KAPPAL SĀTTIRAM

A TAMIḶ TREATISE ON SHIPBUILDING DURING THE SEVENTEENTH CENTURY A.D.

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Although the early literary works in Tamiḷ, epigraphy, numismatics and foreign travellers' chronicles provide enough information about shipping and maritime activities, they hardly throw in a connected manner the systematised practice of shipbuilding that was carried on uninterruptedly on the Coromandel coast for several centuries. However, *Kappal Sāttiram*, a paper manuscript in simple Tamiḷ, throws fresh light on the studies pertaining to certain practical aspects of shipbuilding. The manuscript was compiled by an anonymous author in the late medieval period during the Danish occupation of Tarañgambādi (Tranquebar). At the outset the author describes the various units of a measuring rod (*muḷḷakkōl*). He then discusses a method by which the characteristics of a sea-going vessel could be ascertained. For various types of vessels different measurements are recommended for making masts (*pāymaram*) and sails (*oduthai*). Four types of anchors (*naṅgūram*) were obviously used for anchoring vessels, and the manuscript details a simple method by which the weight of each type of anchor is determined.

The manuscript is replete with astrological directions relating to ships, and the anonymous author's heavy reliance on the importance of astrology in navigation is gleaned from certain portions of the text wherein the auspicious and inauspicious days are prescribed for building, launching and sailing of vessels. A significant feature of this treatise is that it includes a separate section at the end, detailing the measurements of different parts of a contemporary British sea-going vessel.

INTRODUCTION

The development of shipbuilding activity in the land of the Tamiḷs can be traced from the commencement of the Christian era. During the first two centuries of this era, the ports on the Coromandel coast enjoyed the benefits of active commerce with both the Western and the Eastern world. The evidence proving this is furnished by the details given in the early Tamiḷ literature of the Śaṅgam period, in the works of the Greek and Roman authors and partly corroborated by the remarkable finds of Roman coins in different parts of South India. This active period was followed closely by a period of

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maritime supremacy of the Sātavāhana dynasty (the Āndhras) who maintained a regular fleet of ships. This has been confirmed by numismatic evidence. From a study of these coins with ship representations one can glean some information about the characteristics of the vessels of that time. After the decline of the Sātavāhana dynasty in the third century, the command of the sea on the Eastern coast, particularly the Coromandel coast, passed on to the Pallavas of Kāñcī (Conjeevaram) whose naval conquests are highly eulogized in their copperplate grants and lithic records.

With declining fortunes, the Pallavas of Kāñcī by the end of the ninth century completely vanished from the scene of naval activity and their territories were ultimately annexed by the Cōḻas of Tanjore. Under the strong government of a succession of Cōḻa kings, South India witnessed a remarkable outburst of naval activity. The most notable of the Cōḻa kings were Rājarāja I (A.D. 985–1014) and Rājendra I (A.D. 1014–1042) who 'developed a positive maritime policy and evidently had a regular navy'.[1] They, undoubtedly, carried on their naval activities with the countries of the Far East and as far as China. Throughout the succeeding centuries, up to the later medieval period, the Coromandel coast seemed to have been engaged in extensive commerce. This has been commented upon by many contemporary foreign travellers.

Accounts given in ancient Tamiḻ literary works, foreign travellers chronicles and numismatics provide considerable information on Indian shipping and maritime activity. Though we find in them references to the different names of ships, classes of ships, and their parts, and other relevant information connected with navigation, none of them tends to indicate in a connected manner the highly complex information on the art of shipbuilding as such which prevailed along the coast of Coromandel. However, in the late medieval period India's shipbuilding industry on the same coast appears to have been quite developed and flourishing. This is substantially proved by a single work in the Tamiḻ language, the *Kappal Sāttiram*.[2] This work has been ascribed to the late medieval period. One notable feature of this manuscript is that it uncovers certain new facts, hitherto unknown on the studies pertaining to shipbuilding on the Coromandel coastal regions of South India. In this brief note an attempt is made to highlight some aspects of the art of shipbuilding and other connected details as gleaned from the manuscript.

The Danish in Taraṅgambādi (Tranquebar)

The importance of this treatise for the development of the art of ship construction in Tamiḻ country came to be realized first in Taraṅgambādi (Madras State) when, in A.D. 1698, the manuscript was transcribed and copies were taken for posterity in the house of Tinamāraka[3] Tubāśi[4] Kāliṅgarāya Piḷḷai.

