elasticity, i.e. when a small portion can be pulled without breaking, it is applied over the

Fig. 9: Stem heads are marks of identity and are called by different names in different islands. Hence we find the following appellations: 1. bhashi aniyam in Chetlat and palakomb in Andrott; 2. chundu aniyam in Chetlat and poocha komb in Andrott; 3. kudumbi aniyam in Chetlat and chakkakomb, signifying both bread fruit and pineapple in Kalpeni; 4. chattikomb identified with Andrott.

parallel stitches on the outer surface of the hull. This dries immediately. In earlier times ash of dried coconut husk would be added to the remaining amount of *kataranam* and this would be brushed onto the outer surface up to the waterline imparting a black appearance. Later, the carbon drawn from old battery cells replaced the dried coconut husk ash. Above this, up to a height of about 1', a coating of quick lime would be applied. The area above this would once again be black (fig. 1, 3 and 8⁶⁶).

After all aspects of carpentry have been accomplished the main mast is set in place. The mast step, *pooacham*, is positioned at the level of the *tanni* or *adi thulu*⁶⁷. The mast is placed in the *pooacham* and rises through the *nadu* or *valiya kariya*. The *odam* is hauled across *padi* into the sea. The *padi*

63. BPK, Kavaratti, October, '98.

64. AMB, Kavaratti, November, '08.

65. AB, Kadmat, November, '08.

66. KSK, Andrott, February, '89.

67. In the case of the *kondalam*, the mast step was introduced in 1995. Prior to that date, the *kariya*, on which the mast was to rest, was grooved to accommodate the base of the mast (KPP, Kalpeni, March '95).

is made by slicing the *urul*, rounded log, into two horizontal segments each presenting an upper spherical surface and a flat one below. The main sail is tied to the *peruman*, the process being called *pa kaiadikkal*. Apart from the regular tackle, tender coconut leaf is shredded to form a light binding material, which is also used to tie the sail onto the *peruman*. This material provides temporary support as the sail is lifted. Once it is up, the pressure causes these to snap and fall away.

As the *odam* wafts its way across the waters, the shape of the stem (fig. 1, 3, 8) streamlines and enhances course keeping by cutting through the waves and water. It also reduces the physical effort involved in the constant use of the rudder⁶⁸.

Although today mechanised craft have replaced the sailing vessels of Lakshadweep it is hoped that the islands will continue to remember the past heritage and honour the great maritime tradition through a revival in tourism and sport.

LOTIKA VARADARAJAN

Lotika Varadarajan (28 November 1934 - 9 October 2017) was an ethno-historian who, after research into pre-colonial trade in India, dedicated a part of her career to the study of artisanal weaving techniques. Her great interest in textiles and also her feeling for the maritime world led her to turn her research towards the construction techniques of sewn hulled boats, of which she

became one of the great internationally recognised experts. Her work on the architecture of sewn boats of the Laccadive Islands, which was the result of a great deal of ethnographic studies, has become the standard reference. L. Varadarajan also conducted extensive field research into the nautical construction of the Nicobar and Andaman Islands as well as along the Gujarati coast. The conference and publication *Gujarat and the Sea* (2011) testify to the importance of her work within the international scientific community.

