

PORTUGUESE SHIPPING
AND SHIPBUILDING IN GOA
1510 -1780

By

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Under The Guidance Of
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STATEMENT BY THE CANDIDATE

I hereby state that the thesis for the Ph.D. Degree on ' PORTUGUESE SHIPPING AND SHIPBUILDING IN GOA 1510 - 1786 ' is my original work and that it has not previously formed the basis for the award of any Degree, Diploma, Associateship, Fellowship, or any other similar title.

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PREFACE

Indo - Portuguese maritime history is relatively a new field of study. Portugal was the first European power to dominate the Eastern seas by bringing under their control key eastern trading ports like Ormuz, Malacca and Goa. Ormuz and Malacca slipped out from their hands but Goa continued to be an important port of the Portuguese in the East. The Portuguese naval operations at this port merits a detailed study on account of the role it played in the consolidation of their power in the Orient. The present work probes into various issues relating to the Portuguese shipping and shipbuilding operations in Goa from 1510 - 1780.

In the preparation of this work, I was helped by many scholars and other persons.

This study was first initiated under the guidance of Late Prof. Dr. B. S. Shastry, the then Head of the History Department, Goa University. On his sad demise, I transferred my Ph.D. registration under Prof. Dr. K.M. Mathew, the Head of the History Department, Goa University. I am grateful to Prof. K.M Mathew for accepting me as his research student. It was his masterly and scholarly guidance and advice that enabled me to complete my studies. The encouragement and support I received from him during the course of my research is inestimable. Words are inadequate to express my gratitude to him.

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INTRODUCTION

The geographical location of Portugal was the main factor that stimulated the people and the rulers of Portugal to understand the importance of powerful navy. The Royal navy in Portugal came into existence with King Afonso Henrique in 1114-1185.¹ Under Sancho II (1225 -1248) Portugal had a strong naval fleet comprising of the vessels like Naus, Gales etc.² King Diniz can be termed as the true founder of the Portuguese navy.³ In the Charter of 1377, King Fernando encouraged shipbuilders by granting special privileges which were later renewed in a Charter of 1380.⁴ Motivated by commercial, geographical and religious factors, the Portuguese embarked upon an extensive policy of sending expeditions to unknown regions of the world. The initial success of the Portuguese voyages was mainly due to systematic and energetic efforts of Prince Henry the Navigator, who established the first Naval Academy at Sagres.⁵ At this Centre, the cartographers, cosmographers and mathematicians were put to work on numerous navigational problems confronting the Portuguese explorers. An unique achievement of the Sagres Naval Academy was the creation of the Portuguese Caravela, a magnificent ship of some 50t to 100t, capable of putting out regularly on the open sea without any problem relating to the oarsmen.⁶ By 1470, the Portuguese had successfully examined and mapped a large portion of the African coast. In 1481, King John who succeeded Afonso V on the throne of Portugal took up the projects which had been left untouched since the death of Prince Henry the Navigator. He

improved the methods of shipbuilding and began to build full-decked ships of 100t.⁷ In 1482 Diogo Cão passed Cape Catarina, the final point of the discoveries so far made and sailed upto the Cape of Saint Augustin.⁸ Bartholomeu Dias rounded the Cape of Good Hope in 1488, and after sailing for some distance upto the Coast of Southern Africa, returned with the news that the sea route to Indies was evidently open.⁹ Dias's information was further supplemented by the reports of Pero de Covilhvam who was sent to the East by the King of Portugal. Covilhvam reached the west coast of India proper in 1488 and he submitted his report to the Crown showing the feasibility of reaching India by sea via Cape of Good Hope.¹⁰ Based on the contents of the Covilhvam's report and the information obtained from early voyages, preparations were made for the historic India voyage.

On 8th July, 1497, Vasco da Gama, a nobleman and experienced navigator sailed from Belem with a fleet of 4 ships carrying a crew of 160 and reached Kappucat near Calicut on 17th May 1498.¹¹ Thus opened the East-West maritime encounter.

The rich dividends of the Da Gama voyage induced the King of Portugal to send every year fleets to India to obtain the spices. The voyages of Pedro Alvares Cabral and Joao de Nova in 1500 and 1501 respectively yielded good profits to the Portuguese Crown.¹²

In the course of time the Portuguese devised a strategy not only for participating in the spice trade of the East but also for obtaining complete control over the maritime trade route. The

Portuguese captains were instructed to block the Muslim maritime trade between India and the Arab states and to divert the same to Portugal. The system of 'controlled navigation' was introduced by the Portuguese in the Indian ocean by means of Cartaz. The Portuguese realised that, the effective control over the spice trade and the route would be possible only if they possessed a well-equipped navy in the Indian waters and the naval installations at strategic points on the western coast of India.

A strong chain of fortresses with anchoring facilities all along the western coast of India was set up, which served as naval and commercial base. In 1503, the Portuguese established their first factory at Cochin.¹³ In 1505, the King of Portugal changed his policy of sending annual fleets and decided to appoint a resident Viceroy in India for a term of 3 years to guard and promote the Portuguese interest.¹⁴

Though Cochin became the main base of naval and commercial operations of the Portuguese on the western coast of India, they soon realised that Goa has much more to offer for the success of their eastern naval enterprise. From the defense point of view, Goa was a fortified port and therefore the Portuguese navy could command the Arabian Sea from the centre. Emphasising the strategic importance of Goa, Alfonso de Albuquerque in his letter informed the King that "it provided safe passage for all ships laden with Your cargoes and the principal outlet for goods going to the kingdoms of Vijayanagar and the Deccan".¹⁵ On February 17, 1510 Albuquerque attacked the Bijapuri forces and took over the

city of Goa.¹⁶ Highlighting the significance of the capture of Goa, Albuquerque wrote to the king that "the capture of Goa alone has done more for Your Highness's credit than fifteen years of sending fleets to India."¹⁷

The area conquered by Albuquerque in 1510 was about 48 square miles till 1543, Gradually other parts of Goa came under the Portuguese sway: Bardez and Salcete in 1545, Ponda Zambaulim, Canacona and Cabo de Rama in 1783, Bicholim and Satari in 1781 and the Parts of Pernem in 1783.¹⁸ In 1530, Goa became the capital of the Portuguese eastern empire, during the reign of the Viceroy Tristão de Cunha, reducing the position of Cochin to that only of lading the Carracks. With Goa under the Portuguese control, along with Malacca and Ormuz, the Portuguese commercial and political dominations in the east became very effective. Though Goa was not providing all necessary material for shipbuilding, yet the excellent anchoring facilities at Mandovi and Zuari and its geographical location at the centre of the Arabian Sea, enhanced strategic importance. On March 1, 1518 King Manuel proclaimed Goa, to be a royal city never to be severed from the Portuguese crown.¹⁹

Many works have been published by Portuguese and Indian scholars on the Indo - Portuguese maritime history. The works authored by the Portuguese scholars deal with the Portuguese naval technology in general.

Braz Olivera's Os Navios de Vasco da Gama (1892) narrates the ships of Vasco da Gama employed in the historic 1498 India voyage.²⁰ Querino Fonecas A Caravela Portuguesa deal exclusively with the Portuguese Caravela highlighting different aspects of it such as tonnage, dimension, crew, sail - cutting system and so on.²¹ H.L. de Mendonca's Estudos Sobre Navios Portuguese no Século XV e XVI (1972) traces the use of different types of Portuguese vessels in the early voyages of exploration. The documents appended to this work provide information about the dimensions of the various components of the ship.²² J.G.P. Barata's Estudos Arqueologia Naval, 2 Vols. (1989)²³ focusses upon the technical modalities of different types of Portuguese ocean going ships.

Most of the works authored by the Indian scholars explore the maritime trade. Dr. K.S.Mathew's Portuguese Trade with India in the Sixteenth Century (1985) is a scholarly work on Portuguese trade with India during the first three decades of the sixteenth century.²⁴ Michael N. Pearson's work Coastal Western India focusses upon the system of Portuguese trade operation along the western coast of India and the indigenous input in it during the sixteenth and seventeenth centuries.²⁵ Afzal Ahmed's Indo-Portuguese Trade during the Seventeenth Century 1600 - 1663 (1991) elucidates the Portuguese trade relations with the Indian States along with the Portuguese exports and imports with Goa as a commercial base. Thus the above survey reveals that no major study has been undertaken to examine the Portuguese shipping and Shipbuilding in Goa, the main Portuguese naval and commercial

base.²⁶ The History of Portuguese Navigation in India 1498 - 1600 (1988) by Dr. K.M.Mathew is the only work in English which explores different aspects of the Portuguese navigation such as nautical science, cartography, the organisation of the navy and the naval policy of the Portuguese in the East.²⁷ The Present study amplifies the Portuguese Shipping and Shipbuilding in Goa, one of the issues highlighted by Dr. K.M. Mathew in his work.

The study covers the period upto 1780. By 1780 the Portuguese had established their sway over a large portion of Goa and streamlined its naval defense in view of the Dutch and the Maratha attacks. The year 1779, saw the end of the Pombalian era. Marques de Pombal, who was a virtual ruler in Portugal from 1777 to 1779 introduced major reforms restructuring the naval system in Goa. His decree of 1773 reorganised the technical and administrative set up of the Royal dockyard. The decree also made a provision for stationing a permanent and well - equipped naval fleet for manning not only the defense of Goa but to provide assistance to other Portuguese colonies in the East. For the sake of brevity, the study confines the Portuguese shipping from Goa to the shores of India only.

The work is mainly based on the Archival material, collected from the Goa Historical Archives. A brief comment has been made on the sources utilized for the study.

Alfandegas (1779 - 1780), 1 Vol.

These documents are the custom records providing valuable

data on the arrival and departure of the ships to Goa with cargo. Timber rates can be ascertained from this source. However, most of the documents belong to the 19th century.

Assentos de Conselho de Fazenda (1618 - 1740) 10 Vols.

These are the records of the proceedings of the Revenue Council of the State. Authentic and useful data on rigging and repairs of the ships can be obtained from this source. It also contains technical certificates issued to the *Fragatas*, *Manchuas*, *Pallas*, etc.

Alvaras & Provisões de Sua Magestade (1610 - 1781) 7 Vols. [^]

These provide considerable information on the type of the cargo that sailed from the port of Goa to Lisbon. However, it does not throw much light on the system of loading operations.

Cartas, Patentes & Alvaras (1557 - 1664) 20 Vols.

These Documents unfold information on the fortification of the Portuguese naval installations in the East, specially at Ormuz, Malacca and Macau. There are also orders exempting the timber which was brought for Royal dockyard from the custom duties.

Cartas, Patentes & Provisoes (1605 - 1775) 6 Vols.

The documents are the records pertaining to the naval artillery of different caliber installed on the Portuguese ships. A list of artillery carried on board the *Nau Nossa Senhora da Piedade*, *Nau Nossa Senhora de Madre Deus*, *Nau Nossa Senhora de*

Estrella and the Nau Nossa Senhora de Aparecidade can be traced in this series. This also contains technical details of the Palla São Luis which sailed to India in 1723. There is also a decree issued to the Surgeon of the Nau Madre Deus and Nau São Francisco Xavier in 1724.

Cartas, Patentes & Provisões (1726 - 1752) 1 Vol.

The documents include the list of the ship's cargo which sailed to Goa from Lisbon. Details of the voyage of the Nau Nossa Senhora de Livramento in 1726, Nau Santa Thereza in 1729 and the Nau Nossa Senhora da Aparecidade in 1730 are provided in this volume. Other details like the execution of the surety by the captain of the ships, instructions to the Chief-Master of the dockyard about anchoring of the ships etc. have been given in this volume.

Intruções Para O Intendente Geral da Marinha (1774), 1 Vol.

It is a very important source for the study of the organisation of the Portuguese navy in Goa during the 18th century. It contains instructions given to the Chief of the navy regarding the maintenance of the ship at the dockyard, quality control system, economic regulations, etc. This also includes administrative instructions given to the officers of the dockyard.

Livro de Cartazas : (1704 - 1782) 5 Vols.

These are the records of the sailing permits issued by the

Portuguese to the Muslims and other native merchants. They also furnish information on the tonnage of the local crafts and the amount of naval artillery that was allowed by the Portuguese.

Livro de Correspondence da Kanara : (1647 - 1769) 2 Vols.

The documents contained in this are the letters written by the Viceroy of Goa to the Portuguese officials at their Mangalore factory. Some of them throw light on the supply of timber, rice etc. to the Portuguese establishments in Goa.

Obrigações de Feitoria de Goa : (1772 - 1774) 2 Vols.

The documents are a list of medical provisions supplied to the ships during the voyage. It also provides information on the supply of other material to the Portuguese ships sailing from Goa.

Petições Despachados da Conselho da Fazenda (1682 - 1761), 32 Vols

A very informative source shedding considerable light on the Portuguese naval operations in the East. It furnishes a good deal of information on home - bound Indiamen specially regarding the passage and accomodation.

Provisões, Alvaras e Regimento (1515-1596) 2 Vols.

It unfolds very authentic data on various aspects of the Portuguese navigation during the early days of their rule in India. Among the various other documents it includes the orders given to the Governor Diogo Lopes de Sequeira over the safety of the ships carrying the horses and on anchorages in the river

Mandovi. It also furnishes information on the sailing permits issued to the ships sailing to Ormuz.

Provisões dos Visoreis : (1602 - 1631) 3 Vols.

They contain technical fitness certificates issued to Lisbon - bound ships, regulations for loading the home-ward bound East Indiamen and so on.

Regimento E Instruções : (1564 - 1779) 24 Vols.

This is the prime source of the present study. Except one volume, all other volumes contain instructions to the captains of the Northern and Southern fleet. The system of voyages from Goa to Malacca, Macau, Persain Gulf and Timor can be ascertained from this series. It also contains information on the instructions given by the Pombalian administration regarding the fortification of Goa in view of the Dutch and the Maratha pressures.

Registo de Alvaras e Cartas Regias : (1610 - 1645) 7 Vols.

This contains rolls of seamen, remuneration of Viceroys and captains and privileges of Captain-Major of India. It also throws a good deal of light on the construction rules and regulations of the India carrack.

Registo Gerais :(1769 - 1775) 2 Vols.

This appraises about the rates of matti, zambo, jackfruit wood etc.. measurement wise. It also furnishes information of the supply of wood and other material from Daman Bassein and Surat to

the Goa dockyard.

The Thesis is covered under two sections. Part I is on Portuguese Shipping and Part II on Shipbuilding.

The First Part on Shipping comprises of the 3 Chapters as under :

Chapter 1 entitled Portuguese Shipping - Its Mechanism : discusses the operation of the Portuguese voyages from Goa to northern and southern part of the west coast of India. From Goa fleets were sent to these parts under the charge of Captain-Majors to acquire cargo of spices for the Lisbon - bound ships anchored at Goa. It is also proposed here to probe into the rules regulating the entry of the ships into the bar of Goa, the garrisoning of the vital naval installations, and the naval strength of the Portuguese in Goa during the 18th century.

Chapter 2 entitled Types of Ships And Their Artillery & Equipment : narrates different types of Portuguese Ocean - going ships such as Caravela, Carrack, Fragata, Galleon, Nau etc. The country crafts like Charrua, Catur, Tone, Taforea, Paraos etc. were also used by the Portuguese in India. The ships had to be properly rigged and equipped with all naval accessories and artillery pieces to meet the requirements of the eastern voyage and warfare. The artillery of the Portuguese vessels depended upon the make and the tonnage.

Chapter 3 entitled Life onboard the Portuguese Ships

attempts to highlight the general conditions of the people onboard Portuguese ships. The desire on the part of every Portuguese man to sail to India to make fortunes and the Captain's greed for wealth by selling the space onboard to private individuals often led to numerous problems and hardships. The food, the living, diseases, medical treatment, the slaves onboard and religious ceremonies are the issues that are examined here.

The Second Part on Shipbuilding comprises of another 3 Chapters :

Chapter 4 entitled Shipbuilding In Goa 1510 - 1780 explores various issues relating to Portuguese shipbuilding in Goa. The Royal authorities emphasised the need to build at least one ship every year in India for Carreira da India. Supply of timber and other shipbuilding material, selection and cutting system of wood, type of wood used for different parts of the ship, system of joining the wood, causes for the decay of the wood and the wood preservation techniques are the issues highlighted in this Chapter. The ships returning with cargo from Goa had to be properly cleaned. The caulking and the careening system also form important aspect of shipbuilding.

Chapter 5 entitled Dimensions of the Portuguese Ships, examines the tonnage of different types of the Portuguese ships. The Portuguese ships underwent structural changes in the course of time with the addition of the decks. The rigging of the ships depend upon the general tonnage of the vessel. The dimensions of

the vital components of the ships such as yards, mast, keel, stem, stern etc. have been discussed in this chapter.

Chapter 6 entitled Naval Dockyard of Goa probes into the administrative and technical aspects of this establishment. When Albuquerque conquered Goa he was astonished to see a well established Naval dockyard at Old Goa. Series of measures were introduced revamping its working, both technical and administrative. The dockyard became a vital unit of the Portuguese Eastern Navy. The system of ships anchoring, labour, and their operations have been dealt under the above heading.

The concluding remarks sum up the issues discussed in the Chapters earlier. The Portuguese eastern naval enterprise depended upon the indigenous manpower and material. The colossal loss which the Portuguese suffered was on account of the defects in the organisation of the eastern voyages.

The study ends with a Glossary of technical words, 7 Appendices containing selected original documents and their translations and detailed Bibliography.

REFERENCES

1. Goes, D. de Chronico de El-Rei D. Manuel
Vol.I, Biblioteca Classicos Portuguesa,
Lisbon, 1909, p.45.
2. Martins Oliveira Portuguese nos Mares,
de Vol.I, Lisbon, 1902, p.120.
3. Mathew, K.M. The History of the Portuguese Navigation
In India 1498-1600,
Mittal Publishers, New Delhi 1988, p.8.
4. Pires D. History of the Portuguese Discoveries,
Centenary Publication, Lisbon, 1968. p.18.
5. Major R.H. The Life of Prince Henry of Portugal,
Frank Cass Ltd., London, 1967, p.110.
6. Pires, Op.Cit., p.37.
7. Morse Rulers of India,
Clarendon Press, Oxford, 1892, p.22.
8. Pires, Op.Cit., p.30.
9. Boxer, C.R. The Portuguese Sea-borne Empire 1415 -
1825,
Hutchinson, London 1969, p.32.
10. Ibid., p.35.

11. Mathew, Op.Cit., p.117.
12. Pires, Op.Cit., p.35.
13. Shastry, B.S. Studies In Indo-Portuguese History,
IBH Prakashana, Bangalore, 1981, p.48.
14. Ibid., p.50.
15. Villiers J. & Albuquerque: Caesar of the East,
Earle,T.E.(Trans.), Aris & Phillips Ltd., England, 1990, p.16.
16. Shastry, Op.Cit., p.127.
17. Villiers J. & Earle, T.E. Op.Cit., p.16.
18. Shastry, Op.Cit., p 52.
19. Rego S.A. da Portuguese Colonization In the Sixteenth
Century.
A study of the royal ordinances,
Witwaterss and University Press,
Johannesburg, 1959, p.54.
20. Oliveira, J.B.de Os Navios de Vasco da Gama,
Lisbon, 1892.
21. Fonseca, Q., A Caravela Portuguesa,
Coimbra, 1934.
22. Mendonça, H.L. de Estudos sobre Navios Portugese no Séculos
XV e XVI,
Ministerio da Marinha, Lisbon, 1971.

23. Barata, J.G.P. Estudos Arqueologia Naval
2 Vols., Imprensa Nacional, Lisbon, 1989.
24. Mathew, K.S. Portuguese Trade with India In the
Sixteenth Century,
Manohar Publications, New Delhi, 1985.
25. Pearson, N.M. Coastal Western India,
Concept Publishing, New Delhi, 1981.
26. Ahmed, A. Indo-Portuguese Trade In Seventeenth
Century (1600 - 1663)
Gain Publishing House, New Delhi 1991.

CHAPTER I

PORTUGUESE SHIPPING - ITS MECHANISM

The effective maritime communication was the base of safety and survival of the Portuguese eastern empire. The State was directly involved in regulating the maritime trade and obtaining cargo for the Lisbon - bound ships and other overseas establishments. The Portuguese erected a strong chain of fortresses all along the west coast of India with anchoring facilities. Fortresses were built at Bassein, Chaul, Daman, Diu, Surat and Cambay. Similarly fortresses were also erected at Mangalore, Honavar, Calicut, Quilon and Cannanore. To impose the Portuguese maritime supremacy, they adopted two systems namely Cartazas and the Cafilas in the 16th century. The Cafilas had two functions; firstly to provide protection to the merchant - ships against the attacks of pirates and secondly to make sure that all native merchantships adhered to the Portuguese maritime rules and regulations.¹ Special fleets of warships were maintained for effective working of the above system. The Portuguese organised different Armadas, from Goa. The main were the Red Sea Armada, the Gulf Armada, the Armada of Malacca, the Northern and the Southern Armada sailing along the Northern and Southern Coast of Western India. These armadas guarded ships trading under the Portuguese suzerainty. The Indian coast after 1533 was grouped into three Zones, namely Northern, Central and Southern Zones each under Captain Major at Bassein, Goa and Cochin.² The Portuguese Northern Fleet (Armada de Norte) cruised around

Bassein, Chaul, Surat, Daman, Diu, & Cambay, while the Southern Fleet (Armada de Sul) cruised around Kanara, Cananore, Cochin, Quilon and Cape Camerin. This chapter aims at examining the working of the Portuguese Northern and Southern Fleets along with the Portuguese naval security arrangements in Goa.

Operation Of The Fleet

The Portuguese navigation from Goa along the western coast of India can be divided into two groups; namely Northern Fleet and Southern Fleet. The Northern Fleet were sailing upto the mouth of the Red Sea and the Gulf of Cambay, defending the western coast from Ormuz to Goa.³ The Southern Fleet cruised the Malabar coast upto Cape Comorin and even upto Maldives Island.⁴ The Northern Fleet sailed from Goa between 10th and 24th of August, prolonging it throughout the year except in monsoon. The return voyage was made from 8th to 15th of January, till the end of February.⁵ The sailing of the Southern Fleet was from 1st to 15th of August, continuing it throughout the year, except during monsoon, which generally lasted from 1st of May till 10th of August. The back sailing to Goa was throughout the year, except in monsoon, but the best time to reach was between November to January.⁶

The sailing instructions for these Armadas were clear and elaborative. The Regimento given to Henry Mendonca Furtado, Captain - Major of the Northern Fleet, in 1707 stated that, leaving the bar of Goa, he would sail to Chaul along with other ships. From Chaul he would proceed to Bassein where he would unload the supplies meant for that fortress and then would sail to

Daman.⁷ From the port of Daman the ships would sail to Surat carrying the merchandise meant for that port.⁸ Without much delay these ships would sail to the port of Diu.⁹ Trips to Diu were undertaken mainly to supply provisions to the fort garrison. About 300 ships in two convoys sailed every summer from Goa.¹⁰ From Diu the ships would again sail to Surat to obtain the cargo which was kept ready at the fortress and from there the ships would sail to Goa with cargo for Lisbon - bound ships.¹¹ The Cafilas sailing with cargo for home - bound ships were to be provided with security by the ships sent out from Goa. Fleets were sent out at different stages on different missions. In the month of January, a fleet was sent out with the prime responsibility of checking the activities of the Malabar Paraos. The same fleet was entrusted with the task of maintaining a vigil and checking all the ships sailing to Mecca without Cartaza. On their return journey to Goa, they would join other ships, sailing from China, Malacca, Molucco, Coromandel and St. Tome in the month of April.¹² From the coast of Kanara, the ships had to sail with the Cafilas carrying food supplies to the city of Goa. A convoy of 4 ships sailed every summer to Kanara, accompanied by the fleet patrolling these areas to bring rice and pepper. "The Parangues would bring timber for mast and other material for shipbuilding to the Royal dockyard in Goa".¹³ The Malabar Fleets were always kept ready for any action between the coast of Kanara till Cape Camorim. Each convoy initially comprised of 30 to 40 boats, but the number came down to 12 in 1635.¹⁴ The ships of the Southern Fleet would leave the bar of Goa and sail to the fortress of

Piro, for unloading the material if any. From this point they would sail to Mangalore. From Mangalore, the ships would sail to Calicut where they would collect timber and other material for the dockyard. From Calicut sailing in Conserva the ships would navigate to Mahe, Tellicherry and Cannanor. The ships would leave the port of Cannanor without any delay to Goa.¹⁵

The pattern of the Cafilas sailing under the Southern Fleet was that, 'the Portuguese fleet gathered some crafts around the Cape Camorin and sailed to Quilon where other ships from Quilon and also Coromandel joined. All these were taken to Cochin. Then the protection fleet returned to Cape Camorin to collect stragglers and they all sailed to Goa, collecting more ships from Mangalore, Barcelore and Onor (Honavar) on the way.'¹⁶ While on the return voyage, the ships were instructed to make a halt at Angediva, if at all required. From Angediva the ships would come to Cabo de Ram where unloading of the material meant for that fortress was made. From Cabo de Ram the ships would sail at the earliest and in the proximity of Assolna to the bar of Aguada.¹⁷

Crew Of The Fleet

The crew of the commanding vessels such as Fragatas & Manchuas comprised of the Captain, Masters, Under Master, Store-Keeper, Chaplain, Carpenters, Caulkers etc.¹⁸ The Captain - Majors in the command of the Armadas were directly under the orders of the Governor or Viceroy of Goa. The Captain Majors were appointed by the Governor and his Council. The Council also fix the number of vessels in each fleet.¹⁹ The Sarangues and the Tandels of the small

country crafts were the locals. The Portuguese also employed lascarins soldiers, in the Cafilas. They also engaged the services of Mocadam, a native contractor for procuring local recruits, who were mostly oars-men.²⁰

Operational Instructions To Captain - Majors

Before leaving the bar, the Captain - Major of the fleet had to prepare an upto date list of the soldiers on board and divide them as he feels proper for the purpose of defense.²¹ The allotment of work for both, infantry and artillery personel on board had to be made in the presence of their respective Incharge.²² The Captain - Majors had to prepare two reports stating the positions alloted to the people on board. One copy had to be handed over to the authorities on the shore and another had to be maintained on the ship. All technical data such as the hours of tide, soundings, location of shoals etc. obtained during the voyage had to be maintained and submitted to the authorities by the Pilot of the ship on return voyage.²³ If Captain used any material from the store of the ship for his personel use, the same had to be recorded in the official register and all similar expenses had to be mentioned in the Matricula Geral. At the time of making the payment of the wages, a deduction was to be made according to the rules.²⁴ In case of Captains death during the voyage, the Master of the ship was required to get himself acquainted with the work of the Captain. Care had to be taken to maintain secrecy over the same and on reaching the port, replacement had to be made immediately.²⁵

Quarrels among the soldiers were common over the issue of their respective places on board. To avoid this, the Captains were instructed not to allow any soldier to leave his place or sleep anywhere he may please, even if the ship was anchored and free from any equipping operations. The soldiers were prohibited from leaving the ship during the night time at any port.²⁶ The Captain was also instructed not to allow his sub-ordinate officers to select rooms for them during the voyage. The night duty was given to the people by putting lots and the Captain tenents would decide the work duration of each person.²⁷ No unauthorised intervention in the ship's administration was allowed. If any change in the operation was to be introduced at any level, prior permission of the Viceroy was essential. The Captain, Clerk or any other officer of the ship would not leave his ship without prior permission of the authorities, unless called for checking by custom officials in any exceptional case.²⁸ Disciplinary action was to be taken against those who violate the code of behavior. Any rebellion on board was severely punished. Illicit conversations, unauthorised means of amusement etc. were punished with the fine ranging upto 200 Cruzados.²⁹ Illegal arms transactions were common when the ships of the fleet were at the port. To put an end to this, an order was issued by which nobody was allowed to take the arms from the ship. At the same time all required arms and ammunitions were to be obtained from the state Almazens.³⁰