The place Taraṅgambādi, otherwise known in English as Tranquebar, in latitude 11°1′11″ N., longitude 79°53′44″ E., is a coastal town to the east of Māyūram in the Thanjāvūr district of Madras on the Coromandel coast. Another Tamiḻ expression of Taraṅgambādi is Alaippaṭṭaṇam which means 'the village of the wave'. An epigraph from the Māsilāmaṇiśvara temple at Tranquebar belonging to the later Pāṇḍya king Kulaśekhara Īśvar of Madura states that this place was known as Sadaṅgambādi alias Kulaśekharan Paṭṭiṇam.[5] Another inscription from the same temple, issued by Achutappa Nāyaka II, (A.D. 1627), calls this place as Sadaṅgambādi. It is now testified beyond doubt that the present name Taraṅgambādi is only a corruption of the medieval Tamiḻ designation of Sadaṅgambādi.[6]

During the reign of Christian IV (A.D. 1588–1648) in Denmark a Danish East India Company was first founded in 1616 and it was this Company that organized the first voyage to India. As the Portuguese were then holding the Malabar coast and the Dutch held Indonesia, it was to the Coromandel coast that the Danes turned their attention. The first Danish voyage under the captaincy of Roelent Crape in the ship 'Ceresund' reached the coast of Coromandel. Near this coast their vessel was ruthlessly attacked by the belligerent Portuguese and all but the Captain, Roelent Crape, and thirteen sailors were killed in the encounter. The Captain and the surviving thirteen members of the ship reached the court of the Rāja of Tanjore. In November 1618, another expedition consisting of five ships under the commandment of 'Ove Gedde' started from Denmark to India.

By the combined efforts of Roelent Crape and Ove Gedde, an agreement was reached between Achutappa Nāyaka II of Tanjore and the ruler of Denmark. Accordingly, the Rājā of Tanjore ceded Taraṅgambādi including fifteen small hamlets and in return he received an annual payment of Rs.4,000 from the Danes. Here they constructed the fort Daneborg. This has been testified by an inscription[7] inscribed on the front wall of the fort which reads as follows:

The Daneborg
Built by
Ove Gedde
Commander in the
Royal Danish Navy
Circa 1620

That this place was the first settlement of Protestant missionaries in India, founded by Bartholomous Ziegenbalg and Heinrich Plutschau (Lutherans) in 1706, is evidenced by a commemorative stone inscription[8] which reads thus:

1706–1906
Here by the Grace of God

Landed on the July of 1706
The First Ev. Lutheran Missionaries
to India
Bartholomous Ziegenbalg
and
Heinrich Plutschau

Erected by the graceful congregation
Of the Leipzig Ev. Luth. Mission
In the Jubilee Year 1906

Tranquebar was captured by the British in 1807, restored in 1814 and finally, purchased by them along with the other Danish settlements in India in 1845. During the entire eighteenth century Tranquebar was a busy port, frequented by vessels of different countries, and the Danish factory in that place was a very active centre of contraband. During the Anglo-French conflict, the Danes, acting as neutrals, did good business in trading with the belligerents. Trade between Tranquebar and the Mascarenes was established especially during the Napoleonic wars (A.D. 1803–15). After the occupation of the British in 1845, Tranquebar, as a coastal town, lost its importance when the construction of the S. I. Railways was completed from Nāgapaṭṭiṇam to Tanjore in 1861 and to Trichinopoly in 1862. The place is now deserted, and its large export trade disappeared. Some fine old buildings constructed by the Danes still remain, and the fort on the beach is in a state of good preservation.

The Manuscript

The *Kappal Sāttiram* was selected for publication by the authorities of the Madras Government Oriental Manuscript Library who placed at the disposal of Shri T. P. Paḻaṇiyappa Piḷḷai its single copy, in Tamiḻ language and script, with which the Editor could correct the manuscript appropriately and adequately by drawing our attention to them in foot notes. The Editor has stated in the introductory part of this published work that there are a number of mistakes to be corrected. These mistakes, he says, have crept in this work when the copyist with his inadequate language background and poor knowledge of the subject had tried to interpolate many passages from other works on astrology, particularly, the *Jyotiṣa Graha Cintāmani*. These insertions have only reduced the original value of this work. Nevertheless, it is the only existing work on the subject of shipbuilding in Tamiḻ language in India.