REFERENCES

- ADAMS R.M.
1988 Designed Flexibility in a Sewn Boat of the Western Indian Ocean, in S. McGrail, E. Kentley (eds), *Sewn Plank Boats. Archaeological and Ethnographic papers based on those presented to a conference at Greenwich in November, 1984*, Oxford (NMM, Greenwich, Archaeological Series, 10; BAR Int. Series, 276), p. 289-302.
- ARUNACHALAM B.
2002 *Heritage of Indian Sea Navigation*, Mumbai, Maritime History Society.
- ARUNACHALAM B., KARANI R., FERNANDO S.
1990 *CSIR-NISTADS Project, Indigenous Traditions of Indian Navigation, Lakshadweep and Minicoy, 1, Navigational Practices and Boat Building*, Heras Institute of Indian History and Culture and Department of Geography, University of Bombay (unpublished).
- BASA K.
1999 Early Trade in the Indian Ocean: Perspectives on Indo-South-east Asian Maritime Contacts (c. 400 BC to AD 500), in K.S. Behera (ed.), *Maritime Heritage of India*, New Delhi, Aryan Books Int., p. 29-71.
- CASSON L.
1986 P. Vindob G 40822 and the shipping of goods from India, *Bulletin of the American Society of Papyrologists*, 23.3-4, p. 73-79.
- CENSUS OF INDIA
1961 *Chetlat, An Island in the Arabian Sea, Socio-Economic Report*.
- CHITTICK N.
1980 Sewn boats in the western Indian Ocean and a survival in Somalia, *IJNA*, 9.4, p. 297-309.
- DEGUCHI A.
1991 Dugouts of Japan: Hull Structure, Construction and Propulsion, in *Proceedings of International Sailing Ships History Conference, Shanghai, 1991*, Shanghai, Shanghai Society of Naval Architecture and Marine Engineering, Marine History Teachers Association of CSNAME, p. 197-214.
- DE ROMANIS F.
2012 Playing Sudoku on the verso of the « Muziris Papyrus »: Pepper, Malabathron and Tortoise Shell in the cargo of the *Hermaphrodite*, *Journal of Ancient Indian History*, 27, p. 75-101.
- FLECKER M.
2000 A 9th century Arab or Indian Shipwreck in Indonesian Waters, *IJNA*, 29.2, p. 199-217.
- GEORGE A.
1993 Traditional Navigation and Trade in Lakshadweep, 1850-1950, in S. Chandra, B. Arunachalam, V. Suryanarayan (eds), *The Indian Ocean and its Islands*, New Delhi, Sage Publication, p. 128-148.
- HORNELL J.
1920 The origins and ethnological significance of Indian boat designs, *Memoirs of the Asiatic Society of Bengal*, p. 139-246.
1942 A tentative classification of Arab sea-craft, *The Mariner's Mirror*, 28, 1, p. 11-40
1946 *Water Transport and Early Evolution*, Cambridge, Cambridge University Press.
- KOYA HAJI N.
2007 *Sagarika Theerathe Paitharukam Thedi / In Search of Heritage*, Kottayam, Lakshadweep History and Culture, Current Books.
- MANGUIN P.-Y.
1985 Sewn-Plank Craft of South-East Asia, A Preliminary Survey, in S. McGrail, E. Kentley (eds), *Sewn Plank Boats. Archaeological and Ethnographic papers based on those presented to a conference at Greenwich in November, 1984*, Oxford, BAR (NMM, Greenwich, Archaeological Series, 10; BAR Int. Series, 276), p. 319-343.
1993 Trading Ships of the South China Sea, *Journal of the Economic and Social History of the Orient*, 36, 3, p. 253-280.
- OUSEPH A.V., JAMES P.V., HABIBULLAH W.
1988 *Lakshadweep, A Study in Traditional Rural based Craft, Odam Making*, New Delhi, Census of India 1981, Part X-D Series-30.
- POMEY P.
1981 L'épave de Bon-Porté et les bateaux cousus de Méditerranée, *The Mariner's Mirror*, 67, 3, p. 225-244.