The Captain - Majors of the fleet were instructed not to waste the gun-powder in unnecessary firing. They were also instructed to regulate the firing of the shots (salvas) while

entering and leaving the port. This regulation was necessary in order to maintain sufficient quantity of gun-powder on board to face the enemy attack.³¹ No soldier or any other crew member was allowed to disembark at any port of Kanara. If there was any need to do so, for obtaining fresh provisions to the fleet, only a person of high integrity had to be entrusted with this job. The Captain was also prohibited from passing any unauthorised sailing permit to any ship.³² The fleet sent on naval expedition had to furnish a detailed report of the naval exercise carried out to the authorities on the return voyage. The Captain - Major of the Southern Fleet, sailing in the *Fragata Nossa Senhora de Milagres* was asked to give report of the material used in the naval expedition which was sent to Cananore.³³

Specific instructions were given to the Feitor to procure the supply of pepper in time so as to effect a prompt departure of Lisbon - bound ships. The pepper was brought to Goa in convoys sailing under the protection of the warships. At the time of the loading of cargo the conditions of the ship were thoroughly checked by the technical experts in the presence of the officials of the Revenue Council. In one case on December 25, 1617, the Overseer of the Revenue Council summoned the master of the ship *Nossa Senhora do Cabo*, quarter-mestre and clerk along with the Chief Master Valetim Themudo to verify if the holds of the ship were capable and strong enough to receive the pepper.³⁴ Similarly if any ship was in bad shape, the Revenue Council inspected the same before undertaking any loading operation and confirmed the same under the oath. In the case of the ship *Nossa Senhora dos*

Remedios, the Revenue Council declared under the oath that the said ship had undergone complete repairs and was in a position to make a voyage.³⁵

As soon as the fleet reached the port of Kanara, the ships were ordered to take the cargo of rice meant for them. At the time of loading, a register was maintained by the Captain in which the quality and quantity of the cargo was recorded with all specific details. The private cargo of the sailors were also recorded in the register.³⁶ At the time of loading the Captain-Majors of the fleet were instructed not to allow the loading of the cargo on any other ship without first loading the ship of the convoys.³⁷ Under no circumstances the ship could wait at any port for not more than four or five days for the purpose of loading. In the Regimento given to the Captain-Major Augustin Barros of the southern fleet, he was instructed to undertake the loading of rice at Kanara as quickly as possible.³⁸ The contractors were asked to bring the pepper to the ships which were about to leave Goa, till 20th of November every year. They had to store or supply at least half of the agreed quantity by the end of September to the factories at Cochin or Kanara and the remaining half at the end of October.³⁹ To avoid loss to the Treasury, the Captains of the ship were not allowed to leave the port of Kanara without proper loading. If sufficient quantity of pepper was not found, then the Feitor had to make an arrangement for procuring the lacking amount.⁴⁰ On completion of the loading operation, the Feitor had to give to the Master of the ship the keys of camara, camorotes and escotilhes along with the register (Livro de Cargo) which he

would maintain with utmost care and hand over to the Finance Comptroller at the time of the unloading the cargo.⁴¹ All unauthorised loading or embarkation was prohibited. If any permission was granted, it had to be recorded and maintained in the official register.⁴² The Captains, Master and other officials of the ship were not allowed to load wheat, rice or any other heavy cargo, which might hamper the movement and the defense of the ship as well as of the convoy.⁴³

Many irregularities and other malpractices continued at the time of loading the cargo at Cochin and Kanara. Many times private cargo was not registered to evade custom duties. To ensure better revenue collection it was laid down that all people who sail in the ships from Cochin had to register the cargo with the Clerk of the Fazenda. If any unregistered cargo was found, it was liable for confiscation.⁴⁴ On 28th of March, 1618, the king wrote to the Viceroy suggesting that, at the time of loading of the ships, 2 people of high integrity should help in the loading operation and should embark on the same ship. These people were given a special Regimento as regards to the loading operations.⁴⁵ Whatever amount of cargo a person takes from Cochin, the record had to be maintained by the Clerk of the Fazenda. This was necessary because the Finance Comptroller would ask for the cargo records every three years so as to ascertain the amount of cargo sailed to Goa.⁴⁶ All records of the cargo had to be sent to Goa in the first ship sailing from the fortress of Cochin to the city of Goa.⁴⁷ The records had to be delivered to the Board of Despatch of the Finance Comptroller, along with the certificate of

the Ovidor of the fortress certifying that the records had been handed over to the Feitor, stating the name of the person, name of the ship etc. On reaching Goa, the person had to handover the records along with the certificate of the Board of Despatch of the Finance Comptroller to Goa authorities. The Clerk of the Fazenda at Goa, had to issue an acknowledgement receipt of the records received stating in it, the day, the month and the year.⁴⁸

Safety Measures For The Ships

The safety of the ship was given top priority during the voyage. Standing Orders were given to the Captain-Majors of the Northern and Southern Fleets to ensure the safety not only of the convoys but also of the ships of the fleet as well.

The Portuguese ships sailing from Goa to Cochin had to be adequately equipped to counter the Dutch attacks and to check the piracy. An order was given to Francisco da Costa de Ataide, Commander of the Fragata, stating that, the Nau Conceição sailing from Cochin be provided with heavy guns. The same Commander was further instructed to take people from other Fragatas to strengthen the garrison of the Nau Conceição.⁴⁹ The Captains of the ship at the 'bar' had to take all measures to ensure the safety of the anchored vessels.

A security ring was to be provided for the ships at Goa and Cochin during the loading operations. A naval garrison comprising of 26 soldiers with the prime responsibility of replusing the

enemy attack was to be stationed at a distance of 2 or 3 miles.⁵⁰ For effective fire power, the decks of the warship had to be free from any obstruction for smooth mobilization of the artillery. The guns had to be properly arranged on the racks. In case the ship reached late on the coast of India, the Captains were instructed to take the ship to Cochin, and from there they were to sail to Goa, only after verifying the position of the Dutch ships. The Captains had to obey all the orders of the Governor in this regard.⁵¹ During the night, the main ship had to carry one lantern on the gavea. If other ships following the mainship were separated or mistracked during night, they had to follow the lantern fixed on the gavea of the mainship.⁵² The mainship had to sail in the midway along with other ships. Under no circumstances, the ships were to sail at the back of the main ship. In an order issued in 1704 the Viceroy stated that, the ships accompanying the mainship had to sail by its side, without keeping much distance.⁵³

No soldiers on board the mainship were allowed to sleep undressed, as they had to be prepared to face any attack at any moment during the voyage.⁵⁴ The Captain and the crew of the ship were to be people of good technical knowledge and experience. In 1668, the Viceroy wrote to the Captain - Major of the Northern Fleet stating that, only those people who had sufficient knowledge and who could take effective and independent decisions on their own during any emergency should be taken on board.⁵⁵ The Pilot was asked to avoid the bays and shoals and to follow correct route - instructions given to him by the authorities at Goa.⁵⁶ The ships wanting to sail to Goa either from Kanara or Cochin had to keep

their sails ready early morning before the fall of the dew. The Captains were instructed to reach the Mormugao port probably by evening during day light, so that they could take the advantage of the artillery installed in that fortress for defense in case of any attack.⁵⁷ An alert was sounded to the ships sailing to Bassein and Chaul in 1618 and were asked to avoid an open confrontation with the Dutch. In an order given to Manuel Fernandes, who was sailing from Goa to Chaul and Bassein, he was instructed to take the port of Rajapur, in case if he noticed any hostile ship on the way.⁵⁸

Controlled Navigation

The Cartaz or sailing permit was the main weapon of the Portuguese controlling the maritime trade. Ships sailing without Cartaz were liable to be confiscated. Every non-Portuguese ship had to obtain a Cartaz from the nearest Portuguese port. Goa was the main Cartaz - issuing centre. The ships sailing overseas had to obtain their Cartaz directly from Goa while those sailing along the west could obtain from the nearest Portuguese outpost. All Indian ships trading out of the Gulf and Cambay in Gujarat were required to call at the Portuguese fort at Diu to obtain Cartaz.⁵⁹ The Cartaz stated the number of the crew, tonnage of the vessel, artillery, cargo on board, the point of destination and so on. A security had to be executed at the port where the Cartazas were issued as a guarantee that, the ships would make a halt on return voyage at the port and pay the stipulated custom duties.⁶⁰ Before any ship could sail out it had to be searched by

the Royal Factor to see that, it fulfills all the conditions. On 28th of Jan. 1709, the Minister of the king of Sunda, Ramchandra Pandit requested the Portuguese to issue a Cartaz to his barco of the capacity of 250 candis. The request was granted but subjected to many conditions.⁶¹ The ship masters were instructed not to carry on board any Abbissians, Turks and Arabs to any port. In the same manner, they were not allowed to take slaves, especially the Christian slaves and other items of trade which was declared as the monopoly of Crown. No trade connections with the enemies of the Crown were allowed.⁶²

All native ships sailing with the Portuguese Cartaz were required to produce the same before the Clerk of the Portuguese patrolling ship, whenever they were intercepted. The registration and the confirmation of the Cartaz by the inspecting Clerk was ordered only after examining the same carefully.⁶³ The Cartaz had to mention specifically, the number of Muslim sailors, if they happened to be on board. In 1705, Cartaz was issued to one trading vessel which had onboard about 30 Muslim sailors. All their particulars were recorded by the authorities.⁶⁴ No private merchant was allowed to sell any type of trading vessel to Muslim merchants without the prior permission of the authorities. The Feitors at the fortresses were instructed to check this type of transactions.⁶⁵

The violation of the Portuguese maritime regulations were not uncommon among the Asian ships under the disguise of European vessels. The Asians ships Captained by European national, flying

the European flag were sailing in the Portuguese waters. It was therefore suggested by the authorities, that the Portuguese patrol ship should intercept any such suspicious vessel and check the script in which the cargo register was maintained. If the ship was found violating the Portuguese maritime regulations, action had to be taken against the defaulting ship.⁶⁶ This system was very effective in imposing the Portuguese maritime regulations upon the native rulers.

Forts In Goa

Soon after the takeover of Goa, Alfonso de Albuquerque embarked upon the task of fortifying the defense of Goa. The main purpose of fortification was to secure safety of the river passes. With this sole objective, the Portuguese erected number of forts, which were equipped with adequate artillery and manpower. All the naval installations in the river of Goa offered excellent anchoring facilities for the ships. In case of any attack the ships could take shelter behind the artillery fire of these fortresses. The main Portuguese naval installations in Goa included the fortress of Aguada, Fortress of Cabo, Gaspar Dias, Reis Magos and the Fortress of Mormugao.

i) Aguada Fortress

The prime motive behind the erection of this fortress was to check the danger of the Dutch and the English who made attempts to take over Goa. This fortress was provided with powerful artillery providing protective cover and checking the entry of the ships in

the bar of Goa. Though its work started in 1604, it was completed only in 1612 during the reign of Viceroy Dom Rue Lourenso de Tavora.⁶⁷ Located on a hill at the bar of Goa, it encloses the whole peninsula at the South-West extremity of the province of Bardez and forms the Northern extremity of the Goa Bay.⁶⁸ It had a wall measuring 15 feet high and 4 feet broad with a circuit of 48 fathom on which there was a tower, 6 fathoms high, on th top of which is a light house.⁶⁹ There were fountains and wells within the enclosure which provided water for the ships. During the Viceroyalty of D. Francisco da Gama, a new fountain was ordered to be made for the purpose of providing water to the ships.⁷⁰ In 1642 the garrison of this fortress was Captained by Luis Gonsal de Souza which included 18 artillery pieces, 80 soldiers and 3 naiques for guarding the fort.⁷¹ In 1661, the naval garrison of this fortress was of about 100 soldiers.⁷² In 1774, the garrison was restructured and it now comprised of 1 Captain and besides his soldiers, 8 people were employed for special service of the Captain. Provision was also made for 1 Sergeant - Major, 1 Ajudante, 2 Chaplains of Franciscan Order, 2 Condastavel, 1 Ware - housekeeper, 1 clerk and 30 artillerymen.⁷³ This fortress had 2 gun powder rooms, 2 prisons, 4 barracks and a chapel dedicated to Our Lady Of Good Voyage.⁷⁴

ii) Fortress Of Cabo

This fortress was built during the reign of the Viceroy Dom Estevam de Gama in 1540. In 1635, the Viceroy Count of Linhares made some structural alterations. By virtue of the Royal Decree of

the Lisbon Government it was enlarged and a well equipped artillery detachment was installed in it.⁷⁵

iii) Gaspar Dias Fortress

The Gaspar Dias fortress was located on the Island of Goa on the left bank of the Mandovi, $1\frac{1}{2}$ miles to the North-East of the Cabo and faces the fortress of the Reis Magos. Although the construction work started in 1598 during the Vice - royalty of Francisco da Gama, it was not completed even after 8 years.⁷⁶ A number of artillery pieces of different calibre were installed for the purpose of the naval security. The authorities ordered to make 7 large artillery guns, 2 of equal weight of 115 quintals of each, 3 culeibrinos weighing about 159 quintals and 1 camello de marca of 38 quintals.⁷⁷

Reis Magos Fort

This fortress was built by Viceroy D. Afonso de Noronha in 1551 and was subsequently extended during the reign of D. Francisco de Gama. In 1588-89 the Governor-General Manuel de Souza Coutinho added to the fortification 7 casemates or underground vaulted chamber, each provided with 124 steps in the interior of the parapet.⁷⁸ In 1661, the naval garrison of this fortress consisted of 30 soldiers.⁷⁹

V) Fortress Of Mormugao

The fortress of Mormugao was located to the South of Goa in a peninsula at the extreme north-western point of Salcete. The

significance of this fortress lies in the fact that, it affords protection to the entrance of the port and therefore, from a military point of view, this was one of the most important fortresses on the western coast of India.⁸⁰ The main motive behind building this fortress was to guard the river traffic and the ships which sought shelter inside Zuari during the monsoon. In 1625, all ships near the Island of Goa were ordered to be anchored at Mormugao during the monsoon.⁸¹ In 1650, the Revenue Council decided to equip the fortress with sufficient artillery power. It was ordered that 1 bronze piece of 8 pounds, 6 iron pieces of 10 pounds of Galleon San Thome be provided at the cost of the State Treasury.⁸² In 1661, the naval garrison of this fortress was 140 soldiers.⁸³ In 1774, the garrison included 1 Captain-Major, 1 Sergeant, 1 Ajundante, 2 Condestavels, 1 Warehouse keeper, and 1 Clerk of the same. Apart from this there were 4 Squadrons Commanders, 66 soldiers and 30 artillerymen. The Captain-Major had 10 Naiques. This fortress being important and only next to Aguada, was provided with well equipped regiment.⁸⁴

vi) Cabo De Ram Fortress

It was originally built by the king of Sunda. The Viceroy Conde de Ega conquered this fortress and equipped it with 25 bocas de fogo.⁸⁵ Within the walls of this fortress are said to be two springs of fresh water. "The Parangues sailing from Kanara sometimes used to make a halt at this point".⁸⁶ In 1774, its garrison included 1 Sergeant - Major of infantry, 1 Ajundante, 1 Warehouse keeper, 1 Clerk, 1 Condestavel, 1 Captain and 2

companies of sepoy who kept strict vigil over the area.⁸⁷

Apart from this, there were numerous other forts erected by the Portuguese at different points to guard the passes. In 1779, the province of Bardez had around 15 forts.⁸⁸ But more emphasis was laid upon the fortification of Aguada and Mormugao forts, for they were the guarding keys of the Portuguese naval defense in Goa.

Naval establishment In Goa

As early as 1512, there were about 50 ships in India and in 1520, the total was 800. In 1525, there were number of ships in Portuguese India for various purpose. This included 6 Naus, 11 Galleons, 9 latten ship, and the Barges. In 1567, the number rose to over 90.⁸⁹ During the later part of the 16th and 17th centuries, the strength of the Portuguese naval fleet was very less. This was mainly on account of technical and financial difficulties. Two squadrons approximately of 30 ships were protecting the maritime trade, one to the north and other to the south of Goa.⁹⁰ Moreover, ships from Goa were sent to Macau, Mombasa, Timor and to other places on naval expedition. The Dutch began their blockade of Goa from 1640, with the paramount objective of putting down the Portuguese coastal trade. The Mormugao Port became their prime target of attack as they felt that with the fall of the Mormugao, the major Portuguese interport would be closed. The Portuguese therefore increased the number of ships at Mormugao. In 1642 Furtuoza Barboza Jordao, Admiral of the Royal fleet reached the Mormugao Port with 2 ships,

namely a Nau Nossa Senhora de Estrella and the Galleon St. Antonio with 180 people, for reenforcing the Portuguese naval garrison against the Dutch.⁹¹ In September, 1675, a fleet comprising of another 16 ships of which 7 were Galleons, 2 Naus, 1 Patacho and 60 Oar ships equipped with 307 artillery pieces under the command of Luis de Mendonca Furtado, e Albuquerque was raised.⁹² This fleet succeeded in pushing back the Dutch fleet. In 1773, Captain - Major Francis Xavier Henrique was instructed to guard the coast in view of the attacks launched by the Bhonseles on the Portuguese ships. He was also instructed to gear up the naval defense at Aguada.⁹³ In December, 1738, the Count of Sandomil reported to his superiors, that the whole navy in Goa, including officers, sailors and attendants numbered about 120 only, a figure equivalent to the crew of the ship.⁹⁴

The authorities at Lisbon, felt a need for maintaining a permanent naval fleet at Goa, equipped with artillery of various calibre. By a decree of 1774, issued by Marques de Pombal, the naval strength was restored to (a) effective figure.⁹⁵ It now consisted of 1 warship of 64 pieces, 3 Fragatas, 1 of 44 pieces, second of 38 and the third of 30 pieces. Provision was also made for 1 Palla of 24 pieces, 2 covertas of 14 pieces and 16 Manchuas of 5 to 7 pieces. There were another 5 ships meant for river navigation. A separate budget was made by the Revenue Council for maintaining this fleet.

The new decree stated that there should be 2 Fragatas of 1 battery with 26 pieces of 9 pounds calibre, 10 on each side, 4

cacahorres on the prow and 2 pieces on guardaleme carrying the garrison of 50 soldiers along with competent officers.⁹⁶ The fragatas meant to garde the coast were equipped with 20 artillery pieces of the same calibre and was garrisoned with 120 people. There were also 4 Pallas equipped with 18 artillerypieces, with the garrison of 180 people. Manchuas were provided with 9 artillery pieces of 1 to 3 pounds calibre. Each garrison consisted of 30 sailors.⁹⁷

Naval Man-Power In Goa

The decree of 1774 made a provision for 6 Captains of war and sea for the 6 Fragatas of the high sea, being the first two of the large capacity more distinct and graduated. The 6 Captains of war & sea were given the charge of the Fragatas to which they were nominated. When the Fragatas were wintering on land, the Captains had to request the Inspector of Navy to provide all that was required for the vessels for their prompt departure from the bar whenever ordered to do so. Each Captain had to visit the storeroom (paiol) of the ship where the sails and equipments of the respective Fragatas were stored. Every Sunday, the Captains, had to submit a detailed report of the material on board to the Inspector of the Navy.⁹⁸ The number of the Captain - Tenants was laid down as 12, 4 for the Fragatas of the high tonnage; 2 for each of them; 4 to other Fragatas of the less tonnage and 4 to the Pallas.⁹⁹ There were about 14 tenants of sea, 2 for the Fragatas of less tonnage and 4 for the Pallas. Provision

was made for 14 guardas (guards) who had undergone a training in Aula da Nautica. For each of the above mentioned 6 Fragatas and 4 Pallas there was 1 Sergeant of sea and war. There was 1 Pilot, 1 Master, 1 Assistant Master, 1 Guard in the first 2 Fragatas and in other 1 Master and Assistant Master only. The overall authority was entrusted to the Governor and the Captain - General.¹⁰⁰

Naval Patrolling In Goa

As pressure of the Dutch increased over Goa endangering its safety, the Portuguese beefed up the naval security at Aguada and Mormugao. The bars of Aguada and Mormugao were put under strict surveillance by the Portuguese authorities. In 1659 26 ships were deployed to guard the bar of Aguada.¹⁰¹ The Ajundante, Ambrozio Fernandes was instructed to patrol the sea from the bar of Aguada to Mormugao with a Manchua of war, equipped with gun-powder etc, to prevent any incursion of any hostile vessel.¹⁰² If any ship was found entering the bar with superior artillery by overcoming the resistance of the patrolling ship, the Captain of the patrol vessel was instructed to fire 2 signal shots (pedrieros), for alerting the garrison inside the fortress of Mormugão and Aguada.¹⁰³ The Commanders of both the fortresses were instructed not to sleep at night nor they could leave the fortress. They had to give a detailed report to the Governor about the functioning of the fortress and the security arrangements made there of.¹⁰⁴ Prompt and effective mobilization of the manpower was emphasised by the authorities. The Commanders

of the fortress of Cabo and the Gaspar Dias were asked to employ the people from the neighbouring villages after proper screening to maintain a watch on the sea during the night time. The Manchaus which were free from convoys had to patrol the river throughout the night between Aguada and Mormugao to check for any foreign vessel near the bar.¹⁰⁵ Similarly 4 Manchaus were deployed at Dona Paula and no other ship was allowed to sail beyond the marked area without the permission of the authorities.¹⁰⁶ Manchaus were also deployed to protect the merchantships coming to Goa against the pirate attacks. These Manchaus were asked to patrol the coast from Canacona upto Tiracol. If any ship was found at the bar of Assolna, these Manchaus would escort them till the bar of Canacona and on their return would bring the hardware material from the fortress of Cabo de Ram. The Manchaus would then sail with the material to Aguada and deliver the same to the authorities which would then be passed to the dockyard at Old Goa.¹⁰⁷

Regulation On Entry Of The Ships Into The Bar

When ships were entering the 'bar' with the Portuguese flag, the Commander of the Aguada fortress had to give 5 gun salutes to the incoming vessels, while in the case of Viceroy's ship 21 gun salutes were to be fired. If any other European ship such as Pallas happened to be in the vicinity at that moment, they were also required to give gun salutes to the Viceroy's ship.¹⁰⁸ On other occasions, all European and Arab ships had to send their respective officers to the Captain of the fortress to obtain

permission for firing gun salutes. No anchoring was allowed for any ship violating this order.¹⁰⁹ Another important rule for the ship entering the bar was that they were not supposed to sail in groups. If the Captain of the fortress noticed any ship sailing towards the bar in a group, he would order to fire from the fortress two warning gun shots.¹¹⁰ The Captain of the ship had to communicate immediately to the Commander of the fortress the purpose of their voyage. If he failed to do so, the Captain of the Aguada fortress would call the people from the villages of Calangute Candolim and in the case of Mormugao from Vaddem and Sancoale for launching the attack.¹¹¹ If any Fragata, Palla, or any other ship entered the bar during night they were required to lay anchor at a distance and would be allowed to anchor at the quay only after obtaining permission from the authorities.¹¹²

The ships sailing to Old Goa had to cross the Aguada bar and obtain a sailing pass at Mandovi for entering the dockyard area at Old Goa.¹¹³ If any sailor or slave escaped from the ship while entering into the bar he had to be promptly arrested and handed over to the competent authorities. The Captain of Aguada would not allow any ship either of the Northern or Southern Fleet to enter the bar with any smuggled goods. Check was carried out of suspected ships and if anything found, it had to be delivered immediately to the said fortress. If any ship was found sailing with soldiers, slaves or any other person with or even without criminal record, the Captain of the fortress was instructed to send one of his officers to collect all necessary information. In

case, if any information was suppressed, then the ship was denied entry to the port.¹¹⁴

If any European or Asian ship on reaching the bar ran short of supplies, the Captain of (dificient) ship had to approach the Captain of the fortress for obtaining necessary information regarding the availability of supplies.¹¹⁵ As Portuguese got their supplies, both of food and cargo from the Malabar coast, they sought to maintain this venerable supply line intact by all means. Similarly it was their endeavour to keep Goa as a main naval base specially during 17th and 18th centuries. In view of this, the Pombalian administration introduced the above measures, restructuring the naval system, both in terms of material and man power.

REFERENCES

1. Pearson, M.N. The New Cambridge History of India,
Orient Longman, New Delhi, 1990, p.39.
2. Mathew, K.M. The History of the Portuguese Navigation
in India 1498 - 1600.
Mittal Publications, New Delhi, 1988, p.193.
3. Souza, A.B. Subsidios Para Historia De Militar
Maritime da India
(1585-1669) (SPHMN), Vol.I, Imprensa da
Armada, Lisbon, 1930.
4. Mathew, Op.Cit., p.139.
5. SPHMN, Op.Cit., p.73.
6. Ibid., p.74.
7. Regimento e Instruções (RI), Historical archives of Goa (HAG)
Mss.no. 1423, fl.3.
8. RI, HAG, Mss.no.1423. fl.83.
9. RI, HAG, Mss.no.1432. fl.23.
10. Souza, T.R. de. Goa-based Portuguese Sea-borne Trade In
The Early Seventeenth Century (SGPST),
Vikas Publishing House Pvt. Ltd., New
Delhi, 1976. p.38.

11. RI, HAG, Mss.no. 1434, fl.23v.
12. SPHMN, Op.Cit., p.70.
13. SGPST, Op.Cit., p.38.
14. Ibid., p.37.
15. RI., HAG, Mss.no. 1434; fl.32.
16. Pearson M.N. *f* Cafilas And Cartaza, Paper Read at Indian History Congress 30th Session, Bhagalpur, 1968, p.205.
17. RI, HAG, Mss.no. 1436, fl.3.
18. Mathew, Op.Cit., p.236.
19. Ibid., p.140.
20. Ibid., p.145.
21. Patentes & Alvaras, HAG Mss.no. 472, fl.222.
22. RI, HAG, Mss.no. 1439, fl.68.
23. Ibid., fl.11.
24. RI, HAG, Mss.no. 1434, fl.26v.
25. RI, HAG, Mss.no. 1423, fl.2.
26. RI, HAG, Mss.no. 1439, fl.69.
27. Ibid., fl.70.

28. Alvaras & Cartaz Regias (ACR) HAG., Mss.no.477 fl.156V.
29. RI, HAG, Mss.no. 1426, fl.54.
30. Cartas, Patentes & Alvaras (CAP), HAG., Mss.L 177, fl.156V.
31. RI, HAG, Mss.no. 1426, fl.117.
32. Ibid., fl.43.
33. RI, HAG, Mss.no. 1439, fl.69V.
34. Gune, V.T. Assentos de Conselho da Fazenda
Vol.I, Port.I Government Printing Press,
Panaji, 1979, p.76.
35. Ibid., p.28.
36. RI, HAG, Mss.no. 1428, fl.15V.
37. Ibid., fl.52.
38. Ibid., fl.52V.
39. Rego, S.A. de Documentação Ultramarinas Portuguesa,
Vol.III, Centro de Estudos Historicos
Ultramarinos, Lisbon, 1962, p.365.
40. Ibid., p.366.
41. Carregaçãõ, HAG., Mss.no. 2556, fl.4-5.
42. Registo de Alvaras e Regias, HAG., MSS.NO. 2556, FL.169V.
43. RI, HAG, Mss.no. 1426, fl.45.

44. ACR, HAG., Mss.no. 2358, fl.63.
45. Bulhão Pato R.A. Documentos Remittidos da India ou Livro
de (ed) das Monções,
Vol.I, Archivo Nacional da Torre de Tombo,
Lisbon 1880 - 1935, p.81.
46. RI, HAG, Mss.no. 1418, fl.89V.
47. Ibid., fl.93.
48. RI, HAG, Mss.no. 1439, fl.72.
49. Provisões Dos V. HAG, Mss.no. 1184, fl.4.
50. RI, HAG, Mss.no. 1423, fl.2.
51. Iria A. Da Navegaçãõ Portuguesa No India No Século
XVII,
Lisbon, 1963.
52. RI, HAG, Mss.no. 1423, fl.52.
53. Ibid., fl.2V.
54. RI, HAG, Mss.no. 1422, fl.55.
55. RI, HAG, Mss.no. 1421, fl.25.
56. RI, HAG, Mss.no. 1439, fl.69.
57. RI, HAG, Mss.no. 1430, fl.106.
58. RI, HAG, Mss.no. 1423, fl.69.