The paper manuscript, which is now in a good state of preservation in the Government Oriental Manuscripts Library, Madras, bearing D. No. 1996,

$11\frac{1}{8} \times 8\frac{1}{2}$ inches in size, consists of seventy-nine pages having eighteen lines in a page. The available distorted version of the manuscript is a copy of copies previously copied from the original. It comprises of forty-six verses and prose passages, the verses being in *Viruttayāppu* (a type of verse) and some are in *caṅta* verses (poetic prose). The fact that this treatise had borne a sanskritized title called 'Nigama Cigāmaṇi' is amply evidenced in the last line of verse four. This information forces one to infer that the *Kappal Sāttiram* must have been an excellent guide-book in Tamiḻ for shipbuilders and sailors, and since no effort had been shown to take true copies of the manuscript, the work had lost its original merit. The work is divided into several smaller sections and each section is appropriately subtitled to indicate the topic dealt with.

About the author of the *Kappal Sāttiram*, this work itself in its solitary manuscript form gives no definite information regarding the name of the person except this one word 'ceytiṭṭān' in verse eight which runs thus: '*salaikatirāṅgaṇ coṟpaḍi etanaittamiḻ ceytiṭṭāṇ*', that is, the work was composed verbatim into the Tamiḻ language at the instance of *salaikatirāṅgaṇ*. Unfortunately the name of the author of this original work is left unmentioned in the above-cited line. However, the anonymous author seems to give a scientifically reliable yet generally intelligible account of the shipbuilding activities that had been in practice on the Coromandel coast.

The author opens the work with a salutory verse or *stotiram* to the Goddess Sarasvathi in order to seek her heavenly blessings. This is a customary style of beginning in many literary works of Indian languages. Since the work deals with the art of shipbuilding and since the ships were generally considered as feminine, it is worthy of remark, that the presiding and protecting deity of the sailors and shipbuilders has almost always been feminine.

Measurements of a Cubit

The verse three describes a table indicating the various units of a measuring rod (*muḻakkōl*) which literally is equal to one cubit. The measures of length as detailed in it are imperfect and indistinct. Nevertheless, the verse can safely be compared with the *Kaṇakkatikāram*,[9] a mathematical treatise in Tamiḻ, to make out a table for linear measurement. The following improved table is after making necessary emendations:

Table

8 *Aṇu* (atoms)	..	1 *Katireḻutugal* (sunray)
8 *Katireḻutugal* (sunrays)	..	1 *Pañchiṟṟukaḻ* (cotton fibre)
8 *Pañchiṟṟukaḻ* (cotton fibres)		1 *Mayir muṇai* (hairtip or point)
8 *Mayir muṇai* (hairtips or points)	..	1 *Nuṇmaṇal* (fine particle of sand)

8 *Nuṇmaṇal* (fine particles of sand)		1 *Ciṟṟukaṭugu* or *Yeḷḷu* (mustard seed or sesame seed)
8 *Yeḷḷu* (sesame seeds)	..	1 *Nellu* (paddy)
8 *Nellu* (paddies)	..	1 *Viral* (finger)[10]
12 *Viral* (fingers)	..	1 *Chān* (span = 9 inches)
2 *Chān* (spans)	..	1 *Muḷam* (cubit = 18 inches)

The smaller units of measurements of the measuring rod, as found in the above-stated table, are *aṇu* (atom), *katireḷutugal* (sunray), *pañchiṟṟukaḷ* (cotton fibre), *mayir muṇai* (hairtip or point), *nellu* (paddy), *viral* (finger), *chān* (span), and *muḷam* (cubit). Except the last three units, the other units of measure of length are not applicable in the construction of ships.