68. AP, New Delhi.

- RAJAMANICKAM G.V.
2004 *Traditional Indian Ship Building, Memories, History, Technology*, New Delhi, New Academic Publishers.
- ROMERO-FRIAS X.
2014 Rules for Maldivian Trading Ships Travelling Abroad (1925) and a Sojourn in Southern Ceylon, *Politeja. The Journal of the Faculty of International and Political Studies of the Jagiellonian University in Krakow*, p. 67-84.
- SARMA S.R.
2015 Astronomical Instruments in India, in C. L.N. Ruggles (ed.), *Handbook of Archaeoastronomy and Ethnoastronomy*, New York, Springer Science, p. 2007-2010.
- SHARMA I.K.
1999 Indian Seafaring Traditions: Archaeological Perspectives, in K.S. Behera (ed.), *Maritime Heritage of India*, New Delhi, Aryan Books Int., p. 1-10.
- SEVERIN T.
1985 Constructing the Omani Boom Sohar, in S. McGrail, E. Kentley (eds), *Sewn Plank Boats. Archaeological and Ethnographic papers based on those presented to a conference at Greenwich in November, 1984*, Oxford, BAR (NMM, Greenwich, Archaeological Series, 10; BAR International Series, 276), p. 279-302.
- SRIDHAR T.S.
2005 *Alangankulam: An Ancient Roman Port City of Tamil Nadu*, Chennai, Department of Archaeology, Government of Tamil Nadu.
- VARADARAJAN L.
1983 Indian Seafaring: The Precept and Reality of Kalivarjya, *The Great Circle*, 51, p. 1- 11
1987 Commodity Structure and Indian Participation in the Trade of the Southern Seas, circa Ninth to Thirteenth Centuries, in S. Chandra (ed.), *The Indian Ocean: Explorations in History, Commerce and Politics*, Delhi, Sage, p. 90-108.
1991a Dimensions of intra-Asian trade contacts circa 9th to 15th centuries AD, in E. Gonsalves (ed.), *Asian Relations*, New Delhi, Lancer International, p. 425-433
1991b Perspectives on Maritime Activity in Gujarat, in A. Gupta (ed.), *Minorities on India's West Coast: History & Society*, Delhi, Kalinga Publications, p. 1-16.
1998 *Sewn Boats of Lakshadweep*, Panaji, Goa, National Institute of Oceanography.
2006 Indian Rutters: The Indigenous Tradition, in L. Varadarajan (ed.), *Indo-Portuguese Encounters, Journeys in Science, Technology and Culture*, II, Indian National Science Academy, New Delhi, Centro de História de Alem Mar, Lisbon, New Delhi, Aryan Books International, p. 468-475.
- VARADARAJAN L. (Ed.)
2004 *The Rahmani of M.P. Lakshadweep*, Panaji, Goa, National Institute of Oceanography.

LIST OF RESOURCE PERSONS

- Commander Anup Prakash, Indian Navy, New Delhi, cited as AP, New Delhi
Yusuf Rapiapura, chief carpenter, Chetlat, cited as YR, Chetlat, November '08
M. Ali Manikfan, Vallioor, Tamil Nadu, cited as AM, Kavaratti, April, '95
A.M. Misbah, Kavaratti, cited as AMB, Kavaratti, November '08
Mr Panicker, Fisheries Office and Boat Building Yard, Chetlat, cited as Panicker, Chetlat, February '89

LIST OF INFORMANTS

Andrott

- M.N.Koyammahaji, cited as MNK, Andrott, February '92
Saiyid Mohamad Koya Kunhali, cited as SMKK, March '95
Kunhi Seethi Koya, cited as KSK, Andrott, February '89
Kunhacha Abdul Karim, cited as KAK, Andrott, February '89

Amini

- Atta Koya Thiruvathapura, cited as AKT, Amini, November '09
Abdul Kader Kunhacha, cited as AKK, Amini, February, '89
Thoopiakal Koya, cited as TK, Amini, March '95
Hamsa Kaptachettea, cited as HC, Amini, October '86
Pura Ahmad Haji, cited as PAH, Amini, February, '92
T. Koya, cited as TK, Amini, October '86

Chetlat

- P. Hamza, Chetlat, cited as PH, Chetlat, November '08
Kunnel Shaikh, cited as KS, Chetlat, February '92
Sayed Koya, Additional Block Development Officer, Chetlat, cited as SK, Chetlat, February '89

Kadmat

- Abdul Haji, cited as AH, Kadmat, March '95
Acharabioda Abdulla, cited as AB, Kadmat, November '08
B. Pookoya, cited as BP, Kadmat, November '08
Pathada Abossala Haji, cited as PAH, Kadmat, March '95
P.B. Hamza, cited as PBH, Kadmat, February, '89

Kalpeni

- M.K. Kunhi Koya, cited as MKKK, Kalpeni, March '95
K.P. Pookoya, cited as KPP, Kalpeni, March '95

Kavaratti

- Kidabe Malmi, Koyama Kada, aged 84 in February 1987, cited as KM, Kavaratti, '87
Hamsath Velipura, cited as HV, Kavaratti, February '92
Kojan Koya Haji, cited as KKH, Kavaratti, October '86
K. Mohammad Haji, cited as KMH, Kavaratti, January '95
P. Mohammed Koya, cited as PMK, Kavaratti, October '87
B.P. Koyama Haji, cited as BPK, Kavaratti, October '98