59. Pearson, M.N. Coastal Western India,
Concept Publishing House, New Delhi, 1981,
p.22.
60. Mathew, Op.Cit., p.61.
61. Cartaza, HAG., Mss.no. 1363, fl.34.
62. Ibid., fl.45V.
63. RI, HAG, Mss.no. 1432, fl.47.
64. Cartaza, HAG., Mss.no. 1364, fl.34.
65. CPA, HAG., Mss.no. 478, fl.87.
66. RI, HAG, Mss.no. 478, fl.87.
67. Menezes, A Goa-A Brief Historical Sketch
AMA Publications, Panaji, 1953,p.45.
68. Fonseca, J.N. An Historical And Archaeological sketch of
the City of Goa,
Asian Educational Services, New Delhi,
1986, p.41.
69. Mathew, Op.Cit., p.41.
70. Fonseca, Op.Cit., p.41.
71. Alvaras & Provisões, HAG., Mss.no. 7846, fl.110.

72. Esparteiro, A.M. Tres Séculos No Mar.
Vol.I, Ministerio de Marinha, Lisbon,
p.127.
73. RI, HAG, Mss.no. 1438, fl.7.
74. Fonseca, Op.Cit., p.42.
75. Menezes, Op.Cit., p.43.
76. Fonseca, Op.Cit., p.46.
77. Rivara -cunha Arquivo Portugese Oriental,
Fas.I. Asian Educational Service,
New Delhi, 1992, p.64.
78. Menezes, Op.Cit., p.46.
79. Esparteiro, Vol.I, Op.Cit., p.127.
80. Fonseca, Op.Cit., p.43.
81. Esparteiro, Op.Cit., p.124.
82. Assentos Conselho de Fazenda, Goa Historical Archives,
Mss.no.1656, fl.123.
83. Esparteiro, Op.Cit., p.127.
84. RI, HAG, Mss.no. 1438, fl.18.
85. Telles, R.H. Fortalezas de Goa & Suas Legendas
Typografia Rangel, Bastora.

86. RI, HAG, Mss.no. 1432, fl.23.
87. RI, HAG, Mss.no. 1438, fl.15.
88. Telles, Op.Cit., p.139.
89. Mathew, Op.Cit., p.139.
90. RI, HAG, Mss.no. 1437, fl.21V.
91. Alvares e Provisões, HAG, Mss.no. 7848, fl.109.
92. Esparteiro, Op.Cit., p.116. The fleet consisted of Galleon Santissimo Sacramento da Trindade 54 artillery pieces with 270 people, Galleon Santa Antonio da Esperanca 40 pieces with 260 people, Galleon S. Tome 30 pieces with 186 people, Galleon Santa Maria de Anjenges 30 pieces with 100 people, Galleon S. Francisco 30 pieces, Nau Bom Jesus de Vidigueira 30 pieces, Nau Bom Jesus de Carmo 30 pieces, Patacho Santa Tereza de Jesus 12 pieces, with 40 people and 6 warships.
93. RI, HAG, Mss.no. 1436, fl.83.
94. Pissurlencar, P. Assentos do Conselho Do Estado
Vol.II, Tipografia Rangel, Bastora, 1953,
p.40.

In 1681, the strength of the Portuguese navy in India consisted of 11 high seas vessels and other ships. The high sea vessels included a Galleon S. Pedro da Rebeira, Fragata N^a S^a Remedios, Fragata Sao Francisco de Borja, Fragata N^a S^a do Mercês. The other ships were Galeota N^a S^a do Pilar in Goa, 5

Galeotas of 2 decks, 2 oarships, 10 Sanguiceis, (N^a S^a =
Nossa Senhora).

95. RI, HAG., Mss.no. 1438, fl.25-25V.

96. Ibid., fl.25.

97. RI, HAG, Mss.no. 1439, fl.30V.

98. RI, HAG, Mss.no. 1438, fl.30V.

99. Ibid., fl.31.

100. Ibid., fl.31V-32.

101. Esparteiro, Op.Cit., p.101.

102. RI, HAG, Mss.no. 1428, fl.91.

103. Treslados dos Provisões, HAG., Mss.no. 1593, fl.51.

104. RI, HAG, Mss.no. 1428, fl.90.

105. Ibid., fl.90.

106. RI, HAG, Mss.no. 1429, fl.55.

107. RI, HAG, Mss. no. 1776, fl.77.

108. RI, HAG, Mss.no. 1428, fl.47.

109. Ibid., fl.47.

110. Ibid., fl.47.

111. Ibid., fl.47.

112. Ibid., fl.47.

113. Rivara Cunha, Op.Cit., p.81.

114. RI, HAG, Mss.no. 1438, fl.47.

115. RI, HAG, Mss.no. 1428, fl.26.

CHAPTER II

TYPES OF SHIPS AND THEIR ARTILLERY
AND EQUIPMENT

Ships can be grouped in two classes, namely oarships and sail ships. Initially, the only means of propulsion was by oars pulled by the rowers. By around 1000 A.D. sail began to substitute the oar as a prime means of ship propulsion.¹ The Portuguese navy represented a vast variety of ships propelled by oars and sails as well. The early Portuguese vessels were fishing boats, quite modest and deficient in nautical details, but they went on changing little by little and improved.² In the beginning of the 15th century the ships which were used by the Portuguese in great military expeditions were Naus and Gales. In the course of a century or so, other sail ships, such as Barcha, Caravela, Barinel, Urca, Taforea and Carrack also appeared. There were also oar - propelled ships such as Galiotea, Bergantine, Fusta etc.³ When the Portuguese established their power in India, the traditional Indian watercrafts mostly propelled by oars, were used as supporting vessels. These ships were used for bringing the cargo at the fortresses and also for supplying food provisions. Apart from Caravel, Nau and the Galleon there were other less known ships used for explorations like Barca, Barinel and Bergantine, coastal defense ships like Fusta, Gale, Zavra and Galizabra and commercial vessels like Urcas, Naus, Taforeas, Barineis etc. The oar - ships (Fustas and Gales) were employed many times in war against the Muslims.⁴ This Chapter aims at

examining the various types of Portuguese ocean - going ships and inshore vessels along with artillery and equipments on board. The inshore vessels were mostly propelled by oars.

Albetoca:

Albetoca was a vessel of Indian origin. The Portuguese used it for pleasure trips.⁵ It was a warship employed in naval combat by the Portuguese as well as the Muslims in the Mediterranean and in the Orient. According to Azurara , Albetoca could carry 20 passengers.⁶

Almadia

Like Albetoca, Almadia was also of Indian origin. This vessel was 80 feet long, 6 to 7 feet broad with pointed ends sailing with sails and oars at a high speed. The Portuguese made extensive use of this lightship and altered it by adding an esporão to the prow.⁷ It was propelled with oars and carried 1 sail.⁸ The Almadias were used for bringing foodstuff from Onor (Honavar) in Kanara to the city of Goa in the company of the Cafilas.⁹ They were also employed as relief vessels at the time of expedition. In 1652, 6 Almadias were sent to Kanara furnished with foodstuff, gun-powder and other ammunition.¹⁰

Balanco:

Balanco was a vessel of Asian origin used by the Portuguese, probably meant for the service of large ships of the armada. These were light vessels propelled by spade-oars. Its lightness helped

the Portuguese to chase their enemies. They were often used in naval operation at Malacca Strait specially to conquer Bantão.¹¹ The Portuguese chronicler, Diogo do Couto says that each Balanco could carry 10 or 12 people.¹²

Balandra:

This ship was used for coastal navigation. It had a deck and the large Balandras were of about 80 tons and provided with a crew of 3 or 4 sailors.¹³

Batão:

Batão was a small and light ship propelled usually by oars. Batão looked like an Almada, which had a pointed shape at the end resembling to half-moon. Its exact size and dimensions are not known, but could carry 12 gunmen besides crew. The Bataões were used in the service of Naus during the voyage.¹⁴

Barca:

Barca in all probability must be the first type of commercial or merchantship and coastal fishing vessel of highboard in the Iberian Peninsula. Quoting Azurara, Quirino Fonseca says that, the Barca rarely exceeds 30 tons of tonnage which was compatible or consistent with the voyages of discovery. The Barcas were also propelled by oar - like the caravela of less tonnage.¹⁵ It appears to be a ship of about 20 to 25 tons and of only 1 deck when built for a long voyage. This ship was operated with the hackle - oar (remo de espadela) on the track (alhetas) from one ride to

another. The mast was vertical and it was at the centre with the length equal to the keel. For a long voyage, 2 masts were installed. It carried a crew of about 8, 10, 13 or 14 and was equipped with 14 oars.¹⁶

Barinel:

The first reference to this ship can be found in 1415. After the conquest of Ceuta, the Portuguese seems to have made use of this ship which had Muslims as well as Italian influence. It was first used in the discoveries in 1434, the year in which Afonso Baldaia and Gil Eanes made the second voyage towards the south of Cabo de Bojador.¹⁷ The Barca and the Barinel were heavy, slow, broad and low in the water. They carried a large quadrangular sail hanging from a horizontal cross-tree. The sails bottom corners were tied into the gunnel edges.¹⁸

Batelão:

It was a ship made out of wood and used mainly to transport material. It had a small calado. There were different types of Batelaões the Batelão do Carvao, was meant to carry coal on board the ship while Batelão de Iragados, would carry the sand, etc.¹⁹

Bergantine:

The Portuguese Bergantine was a magnificent vessel commonly used to carry state dignatories and fidalgos. (Fig.1) An old ship with the form of Galiota but of lesser dimensions, it was provided with 8 to 10 benches for the oarsmen. Bergantine was equipped with

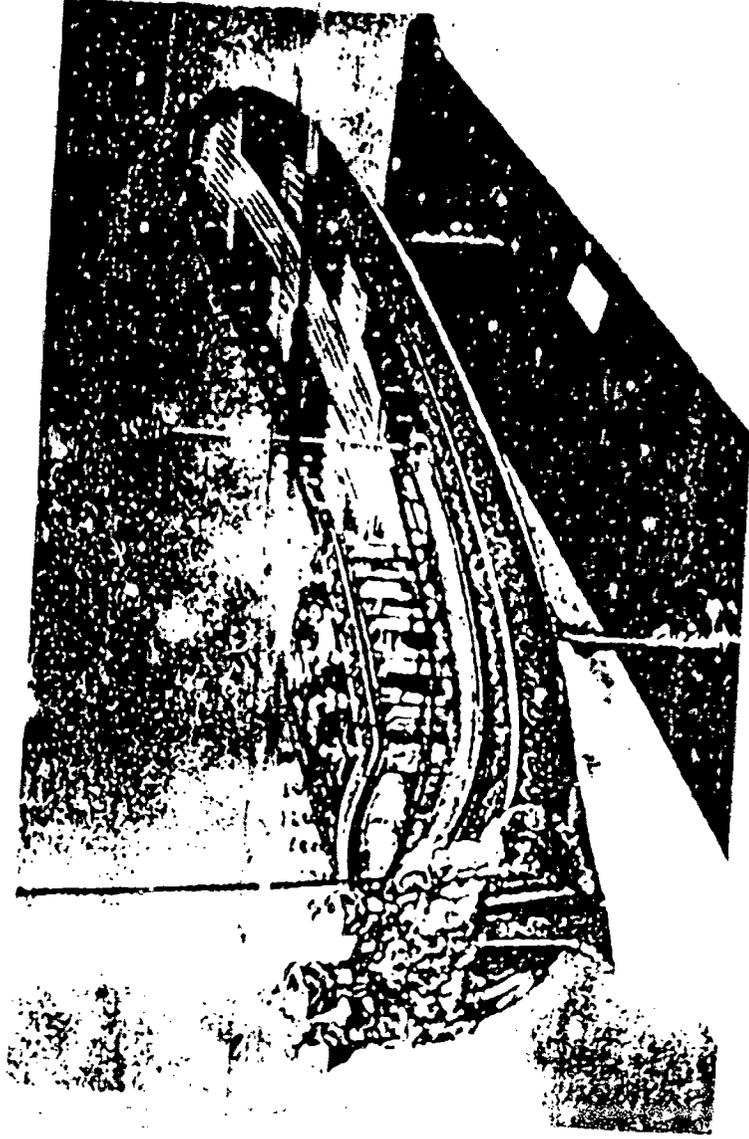


Fig. 1. Model of the Portuguese Bergantini

1 sail and was armed with 12 to 20 artillery pieces.²⁰ It was a light ship of less tonnage with 2 latten masts and 1 deck and was suitable for fighting purpose. This oar - vessel was usually used as an advice boat (aviso) of a fleet and looked like a Gale.²¹ Bergantine Real was a type of Galiota exclusively, meant for the service of king with many oars on side and had a luxurious quarter - deck on the poop. It was normally equipped with 2 latten masts and sailed with the help of 8 oars on each side. It could also navigate on the sails.²²

Bote:

It was a ship of oars much smaller than the life - boats. It was used for carrying light cargo. In India it must have been used to collect and deliver the pepper cargo at the fortresses. By name it is meant a certain type of fishing vessel whose technical features differ from port to port. Botes de Exiceirão were the powerful ships of straight prow, elliptical poop, which carried 1 mast, having 1 bastardo which could equip the oars whenever it was necessary. The botes proveiros had 6 palmos of keel and the crew of about 2 people. The botes de sesimbro were the vessels meant for high sea fishing.²³

Caravela:

The Caravela originated in Portugal and its traces can be found since 13th century. The earliest reference to Caravel as a Portuguese ship can be found in 1255 in the Foral de Vila Nova de Gaia during the reign of D. Afonso III. Similar mention to it can

be found again in 1286.²⁴ Quick in movement and of less than 200 tons, this vessel was provided with 2 or sometimes 3 masts which were exclusively latten rigged. The Portuguese Caravela had 1 casco different from the rest of the sail - ship. The relation between the length and the width was 3:1 observed systematically in the oared ships. The Caravela did not carry a prow castle. The bottom was narrower than the round ship.²⁵ The Portuguese Caravela was a basically round ship, more rapid, easy to manoeuvre and smaller than the Nau Bointes of 20 to 30 m. of length with 6 or 8 m. of width.²⁶ It is also stated that the Caravela was a ship of 2 masts later on 3, rigged with velas bastardas and was of smaller dimensions. The pano latino sail was substituted by 1 or 2 pano redondo sails. The hold was imposing on the poop. The vante was more levelled and its maximum capacity did not exceed to 80 tons.²⁷ This ship was light and long but solid with the tonnage below 200t with exclusively triangular type sails.²⁸ As a result of the revolution in the naval construction started in the northern shipyards by the Portuguese Caravel builders, the round rigged ship progressed rapidly in the second half of the 15th century. There were 2 types of Caravelas, Latten Caravela, (Fig.2) and the Round Caravela. (Fig. 3) The Latten Caravelas usually had a latten mast and the main mast of the Round Caravela was round. The castle prow of the Latten Caravela never exceeded 0.50 m. But in the case of Round Caravela there was 1 castle. The Caravela of 4 masts carried 3 latten and 1 round mast at the prow and therefore it was

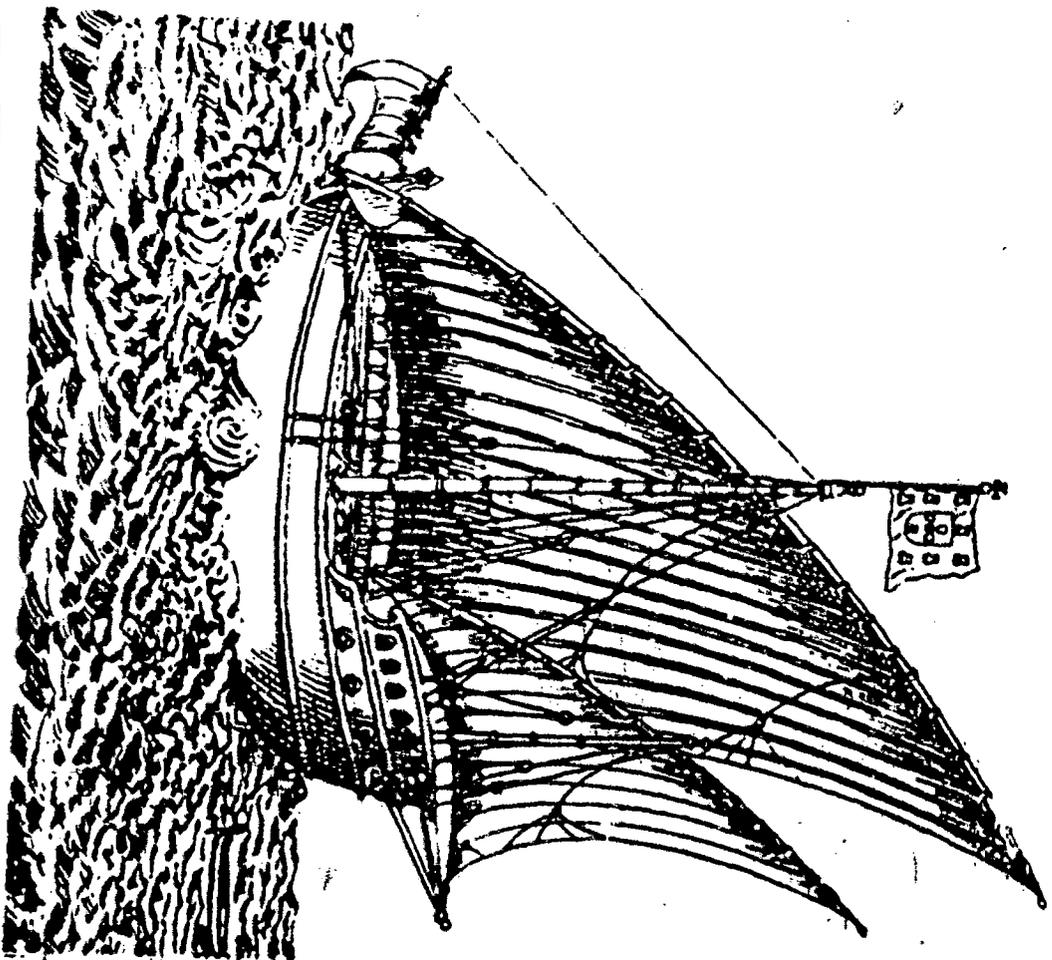


Fig. 2. Latten Cananda.

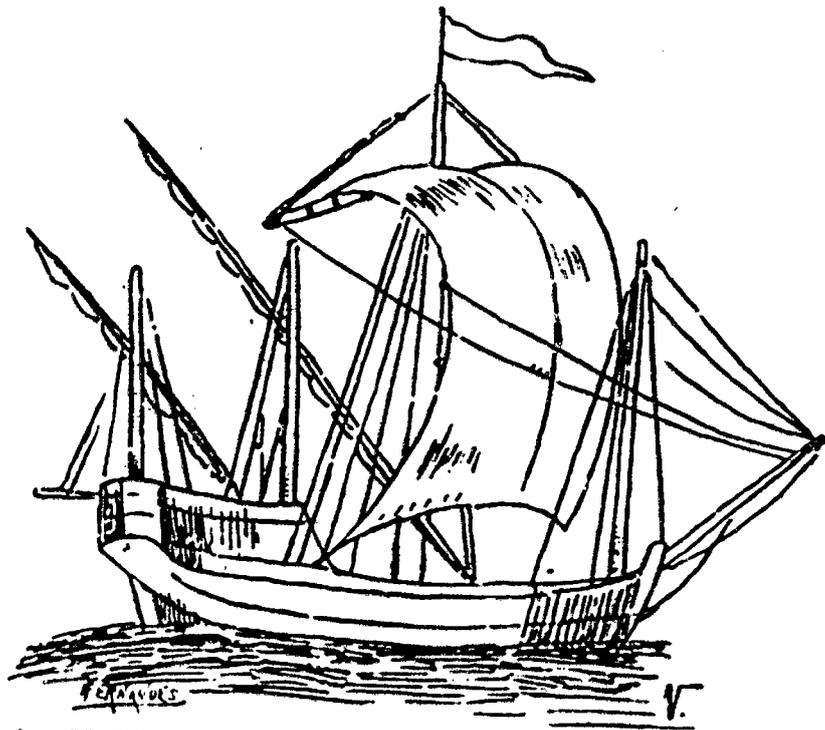


Fig. 3. Round caravel.

given a designation as round.²⁹ There were Caravelas with different number of masts.

- a) One Latten Mast Caravela: It was a small fishing vessels of latten mast with the tonnage of 20 to 28 tons.
- b) Two Latten Masts Caravela: Two latten masts caravela appeared by the beginning of the 15th Century when caravela began to gain importance. It is very certain that the Caravela of the explorers were of 12 masts and of 100 tons. This type of Caravelas were in use even during the 17th century. (Fig.4)
- c) Three Latten Masts Caravela: This appeared somewhere at the end of the 15th century and ceased to exist by the middle of 16th century. It was substituted by Round Caravela. This Caravela had 2 andaes on the poop castles. (Fig.5)
- d) Four Masts Caravela: This Caravela figured by the second quarter of the 16th century which led to the fixation of one round rigged mast at the prow. This 4 masts Caravela is different from others i.e. from Latten Caravela as it carried 3 latten masts and 1 round mast. By the beginning of the 17th century it had 1 or 2 decks, sobrados on the poop castle and 1 on the prow.³⁰ (Fig.6)

Carrack:

Carrack was a merchantship of considerable size and was the largest roundship sailing in India. A minimum depth of 60 feet of water was required to float this ship. It had more than 3 decks

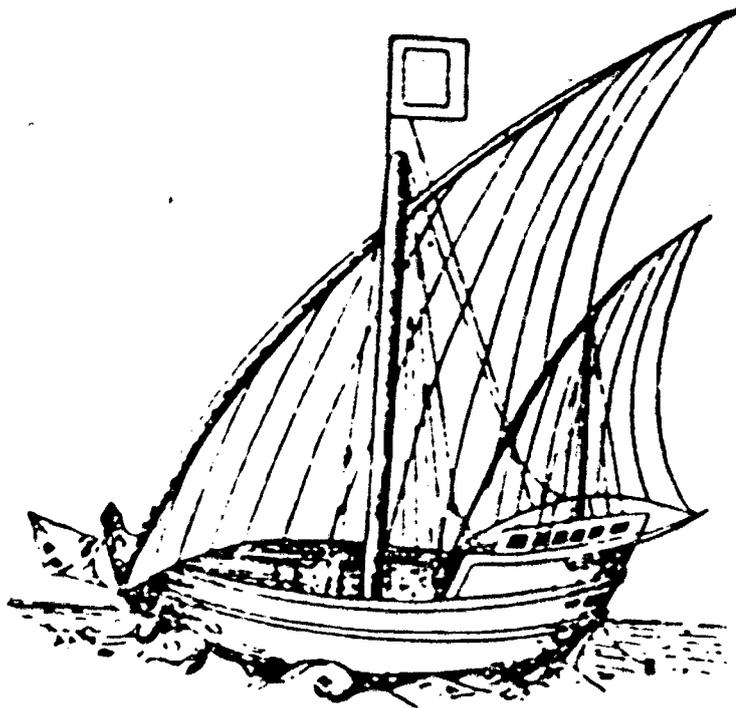


Fig 4. Two Latten Maets Caravela

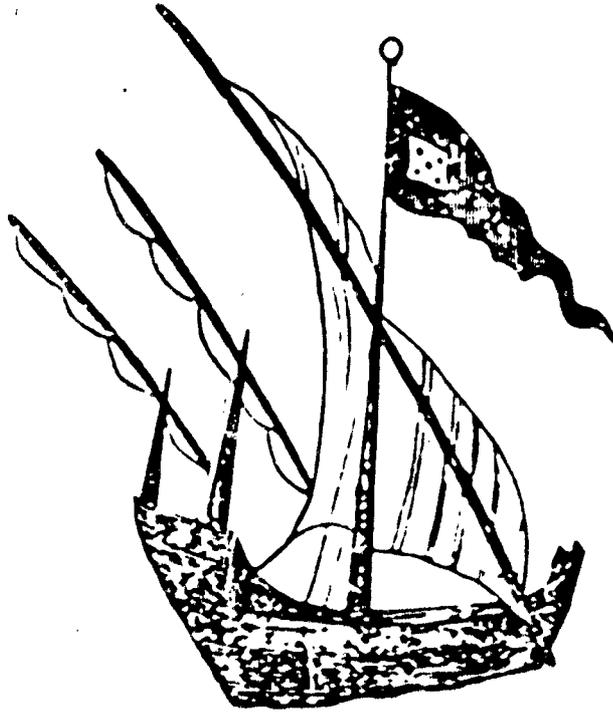


Fig. 5. Caravela of 3 masts

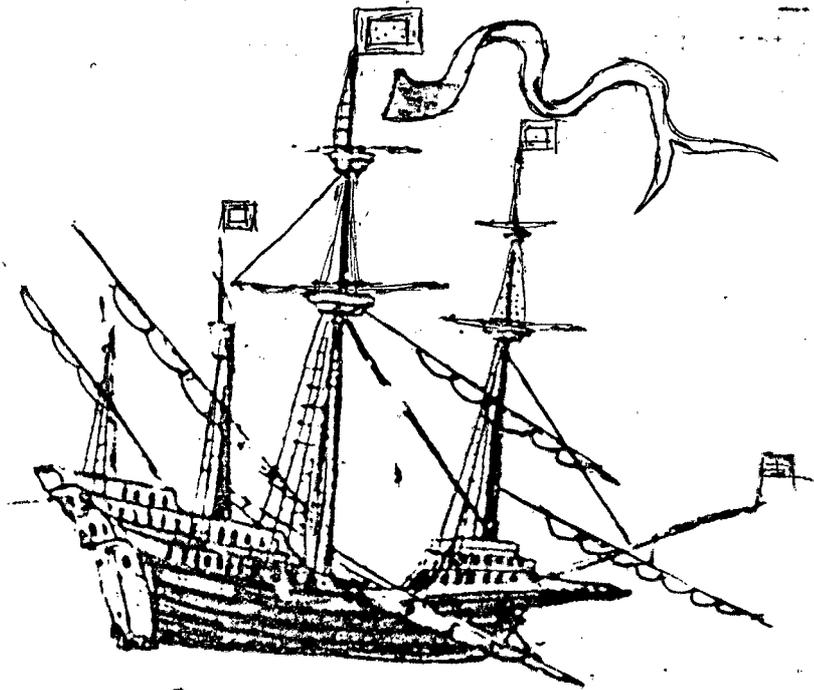


Fig. 6. Caravela of 4 masts

and could carry up to 2000 people. The stern and the prow were higher than the upper deck. Between the 2 castles there was a 2 storeyed platforms on verandha. ³¹

Caique:

Caique was a latten ship which generally carried 2 masts, having 1 deck of straight prow and popa de paniel. (Fig. 7) It had a length of 18 m. by 6.5 m. by boca and 1 m. depth carrying 2 masts. Each mast was equipped with vela bastardas. During the storm, the sails of main mast was substituted either by quadrangular or triangular sail which was called cachapana. The Caique could also sail on oars. It was used for carrying passengers.³² The fundamental structural differences between the Caique and the Caravela were:

- i) The absence of a systematic poop castle on the Caique and the existence of the same on the Caravela .
- ii) The configuration of the hold of the Caravela appears from above presents a conception of a ship totally different from that of the Caique.³³

Calamute:

Calamute was very much used on the Malabar coast. Not much is known about the technical features of this ship. Calamute was probably a name of a port on the Malabar coast, where this ship was used for loading the cargo.³⁴