How to Estimate the Characteristics of a Ship

In verse five the author describes a method by which the standard quality of the sea-going vessel could be established. The method is as follows: 'To ascertain the quality of the ship (*vaṅgam*), the entire length of the *ērā* (keel) of the ship is measured with a measuring scale and divided into ten equal compartments without any remainder. It is desirable if the *kaṇṇiḍai*, *karuviḍai*, *eḷakkiḍai* and *chuḷikkaḍai* appear in all the seven compartments—first, second, third, sixth, seventh, ninth and tenth—or in any one of these seven compartments.' The appearance of these four distinctive features in wood which went to the making of ships would not in any way weaken the strength of the keel; on the other hand, they would add to its strength. It is possible that the shipbuilders of the Coromandel coast of South India would have shown preference to wood with such characteristic features while selecting the timber for the construction of vessels.[11] Besides pointing out the properties of wood, the author lays down a very important direction for shipbuilders in the nature of a warning which is worth noting. He says that the most serious defect in the wood to be totally avoided is the presence of the *kaṇu* (knot or node) in the fourth, fifth and eighth compartments. The *kaṇu* which forms in trunk at insertion of branches causing round cross-grained piece in wood is the weakest portion to be avoided; for the keel, the longitudinal timber on which the framework of the whole vessel is built up, is liable to develop fine cracks and give way.

Propitious Day Fixed for Launching the Ship

The custom of fixing the propitious day for launching the ship in high seas among the Hindus must have been an age-old practice. For the author devotes a separate section with a suitable subtitle in order to emphasize the behaviour of the shipbuilders who attached much importance to this practice.

After finding the qualities and attributes of ships, the *vaṅganāl* (*vaṅgam* (ship)+*nāl* (day), that is, the day fixed for launching the ship for a test-sail), is reckoned by the application of a simple but effective method which is found to be interesting in verse six from its description. The *vaṅganāl* is determined as under:

To find out the *vaṅganāl*, the keel (*ērā*) of the ship is measured with a cubit and the length of the cubit is said to be equal to 24 *aṅgulam* (inches). Multiply the length of the keel by 24 (24 being the total number of inches in the cubit in this particular case) and from the total so determined subtract 27 (27 being the total number of lunar constellations). If the remainder is one, then the *vaṅganāl* is *Aśvinī* (β and γ Arietis), if the remainder is two, then the *vaṅganāl* is *Bharaṇī* (35, 39 and 41 Arietis), and so on. The possible remainder is within one to twenty-seven corresponding to the 27 lunar constellations counting from *Aśvinī*. In connection a very pertinent doubt naturally occurs to mind; for the author does not inform us as to how to fix the propitious day if the remainder is more than 27. We have probably to assume that the counting of the lunar constellations from *Aśvinī* to *Revatī* should be continued and repeated so as to bring the *vaṅganāl* within the 27.

Installation of Ship's Mast

The favourable and auspicious time set for the installation of ship's mast (*pāy-maram*), as prescribed by the anonymous author in verse thirteen, is the conjunction of a favourable *Rāśi*—namely *Tulām* (Librā), *Kumbam* (Aquarius), *Makaram* (Capricorn), *Karkaṭakam* (Cancer), *Meṣam* (Aries), *Riṣabam* (Taurus), and *Virchchikam* (Scorpion)—with a *Śubha graha* (auspicious planet). Here the exact time of the auspicious ceremonies is not specified.

Tutelary Deity of the Ship

The verses fifteen, sixteen and seventeen deal with the position of the tutelary deity of ships. It is mentioned that it was customary to personify a particular pattern or arch type as the tutelary deity of the craft irrespective of types used for water-transport. The position of such tutelary deities (*vāstu puruṣan*) in ships must have been a cardinal place for adoration of ships. Such beliefs and customs existed among Hindu sailors and seafaring people showing an intimate association between the protective deity and the craft. Among the Tamiḷs such beliefs were probably wide-spread in ancient times, and their survival even during the late medieval period was mainly to ensure good fortune and safe voyages across the sea or to counteract or nullify the malignant glance of the mischief-minded.

The anonymous author says that 'if the *ērā* (keel) of the ship is placed below the head of the *vāstu puruṣan*, the standard or quality of the ship

would be taken to be pre-eminent (*uttamam*). It is unadvisable to change or alter the head position of the *vāstu puruṣan*.[12]

Astrological Instructions

The *Kappal Sāttiram* is replete with elaborate astrological directions regarding the auspicious and inauspicious days for building, launching and sailing ships. For example, in verse nine it is declared that the *Mituṇam* (Gemini), *Kumbam* (Aquarius), *Mīṇam* (Pisces), *Dhaṇuśu* (Sagittarius), and *Makaram* (Capricorn) are the most inauspicious and unfavourable five signs of the Zodiac during the period of which the construction, the launching and sailing of ships are totally to be avoided.