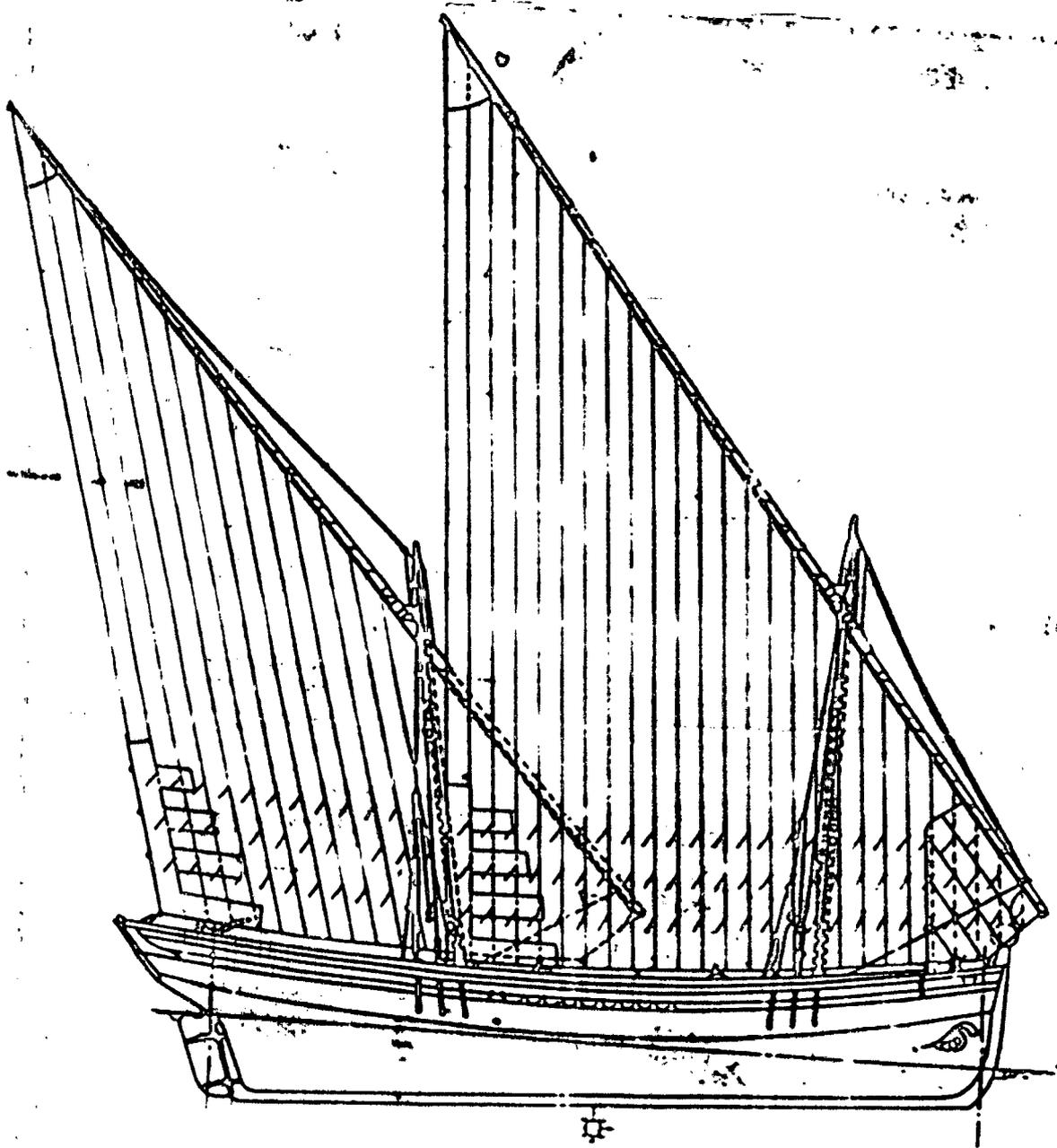


fig.7, Caique of Algarve

Canoa:

Canoa was a small vessel made out of a single piece tree trunk, later on it acquired a complex structure. It was operated by oars and was used for communication from the shore to the anchored ship.³⁵

Caravo:

Caravo was a trading vessel used for transporting horses. It could accommodate 60 horses besides a crew of 30. Equipped with latten sails with 1 or 2 masts, it usually had 1 deck.³⁶

Catur:

A small ship of oars like Bergantine used for the purpose of fishing and piracy. In times of war, it was used as supporting vessel. Catur was furnished with pointed bows, oars and had 1 mast. It carried only a straw sail.³⁷

Chalupa:

Chalupa was a ship of 1 mast. The mast was provided with latten quadrangular sail. On the main mast it carried a mastareu i.e. mastareu de gavea tope.³⁸

Charuto:

It was a small recreation ship of flat bottom operated with oars.³⁹

Charrua:

Charrua was usually used to carry troops, ammunitions etc. It was like a warship which could carry the required amount of artillery.⁴⁰

Coverta:

It was a name given to a warship of 2 masts. It had only 1 battery and was much smaller than the Fragata. But later, the Coverta was used for a light ship of 3 masts with pano redondo having 20 to 30 bocas de fogo.⁴¹ Mahamai Kamat papers mentions Coverta as a trading vessel, sailing from Muscat to Goa with the cargo of rice etc. during 18th century.⁴²

Esquife:

This ship was used in the service of the bigger ships. It was resembling the Batel of the Navios. In the 17th century, the Esquife of the warships were equipped with 4 or 6 oars.⁴³ Manuel Fernandes in his Regimento states that, an Esquife of 7 and 9 quilha de Goa was meant for the Naus and Galleons having length between 8 m. to 10 m. and width (boca) 1/3rd of the length of keel, measuring between 1.75 and 2.25.⁴⁴

Fragata:

It was a sailship without castles, smaller and lighter than the Nau with 2 decks where 30 to 60 pieces of artillery could be mounted. In the light Fragata (Fragata Ligeira) The number of artillery pieces was not more than 44, while on heavy Fragata

(Fragata de Forsa) it was 60. These ships always sailed in squadron. In the naval combat, it was a prime responsibility of the Fragata to help the destroyed or the wrecked ship. In Tejo, this ship was used exclusively for carrying the merchandise and was of open boca and the poop de painel. It had 1 mast of good height inclined towards the stern, where there was 1 large latten quadrangular sail with pulley. At the prow it was provided with 1 or 2 sails. The old Fragatas of Tejo were equipped with 1 bastardo. It did not have any sail at the prow.⁴⁵

Fusta:

Fusta was a very common vessel used by the Muslim traders. It belongs to the family of oarship binded together by common features such as the general form, deck, rigging, velame and the setup of the oars.⁴⁶ The dimension of the Fusta depended upon the number of oars. The distance from the length to the width was about 1/6 and could sail in less water. It did not carry any deck and the food was stored in paios. The ré and the vante had the chapiteu and the castle resembled that of the Fragata. Its dimension was 22 palmos of length, 12 of width and 6 of pontal.⁴⁷ The Fustas of 35 oars were operated by 37 oarsmen.⁴⁸

Galeaca:

Galeaca was another war vessel. It was the biggest of all oar-boats and was equipped with 3 latten masts which could not be lowered like the Galley. It had 32 benches with 6 to 7 people at each oar and could carry about 1,200 people.⁴⁹ It had 1 castle at

the prow and 1 at the poop. The oars were very long which were propelled by 6 people on each bench.⁵⁰

Galiota:

Galiota was a small boat of complicated structure used for war.⁵¹ It had lesser dimensions than a Gale. The Galiota had 15 to 20 benches on each side with 1 man facing another.⁵¹

Galley:

It is certain that during the first centuries of the Portuguese monarchy this type of ships had frequently taken part in the war against the Castle. Though the use of the Galley was very much restricted, yet there are frequent references to it. During the Alcacer enterprise in 1458, D. Afonso V gathered about 280 ships which included Naus, Galleys and other ships.⁵³ Gale was a battleship of small tonnage with triangular latten sail. (Fig. 8) It carried 25 to 30 oars on each side with 3 men for each bench. Normally a Gale was about 25 palmos long and 30 palmos wide and had 2 masts and 2 latten sails. There were two types of Gales. Gale Sutil and Gale Grossas and they differed from each other in their length and tonnage. Gale Sutil had in the middle only 1 latten mast and sometimes at prow a small mast with a banner sail. Gale Grossas had 3 latten sails.⁵⁴ Royal Gales were longer and usually carried the chief of the fleet. Gales Bastarda shared latten and round structure. Gales required number of rowers and therefore many slaves were condemned for serving on the Gales. There used to be 200 to 300 men-at-arm.⁵⁵

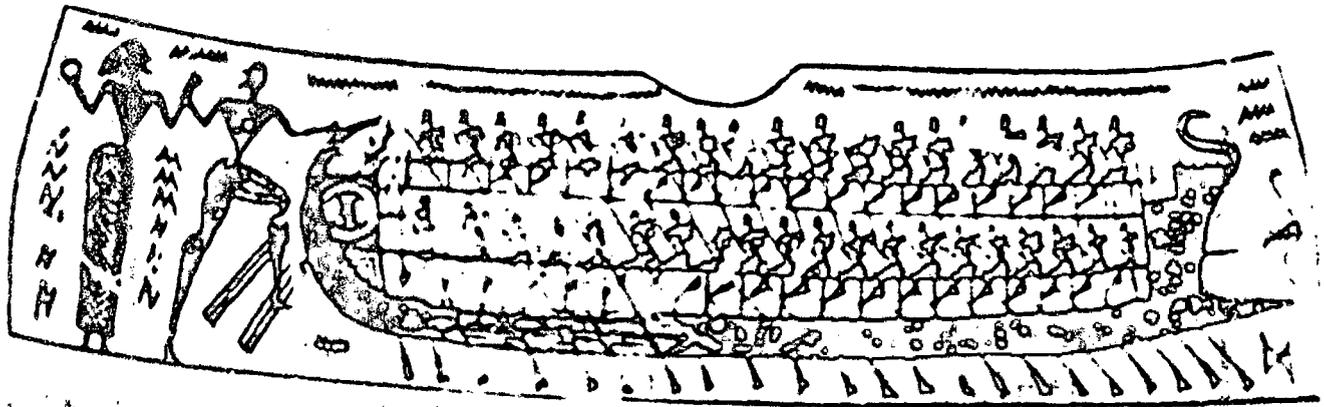


Fig. 8. Portuguese Galley.

Galleons:

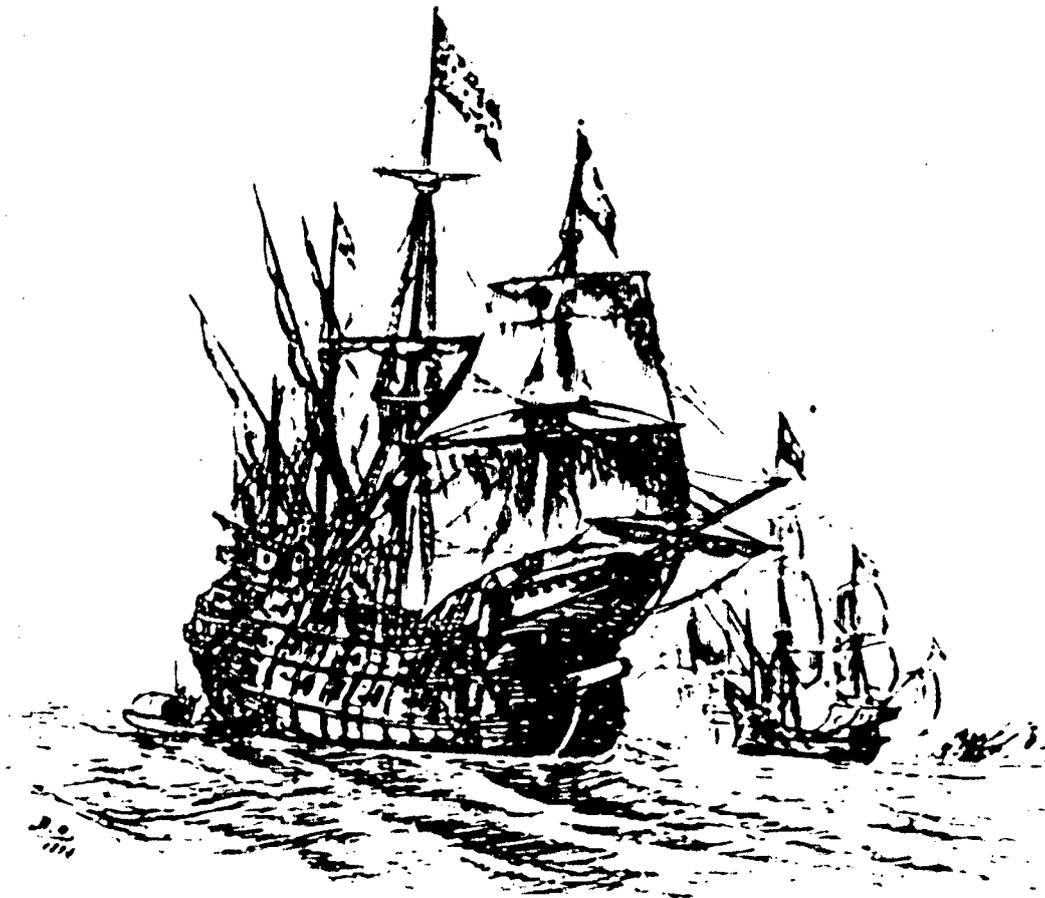
The Portuguese Galleon was a very important vessel, as it was one of the main technical means of Portuguese all over the East after the historic voyage of Vasco da Gama. (Fig.9) Naval confrontation with the Turks and Arabs followed by a need to protect the spice trade and route led the Portuguese to conceive a squarerigged ship with unique proportion, dimensions and features. This new ship was called Galleon because it fulfilled on a bigger scale the warlike functions of the Galley. The first reference to this squarerigged ship meant for warfare on high sea can be found in 1519.⁵⁶ A Galleon had 2 decks with a prow. The number of sails was not definite. The bigger Galleons had 4 masts, 2 round in the front and 2 latten at the rear.⁵⁷ These were the foresail masts, main masts, mizzen mast (artimaö) and contra artimaö.⁵⁸

Galizabra:

This ship was a combination of Galley with Zabra. It carried 1 mast and was equipped with the oars. The 17th century Galizabra was of 14 rumos of keel with the breadth of 8 m. and approximate length of 29 m. The ship had 14 oars and only 1 deck. The castle poop was formed by the quarter deck and 1 chapiteu and from the prow there was only 1 pavimento or floor.⁵⁹

Gundra or Gundres or Cundura:

This was a small Galley - type boat with pointed bows. The planks of Gundras were bound together with coir.⁶⁰ This ship was



Galeão — 1560.

Fig. 9. Portuguese Galleon

mostly used in Maldives, exclusively built and rigged with wood and other material obtained out of coconut fibre.⁶¹

Hiate:

It was a latten ship consisting of 2 masts of which the main mast was more inclined towards the stern than the foresail mast. Generally it did not carry mastareus on the mainmast but there was a cable to hoist the flag. Each mast was equipped with latten quadrangular sails and 1 gavea tope.⁶²

Manchua:

Manchua was used by the Portuguese at Macau and Goa. It was a small oarship used on the Indian coast and equipped with 1 quadrangular sail. It somehow resembled the Galiota. The Manchua could carry 4 to 9 artillery pieces.⁶³

Nau:

The term Nau is not always used with any specific naval meaning in the early documents of the period. It was held as equivalent to the term navio a high-sea ship (navio da alto bordo), round rigged and was meant for commerce.⁶⁴ (Fig.10 A and B) The early Naus were between 100 to 120 tons. They had 2 decks, The first one extending from the rear to the front containing the cargo hold, store room for water and provisions, cables, clothes, gun-powder etc. The second deck at the prow had at the rear the captain's quarter-deck covering the castle of bombardeiros.⁶⁵ During the second half of the 15th century, the

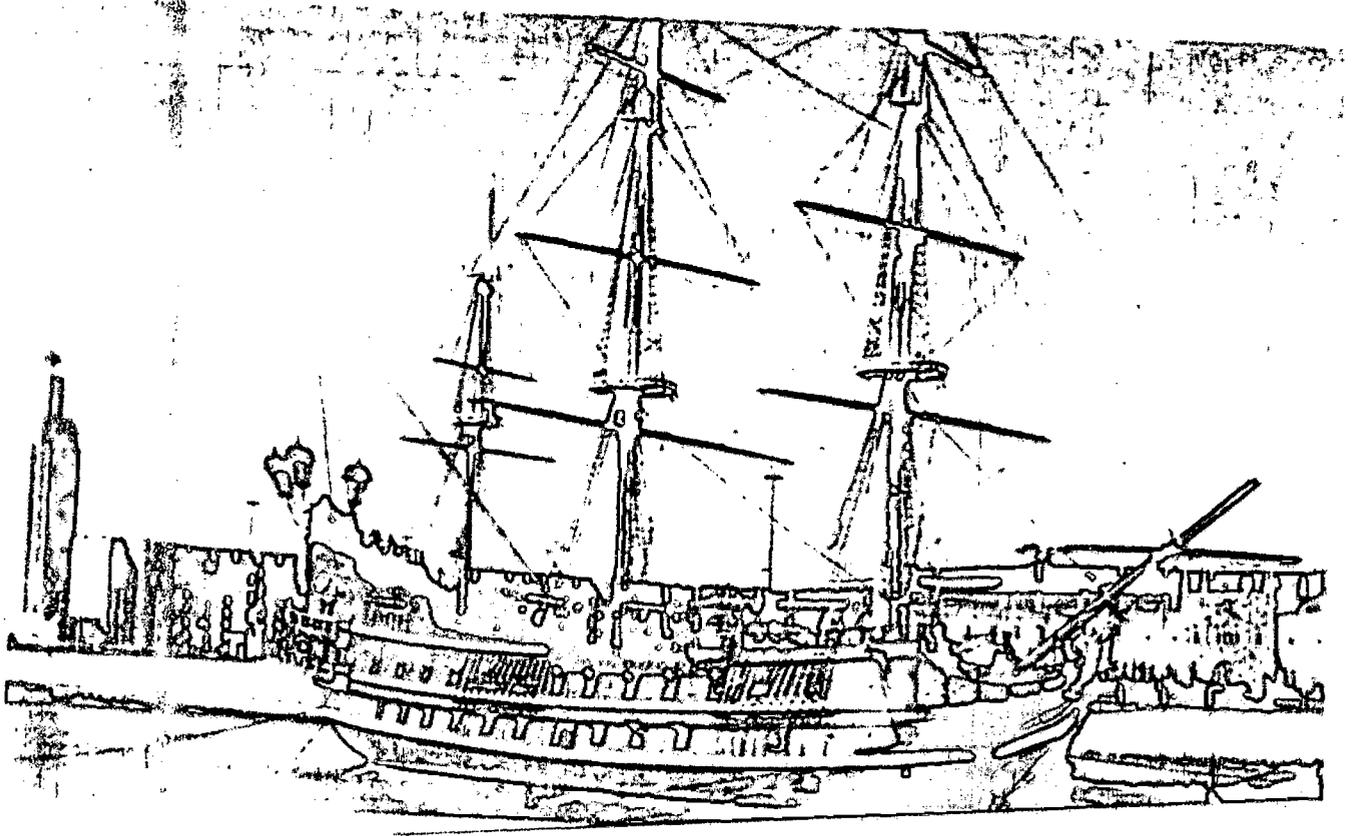


Fig. 104. Portuguese Nau of 17th century

IN THE MODEL OF AN ACABADA

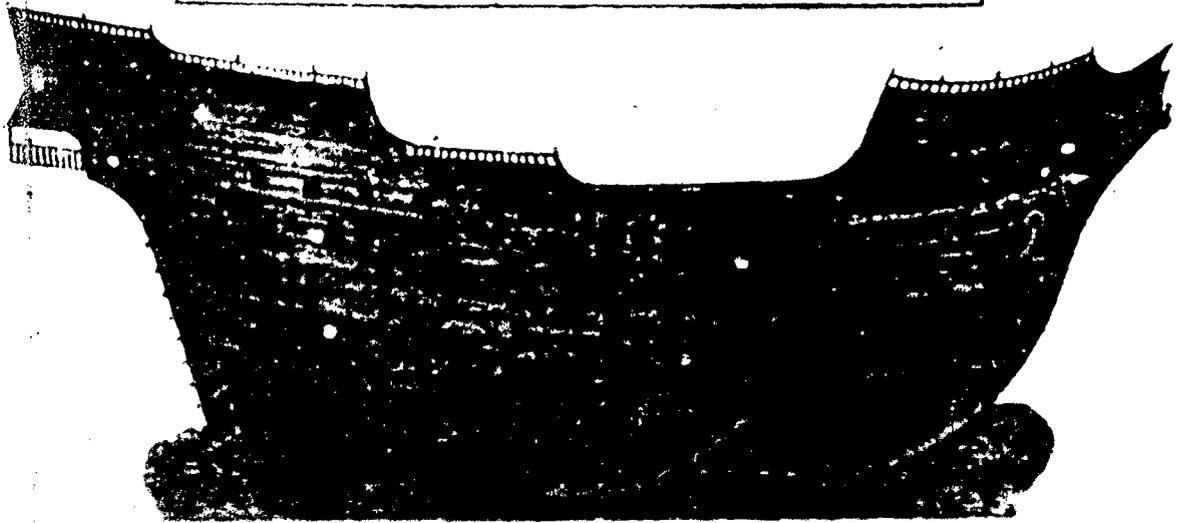


Fig. 10 B. Model of the Nan of 4 Decks
During the XVIth century.

Nau with 3 masts appeared, 2 of which were round rigged and 1 latten with the castles totally integrated on the hold.⁶⁶ Since there was no distinction between the warship and the merchantship, the naval experts suggested the use of Nau for India voyage. Naus between 500t to 800t and above were used for India voyage. In this manner the Naus of Carreira da India came to be termed a Nau Grossas of above 300 tons (Q=20, 02m), most of which were between 450t and 500t. By the middle of the 16th century, the Nau of 17r to 18r of keel with 600t to 700t capacity was common.⁶⁷ In the course of time a Nau became a large merchantship with 3 or 4 flush decks, a high poop and fore castle but highly gunned for its size.⁶⁸

Naveta:

It was a small sail ship similar to the Nau. This name was given by some dockyard masters in the middle of 18th century to differentiate the Naus of 3 decks from the 4 decks.⁶⁹

Palla:

It was a big warship of sails with 2 or 3 masts used in India. (Fig.11) The prow was of esporaõ like that of the Gales. It resembled the Fragata and could carry 40 artillery pieces.⁷⁰ The Pallas were built and repaired at the Royal dockyard at Goa. They sometimes formed a part of the convoy sailing from Mangalore to the city of Goa.⁷¹

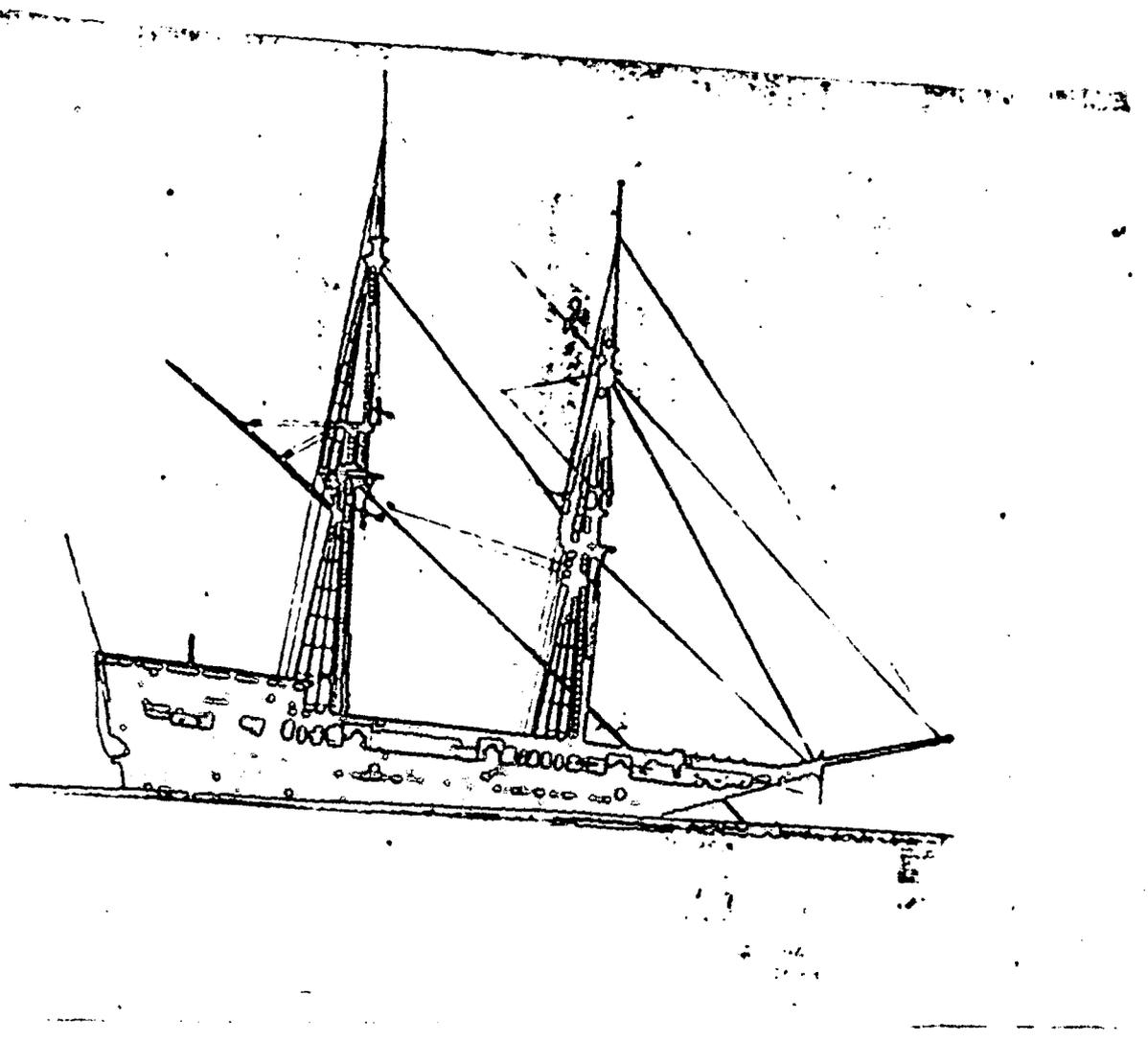


Fig 11. Palla of 2 Masts

Pangaio:

Pangaio was very much used in the Indian Ocean and the Red Sea. It was a sail ship and possibly carried 2 masts of prow, inclined towards the vante and from the stern approximately vertical and with high poop. (Fig.12) The so called Indian Pangaio's were equipped with 2 latten sails similar to bastarda later on substituting from the stern by 1 latten quadrangular sail equipped with pulley. At the beginning of the 16th century these ships which were built in some parts of East African coast were similar to those built at Maldives.⁷²

Paranque or Parguere:

The Paranque or Parguere was a small ship, which was loaded like Caravela. It was equipped with oars and sails.⁷³

Paraö (Parau, Paro):

This ship was usually found in Malaysia and was like a Fusta with 18 to 20 benches without deck. Besides the oarsmen, it could carry 120 to 130 men of war and 32 bombards.⁷⁴

Patamarim:

It was a lightship of 5 to 12 tons used in India for coastal navigation. It was equipped with 2 masts.⁷⁵ In Goa, the Patmarims were also used to carry people from one side of the river to another.

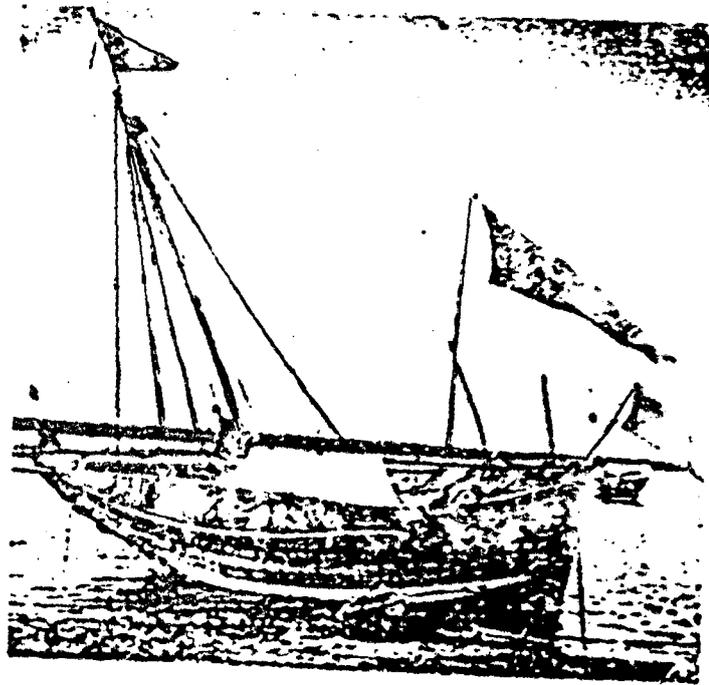


Fig. 12. Pangai

Pinaca:

Pinaca was light and narrow vessel operated with oars and sails with 3 masts and a square stern. It was generally used for reconaissance and desembarcation of people on land.⁷⁶

Patacho or Pataxo:

It was a light merchantship used by the Portuguese to guard the entrance of ports, to explore the seas and for naval reconaissance. This ship was of 2 masts, with 2 small mastareus and round sail on the prow with another small mastareu on the stern, where it was provided with latten sail on the prow. There was a foresail mast, velacho and joanete. On the stern there was 1 latten quadrangular and 1 triangular sail. The old Patachos were more or less like a warship and were equipped with 3 mast.⁷⁷

Sambuco:

Sambuco was a small ship of flat bottom without deck used by the natives against the Portuguese. It was like a small Galley manned on each side by 20 to 30 oarsmen. It could carry 3 to 4 pieces of artillery and more than 100 archers. The artillery was placed on the bows reinforced by flaning pots of gun powder which were thrown on the Portuguese sails during the combat.⁷⁸

Sanguicel:

Sanegucicels were small and light warships mostly used on the west coast of India. It could carry about 20 people.⁷⁹

Toforea:

Toforea was a transport ship meant to carry horses. It had a wide door at the stern which enabled 20 horsemen to come out.⁸⁰ The size of the Toforea varied. The 2 fleets of Dom Francisco de Almeida consisted of 1 Toforea each, which took part in the seige of Diu. Gaspar Correia termed the first as Nau Grossa and the second as Navio de Gavea. These ships had special provision to accommodate the horses with adequate hatchway for the animals and the holds to store the hay etc.⁸¹

Tone:

Tone was used in fluvial navigation and was employed for taking the pepper to the ports. It was a flat bottom ship without deck and only 1 mast and oar.⁸²

Urca:

The Portuguese made use of Urca in the naval expedition sent to India. The fleet which was sent in 1540, included a ship called Urca. Again in 1545, Urca formed a part of the India fleet.⁸³ It was a cargo vessel of low speed with flat ribs, broad on the planks and round in the rear. It carried 2 masts.⁸⁴

Zabra or Zavra:

It was basically an Arab ship used for carrying the cargo in the Mediterranean and in the Indian Ocean.⁸⁵ Not much is known about its technical features. Zabras could carry even 100 people and were used in the naval operations even by the Portuguese.⁸⁶

Artillery And Equipments on Board:

The cannon, key of the naval artillery was developed during the 16th century in Europe and used on ships by the end of the century. The amount of ammunition on board depended upon the total capacity or tonnage of the ship which was graded as from 25 to 60 tons, 60 to 100 tons, 100 to 150 tons, 150 to 200 tons and so on.⁸⁷ The oarship carried the artillery on the prow and the sailship on the costado. There was a gun-powder store (paiol de Polvora) under the castle of bombardeiros.⁸⁸ Gil Eanes was the first person to carry artillery on board. Later on, the use of fire arms was regularized by the authorities.⁸⁹ D. Joao II ordered that, the Caravelas had to be equipped with Tiros Grossas for the defense of the port. He further emphasized the need for equipping the Caravelas adequately with heavy guns so as to counter the Dutch and the English attacks.⁹⁰

The artillery of small ships consisted of falconets, bombards, small canons and the swivel guns (pedreiros). There were also protective instruments like laminated leather (couro), coat of nails (saio de mathe) and the head gear.⁹¹ The artillery, gun-powder and ammunition which the ship carried on board was put under the charge of an officer called Meirinho. If he was found unreliable, it was suggested that the charge may be given to the Condestavel who had to maintain an upto date record of the artillery used.⁹² After the voyage, if any gun-powder was found surplus and which could not be used, the same had to be delivered to the Casa de Polvora at the city of Goa.⁹³ In order to improve the defense of the India-bound ships the Crown promulgated an

edict in 1604 to the effect that, a Carrack should carry at least 28 guns of which 20 were to be pesos grossas (great guns).⁹⁴ The Viceroy Count de Linhare issued an order by which the ships sailing with cargo had to be adequately armed to face any eventuality on the high sea.⁹⁵ As soon as the ships sailed from the bar the Captain had to make a general survey of all ammunition and war equipments on board.⁹⁶ He would also check the roll of the garrison of the men of war, weight of the ammunition and the pretrechos.⁹⁷ There were 2 armeiros to repair the arms and were paid daily.⁹⁸

The artillery of a Caravela of 160 tons at the end of the 16th century consisted of 2 esperas of 22 quintals each, 6 falcons of 7 1/3 quintals each and 6 bercos of 1 3/4 quintal each.⁹⁹ The Caravela captained by João Serrão in 1584 had a artillery comprising of 20 bombardos, 6 camelos and 12 falcons. In 1528 another Caravela captained by João Frois was furnished with 1 camelo, 2 falcons and 2 bercos.¹⁰⁰ By the middle of the 16th century a Caravela of 160 tons carried 18 bocas-de-fogo, 120 pelouros de berco and 8 bombos de fogo and 20 pelouros de cobre.¹⁰¹

The artillery of the Galleon sometimes depended upon the tonnage which was more than Nau. There is no precise information about the artillery carried on board on the first Galleon. A small Galleon of 200 tons at the end of the 16th century was equipped with 20 bocas-de-fogo which was as much as that of the Nau of 800 tons. The Galleon of 500 tons in 1600 was provided

with 40 bocas-de-fogo.¹⁰² However, an important point that is to be noted is that, this figure was not rigid and the number of the artillery pieces varied even among the Galleons of the same tonnage and the amount of artillery was not always in relation to tonnage. According to the Royal Order of 1601, the artillery of the Galleon consisted only of 17 pieces generally of small calibre. The ammunition was a less consisting only of 30 cannons balls and a large number of fardos.¹⁰³ In 1644, the Galleon Nossa Senhora da Candelaria of 700 tons was provided with 36 pieces. Another Galleon São Pedro of 600 tons was provided with 30 artillery pieces.¹⁰⁴

As regards the artillery of Galley, each Gale had a big cannon called coxia and some small cannons. There were 4 pieces of artillery, 2 bastardas and 2 of small calibre. Many pieces called breços were stored in the remeiros.¹⁰⁵ Each Gale had 20 cannons of different calibre. The Gale had 2 batteries on its prow, 1 having 2 pieces of 35 pounds of bullet, another having 10 pieces of 10 pounds.¹⁰⁶ The Fragatas were provided with the artillery pieces of 8, 6, 4, and of 2 pounds calibre. All unnecessary artillery pieces had to be stored in the hold of the ship in the form of ballast, thereby making space for loading.¹⁰⁷ The Viceroy Caetano de Mello Castro declared that, the Fragatas mounting 30 to 40 guns would be better and cheaper for use in the Carreira.¹⁰⁸

The Portuguese Nau was a merchantship and as such it was scarcely armed. The Nau of 700 tons at the end of the 16th century had 26 bocas-de-fogo. The Naus of the first quarter of the 16th

century had bocas-de-fogo placed on janeladas de proa and Janeladas de pop.¹⁰⁹ The Nau São Gabriel, the captainship of Vasco da Gama was equipped with 20 artillery pieces of 6.450 tons and other ammunition of about 6.000 tons.¹¹⁰ It also had 3 batteries, 2 located on the first castle, above deck as well as on the stern and 1 on the castle above poop. The battery at the stern was very important on account of its quality. The number of the bocas de fogo was 8 pieces, 4 on each side built with stave which was fabricated and strengthened by the circular rings and was loaded by breech-loading guns. These pieces were fixed on row back (forqueta).¹¹¹ The Nau Nossa Senhora de Esperança which sailed to India in 1774 was provided with 2 bronze artillery pieces of 1 pound calibre, 6 cannon balls etc.¹¹² The Portuguese naus of 800 to 1000 tons were filled with 14 to 24 cannons with 140 to 180 soldiers to meet the Dutch challenge.¹¹³

The Cartaza records available at the Goa Archives reveals the amount of artillery carried onboard by the native crafts. Nacoda, a native craft was equipped with 10 pieces of artillery of 4 pounds calibre.¹¹⁴ The Pallas were furnished with 20 to 26 pieces while the Pataxos were provided with 26 pieces.¹¹⁵ The Pataxo Nossa Senhora da Conceição commanded by Captain Jose E Ribeiro carried 12 artificos and 30 soldiers.¹¹⁶ The Captains of the fortresses were prohibited from removing any artillery piece from any ship either on its arrival or departure. The violation of this order was made punishable by the Judicial authorities in Goa.¹¹⁷

Equipments:

The rigging of the Portuguese Naus differed slightly from that of other European ships of that period. The Portuguese Nau had one unique feature which distinguished it from the rest of the ships i.e., the yards were proportionally very high. Besides, gurupes, the Nau carried 2 round masts (main and the fore sail), 1 latten mast, and the mizzen mast. There were Naus with 2 latten masts at poop specially during the middle of the 16th century and the same was continued up to the first half of the 18th century. The verga de cevadeira which was crossing on gurupes existed since many years. In 1600, mastereu da sobrecevadeira appeared which was placed vertically on the extreme point of gurupes.¹¹⁸ All ships had 3 masts, main, foresail and mizzen. With the exception of the ships São Antonio de Sesimbra, Conceição Flamengo and São Antonio de Lisboa, all others had mastereu de gavea grande. There was no mastereu de velacho or any mention of gurupes.¹¹⁹ The rigging list of the ships mentions the following accessories of different masts:

Main Mast:

The ovens with cadeias and moitoes, the caroas with poles amantes, betas and the estai.

Foresail Mast:

The ovens with cadeias and moitoes, the coroas with poles amantes, betas and the estai.

The Mizzen Mast:

The ovens; mastareau de gavea grande and the ovens.¹²⁰

The Portuguese Indiabound ships were furnished with large quantities of naval spares such as 3 sets of clothes, anchors and large amount of cables.¹²¹ Most of the Navios and the Caravelas were provided with 4 anchors and 1 small anchor (fateixa de batel). The Navio São Conceição Flamengo and the Bargantine São Roque carried only 1 anchor.¹²² The cordage of all the ships consisted of buoy (pecas de ourinque) i.e. the cables connecting or joining the anchor buoy which showed the anchoring position.¹²³ The masts and provisions were stored in front of the storeroom of the ship while the rest of the accessories were stored in the rear.¹²⁴

The sail equipments included cables of various types such as escota, coeta, and estingua.¹²⁵ One Batel and one Esquife was equipped with 48 oars 36 for the Batel and 12 for the Esquife.¹²⁶ All the ships of the carreira da India sailing from India to Lisbon had to be provided with exos de estrinca, calceses, cadeias, and the cabrestantes in sufficient quantity so that the ships may not face any problem on account of the shortage of material.¹²⁷ When a ship was equipped with all necessary accessories, the Master of the ship had to give a declaration of the material taken on board. In 1537 Sebastain Gonsalves de Arvelos was ordered to give a declaration of the material provided for the Nau Esperança de Galega.¹²⁸ The Nau Nossa Senhora de Livramento was provided with 70 barrels of Atleatraö, 4 caldueas

of copper and 3 iron barrels.¹²⁹ The Nau São Gabriel carried 2 guarda - lemes and 2 anchors, one on each side with the block of wood, having one big ring.¹³⁰ The Galeiota which left Bassein to Goa carried onboard 4 masts, 4 main yards 3 mizzen masts and 2 mizzen yard.¹³¹ The Nau Nossa Senhora de Esperansa which sailed to India in 1774 had onboard 417 espingardas, 410 calçoens de pano branco, 120 boleas patromas etc.¹³²

Besides the naval artillery and equipments many tools and utensils were also taken onboard during the voyage. The tools consisted of the chisel, gauge chisel, hammer, drill etc. needed to undertake any repair work. The utensils included wooden bowls, funnels, couldron, kettle, buckets etc.¹³³ The four decks ship which used to sail from Lisbon to India had a hold. On the first deck some water, wine and beef were stored which were meant for the consumption during the voyage. The same provisions were also to be found in the case of three decks ship. The first deck from the mast upto the prow had a storage capacity of 600 quintals. The space from Arca da Bomba to the stern was meant for storing drugs. Other decks carried the liberty chest and the boxes of the officers.¹³⁴ The Royal orders laid down the pattern of loading and equipping the ships with all essential naval spares. the person entrusted with the job of supplying the masts and sails had to do so in time. Inorder to avoid loss to the Royal Treasury, the contractor had to give a guarantee to supply enxarcia and masts in time.¹³⁵ Once the ship was anchored at any port in India, the

Feitor had to purchase ropes and naval equipments to the ships along with food provisions. In 1503, the Feitor of Cannanore ordered, Gonsalo Gil Barbosa had to provide tar for repairing the ships.¹³⁶ The equipping expenditure of the Goabound Lisbon ships were placed and discussed before the Revenue council after making the estimate of the same by the officials of the Royal Dockyard.

REFERENCES

1. Kemp, P, (ed) The Oxford Companion To Ships And The Sea,
Oxford University Press, London, 1976,
p.32.
2. Mathew, K.M. History or the Portuguese Navigation in
India 1498 - 1600,
Mittal Publication, New Delhi, 1988, p.276.
3. Mendonca, H.L.De Estudos Sobre Navios Portugese Nos
Seculos XV e XVI,
Typograpfia da Academia Real da Cienciaia,
Lisbon, 1892, p.3.
4. Barata, J.P. Estudos De Arqueologia Naval,
Vol.I, Imprensa Nacional, Lisbon, 1989,
p.217.
5. Mathew, Op. Cit., p.278.
6. Leitão H. & Lopes V. Dicionario da Linguagem de Marinha
Antiga E Actual,
Centro de Estudo Historicos E Ultramarinos
Lisbon, 1970, p.25.
7. Oliveira, B, Influencia de Infante D. Henrique Nos
Progressos: da Marinha Portuguesa,
Navios e Armamentos.
(OITHPHPNA), Imprensa Nacional, Lisbon,
1894, p.76.

8. Leitão H.& Lopes V. Op. Cit., p.31.
9. Cartas, Patentes e Alvaras, Goa Historical Archives (HAG),
Mss. no.478, fl.87.
10. Regimentos e Instruções (RI), HAG. Mss. no.1422. fl.56.
11. Mathew, Op.Cit., p.278.
12. Leitão H.& Lopes V. Op.Cit., p.93.
13. Mathew Op.Cit., p.278.14, Leitão H. & Lopes V. Op.Cit., p.77.
15. Barata, Vol.I, Op.Cit., p.220.
16. Oliveira, B. Os Navios de Descobrimentos (OND),
Ministerio da Marinha, Lisbon, 1940,
pp.18-19.
17. Barata, Vol.I.Op.Cit., p.223.
18. Peres, D. History of the Portuguese Discoveries,
Centenary Publication, Lisbon, 1968, p.36.
19. Leitão H. & Lopes V. Op.Cit., p.91.
20. Ibid., p.93.
21. Mathew, Op.Cit., p.279.
22. Leitão, H. & Lopes V. Op.Cit., p.93.
23. Ibid., p.107.
24. Fonseca, Q. A Caravela Portuguesa, Coimbra,1934, p.22.

25. Mendonca, Op.Cit.,p.65.
26. Fonseca, Op.Cit.,p.33.
27. Ibid.,p.35.
28. Mathew, Op.Cit., p.282.
29. Barata, Vol.I. Op.Cit.,p.27.
30. Barata J.P. Estudos de Arqueologia Naval
Vol.II, Imprensa Nacional, Lisbon, 1989,
pp.30-31.
31. Mathew, Op.Cit.,p.286.
32. Leitão H. & Lopes, V. Op.Cit.,p.123.
33. Filgueiras, O & O Caique De Algarve Caravela Portuguesa,
Barroca A Junta de Investigações de Ultramar,
Coimbra, 1970,pp.32-33.
34. Leitão, H. & Lopes V. Op.Cit., p.120.
35. Mathew, Op.Cit.,p.114.
36. Britto, N. de Caravelas, Naus e Gales de Portugal,
Livraria Lello, Porto, 1960,p.28.
37. OND. Op.Cit.,p.29.
38. Leitão, H.& Lopes V. Op.Cit.,p.15.
39. Ibid.,p.156.

40. Ibid., p.157.
41. Ibid., p.155.
42. RI HAG, Mss.no.142, fl.15v.
43. Ibid., p.246.
44. Fernandes, M. Livro de Tracas de Carpintaria com todos os Modelos e Medidas Para da fazer toda, a Navegação assy do Alto Bordo como de Remo, 1616.
Biblioteca da Ajuda, Lisbon, 1616, fl.12.
45. Leitão H.& Lopes V. Op. Cit., p.37.
46. Mendonca, Op.Cit., p.34.
47. OND, Op.Cit., pp.28-29.
48. Leitão H.& Lopes V. Op.Cit., p.279.
49. Mathew, Op.Cit., p.285.
50. Leitão H.& Lopes V. Op.Cit., p.283.
51. Ibid., p.285.
52. Ibid., p.286.
53. Mathew, Op.Cit., p.284.
54. Mendonca, Op.Cit., p.34.
55. Mathew, Op.Cit., p.284.

56. Barata, Vol.I, Op.Cit., p.325.
57. Mathew, Op.Cit., p.286.
58. Mendonca, Op.Cit., p.28.
59. Leitão, H. & Lopes V. Op.Cit., p.279.
60. Bouchon, G. Regent of the Sea (BRS)
Oxford University Press, Delhi, 1988,
p.40.
61. Wicki, J. "List de Moedas Pesos Embarcasoes Do
Oriente",
In Studia Centro de Estudos
Historicos Ultramarine, Lisbon, 1971,
p.33.
62. Leitão, H. & Lopes V. Op.Cit., p.305.
63. Ibid., p.336.
64. Barata, Vol.I, Op.Cit., p,328.
65. Mathew, Op.Cit., p.289.
66. Barata Vol.I, Op.Cit., p.250.
67. Ibid., p.258.
68. Britto, Op. Cit., pp.43-45.
69. Leitão H & Lopes V. Op.Cit., p.371.

70. Ibid., p.386.
71. RI, HAG, Mss. no. 1427, fl.65.
72. Leitão, H.& Lopes V. Op.Cit., P.391.
73. Godinho, M. Mito E Mercadoria Utopia e Pratica De Navegam Seculo XIII - XVIII,
Lisbon, 1990, p.309.
74. Ibid, p.309.
75. Britto, Op.Cit., p.16.
76. Mathew, Op.Cit., P.292.
77. OND, Op.Cit., p.37.
78. Bouchon, G. 'Sixteenth Century Malabar And The Indian Ocean'
In India And The Indian Ocean
(ed) Gupta A & Pearson, M. N., Oxford University , Delhi, 1987, p.176.
79. Leitão H. & Lopes V. Op.Cit., P.474.
80. Mathew, Op.Cit., p.292.
- 81 Mendonca, Op.Cit., p.24.
82. Mendonca Op.Cit., p.33.
83. Mendonca Op.Cit., p.22.

14. Mathew, Op.Cit., p.292.
15. (BRS), Op.Cit., p.292.
16. Leitão H. & Lopes V. Op.Cit., p.547.
17. Martins, O. Portugal Nos Mares
Vol.I, Lisbon, 1982, p.44.
18. OND Op.Cit., p.56.
19. Mendonca, Op.Cit., p.40.
20. Ibid., p.41.
21. Britto, Op.Cit., p.54.
22. Mathew, Op.Cit., p.294.
23. Boxer, C.R. Carreira da India (Ships Men, Cargos, Voyages),
Centro de Estudos Historicos Ultramarinos,
Lisbon, 1959, p.30.
24. Provisões dos Viso reis, HAG., Mss.no.1184, fl.5v.
25. Ibid., fl.6.
26. Boxer, C.R. The Porturuese Seaborne Empire 1415 - 1825,
Hutchinson & Co., London, 1972, p.209.
27. Alvaras e Cartas Regia, HAG Mss. no. 2358, fl.242.

98. RI, HAG, Mss.no.1439, fl.2.
99. RI, HAG, Mss. no.1436. fl.147v.
100. RI, HAG, Mss.no.1438, fl.28.
101. Fonseca, Op.Cit., p.462.
102. Ibid., p.463.
103. Barata, vol.I, Op.Cit., p.245.
104. Vasconcelos, Susidios Para A Historia No Tempo Dos Felipes,
J.A.A.F. Agencia Geral do Ultramar, Lisbon, 1959,
p.6.
105. Souza, B. Subsidios para Historia Militar e Naval da India
Vol.II, 1605 - 17 Impreça da Almada,
Lisbon, 1948.
106. Boxer, C.R. O Almirante Joao Pereira corte Real e
Construcao da Frota Portugueses da
India Orientais Nos principios dos
seculos (JAJPCR),
In seperatata Boletim do Institute Vasco da Gama, No. 49, Typografia Rangel,
Bastora, 1941, p.2.
107. Esparteiro, A.M. Portugual Nos Mar, Lisbon, 1956, p.5.

108. Britto, Op.Cit., p.98.
109. Mathew, Op.Cit., p.294.
110. RI, HAG, Mss.no. 1438, fl.36.
111. Boxer, AJPCR, Op.Cit., p.40.
112. Barata, Vol.I, Op.Cit., p.269.
113. Silva, B.A.A. Noticia Sobre A Nau São gabries Em que
Vasco da Gama for India Premeira Vez,
Typografia da Academia Real das
Ciencias, Lisbon, 1842, p.12.
114. Ibid., p.20.
115. Cartas, Regias e Provisões, HAG. Mss.no.7541, fl53v.
116. Boxer, C.R. Andre Furtado De Mendonca,
Centro De Estudos Maritiman de Macau,
Macau, 1989, p.135.
117. Soares, J.P.C. Bosque Das Possessoes Portuguese Do
Orient,
Vol.I, Imprensa Nacional, Lisbon, 1881,
p.138.
118. Barata, Vol.I, Op.Cit., p.265.
119. Ibid, p.117.
120. Ibid., p.118.

121. Cartazas, HAG, Mss.no.1363, Fl.20v.
122. Alvaras, Cartas e Regias, HAG, Mss.no.2358 fl.125.
123. Mathew, Op.Cit., p.298.
124. Barata, Vol.I, Op.Cit., p.298.
125. Ibid., p.147.
126. Ibid., p.148.
127. Azavedo, A. 'Documentos Para Historia Do Brazil -
Thome de Souza e Seu Famlia'
In Revista De Historicos,
Livraria classica, Lisbon, 1944, p.358.
128. Alvaras Cartas Regio HAG, Mss.no. 2358, Fl.164.
129. Azavedo, Op.Cit., p.358.
130. Cartas, Regias, HAG, Mss.no. 754 fls. 47-47v.
- 131 Silva, Op.Cit., p.20.
132. Cartas Alvaras da Feetoria, HAG, Mss.no. 2316, fl.70.
133. Cartas, Regias e Provisoes HAG, Mss.no. 7541, fl.53v.
134. Vasconcelos, Op.Cit.,p.90.
135. Ibid., p.144.
136. Bouchon, Op.Cit.,p.64.

CHAPTER III

LIFE ONBOARD OF PORTUGUESE SHIPS

The excitement of India voyage was so much that, it was a dream of every Portuguese man to sail to India. Then followed the greed of the Captains of the ship to make as much profit as possible by selling the space allotted to them to private individuals. The majority who sailed to India were not accustomed to the Eastern sea conditions and at times had hardly any navigational knowledge. The crowd on board consisted not only of men but young children, women, orphans and slaves. The repercussions of the presence of such a crowd could well be imagined when the ship faced a storm. The Indiabound voyage was crowned with all hazards and uncertainties. Writing on Lisbon - India voyage an anonymous source commented that, "this voyage is so hard that you will run out of tears, before you run out reasons for shedding them".¹ It is proposed in this chapter to discuss the general conditions on board Portuguese ships, provisions on board, causes for the outbreak of diseases and their treatment, slaves on board and the religiosity on Portuguese ships.

Time Of The Voyage From Portugal:

The annual fleet for India left Lisbon usually in March/April and reached Goa in September. The ships left before Easter with a view to catch the tailend of the South-West monsoon winds of the East Africa North of Equator which brought them to Goa in September/October. Ships often left Goa in February and March and

sometimes in April instead of leaving on the eve of Christmas or at the New Year.² The officers and the seamen of an average East India Carrack included 18 Officers, 60 Sailors, 60 Grummets, 24 Cabin boys and 26 Gunners.³

Problem Of Overcrowding:

The India ships were always overcrowded with 600, 700 or 900 or even more persons.⁴ Fr.Gonsalo de Silveira describing the conditions of the people onboard during the voyage in his letter written from Cochin states that," as one cannot draw or paint a picture of death when a person dies, as only a person attending the dying could have only an idea of it; in the same way one cannot say anything of the people sailing from Portugal to India nor could we understand; only the people who sail know about it."⁵

Till Madeira, Canaries and upto Capo Verde, the life onboard was of pure adaptation as there were no chambers for accomodation.⁶ The space allotted or reserved for each passenger which was fixed by law was of about 7 palmos by 2 1/2 palmos (1, 822 * 0, 65),but this space could be shared by two people by turning the legs of one towards the head of another.⁷ During the day time, the towels, straw mats and blankets were hanged to the partitions to allow free movement. In large ships, the best space was kept reserved for the fidalgos and other privileged people. The second and the third were meant for those who pay 70 livres per head. Those who were not in a position to pay 70 livres were allowed to sail on payment of 40 livres and were allotted

the pavement space.⁸ However, Fr. Bernardo Regio onboard São Bartolomeu had a cubicle neither longer nor wider than his person, but only little higher. The cubicle was crammed with medicine bottles. Mice were so numerous and bold, that they ran across his face even when he was awake.⁹

Clandestine embarkation of the people on Indiabound ship, was not uncommon. On 19th March, 1594 the Viceroy D. Antão de Noronha ordered a review of the passengers roll on the Nau Santo Antonio and those who were embarked illegally were punished.¹⁰ The lack of accomodation on board compelled many to sleep on decks, exposed to rain and tropical sun.¹¹

Provisions Onboard:

Biscuits, wine and urraca were the prime items of consumption on Portuguese ships. Every Portuguese ship during the voyage carried provisions which included 1 moio of flour (60 alqueiros), some quantity of salt, 20 alqueiros of pulses, 80 alqueiros of almonds and a certain amount of mustard, sugar and honey.¹² Biscuits were made out of wheat flour. The ships were supplied with wheat flour wheat in India. Francisco Cornivelle, Feitor, of Goa was asked to acquire wheat to meet the requirements of the Portuguese soldiers onboard. This was followed by another order of the Pero Mascarenhas, the Captain of Cochin, to provide the Captain of the Nau St. Helena 4 moios of wheat to carry to Malacca.¹³

Wine was another important item only next to biscuits. The

quota of wine that was to be given to each soldier and sailor was laid down in the Regimento and the supply depended upon the situation and the condition of the stock.¹⁴ Sometimes it was impossible to provide all ships with sufficient quantity of wine. The wine was substituted by Urraca which was made out of the distillation of the dry Cachos de Palmeiro. It was also extracted from coconut, perhaps fermented with Jaggery. This drink is frequently mentioned in the list of the food items of the home bound ships. In 1512, Naus Santo Antonio and Santa Maria de Conceiçãõ were supplied with 15 pipas of Urraca.¹⁵ Apart from this, there were other food items such as live chickens, fish, dry fish, vegetables, etc. In 1624, 22 navios comprising of 22 Captains, 1,263 soldiers were provided with 884 pipas of wine, 1,378 pipas of water, 4,190 arrobas of meat, 3,789 of fish, 2,782 arrobas of rice, 122 quartos of oil and 93 pipas of vinegare.¹⁶

The India-bound ships were provisioned at the cost of the Royal Treasury. The Steward of the ship recorded the definite and exact quantity of wine, vinegar or water contained in the casks or barrels and got it properly stamped.¹⁷ These were then kept in the store room (hold of the ship) having 3 different keys, one with the Master of the ship, one with the Druggist and another with the Second Pilot. The Captains had to see that no holes were made in the barrels and casks and if found any, then they were to be broken or open.¹⁸

Before storing the provisions the quality of the same had to be thoroughly checked by the Clerk and the Master of the ship. In

an instance, the Master and the Clerk of the Nau São Thereza were asked to examine the food provisions regularly which were meant for the voyage of six months. This work had to be carried out with the help of two other officials.¹⁹ All India-bound ships were provided with empty casks for transferring the wine at the time of distribution.²⁰

During the 16th century, each member of the crew had a right to 700 gms of biscuits per day, 0.350 ml of wine, 500 gms. of beef, 1,400 litres, of water and 0.700ml. of vinegare per month.²¹ The ration quota provided for 800 soldiers on Indiamen in 1636 consisted of 40 pipas of wine for six months, 690 pipas of water for nine months, 1200 arrobas of rice for 1 month, 15 quarters of ordinary oils, 16 pipas of vinegar and other vegetables. The ration quota for 400 sailors consisted of 154 pipas of wine, 193 pipas of water for nine months, 800 arrobas of cord fish for two months, 400 arrobas of rice for two months, 13 quarters of ordinary oil and 11 pipas of vinegar.²²

The consumption quality and the quantity of the food provisions necessary for each person was stated in the name of the king by the Provedor of the ware-house. Till the Cape of Good Hope, the quota of wine to every soldier, mariner and artillery men was one quarter. On the coast of Natal where the climate was cold, the quantity was fixed as a half canada of wine per head. Entering the hot zone, the quantity of wine and water had to be examined and the quota had to be fixed according to the amount that was left in proportion to the number of days that were left

to complete the voyage.²³

In the absence of cold rooms in the ship, salt was the prime means of preserving food in an edible state for any length of time.²⁴ Garlic and Clove were used to flavour the monotonous rations. Olive oil was used for cooking and carried in large earthenware jars.²⁵ The barrels and casks of wine, vinegar and water served as a ballast for the ships.²⁶ As ration provided to the crew was raw, every person had to cook his meal. About 80 to 100 pots were seen successively on fire. The sailors and soldiers cooked their food separately in order to avoid quarrels. Cooking facilities were limited to large sand filled boxes in the waist on either of the main mast.²⁷ Cooking was by and large depended upon the weather conditions and no fire was allowed on board during the night time.²⁸

Frequent food shortages were experienced during the voyage. This was mainly on an account of the rotting conditions of food, stealing, black marketing and sometimes even by overconsumption. The amount of provisions delivered onboard was not always in proportion to the total figure of the passengers onboard. The people embarking on Indiabound ships hardly carried sufficient quantity of provisions with them. A Jesuit missionary priest Fr. Alexander Valignano who sailed to India in 1574 states that, 'It is an astounding thing to see the facility and frequency with which Portuguese embark for India..... . Each year 4 or 5 Carracks leave Lisbon full of them, and many embark as if they were going no further than a league from Lisbon, taking with them,

only a shirt and two loaves in hand, and carrying a cheese and a jar of marmalade without any other kind of provision.²⁹ This naturally increased pressure upon provisions onboard.