The verse fourteen signifies the importance of 'astrological guidance' prior to the sailing of ships and voyages of merchants to a distant land in the open sea. The prose passage of the same verse clearly informs us of the exact procedure as detailed in the *Jyotiṣa Graha Cintāmaṇi* which is suggestive of the fact that the seafarers of the Coromandel coast either consulted proficient astrologers or used such astrological treatises before they set sail in the open sea.

The 'navigational guidances', that are mentioned in verses 21 to 46, are tied up with astrological details and indicate the heavy reliance of the author on astrology for navigational guidance.

Measurements of Masts and Sails

For various types of ships, different measurements are recommended for preparing masts and sails. Here is an example from the text: The length of the *ērā* (keel) of the ship is 45 cubits. The width of the ship is 15 cubits. For that ship, the width of the *oḍutai* (sail) of the mast which must be strong enough to stand well in a storm would be $2\frac{1}{2}$ cubits. The *urai* (length or height) of the sail would be about 37 cubits. Likewise ten different types of sails with varying measurements are briefly mentioned and they must be in proportion to the size and type of the vessel.

In the manuscript the mast is termed as *pāy-maram*, which means a 'pole-mast with sail'. The term '*pāy-maram*' literally brings to light only the original material of the sail and not the mast (*maram*).[13] The word '*maram*' which literally means tree, in this context, stands for a long wooden pole. The material employed for making sails varied very much in different places. The word '*pāy*' here stands for 'rushmat' which must have been in use in the early stages on the Coromandel coast for the preparation of sails. Since such sails were noticeably a disadvantage for long distance voyages, the seafarers on the same coast would have shown preference to durable material and fitted their sea-going vessels with sails made of cotton sail-cloth. We can only presume that the change-over from rushmats to cotton would have taken effect only after some centuries of trial and error processes.

The author does make special reference to the use of double sails which were fitted to the mast to catch more wind. This was definitely a valuable improvement in the art of shipbuilding; for in the beginning, ships had only a single mast and one sail. The use of double sails, moreover, enabled the seafarers to increase the tonnage. In this context, it is imperative to mention that the author does not specify the typical form of sail and it is also difficult to construe from the above-mentioned measurements the exact form of sail, whether the lateen or square, used by them. But the typical sail native to India is the square, and there are definite evidences for it. Hence the mention of double sails in the manuscript mean only the square sails.

Sizes of Anchors

Regarding the usage of anchors we may authentically say that the ships of the seventeenth century on the Coromandel coast were provided with four types of *naṅgūram* (anchors). In the *Kappal Sāttiram* these four types of anchors are clearly accounted in terms of avoirdupois pounds (*rāttal*). Generally the weight of anchors depends on the size and type of the vessel. The work describes a simple method by which the weight of each type of anchor is determined. First, the length of the *ērā* (keel) is measured with a measuring rod and converted into feet. If one foot length of the keel is equivalent to 26 pounds (*rāttal*), then the total weight of the anchor could be found out by multiplying 26 by the length of the keel. The anchor in this case would be a 'large sized' one, that is the *periya naṅgūram*. In the second type, the weight in terms of pounds equal to one foot is unmentioned. It is quite probable that the copyist absent-mindedly proceeded further without repeating the information from the original. In the third type, one foot is equal to 12 pounds; and in the fourth, it is 8 pounds.

This is in close approximation to the modern method of determining the weight of a steamer's anchors. The reason is that in this case the length of the keel is taken into consideration for fixing the weight of anchors; whereas the modern steamer's anchors is decided by the entire length of the vessel.[14]

Technologically speaking, this is the first time we find a method for preparing anchors in proportion to the size of the ship and this vital information has not been traced in any of the then existing work on the science of shipbuilding. One discernible fact is that the weight of the anchor must be proportionate to the length of the keel in terms of feet.

The work does not disclose the material out of which the anchors were made. But from the contemporary accounts it is learnt that large-sized stone-anchors with holes through the middle for the ropes and metal anchors of grapnel shape were known and used in South India in the seventeenth century.