The rich, especially the fidalgos and the ship's personnel were better off than the others since they usually had their own provisions of wine, water and food in addition to their daily rations.³⁰

Many times, the quality of the public provisions was very poor. Gassetti says that the biscuits carried onboard his ship was a year old and soon began to rot. The wine was almost undrinkable.³¹ Black marketing as well as stealing of the food provisions onboard was very common. The Jesuit missionaries sailing onboard the Nau Bom Despacho, found themselves robbed of their salt-meat, chickens and preservatives. They were also robbed of wine and water which they had in their scabbards.³² Many times Captains refused to carry extra water barrels during the voyage even if they were ordered to do so by the Governors. In 1607, the Governor directed the Captain of the Nau São Alberto to load extra barrels of water in addition to the usual figure so as to face effectively any water shortage onboard during the voyage. The Captain, however refused to follow the instructions.³³ To remedy this situation the king issued orders emphasising that, all Indiamen should be well provisioned with adequate quantity of water so as to avoid halting at any port.³⁴ This order was also issued as a safety measure against the attacks on the Portuguese

ships at Port of Calls, which were under the constant watch of the Dutch.³⁵

Outbreak Of Diseases Onboard And Their Treatment:

The long stay on the sea, unavailability of fresh food and water and the lack of proper sanitation resulted in the frequent occurrence of diseases like scurvy, beriberi and high fevers among the sailors and soldiers. There were three prime zones of sickness during the voyage. The first was at the turn of the Equator and it was due to calm winds. The people used to fall sick sometime little before or after the doubling of the Cape of St. Agostinho. The second zone was starting at the height of 23" latitude south with insensible cold. In the absence of proper clothing, the cases of cold, pneumonia and high fever were not uncommon. The third zone was the Island of Mocambique which was the prime zone of wintering and disease.³⁶

There were numerous causes responsible for the occurrence of various kinds of diseases onboard during the voyage.

The method followed for storing the food onboard for the long voyage was improper and unscientific. In the absence of cold rooms, the only means of preserving was by applying salt. No efforts were made to study the climatic impact at different zones upon the stored provisions. The food stored was insalubrious and was exposed to intense heat of the tropical region.³⁷

The outbreak of scurvy was due to insufficient quantity of fresh vegetables and fruits. Heavy reliance on salted meat

resulted in intestinal disorders. Some attempts were made in 1740 on the lines of the Brazilian Viceroy to improve the quality of provisions onboard. Emphasis were laid on the proteins intake by means of cooked beans with a corresponding decrease in salted meat, but this failed to yield any appreciable result.³⁸ Pyrad de Laval states that every individual was required to prepare meals on his own. This proved to be disastrous as sometimes the sick had no option but to eat whatever their companions served them.³⁹

Insanitary habits among the most ignorant soldiers and sailors was another cause of high mortality rate during the voyage. The sick persons were often left wallowing in their own filth. This led to the spread of fiscal borne disease.⁴⁰ There was no Regimento obliging the crew and the passengers to maintain cleanliness on board during the voyage. To remedy the situation Captain Francisco de Mello Castro thoroughly inspected his ship, Nossa Senhora de Bom Despacho twice a week and wherever any filth was found he compelled those responsible to clean it and denied their day's ration.⁴¹

By and large, medical treatment that was made available was far from satisfactory. Sometimes the medical staff acted in an arrogant way. It was therefore decided in 1698, that the Friars of the nursing order of São João de Deus should be asked to act as Physicians on the ship. It was also suggested that two of them should sail in each Indiamen and that they should have four male nurses.⁴² Although the Royal authorities ordered that the ships should be equipped with adequate medicines and medical staff, it

proved to be of little or no use at all. In 1691, the Captain-Major of the fleet complained that, there were no Surgeons, Bleeders or any other medical staff to work on his ship.⁴³ Sometimes, bleeding was done by Barber-Surgeon by the Pilot, the Second Pilot and even Grummetts as was in the case of Nau São Paulo. Soldiers recruited in Lisbon for the purpose of defence, sometimes never reached India.

Scurvy was most common. Its onslaught was indicated by a great weakness and weariness. The victim's legs used to become as heavy as lead and swelled up to two or three times their normal size. Swellings also used to appear elsewhere and become as hard as wood, specially in joints, limbs, and in the cheeks and throat. A person's face used to lose its colour and become pale and spotty. The gums also used to turn blue and swollen.⁴⁴ The mortality rate on account of this disease was so high, that every year about 1,000 men died during their journey to Goa.⁴⁵ In 1716, scurvy swept a Nau São Francisco Xavier which arrived only with four passengers. In 1769 about 27 people died of scurvy during the voyage.⁴⁶

Beriberi was another disease caused on account of malnutrition. The general symptoms included loss of appetite and overall lassitude and feeling of numbness and weakness in the limbs and extremities.⁴⁷ In the fleet of D. Antonio Barreto Moniz, most of the dead were the victims of beriberi.⁴⁸

Incidents of high fever were not uncommon onboard. The infectious fever that broke out onboard the Nau São Paulo was so

severe that those who fell ill immediately became delirious. Some of the victims who tried to throw themselves overboard in their delirium had to be tied to each other to prevent them from doing so.⁴⁹ In 1564, many people who were sailing to Goa fell sick at Mocambique on account of this fever.⁵⁰

The mortality rate on account of the above disease was severe and unprecedented. A Jesuit report in 1579 states that 500 out of 1140 and 300 out of 800 died during the voyage. Pyrard de Laval gives the total number of persons onboard the Nau Nossa Senhora de Jesus on departure from India as 800 including slaves, but only 550 were alive when the ship arrived at Bahia.⁵¹ The fleet of the Viceroy Rui Lourenço de Tavora, comprising of four naus, carrying about 1,000 people, reached India with only 300 people alive.⁵²

The first fleet of Vasco da Gama had in each ship all articles for an Apothecary's shop. There were two medical chests in every ship, one for the sailors and one for the soldiers.⁵³ Before the departure of the ship from Goa to Portugal, the Chief-Physican and the Chief-Surgeon of Goa prepared a list of medicines required for the voyage. This was forwarded to the Storekeeper of the provisions of the Goa dockyard.

The medical staff in the beginning was graded as Surgeon First, Surgeon Second and Surgeon Third. But this arrangement was not a harmonious one and therefore it was decided to have a Surgeon to look after the medicine chests and instruments. All medical staff were sub-ordinate to the Captain of the ship.⁵⁴

In 1564, the ship of the Viceroy had a Medical Officer, a Surgeon, a Pharmacist and a Barber who visited the sick each day with one or two Jesuits and gave them necessary advice.⁵⁵ The Barberios employed to administer the treatment were not supposed to charge any fee from any patient and instructions were given to the Captains in this regard.⁵⁶

The medicines onboard included syrups, oils, ointments, spirits, and plasters. If anybody fell sick on ship during the voyage all care had to be taken for his treatment. For this purpose, the Regimento of 1707 stated that the Captain-General of India voyage had to make separate rooms by putting partitions on the artillery deck, thereby making some sorts of cabins wherein sick were lodged and attended to by the Surgeon - Bleeder and the Nurse.⁵⁷ There were three main means of treatment to regain their health, namely, bleeding, enema and trust in God.⁵⁸ The Captain would order the Physician and the Barber - Surgeon to draw up a list of the sick people. Every morning they were visited by the doctors. They were cleaned and their wounds (if any) were bandaged regularly. As per the order of the Physican, syrups, Tisane and marzinan were prepared. A small piece of Alexandrino was also given. Everyday food was prepared in two large pots. The sick were also provided with Pollas every morning and evening. Bread with some quince jelly was also given to the sick. The sick were also provided with chicken, lentil and flour soup. In 1551 soup made of flour with honey was given to them.⁶⁰

Slaves Onboard:

Goa was the main centre of the slave trade. Slaves were brought from East Africa, Japan, Macau and Bengal. It was from Goa that the slaves were sold and distributed to other Portuguese colonies. It was stated that, there was a relief in Portuguese India when the ships used to arrive with ivory and slaves. The ships which brought slaves to India were nicknamed navios tumbeiros (Coffin ship). It was difficult for captors to transport the slaves to India in their individual capacity. They, therefore used to strike a deal with the Captains of the India-bound ship and offered them lucrative terms. This resulted into an indiscriminate loading of the slaves. These slaves were confined in the hull of the ship huddled together with little space to breath. They had to spend days together in the dark pit in the most unhygienic way and under this situation many of them died before they could reach their destination.⁶¹ The slaves had to face brutalities at the hands of the servants of the fidalgos, when the former were struggling for priority for preparing meals.⁶²

The indiscriminate loading of the slaves was naturally a burden of the ship's provision and orders were issued to regulate the same during the beginning of the 17th century. The Feitor of Goa was directed to register the number of slaves onboard the ship which were carried with the permission of the authorities and also to see their capability to work on the ship.⁶³ The sick and old slaves were debarred from sailing. Only those of 18 years of age and able-bodied, who could work onboard were allowed to embark on

Indiabound ships. The Captains of the ship were directed to display this order at the foot of the mast of the ship for public information.⁶⁴ Efforts were made to maintain correct proportion of slaves in relation to the availability of the provisions onboard. In 1754, the Captain-Major Nicholau Dalgado Figuerra da Cunha was instructed to take slaves in his Fragata only in proportion to the availability of foods stuff on the Fragata.⁶⁵ The apportionment made to each slave had to be communicated to all Captains declaring the exact number of slaves which they could carry. If the number was found more than what was prescribed, it was declared an unpardonable offence and severe penalty was laid down.⁶⁶

The slaves were used on the ship to clean and scour the deck, wash the linen and assist in various odd menial jobs.⁶⁷ They also constituted a major part of the manpower for the Royal Galleons at Goa. Slaves were employed on Galleys for the purpose of oaring. To fill the crew of the Galleys, slaves of the poor from the city of Goa were acquired by force. An order was passed declaring such an act as an offence. The order stated that if a crew was needed for the Galleys, captives were to be taken first and slaves should not be taken from the residents of Goa.⁶⁸ The heavy barreles of wine and water were usually lifted from the holds of the slaves.⁶⁹ Though the slaves were employed onboard to do all sorts of work yet there was absolutely no regard for their safety. Whenever a ship faced a storm, the slaves were thrown into the sea to lighten the weight of the ship. When Nau São Thome was wrecked in 1598, may slaves were thrown overboard.⁷⁰

Disciplinary Measures:

There was no effective co-ordination among the Captains of the Portuguese ship. Indiscipline and discord among the officials were common. The Captains often had no regard for their companions in times of distress. In one instance, two Galleons, São Santiago and São Felipe and São Jose were far in advance of the three ships when the two Portuguese vessels caught sight of the superior Dutch force. They made no attempts to rejoin the other Portuguese Galleons to face the Dutch ships. As a result the Portuguese ships were defeated by the Dutch.⁷¹ Quarrels and misunderstanding among the high officials of the ship were not rare. During the voyage of the Nau Aguia and Gracia, sailing from India to Lisbon, quarrels broke out between Captain Francisco Barreto of the Aguia and with Joao Rodriguese Carvalho of the Nau Gracia who refused to sail together and disregarded the Captain's orders.⁷²

Measures were initiated to ensure peace and tranquility onboard. Any act of indiscipline was severely punished. No officer of the garision was allowed to sleep outside his allotted space. This order was issued in order to avoid quarrels which were very frequent in matters of loading.⁷³ Instructions were given to priests sailing to India to avoid dissensions and their occasions, since the people were inclined to violence. The swords of the soldiers and the daggers of the fidalgos were always present among these hotblooded voyagers. The heat and hardships of the long voyage, the strange wine and the frenzy of the tropics provoked insane violence.⁷⁴

The practice of taking oaths onboard was strictly prohibited. People found violating this order were punished as per the law. In 1561, Fr. Gonsalo Rodrigues, who was sailing to India onboard Nau Graca preached a sermon on Sunday attacking the practice of taking oaths onboard. with the authority of the Captain a vigilnet was set up to check this practice. The Captain was to maintain a watch against the fidalgos and other honorable people sailing on the quarter deck (tolda), the contra-Mestre would keep a watch on those on the prow castle and other honoured people would maintain an eye on all those who were accomodated in the ship. If any fidalgo was found violating this order he was fined 100 marevedis which were paid to misercordia while others were condemned to the tronco for sometime.⁷⁵

The young people onboard were not allowed to drink, wine. The use of urraca was also prohibited. In 1771, Captain Francisco de Costa de Ataide who was sailing in the naus Santa Anna and São Joaquim was instructed not to allow urraca drink.⁷⁶ The Captains were also instructed not to give any punishment not mentioned or laid down in the order. They had to refrain from inflicting any injuries to sailors.⁷⁷ However, the punishments were frequent and harsh as well. Every ship had the tronco where men were secured by the neck or legs and abandoned to sun and sea-water. For more serious offenses the offenders were keeled (hailed), but this practice was not as brutal as that followed in other European ships. The Portuguese simply tied the victims to a rope and lowered him from the poop into the sea, from where he was later hauled up. The lascaries who were sailing with the

Portuguese sailors and who were thrashed and injured at the hands of the officials and soldiers were not allowed to sail and steps had to be taken for their treatment.⁷⁸

Acts of immorality onboard were not uncommon. The Jesuit letters written from Goa and Cochin provides information on the morals of the Portuguese sailors and soldiers sailing to India. The crew of the ship included respectable married women, Crown orphans (orfas d'El-Rei) and the prostitutes. It was not uncommon for a Portuguese officer to carry with him a mistress on-board during the voyage. In fact, Joao de Castro wrote after the arrival of the Santo Espirito at Goa in 1546 that all the officers had mistresses and were at odds with Captains. He ordered that any Master, Pilot or any other officer of the ship who brings out a mistress or take one during the voyage should suffer capital punishment.⁷⁹ Instances of satisfying long sex starvation at the ports with the local women were not rare. Portuguese sailors at the Port used to take local women to the ship for casual sex, which Albuquerque termed as 'infernal play'. However, his order dated 3rd December 1513 stated that he was sending eight women for the use of the Portuguese men and they should be looked after well. The order further stated that, in four months time they would be replaced by new ones from Cannanore.⁸⁰ The port areas were infected with social vices. Women and vices have been historically the prime compensation for the sailors on shore for months of hardships on the high-seas. The Portuguese mariners were no exception to this tradition.⁸¹

In Goa, areas closed to the city, must have been definitely known for the immoral trade. Flagrant prostitution, widespread immorality, the increased incidence of drunkenness, street - fights and robberies were common occurrence when an Indiamen were at the port.⁸²

Amusments And Entertainments:

There were various means of amusments onboard which were permitted within the acceptable social norms. Entertainments of considerable cultural merits were put up during the voyage. When a Viceroy was sailing in an Indiamen, he and the fidalgos onboard might gather on an evening in the ship's stern gallery or chat or gamble, while others could walk and talk on the upper deck between the main mast and the foremast.⁸³ In 1561, Fr. Gonsalo Rodrigues, sailing in the Nau Graca allowed only Jogo das Tabuas. The nobles who were interested in any other means of entertainment had to pay 20 cruzados to Misericordia. In 1563, Vasco Lourenco de Barbuda, Captain of the Nau São Filipe, allowed only the Jogos de Cartas and Jogo das Tabuas, at a fixed time. If anybody was found playing beyond the fixed time was punished with the confiscation of gains and some hours of tronco.⁸⁴ In another instance, in 1688, an audience of over 500 assembled on the Nau Nossa Senhora da Conceição to witness a lunar show performed on the quarter deck.⁸⁵ No entertainment was allowed after the sun set as this time was fixed for evening prayer.

Religiosity on Portuguese Ships:

All India - bound ships sailing from Lisbon had Chaplains onboard who were usually Franciscan Friars, although there were also Jesuits during the outward voyage. The performance of all religious ceremonies was the official obligation of the Chaplain of the ship. Like other ship officials he was allotted a special accommodation and remuneration. He was assisted sometimes by other clergymen belonging to different orders.⁸⁶ The main celebrations onboard included Holy Mass on Sundays and Holy Days depending upon the weather conditions, besides Rosary, Litany and the Salve.

During the first century of the Carreira da India, mass was said on Sundays and Holy Days. The first mass on Carreira da India was celebrated on 8th December 1608 by a Franciscan Chaplain on the Nau Santo Antonio.⁸⁷ No Holy Communion was administered to people during the mass as the consecration of the Holy Host was not allowed by the Pope in the sea.

Rosary was said every evening onboard the ships on Mondays, Wednesdays and Fridays. Litany was also recited everything. Usually the litany was said on the poop but permission was sought from the Chaplain to say the same on the prow as some people could not hear saying it from poop.⁸⁸ Saturday evening was kept for the Salve. At the sunset, the ship's personnel and passengers would come on the main deck. The Chaplain would recite the Slave Regina, one of the most ancient antiphony sung in honour of Virgin Mary.⁸⁹ The Salve was followed by loud utterance of exorcism against the evil spirit. This was done to keep away any possible danger to the

life of the people onboard during the voyage. It was also a practice to invoke the names of the four evangelists namely St. Mathew, St. Marcos, St. Lucas and St. John.⁹⁰ Fr. Arboleda writing on 13th of January 1561 states that, the slave ended with the recital of oration in honour of Our Lady. However, the salve was not performed when the land was insight or when the ship was nearing the shore.⁹¹ Every Portuguese Indiamen was equipped with a banner of the Holy Relics, which used to be displayed on her poop in the hour of distress. Various propitiatory rites were also performed.⁹²

Instructions in the faith were given every day. The meirinho was required to impart catechism to young ones and the slaves during the voyage.⁹³

On the Nau São Santigao sailing to India, St. Francis Xavier gave instructions in the faith every evening on the main deck to the children, cabin boys, slaves and crew.⁹⁴ Instructions were given according to the rules laid down by the Jesuit Order. The most diligent and learned were rewarded. The reward consisted of small water cup (pucaro de agua) which the missionaries carried with them.⁹⁵ At the end of the session they recited hymn before the altar in honour of Our Lady. However, there is no mention of religious instructions being imparted to adults, but it is believed that the teaching of the catechism was witnessed by all. When the fury of the seas rises, the missionaries prayed on their knees or even sometimes went about all over the ship with a vase of Holy Water spilling the same all over the ship and even

into the sea to invoke the blessings of the Almighty.⁹⁶ In 1560 when a ship sailing from Lisbon faced severe storm, the Pilot of the ship pleaded with Fr. Gonsalo Rodriguese who was sailing in the same Nau to display the Holy picture of Virgin Mary on the stay of the ship and the Chaplain was asked to say the Litany.⁹⁷

Holy Week was celebrated onboard with great solemnity. Fr. Antonio Fernandes who was sailing to India in 1562 onboard Nau São Martinho states that, during the Holy Week an altar below tolda was ordered to be erected. Three crosses were also ordered to be put up depicting the curcification of Christ.⁹⁸ Processions were used to be taken out on ship during the Holy week. The procession was headed by the Captain, carrying himself a cross on his shoulders who was followed by other people, singing mournfully the melody of Senhor Deu Misericorda. Special altar was occasionally raised either on the prow castle or the poop.⁹⁹ The celebrations started with Maundy Thursday. A mass was celebrated at which feet washing ceremony was performed. All missionaries onboard took part in this with great zeal and devotion. Many a times, the priests and the brothers (Irmaos) on board washed the feet of the poor and the ailing ones. At the end of the service, penance procession was taken out on the ship. In 1563 Captain Vasco Lourenco de Barbude solemnly took part in the procession carrying cross on his shoulders.¹⁰⁰ On the following day, the Good Friday, the adoration of the Cross was followed by the Hymn of the Coffin (O Canto de Paixaö). The ceremony of penance continued with more and more people onboard joining it. The penance included self-

striking, carrying of the lead load, physical rolling on the ground with hands tied and so on.¹⁰¹

The fervour was continued on the Holy Saturday with the blessing of the fire, the song of the prophecy and the litany. Easter was celebrated with great pomp. After the intonation of Glory of God the whole ship was filled with joy to the sound of artillery and the trumpets.¹⁰² The celebration of Easter was followed by the feast of the Holy Spirit. The Holy service consisted of two parts; one was the mass and other was the selection of the Emperor. The selection of the Emperor was done by the Chaplain of the ship or by any clergy.¹⁰³ On this day, the whole ship was tastefully decorated.

No Sacrements were administered onboard during the voyage. The only Sacrement that was allowed was confession. Confession of all passengers had to be made by the Chaplain and they had to produce certificate regarding the same.¹⁰⁴ The Captain-Majors of the Northern and Southern Fleet were instructed to do confession of all people onboard within 15 days. This was stated in the order given to Captain Antonio Marinho de Moura in 1753.¹⁰⁵ The use of Holy Oil was not allowed. However, Fr. Joao Baptista de Rebeira managed to bring from Lisbon Holy Oil and administered the same to the dying people.¹⁰⁶ When any person fell seriously ill, the priest or the friends of the ailing person made all preparations for a peaceful possible death. Burial at sea was common. According to Laval, the dead bodies were lowered over the ships side as the

Master called the people to pray. Bodies were weighted and immersed into the sea at the salute of the gun-fire.¹⁰⁷

Although performance of the marriage onboard was prohibited, yet there are references to it. In 1562, Fr. Sebastiaö Goncalves officiated two marriages on the ship in which he was sailing.¹⁰⁸

The voyagers placed their whole trust in God. Linschoten remarks " Only by the grace and special favour of God, the Indian ship does perform their voyages yet with great miserie, pain, labor, loss and hinderance."¹⁰⁹

REFERENCES

1. DISNEY, A. 'The World of Long-Distance Voyaging in the XVIIth Century. The Lisbon Goa fleet of 1629 as a case study',
In Studies in Maritime History,
Mathew, K.S.(ed) (Pondicherry, 1991). p.2.
2. Mathew, K.M. History of The Portuguese Navigation in India 1497 - 1600,
Mittal Publications, New Delhi, 1988,
p.232.
3. Boxer, C.R. The Portuguese Sea Borne Empire 1415-1825 (BPSE)
Middlesex, London, 1973 p. 213.
4. Rego, S. A. da Documentação Para Historia das Missoes da Padrao do Portuguese do Orient India, (RDHMPPOI),
Vol.IX, Centro de Estudos Historicos de Ultramarinos, Lisbon, 1950 - 1955. p.51.
5. Ibid ., Vol.III, p.232.
6. Ibid., Vol.X, p.51.
7. Menezes & Vasconcelos, F. 'Portuguese Armadas' in
Botelim Sociedade de Geographia de Lisbon,
Ser.31, No.23, May- June, 1936, p.21.

8. Ibid., p.29.
9. Disney, Op.Cit., pp.3-6.
10. Rego , S.A. da, Viagem Portuguesa A' India Em Meados do Século XVI = (RVPI),
Academia Portuguesa Da Historia, Lisbon,
1956, p.111.
11. Carvalho, S.J. 'Alguns Subsidios Para A Historia da Organizacao Do Servicos Medicos e Hospitalares Nas Conquistass Séculos XVI, XVII,XVIII'
In Boletim Sociedade Geographia de Lisboa,
Ser. No. 54, No. 5 - 6 May - June, 1946,
p.112.
12. Mathew, Op.Cit., p.256.
13. Menezes & Vasconcelos, Op.Cit., p.80.
14. Ibid., p.82.
15. Ibid., p.84.
16. Rego S.A. da Documentação Ultramarina Portuguesa (RDUPH),
Vol.II., Centro de Estudos Historicos Ultramarinos, Lisbon, 1962, p.532.
17. Mathew, Op.Cit.,p.249.

18. Ibid., p.250.
19. Cartas, Regias e Provisoes (CRP), Historical Archives of Goa (HAG) Mss.no.7541, fl.23v.
20. Menezes & Vasconcelos, Op.Cit., p.84.
21. Barata, J.G.P. Estudos de Arqueologia Naval, Vol.II, Imprensa Nacional, Lisbon, 1989, p.32.
22. Boxer, C.R. Carreira da India, Centro de Estudos Historicos Ultramarinos, Lisbon, 1961, p.40.
23. Ibid., pp.78-79.
24. Water, D.W. 'Reflections upon some Navigational And Hydrographic Problems of the XVth Century Related To The Voyage Of Bartholomeu Dias' In Reuniao Internacional Da Historia Da Nautica E Hidrographic, comissão Nacional Para as Comemoração Do Descobrimientos Portuguesa, Lisbon, 1989, p.282.
25. Mathew, Op.Cit., p.250.
26. CRP, Op.Cit., fl.28v.

27. Laval Francisco Viagem de Francisco Pyrard de Laval
Pyrard de (1601 - 1611),

Trans. J.H. de Rivara Cunha, Livraria
Civilizaçaõ, Porto, n.d.a., p.149.
28. Instruções Para Intendente de Marinha, HAG, Mss.no.816
fl.30.
29. BPSE, Op.Cit., p.218.
30. Schurhammer, G. Francis Xavier : His Life, His Time
Vol.II, Jesuits Historical Institute,
Rome, 1983, p.17.
31. Disney, Op.Cit., p.7. Fr. Tranquilo Gasseti, was a Jesuit
Priest at Rachol Seminary in 1630. He described the
conditions onboard the Portuguese ships in a letter written
by him to his Priest brother in Spain.
32. Ibid., p.9.
33. Iria, A., Da Navegacao Portuguesa No India no Seculo
XVII,
Lisbon, 1963, p.19.
34. Souza, A.B.de Subsidios Para Historia Militar Maritima
da India, (1618-1635)
Vol.III, Imprensa da Armada, Lisbon, 1948,
p.496.
35. RDUP, Vol.IV, p.72.

36. RVPI, Op.Cit.,p.72.
37. Carvalho, Op.Cit.,p.221.
38. Rusell-Wood,A.J.R. 'Men Under Stress'. The Social Enviroment
Of The Carreira da India, 1550 - 1750
In II Seminario Internacional de
Historia Indo-Portuguesa,
Lisbon, 1985.
39. Carvalho, Op.Cit.,p.205.
40. Boxer, C.R. An Introduction To The Historia
Tragico - Maritima (BTHM),
Lisbon, 1950, p.16.
41. Disney, Op.Cit., p.10.
42. BTHM, Op.Cit., p.64.
43. Petiçoes Despachados Conselho da Fazenda, HAG, Mss.
no. 1130, fl.10 v. Most soldiers were taken straight from
jail and many of them were suffering from Syphilis.
44. Schurhammer, Op.Cit., p.18.
45. Gracias, F.S. Health And Hygiene In Colonial Goa 1510
-1961,
Concept Publishers, New Delhi, 1994, p.91.
46. Ibid., p.93.

47. Swartout, H.O. The New Modern Medical Counsellor
Pacific Press Publishing Association,
California, 1959, pp.685 - 688.
48. Gracias, Op.Cit., p.91.
49. Boxer, C.R. Further Selection To The Tragic History of
The Sea 1559 - 1565 (BFSTHS),
CUP, Lisbon, 1967, p.64.
50. RDHMPPOI, Op.Cit., Vol.IX, p.332.
51. Pinto, J. Slavery In Portuguese India (1510 - 1842),
Himalaya Publishing House, Bombay, 1992,
p.42.
52. Carvalho, Op.Cit.,p.27.
53. Mathew, Op.Cit., p.253.
54. Ibid., p.249.
55. Schurhammer, Op.Cit., p.21.
56. Regimentos e Instruções (RI), HAG, Mss.no.1426, fl.53.
57. Ibid., fl.55.
58. Wicki, J. Documenta Indica (WDI),
Vol.X, Historices Societas, TESU, Rome,
1968, p.19.

59. Wicki, Op.Cit., p.224.
60. Pinto, Op.Cit., p.36.
61. Xavier, P.D Goa - A Social History,
Rajhauns Vitaram, Panjim, 1993, p.62.
62. Schurhammer, Op.Cit., p.18.
63. RDUP, Vol.IV, p.68.
64. Alvaras e Cartas, HAG, Mss.no. 2358, fl.153v.
65. RI, HAG, Mss.no. 1439, fl.80.
66. Ibid., fl.79v.
67. Pinto, Op.Cit., p.42.
68. Ibid., p.28.
69. Provisões de Viseoreis, HAG, Mss.no. 1185, fl.150.
70. Pinto, Op.Cit., p.57.
71. Winius, G.D. The Fatal History of Portuguese Ceylon,
Harward University, Massachussets, 1971,
p.43.
72. BFSTHS, Op.Cit., p.37.
73. RI, HAG, Mss.no. 1439, fl.2.
74. Schurhammer, Op.Cit., p.23.

75. RVPI, Op.Cit., p.23.
76. RI, HAG, Mss.no. 1429, fl.58v.
77. Disney, Op.Cit., p.10.
78. RI, HAG, Mss.no. 1429, fl.58.
79. BTHS, Op.Cit., P.21.
80. Gracias, Op.Cit., p.163.
81. RDHMPPOI, Vol.IX, pp.445-446.
82. Russell-wood, Op.Cit., p.22.
83. Scamell, G.V. 'European Seamanship in The Great Age of
Discovery'
In Mariner's Mirror,
Vol.68, No.64, National Maritime Museum,
London, 1982, p.10.
84. RVPI, Op.Cit., pp.112-113.
85. Scamell, Op.Cit., p.11.
86. RVPI, Op.Cit., p.138.
87. BTHS, Op.Cit., p.22.
88. RDHMPPOI, Op.Cit., Vol.IX, p.200.
89. Schurhammer, Op.Cit., p.24.
90. RDHMPPOI, Op.Cit., Vol,IX, p.183.

CHAPTER IV

SHIPBUILDING IN GOA - 1510 - 1780

India afforded Portugal very commendable infrastructure for shipbuilding. The availability of wood and skilled manpower, the two main ingredients of shipbuilding were found in abundance in India. There were about 120 valuable varieties of timber in Malabar alone including the well-known Angeli-wood.¹ With the Arab patronage, the shipbuilding yards thrived on the Malabar coast, Broach and Surat.² There are many references to Indian rigging material i.e. cordage and cables, but they had to be stored in salt water to keep them strong.³

When Albuquerque conquered Goa in 1510, he was astonished to find a number of ships, naval spares and artillery pieces of different calibre there. In a letter written to the Crown in 1510, he informed about the expertise and excellence of the Indian carpenters.⁴ The durability and the toughness of the Indian teak wood over European pine was well known to the authorities in Lisbon, although there was no unanimous opinion about the cost of it. A Royal order dated 1585 to Viceroy D. Duarte de Menezes and again in 1595, to the Viceroy, D. Mathias de Albuquerque emphasised the need of building ships in India.⁵ Galleons, Galiotas, Galleys etc. were built at the shipyards of Bassein, Cochin, Daman and Goa. It is proposed in this chapter to examine the various aspects of the Portuguese shipbuilding such as, the type of wood used, supply of timber and other material, selection

and cutting of timber, type of wood for different parts of the ship, system of joining the wood, causes for the decay of the wood, wood preservation techniques, and repairs at the dockyard etc.

Type Of Wood Used For Shipbuilding In India :

The Portuguese ships were built out of two types of wood. Firstly, the pine and the oak wood used in the Lisbon shipyards and secondly, the teak and other local variety that was available in India. The timbers used for shipbuilding had to be hard, dry and of a bitter and resinous sap. It had also to be soft. The hardness and sturdiness help to resist the fury of the seas and of the winds. If the timber is dry, it would not perish in the water. To avoid the ship-worm penetrating into it, the timber should have a bitter sap. It must be so soft that while giving a shape to the wood it should not develop cracks. The timber which the Portuguese used in India for shipbuilding was Teak, Zambo, Mango, Matti, etc.

a) Teak wood :

Teak wood was found mainly in India, Siam, Java and Phillipines. The wood was tough, durable, incorruptible and was used specially for pavements and costado. Its weight per cubic feet was 20 to 24 kgs.⁶ The ships built out of teakwood had certain advantages than that of the oak. Oak contains a powerful organic acid which corrodes iron and consume the very material which was supposed to keep the structure intact. The teak weighs

one-fourth less than oak. The ships built out of oak required repair or replacement every 12 years whereas the one made out of teak lasted more than 50 years.⁷ Another special feature of the teak wood is that it is hard and unalterable and does not contract when it is dried up. It does not attack iron and for this reason it was used in the planks of conves and decks.⁸

a) Zambo-wood :

Zambo was found basically in the southern parts of India and Indo-China and also in Goa. The wood was moderate in weight, durable and susceptible to the variations of humidity. The height was normally between 30 to 40mts. The fibres of this wood were long and straight. This wood was used mainly because of its resistance capacity to white ants.⁹

b) Mango Wood :

This wood was used mainly to build auxillary ships like Canoes, Pattmari etc.¹⁰

c) Goting Wood :

Another type of wood that was used for building country-crafts was of Goting. This was found in Goa, Sri Lanka and even in Indo-China. The trunk of a tree had a large dimension of 35 m.¹¹

d) Matti :

Matti wood was used for putting up internal beams of minor proportions. The sap-wood was reddish-white and the heart wood dark brown. The pores were moderately sized and uniformly

distributed. Each pore was enclosed in an irregular shaped and elongated patch of soft tissue.¹² Jackfruit and Champo were also used in the dockyard for raising supporting platforms for undertaking shipbuilding and repairs.¹³

Supply of Timber And Other Materials :

The Portuguese got much supply of their wood and other material from Bassein, Kanara, Cochin, Cannanore and even from Maldives. Almost all the Regimentos given to the Captains of the Northern and Southern Fleet had instructions to give top priority for loading timber and other material for the shipyard. Under the various treaties signed by the Portuguese with the local rulers, the latter agreed to supply timber for Portuguese shipbuilding. In the treaty signed between the ruler of Amin Islands and the Portuguese, the former agreed to provide the latter all the necessary coconut fibre needed for shipbuilding.¹⁴

The export or the sale of timber to any port was prohibited by the Portuguese. One of the conditions laid down in the Cartaz was that, the local merchants were not allowed to trade in teak wood and declared it as a Royal Item.¹⁵ This step was taken to ensure the easy availability of good quality timber. From Kanara, timber was brought for making masts and the yards.¹⁶ Nuno Vaz de Castelo Branco was asked to arrange teak wood in the north of Kanara, as the same was found to be highly durable and in conformity with the quality laid down in the shipbuilding rules.¹⁷ The supply of timber also came from Bassein. The Portuguese fidalgos who owned large forest areas around Bassein exported

timber to Goa.¹⁸ In 1683, the Feitor of Bassein purchased 100 corjas de patnigas of teak wood and sent the same to Goa in the ships of the Northern Fleet.¹⁹ Again in 1690, the Feitor of Bassein Raphael Mendes bought 50 Corjas de patnigas of teakwood for the naval dockyard at Goa.²⁰

Supply was also obtained from the individuals who were involved in the timber trade with state permission. In 1712, an amount of 2,000 xerafins was given to the warehouse keeper of the fortress of Angediva who was felling the teak wood. The warehousekeeper was instructed that he should not spend any portion from the amount given for the purchase of timber without the orders of the Captain - General of the city of Goa.²¹ In order to facilitate shipbuilding in Goa advance timber acquisitions was made. In 1684, 1 Fragata and 6 Bracos sailed to Goa from Daman with wood measuring about 1000 covados. The authorities at the dockyard were ordered to measure and register the same in the Warehouse register.²² The Portuguese apart from acquiring timber from Cochin and Cannanore also acquired accessories like masts, yards, etc. for equipping Lisbon - bound ships. In 1641, some masts were acquired from Cochin to equip a Galleon. An amount of 3,000 xerafins was given to the Captain to make the payment for the same.²³ Teak wood and Zambo were also acquired from the forests of Goa. In 1717, the Commandar João Marinho de Mouro was asked to load all timber that was available at Canacona and to send the same to the dockyard. He was further instructed to make payments for the same at the prevailing rate.²⁴ In 1683, the Feitor of Mangalore was

instructed to purchase coir from the Maldives for the stock of the Mangalore warehouse, which was later to be sent to Goa in the Nau Nossa Senhora dos Milagres.²⁵ Coir was also obtained from Goa. In 1772, Pascoal de Braganza, Master Winder received 11 candis of fine coir from Bardez. In the same year, Antonio Baptista, Master of the Nau São Francisco Xavier, received from the Feitor of Goa thick coir of 7 arrobas for the service of the said Nau.²⁶ There are references to the export of timber from Goa to other Portuguese colonies and even to Lisbon. In 1613 the King instructed the Viceroy of India and the Finance Comptroller to load the ships coming from India with timber for making various parts of the ship, such as caleses, cabrestantes etc.²⁷ Teak wood was also taken to Brazil for shipbuilding and for undertaking repairs.²⁸ The supply of material was not always regular. This was mainly on an account of the lack of finance and other technical problems which the Portuguese Feitors faced at Kanara, Cochin and Bassein. In 1628, it was found that, the wooden planks and the poleam which were in the Northern Province did not reach Goa in time inspite of the consent of the Viceroy.²⁹

Selection And Cutting Of Timber :

The selection of timber was given top priority as the safety of the ship depended on it. As Anacarsi Selyta, Greek Sage described that, "It is a plank on it depends the safety of the seafarers as only two fingers of thickness lies between it and death".³⁰ Only those tress whose wood posses certain distinct features and having all essential ingredients were used for

building different parts of the ship. If a tree is cut in transversal and perpendicular to the axis of the trunk 2 distinct zones or areas can be noticed (Fig. 13). The outer or external is called bark (casca) and the internal has been termed as lenho, both were made out of concentric layers but with different features.

As regards the bark (casca) there were 2 portions internal and external. The internal portion, liber was composed of vertical fibres easily separable by marking. The layers were formed throughout the year as the tree matures. Between the external portion, epiderme and the liber there is a layer called subersoa which in certain trees acquires rapid growth.³¹ The line forming it also had two parts. One little adjacent to liber, generally dark in colour than that of the centre layer, which acquire toughness both, internally and externally as the time goes by. It was termed sapwood. The other was the heart (crene or corasao) which was dry, tough and compact.³² The central part of the tree trunk had a spongy substance called medulla which vanishes as the tree matures. The growth of a tree depended upon the circulation of sap which in turn depended upon the nutrition of the tree.

The prime season for the circulation of the sap was spring season. Every year it forms one new layer of line. The age of the tree can be determined on the basis of number of layers and in this manner the tree shown in (fig.14) was of 6 years. On each layer, every year a tissue is formed during the spring and autumn

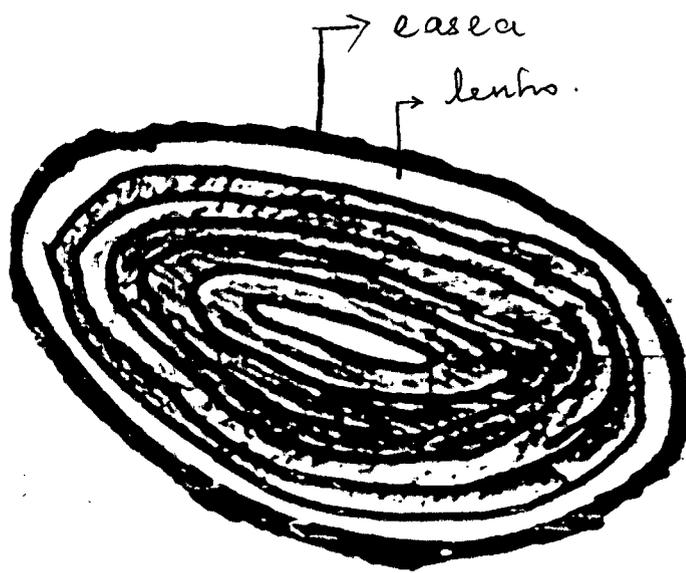


fig.13, Inner portion of the tree



fig. 14. Inner portion showing 6 layers.

season. The growth of the tissue was not always identical in all the trees. In the case of the oak tree, the thickness of the layer during the spring season remains constant while it varies during the autumn and in the case of pine-tree it was contrary.³³ The wood which was meant for naval construction had to fulfill the following conditions. Firstly, the wood should have precise homogeneity so that all its parts offer equal resistance. Secondly, the wood should be elastic, so that any excess load of cargo does not lead to any permanent deformation. Thirdly, the wood should be well dried so that it does not develop any crack after its use. Lastly, the wood should have straight fibres to provide resistance to pressure and to guarantee its durability.³⁴

Certain experts were of the opinion that, the trees should not be cut down either during the spring season or in the summer as the sap saturating from the vascular fibres of trunk leads to easy fermentation within the tree, and as a result the wood gets rotten. Others were of the opinion that, the felling of the trees should not be made during cold, winter or in autumn because the sap was solidified and as a result the wood becomes tough and susceptible of producing the cracks.³⁵ The most appropriate time when the trees attains maturity and fit for felling is after they yield fruits i.e. gaining all their virtue and strength. The maturity of the tree depends upon the sun. The sun warms the tree in the beginning of spring and summer. When autumn arrives, the sun withdraw from the trees and with its absence they become cool. Thus autumn and winter season were considered suitable and appropriate for felling the trees.

The movement of the Moon also influence the trees. The increase and decrease in their humidity depended upon the light which they receive from the Moon. The experts recommended that, during December and January the waning of the Moon should be noted and the timber should be cut at that time. Timber for shipbuilding had to be cut at the waning of the Moon during the two months closer to the winter, one before its beginning and other after it.³⁶

As regards the method adopted for cutting the tree, a side of the tree was first identified and a rope was tied at the top of the tree and was taken the opposite side. Then a cut was put on that side with the axe, measuring approximately 2/3rd of its (tree) diameter. A profound stroke is given as it was required to bring down the tree. On some occasions such cut produce cracks and damage the wood and therefore the experts suggested the use of saw blade. The first cut was usually measured about 2/3rd of its (tree) diameter while the second was of 1/3rd just opposite and little above the first one.³⁷

Types of Wood Used For Different Parts Of The Ship :

A single tree could never posses all technical requirements of the shipbuilding and therefore a certain type of wood was used for specific portion of the ship. The sovaro or sobro wood was used specially for the liames because of its water resistance capacity. The sobro wood was substituted by 'azinho' which had the similar qualities.³⁸ The resinous-pine was used for supporting interior of the hull while stone-pine was used for the

obras mortas.³⁹ The masts of the caravela of small tonnage were made out of only 1 piece of phino de flandres. The yards were also made out of pine-wood.⁴⁰ The size and the shape of the tree was given much importance as the same determines the fitness of the ship. In 1628 Master Manuel Gomes Galego declared that, the wood of savaro which they (contractors) fell was of insufficient size to make a tough ship boards and to join them with each other.⁴¹ It was on account of the non-availability of the wood of sufficient size the shipbuilders began to use raw wood and of insufficient dimensions which was one of the main reasons for the enormous loss of the ships. The standard timber requirements for one Nau of 17,5 r of keel (29,95cm) was 35 chaos of ribs, 70 bracos, 140 first riders and 145 second riders and more than 13 enchimentos de proa with 26 long sticks and 21 enchimentos de popa with 42 reversed. Each chao de caverna was required to be of a plank measuring about 8.10 m. of length by 0.50 m. and thickness of 0.30 m. Each braco and each rider required the planks of 2,00 m. of length by 0.50 m. width.⁴² Generally, there were two classes of wood. One meant for the hull and second meant for rigging. The wood meant for rigging (such of teak and oak) should have certain shape and dimensions as mentioned as below :-

- a) Paus Direitos : Piece of wood with no curves AB in (Fig.15.)
- b) Paus de Volta : Should have one regular and continued curve equal to 1/50 m. of its total length, like the piece C in fig.15.

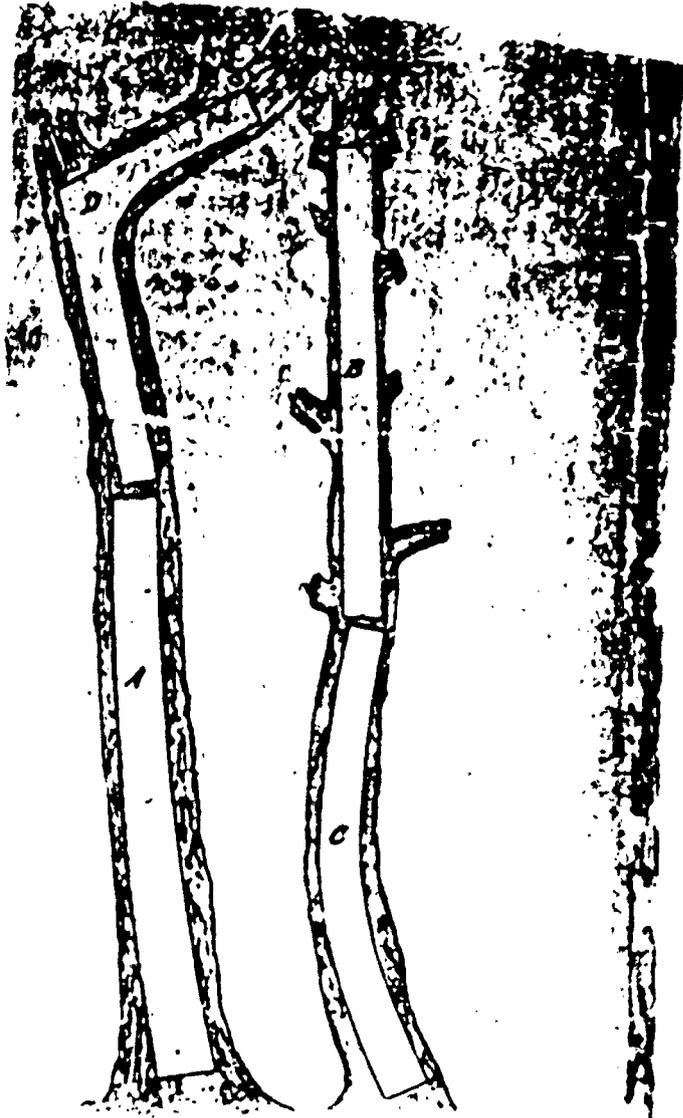


fig 15.

- c) The Curvas : Called improperly because they are the pieces in angle with two straight logs, one forming the trunk and another forming the branch of the tree as seen in D, fig.15.
- d) Piques : These were very much used for the balisas de proa and for stern. The stone-pipe provides the best piques (Fig.16). The dimensions of the paus were classified by its thickness. The straight and the turned ones were divided in five groups. The first two of lower classes were termed as liames pequenos with the maximum thickness of three inches and the second was termed as liames grandes with the maximum thickness of six inches. The thickness of the paus of the third group was eight inches, while that of the second category the maximum thickness was of ten inches. The maximum thickness of the first category was twelve inches.⁴³

System Of joining The Wood :

To ensure proper joining, special cuts were put to connect the wood pieces. The samblagenes had to be as simple as possible so as to reduce the cost. The joining invariably could not be matched since its toughness was destroyed, not only by the contraction of wood, but also on account of different forces of pressure affecting the skeleton of the ship. This invariability is obtained by means of bolts and nails which were always put where the pieces were to be joined. When two pieces were crossing, it was sufficient to fix one piece crossing another, placing certain number of bolts on the points of intersection. But in most cases it increases the resistance of joining by

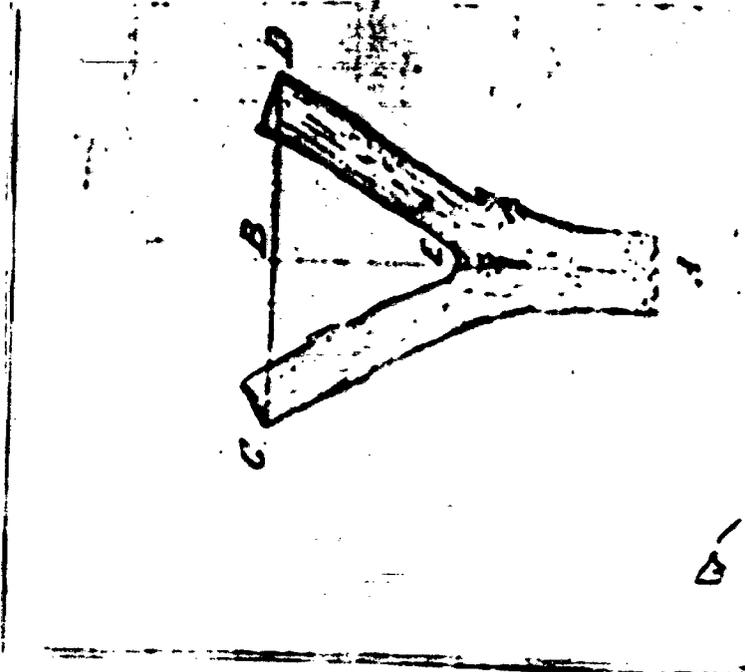


fig. 16.

putting one entalhe on each piece as seen in the (Fig.17). In case the end point of one piece meets another rectangular point, the samblagen was to be made as shown in (fig.17) which is said mecha and respiga, consolidated by means of one bolt.⁴⁴

The cavity put on piece A is mecha or mortagem and on the part of the piece B which enters in this cavity is called the respiga. The two pieces which forms the escarva are fitted on the bixel as shown in (Fig.18) The length of escarva AB was between four to six times the height H of viga and the thickness B of the end point was in general equal to one-third of the same height. It could also give the form as shown in (Fig.19). The connection or joint was made by means of three or four bolts depending upon the dimensions of the escarva and sometimes even using two nails on each end. The escarva is described as escarva lisa or lavada whose make was simple and of great resistance. (Fig.20) shows the escarva de dentes which was used during the early days of naval construction. The number of dentes was variable. But the use of this type of escarva was given up since its efficacy was guaranteed only by the accurate cutting of the connecting piece. The shipbuilders adopted another method of joining known as escarva de cunha, which consisted of putting a cunha at two places.⁴⁵ (Fig.21)

Nails and bolts were used to connect the planks and wood pieces. The bolts used to connect the joints must have the top embutted in the wood. The escarva having the length of 2.50m would have 4 bolts, being the last one placed at a distance of

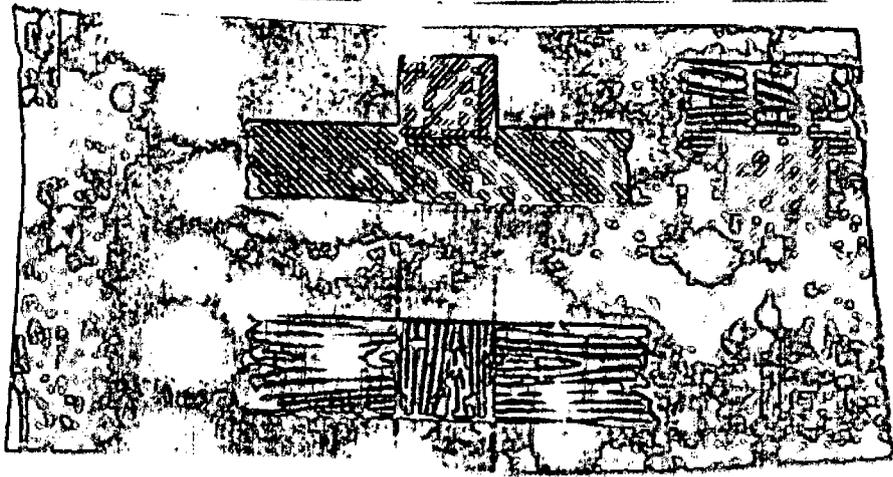


Fig. 17.

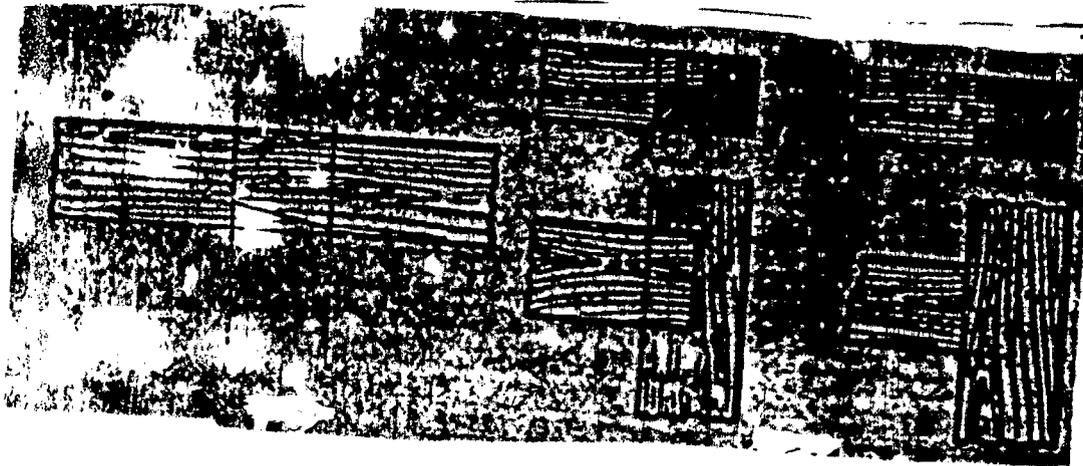


Fig. 18

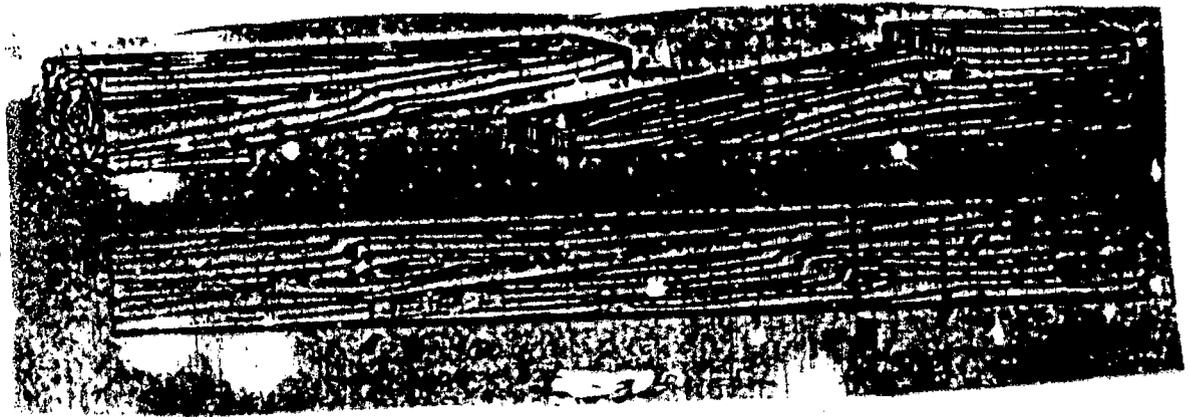


Fig. 19.