Measurements of British Ships

More interesting and reliable information regarding the exact measurements of the principal parts of the British sea-going vessels in terms of the British system are given in a separate section at the end of the treatise. It is likely that this section would have been added as an additional information for the local shipbuilders on the method of shipbuilding at a later date; for the impact of the British naval architecture started taking effect in this region only from the beginning of the nineteenth century. This particular section, although gives the details of ship of alien make, is probably as convincing as any other work hitherto existing on the subject.[15] The details given therein are almost certainly very difficult to interpret because of the use of local dialect for the technical terms; but are nevertheless significant. It will be further stimulating at this point to go through the entire list of details in this section and by using proper lexicons and historical imagination the most likely shape of the vessel could be reconstructed.

The measuring rod (*kōl*) mentioned in this connection is reckoned at three feet, which in modern usuage is nothing but a yardstick.

Conclusion

The work referred to here shows that in the late medieval period maritime and shipbuilding activities along the coast of Coromandel were well developed and flourishing. A few expressions like *vaṅgam*, *kappal* in the text show that the vessels were built for the main purpose of sailing in the high seas. This is further corroborated by the knowledge of navigational guidance as found in the verses from 21 to 46. But the mention of *aṅgulam* (inch), *aḍi* (foot), *kōl* (one yardstick) and *rāttal* (pound) in the body of the text unmistakably points to the fact that the impact of the British naval architecture had already taken strong and sure roots in Indian shipping. And at this stage the Hindus must have borrowed from the British many improvements which they had adapted with success to their own shipping.

To sum up, the *Kappal Sāttiram* in its condensed form sets forth all the available information and knowledge about the shipbuilding activities of the people on the coast of Coromandel. The work, therefore, requires a full treatment and its contents have to be elucidated with citations from other contemporary records.

References

[1] Basham, A. L., *The Wonder that was India*, London, 1963, p. 75.

[2] *Kappal Sāttiram*, edited by T. P. Palaniyappa Piḷḷai, Madras Government Oriental Series Publication, No. 1, Madras, 1950.

[3] '*Tinamāraka*' stands for Danish language spoken in Denmark.

[4] The word '*Tubāśi*' in Tamiḷ is derivative of the Sanskrit term *Dwibāśi*.

[5] Annual Report on South Indian Epigraphy, No. 15 of 1890; also South Indian Inscriptions, Vol. IV, No. 399.

[6] *Ibid.*, No. 77 of 1890; also South Indian Inscriptions, Vol. IV, No. 401.

[7] *Kappal Sāttiram, op. cit.*, p. V.

[8] *Ibid.*, p. VI; *see* for full details, 'Danish Coins in Tranquebar' by Dr. E. Hultsh, *Indian Antiquary*, 1893; and the account given by W. W. Hunter in the 'Imperial Gazetteer of India', Vol. XIII.

[9] The *Kanakkatikāram*, the earliest work on Arithmetics in Tamiḷ composed by the poet Kārināyaṇār, contains a table very similar to the one mentioned above in the form of a verse.

[10] Probably the thickness of the thumb was taken into consideration.

[11] Four types of trees are recommended for shipbuilding, viz. Nāval (Jamoon plum, *Eugenia jambolina*), Teak (*Tectona grandis*), Vēmbu-Margosa (*Azardirachta indica*), and Iruppai-South Indian Mahua (*Bassia longifolia*).

[12] *Kappal Sāttiram, op. cit.*, verse 17.

[13] Two types are used for preparing masts, viz. Puṇṇai (Mast wood, *Calophyllum inophyllum* belonging to the family of *Guttiferae*), and Neṭṭi liṅgam (the Indian mast tree, *Polyalthia longifolia* belonging to the family of *Anonaceae*).

[14] Brown, Charles H., and Brown, H. H., Nichols's Seamanship and Nautical Knowledge, Glasgow, p. 108.

[15] The *Yukti Kalpataru*, a Sanskrit work on various arts compiled by Bhoja Rāja of Dhara (A.D. 1018–1055), gives an elaborate classification of ships, their types and the measurements of their respective length, breadth and height. For details see Radha Kumud Mookerji, *Indian Shipping* (A History of the Sea-borne Trade and Martitime Activity of the Indians from the Earliest Times), second edition, (revised), 1956, Orient Longmans, Bombay, India.