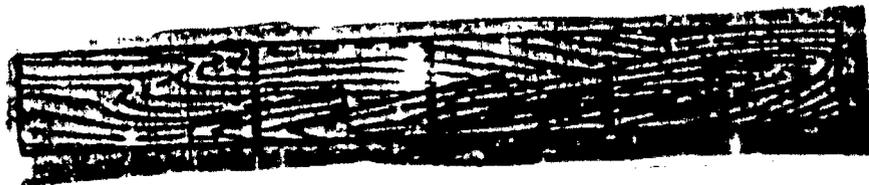


Fig. 20

0.25m. from the end point of the joint.⁴⁶ The nails were made of iron, copper and even of wood. In cold water the wooden nails were used but their use in the warm waters of the Indian Ocean was not suggested by the naval experts for two reasons. Firstly, due to heat the wooden nails breed worms which completely destroy timber and secondly, the insertion of wooden nails was not feasible on account of the size of India-ships and the thickness of the planks.⁴⁷

Sometimes, a chemical content called tanino found in the wood attacks the iron nails slowly if the wood was well dried, but if the wood has humidity the corosion is rapid and the wood decays.⁴⁸ The head or the top of the nail was put, in the wood at the profoundity of one - inch and the upper portion of it, i.e. from the head of the nail till the surface of a plank was covered by one wooden plug called rolha.

Many times in certain parts of the ship bolts of square section were used. But the disadvantage of this was that, it was difficult to fix the square shaped bolt in the round drilled whole. This was one of the causes for the deterioration of wood at the time of building the ships.

Cavilhas Frapadas : Was another type of nail which was used for shipbuilding. But the experts declared that the wood was more prone to develop cracks while inserting this bolt on account of its sharp edge. (Fig.22)

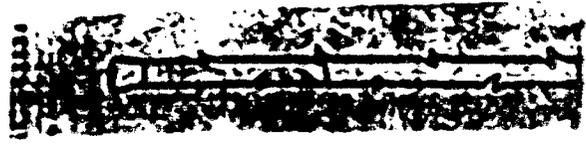


Fig. 22. Cavilhas Farfadas

The Portuguese naval architects unanimously supported the use of iron nails in place of copper and wood for India ship.⁴⁹

Causes For The Decay Of The Wood And Preservation Techniques :

The tress such as teak, pine, oak etc. were affected by various kinds of diseases which generally led detrioration of the decay of wood. Some of the most common diseases which affected the trees were as under :-

- a) Caria : It is a local disease which led to the rotting of the tree. The tree develops cracks on its trunk which facilitates the infiltration of water through them specially at the junction point of the branches.
- b) Pe de Gallinha or Crows Foot : It is another type of disease which affects the wood. The main indication of this was that a crack starts developing from the crene and then moves towards the periphery of the tree. When there is a violacious or dark powder, it was a sign of severe decay of the wood. Sometimes the cracks were caused due to the action of winds or intense heat. But this does not always affects the wood, as the wood contains a preserving substance.
- c) No's : It is a kind of disease which develops from the improper cutting of the branches. This results in reducing the resistance of wood and making it difficult to work with it.

- d) Madeira Picada : The wood was affected due to the action of the larvae which were affecting the tree from the bark and making cavities in all directions which totally ruins the tree.
- e) The white ant is another insect which destroys the heaps of wood stored at the dockyard. The attack of white ants to wood could go unnoticed as it does not affect the external surface.
- f) Taredo : It was a mollusc disease which could increase to one meter. This insect penetrates into the wood by small orifice which was made externally and extraordinarily increasing the same in the direction of the fibres. This larva was usually found in the clean water but not beyond the depth of 3 m. The growth of this larva was more rapid in the warm water than in cold water.
- g) The lymexylon was a very small larva that penetrates into the wood before the tree is cut, but it develops only when the wood was kept in a heap.
- h) The rosca or Carancho was a parasite insect which basically destroyed the wood.⁵⁰

Wood Preservation Techniques :

Once the wood is cut and felled it should not be used

immediately for shipbuilding as it would warp, shrink and crack. To avoid this the wood should be kept either in the field or in the yard or in the salt water according to the nature.⁵¹ Before the wood is used, its bark was to be removed because besides, providing protection from the larva, which affects the tissue of plants, its contact with the sambago and the variations of heat and humidity could lead to the decay of the same.⁵² The presence of sap in the wood facilitates the decay of the same. Another method that was followed was to desiccate the intrinsic humidity. This involves the cutting of the tree till the middle of its heart and keeping it erect, so that all its superfluous humidity is removed through that and the tree was brought down when it ceases to drip humidity. The branches were to be cut while it is kept erect and the bark should be removed, so that the tree does not get nourishment neither from the bark nor from the roots. The sap in the wood could be dissolved rapidly in the sweet water, but it leads sometimes to the weakening of the wood. The use of salt water although suggested, could also have an adverse effect on the wood as it was affected by taredo. In view of these reasons, the following measures were recommended:-

i) Depositing the wood at the mouth of the river at such a point, that it would get the mixture of sweet and salt water thereby preventing the growth of taredo.

ii) Burying the wood in the sand. This process was used to conserve wood which was kept in the dockyard.

iii) The wood had to be preserved in the water because long exposition to air results in the loss of resin and reduces the resistance capacity. After the immersion, the wood had to be exposed for a sufficient time to moderate and regular ventillation.

iv) The wood which was stored in the warehouse should have proper and unaffected floor which would not lead to the decay of the wood. The warehouses with low roofing should have convenient openings in the form of chimneys on the roof. To have a tough and dry wood at least 3 years were required for resinous wood and 4 years for the oak.⁵³

Repairs at the Goa dockyard :

There is no specific reference for any first Portuguese ship built or repaired at the Goa dockyard. Albuquerque may have repaired his ships at Goa before departing for Malacca. In 1512, ships of 800 tons were built at the Goa dockyard.⁵⁴ The dimensions of the parts of the ship, tonnage, etc. were discussed and elaborated by a Technical Board known as Junta de Fabricas de Rebeira de Lisoa, formed in 1623.⁵⁵ All master builders, who were appointed by the authorities at Lisbon had to be acquainted with all naval construction rules and regulations formed or laid down by the Technical Board at Lisbon. The Revenue Council was the main body approving the construction and repair of the ships with the help of the dockyard officials and making payments for the same. Based on the guidelines of the Technical Board, the Revenue Council laid down the measurements of the ship which were

to be built on contract basis by the captain of the fortresses.

In 1655, the Revenue Council laid down that the keel of a ship was to be 6 covados and would have boca of $7\frac{1}{2}$ covados while the depth would be $\frac{1}{2}$ of the boca. The thickness of the bottom planks was laid down as $2\frac{1}{2}$ angullas while the planks of the keel upto the ponta de caverna and from there to apostura the thickness was to be of 2 angullas.⁵⁶ Among the most celebrated ships built at the Goa dockyard was a Carrack Cinco Chagas built in 1559-60 under the personal supervision of the Viceroy D. Constantino de Braganza. Another Galleon Bom Jesus was built whose keel was laid in 1630 at Goa.⁵⁷ In 1650, a Galleon Madre Deus along with Nau São Francisco was built in Goa.⁵⁸ To meet the Dutch challenge, the Portuguese built a Galeota in 1655 at Vengurla for its quick deployment.⁵⁹

In 1613, the authorities finding many handicaps to shipbuilding at Cochin and in the North decided to build ships in Goa on contract basis. A contract was signed with one, Bostião Fernandes and a sum was allotted to him from the amount of Cabedal.⁶⁰ In 1616, two Navios and two Sanguicies were built and equipped with all necessary accessories and fulfilling other technical requirements as laid down by the Revenue Council.⁶¹ In 1618, the Viceroy D. Francisco approved the building of two Naus and the shipyard Master was asked to prepare a detailed report of expenditure of the same.⁶² A new yard near the wharf of St. Catherine, next to the Galley's yard, was established by the Viceroy Conde de Linhares, where he laid down the keel of two

powerful Galleons. The old yard became unserviceable on account of the flooding of the sea water. This was the only yard where the construction of the carracks could be undertaken.⁶³ In 1654, the Master of the dockyard, Francisco Carneiro built the keel of a ship measuring 66 covados with the bocca of 18 covados. The depth was 9 covados with the stem height of 18 covados. The thickness of the keel was given as 12 angulos with the breadth of 14 angulos.⁶⁴

Ships built at Goa shipyard were sent to all Portuguese naval establishments in the East. In 1703, the lanchas of the fortress of Mocambique were ordered to be repaired at Goa. The order further stated that, if the Lanchas were found irreparable, the Feitor had to make arrangements for building new ones, capable of rendering good and effective service.⁶⁵ In 1747, Marques de Castello Novo ordered to build one Palla and two Pataxos each with twenty-four artillery pieces.⁶⁶ The ships were anchored at some distance from the main dockyard and were taken to the yard only at the time of undertaking the repair. In 1652, the Galleon São Jacinto which was at Panelim was ordered to be repaired immediately before the outset of winter. The said Galleon was to be taken from the São Pedro, Ribandar to the dockyard.⁶⁷ Expert opinion was sought to bring the Galleons from the bar to the Panelim dockyard. In 1644, two Galleons namely Santa Milagrina and Santa Margarida which sailed from Lisbon were ordered to be repaired immediately. The Revenue Council sought the opinion of the officials of the dockyard and the pilots of the bar whether it would be safe for the Galleons to pass through the shore of

Panelim during the full moon night. The experts suggested that, the said Galleons should be brought before 16th of that month from the bar to Panelim.⁶⁸ Repairs of the ship were undertaken only after ascertaining the exact nature of the damage. In 1680, the *Fragata Nossa Senhora de Conceição* was declared unfit and beyond any repair. The same *Fragata* was repaired in 1672. The keel was found totally decayed and it was so weak that, it was difficult to make safe entry and departure from the bar. The authorities suggested that the mast and other wood be used for some other work.⁶⁹ Periodical inspection of the ships were carried out by the officials of the dockyard. In 1737, the Clerk of the Treasurer and the Feitor inspected the *Nau Nossa Senhora da Aparecida* along with the dockyard officials to ascertain the condition of the same.⁷⁰ In 1740, the same officials examined the *Nau Nossa Senhora de Nazareth* and found that the stern of the ship was in bad shape.⁷¹ In 1690, all the *Fragatas*, *Galiotas* and *Navios* of Goa and Diu were ordered to repaired. These vessels were meant to guard the coast.⁷² Old and irreparable ships were disposed off in public auction. This was done in order to get rid of the old and unfit vessels, thereby reducing the anchoring pressure at the dockyard and also to obtain some revenue for the State Treasury. In 1632, the Finance Comptroller Lourenco Melo de Sa was ordered the dispose of old *Navios* and *Sanguices*.⁷³ In 1690, three *Galeotas* of one mast, two *Navios* of the fleet, one *Bicha* and two *Barquinhas* which were in the dockyard and not serviceable were ordered to be sold out in public auction. The Finance Comptroller was directed to make the valuation of the ships with the help of

the dockyard officials.⁷⁴ No auction could be held without the presence of the Feitor of the city.

Shipbuilding or repair was carried out under the supervision of the people appointed by the King or the Viceroy. In 1640 two Jesuits Priests, Andre Ferreira and Gaspar de Valle were authorised to supervise the building of 2 Galleons. All the materials that were received and utilized for the work had to be recorded in the official register.⁷⁵ In 1652, the Revenue Council decided to appoint a person of high integrity to oversee the building of Galleons at the dockyard. The person appointed was entrusted with the task of supervising the use of timber, nails planks etc. meant for the Galleon.⁷⁶ The person appointed to monitor the work, had to report irregularities, if any to the authorities. Damage to the hull of the ship was caused on account of the use of immatured wood, improper loading, the use of wooden nails and the attacks by the tropical water insects. The damage caused to the bottom of the ships by boring worms was heavy. In Surate, such was the situation that it could make the wooden hulls and the rudders unseaworthy within three or four months.⁷⁷ In 1636, Princess Margarida, on behalf of Felipe V. wrote to the Viceroy of Goa to take adequate measures to protect the ships from the ravages of insects.⁷⁸

The ships before leaving the shores of Goa to Lisbon had to be cleaned underneath for greater durability of the hull. The Portuguese Captains felt that, one of the primary reasons for the damage by ship worms was the failure of the dockyard officials to

clean the bottom properly.⁷⁹ The use of wooden nails also facilitated the worm attacks. Due to heat, the wooden nails caused breeding of worms. These worms enter into the plank at the back (under) the ship and through them they go on making holes all along till they reach the most interior portion of the wood.⁸⁰ The best remedy was to clean the bottom of the ship. Almeida ordered that India ships should be unloaded, cleaned and repaired before taking a new cargo.⁸¹

Careening Of The Ships :

Careening was probably an ancient technique that originated and used in the tideless Mediterranean and spread rapidly when ships became too large to readily haul them at ashore.⁸² The use of careening in Portugal was at least a century old. There were three fundamental requirements of careening. (i) It required that wherever practicable the ship should be lightened (ii) It demanded a control over the movements of ballast or of an equivalent weight within the ship. (iii) It required an ideally sheltered water.⁸³ Under the system of careening the ship left a float, but put on her beam ends by shifting her ballast and hauling her down with rackle rigged to her masts even to the extent that the part of the keel was exposed. All the difficulties of keeping large rounded hulls upright ashore were avoided but enormous stress was put of poorly fastened ship.⁸⁴

Caulking System:

Another measure that was used for checking the underneath damage was the caulking system. Caulking is a technique of making

joints tight or leak proof by forcing oakum between the parts that were not tightly fitted. Caulking was therefore a second step in the European shipbuilding after the planks were joined together by any method of carpentry.⁸⁵ At Goa dockyard, caulking check was carried out by the Master Caulker in the presence of the Chief-Master. Sometimes, the material used for caulking was of a very poor quality and as a result, many a times the caulking had to be removed.⁸⁶ Early in the 16th century, the Portuguese adopted a technique of protecting the hull by applying additional strake layers, both above and below the waterline, a technique which they had borrowed from the Chinese junks.⁸⁷ Almost all the ships were provided with a pitch stove etc. for undertaking caulking work whenever desired to do so.⁸⁸ The authorities at Goa were directed to carry out proper check of all the vital components of the ship particularly of the pitch used in caulking operation at the time of issuing technical fitness certificate for undertaking a voyage to Lisbon. However, there was no separate area in the dockyard marked for undertaking any caulking or careening operations of the ship.

The Economics of Shipbuilding :

Since the days of the early Portuguese discoveries, shipbuilding was directly financed by the State. Sancho Afonso III gave his estate to the shipbuilder João de Miona. King Fernando initiated series of measures to boost shipbuilding by offering timber from the state forests at concessional rates, allowed duty free import of raw material etc.⁸⁹ After 1498, the

Portuguese King embarked upon the policy of sending annual fleets to India. The State now began to award contracts of shipbuilding to the Captains of the fortresses. The objective of this policy was to raise the required number of ships promptly for undertaking naval expeditions. In 1530, Governor Nuno da Cunha declared that, any person who built a ship of any type would be given a Captain's salary and receive artillery to arm the vessel.⁹⁰ In 1636, Princess Margarida ordered the Viceroy to build oarships and also a high-sea vessel. This contract was given to Rui Dias de Cunha, Captain of Bassein.⁹¹ In 1663, Joao de Faria built 13 ships on contract signed with the Revenue Board.⁹²

Purchase advances were made to the contractors by the state only under exceptional circumstances. In 1631, the Revenue Board provided capital to the contractors to buy wood, iron nails etc. for the dockyard.⁹³ The funds were allotted from the Cabedal for undertaking the ship repairs. The King ordered the Viceroy to formulate rules for setting aside a certain portion of amount from the Cabedal every year for meeting the cost of shipbuilding and repair. The difference that occurs in the amount on account of the diversion of finance had to be adjusted from other sources of revenue.⁹⁴ The authorities suggested the use of 1/8th of the amount from the cabedal for buying sails, teak wood, iron, nails, etc.⁹⁵ In 1655, the Revenue Council ordered to purchase timber from Cochin. An amount of 9,000 reis from the cabedal was sanctioned. The timber was to be sent to Goa in the Galeota captained by Manuel Coutinho.⁹⁶ Revenue obtained out of tobacco duties was used for carrying out artillery production in the

dockyard. In 1636, during the reign of Conde de Linhares, revenue collected in the form of tobacco duties in Bardez and Salcete was allotted to the Goa dockyard to expediate artillery production for ships.⁹⁷

The rate of the timber was fixed only after ascertaining the quality of the same by the officials of the dockyard. One plank of teakwood of standard size, costed around 9 'xerafins' in 1620.⁹⁸ In 1640, the cost of a teak wood plank measuring 13 inches, the rate was 2 tangas 18 reis per covado, while the planks of Zambo measuring 17 inches of height and $3\frac{1}{2}$ of the thickness the rate was 2 tangas 25 reis per covado.⁹⁹ In 1668, the repair cost of the Nau Nossa Senhora de Oliveira was put to 12,522 cruzados, including the cost of timber and labour.¹⁰⁰ In 1775, the Revenue Council approved the cost of lead which was 200 cruzados for 40 quintals, while that of the pitch was 70 cruzados for 70 quintals.¹⁰¹ In 1655, the Revenue Council approved the purchase of timber which consisted of the following :-

Thirty planks of costado of 3 angulos, the cost was 3600 xerafins, while the cost of the 7 planks of teakwood was 560.¹⁰² The cost of 1 Nau of Carreira da India with all accessories was about 29,534 cruzados.¹⁰³ The officials of the dockyard at Goa demanded 30,000 to 40,000 cruzados to start a work.¹⁰⁴ The repair cost of the Nau Nossa Senhora de Neves undertaken at the Goa dockyard in 1710 was around 13,550 xerafins.¹⁰⁵ Timber meant for the dockyard was exempted from the custom duties and registered in the seperate book.

REFERENCES

1. Mathew, K.M. History of the Portuguese Navigation In India, 1498 - 1600
Mittal Publications, New Delhi, 1988,
p.305.
2. Banger, M.K. 'Ancient Shipbuilding In India - A Historical Prespective.
In studies in Maritime History
Mathew, K.S.(ed), (Pondicherry) 1991, p.8.
3. Quaiser, S.J. Indian Response To European Technology And Culture.
Oxford University Press, New Delhi, 1982,
p.22.
4. Boxer, C.R. From Lisbon To Goa 1500 - 1750
Variorum Reprints, London, 1984, p.51.
5. Mathew, Op.Cit., p.302.
6. Esparteiro, A.M. Dicionario Ilustrado de Marinho,
Livraria Classica Editoria, Lisbon, n.d.a.
p.530.
7. Roy, A.C. A History Of The Mughal Navy And Naval Warfare;
The world Press Ltd., Culcutta, 1972,
p.64.

8. Barros, E.E. Construção Naval.
Vol.II, Lisbon 1947, p.10.
9. Freitas, M.C.P.G Madeiras da India Portuguese,
Junta de Investigações do Ultramar,
Lisbon 1963, p.54.
10. Ibid., p.12.
11. Ibid., p.20.
12. Gamble, J.J. A Manual of Indian Timber,
Dehra, 1972, p.342.
13. Registo Gerais, Historical Archives of Goa
(HAG), Mss.no. 2275, fl.75.
14. Mathew, Op.Cit., p.305.
15. Livro de Cartaza, Goa Historical Archives (HAG), Mss. no.
1364 fl.25v.
16. Relação da Plantas e Descreções De Todos As Fortalezas,
Cidades e Povoações Que os Portuguese Tem No Estado da India
Orienta,
Lisbon, 1936, p.24.
17. Alvaras & Cartas (AC), HAG, Mss.no. 2358 fl.165.
18. David, M.D. 'Historic Bassein'
In Indica, Vol.24, No.2. Bombay, Heras
Instituto of Indian culture, September,
1957, p.97.

19. Assentos Conselho de Fazenda (ACF), HAG, Mss.no.1173, fl.250.
20. ACF, HAG, Mss.no. 1174, fl.34v.
21. ACF, HAG, Mss.no. 1197, fl.26.
22. Cartas, Alvaras de Feitoria, HAG, Mss.no. 2316, fl.144.
23. Regimentos e Instruções (RI), HAG, Mss. no. 1421, fl.9v.
24. RI, HAG, Mss.no. 1426, fl.10v.
25. ACF, HAG, Mss.no. 1160, fl.28v.
26. Obrigações de Feitoria de Goa, HAG, Mss.no. 1603, fl.4.
27. Bulhao Pato, R.A. Documentos Remittidos da India ou Livros dos Monções,
Vol.II, Archivo-Nacional da
Torre da Tombo, Lisbon, 1880- 1935, p.245.
28. ACF, HAG, Mss.no. 1161, fl.30.
29. Ibid., fl.32v.
30. Barata, J.P. Estudos de Arqueologia Naval,
Vol.II, Imprensa Nacional, Lisbon, 1989,
p.161.
31. Barros, Op.Cit., p.1.
32. Ibid., p.5.
33. Ibid., p.2.

34. Ibid., p.4.
35. Ibid., p.5.
36. Barata, Op.Cit., p.205.
37. Barros, Op.Cit., p.5.
38. Barata, Op.Cit., p.162.
39. Ibid., p.164.
40. Ibid., p.29.
41. Ibid., p.32.
42. Ibid., pp.289-290.
43. Barros, Op.Cit., p.14.
44. Sambalgen a technical term given for a half cut, put on the piece of wood or plank to make a joint.
45. Barros, Op.Cit., p.18.
46. Ibid., p.19.
47. Barata, Op.Cit., p.14.
48. Barros, Op.Cit., p.19.
49. Ibid., p.21.
50. Ibid., p.5.
51. Ibid., p.6.

52. Ibid., p.7.
53. Barata, Op. Cit., p.7. For longevity of wood coconut oil was applied to the planks and the heat was given to the same, Oral information obtained from the country craft builders from Betim, during the field trip on 24-8-93.
54. Barata, Op.Cit., p.271.
55. Ibid., p.210.
56. ACF, HAG, Mss.no. 1168, fl.174v.
57. Boxer, C.R. Carreira da India,
Centro de Estudos Historicos Ultramarinos,
Lisbon, 1961, p.39.
58. Esparteiro,A.M. Tres Séculos No Mar,
Vol.I, Ministerio de Marinhas, Lisbon,
p.22.
59. Ibid., p.101.
60. ACF, HAG, Mss.no. 1159, fl.124v.
61. Cartas, Patentes e Alvaras, HAG, Mss.no.472, fl.397.
62. Alvaras E Cartas Regias, HAG, Mss.no. 472, fl.397.
63. Boxer, C.R. 'Asia Pontentates And European Artillery'
(BPEA)
In Journal of The Malaysian Branch of
Royal Asiatic Society,
Vol.38, 1965, p.163.

78. Iria, A. Da Navegação Portuguesa No Indico no Século XVII,
Lisbon, 1963, p.67.
79. Barker, R. 'Careening Art and Anecolote'
In Mare Liberum,
No. 2, Comissão Para As Comemorações
Dos descobrimentos Lisbon, 1991, p.195.
80. Barata, Vol.II, Op.Cit., p.215.
81. Ibid., p.195.
82. Ibid., p.201.
83. Barker, Op.Cit., p.190.
84. Scamell, Op.Cit., p.36.
85. Qaiser, Op.Cit., p.22.
86. ACF, HAG, Mss.no. 1178, fl.22.
87. Lobo, F.M. Portugal - A. Acção Maritime Dos Portuguese.
Imprensa Nacional, Lisbon, 1990, p.65.
88. Barata, Vol.II, Op.Cit., p.43.
89. Mathew, Op.cit., p.69.
90. Ibid., p.313.
91. Iria, Op.Cit., p.69.

92. ACF, HAG, Mss.no. 1168, fl.175v.
93. ACF, HAG, Mss.no. 1160, fl.27.
94. ACF, HAG, Mss.no. 2358, fl.71.
95. ACF, HAG, Mss.no. 1160, fl.274.
96. ACF, HAG, Mss.no. 1167, fl.88v.
97. ACF, HAG, Mss.no. 1162, fl.209.
98. Alfandega de Madeira, HAG, Mss.no. 6319, fl.95.
99. Registo Gerais, HAG, Mss.no. 2275, fl.3.
100. Vasconcelos-F. 'Subsidios Para A Historia De Carreira Da India, No Tempo Dos Filipes'
In Boletim Geral do Ultramar,
Agencia Geral do Ultramar, Lisbon, 1959,
p.33.
101. Ibid., p.139.
102. ACF, HAG, Mss.no. 1167, fl.35v.
103. Barata, Vol.II, Op.Cit., p.272.
104. BPEA, Op.Cit., p.183.
105. ACF, HAG, Mss.no. 1176, fl.141v.
- | | |
|--------------------------------|-------------------------|
| The cost of the timber was | 5,550 <u>xerafins</u> . |
| 7 Candis of Iron | 5,600 <u>xerafins</u> . |
| 2 Iron anchors | 400 <u>xerafins</u> . |
| 2 <u>Amarra de Lenho</u> | 2,000 <u>xerafins</u> . |

CHAPTER V

NAVAL DOCKYARD of GOA

Pre-Portuguese Goa was an international port, frequented by the ships from Aden, Ormuz, Palestine, Cambay and other hinterland kingdoms. To build new ships and to provide repair facilities, the Pre-Portuguese rulers had maintained a well equipped shipyard at Old Goa. The easy availability of skilled manpower and appropriate material gave an impetus to shipbuilding in Goa. The Portuguese on annexation of Goa in 1510, got an absolute control over one of the key points, by which they could check the operation of the spice-trade. The already existing dockyard at Old Goa provided basic and important infrastructure to the Portuguese eastern maritime empire in the East.

When Adil Shah surrendered to the Portuguese, Alfonso de Albuquerque found in the dockyard about 40 large ships, 26 brigs and large number of fustas. He also found a large amount of artillery comprising of 40 heavy guns, 55 pieces of ordnance called falcons, 200 muskets and a large quantity of gun powder, pitch, naphtha oil, copper, iron and other hardware.¹ This chapter aims at throwing light on various aspects of the Portuguese naval establishment at Goa.

The Portuguese initiated a series of measures to restructure its working and appointed Francisco Corvinel as its Superintendent with the title of Feitor.² This Royal dockyard received successive names such as Rebeira, Rebeira Das Naus, Ribeira Das

armadas and finally Arsenal de Ribeira da Naus de Cidade de Goa. The Royal dockyard at Goa was roughly equivalent to the Lisbon armazen, except that, it not only provided shipbuilding and repair facilities but also had a gun foundry and a mint.³ Pyrard de Laval who visited Goa after its conquest by the Portuguese gives the following account of its different wings and functioning. "Between the city of Goa and the river bank there were three large dockyards. The main dockyard which was on the western side of the city was the Rebeira de Grande or Ribeira das Naus. In this dockyard were important units, like the mint (Casa da Moeda) and gun foundry. It minted coins, manufactured artillery pieces and also other naval hardwares.⁴ Next to this dockyard was the quay called 'Cais de Santa Catarina. This quay was busy whenever any armada lays anchored.' The Rebeira das Gales was another wing of the dockyard, which was well fortified. This unit was well structured and provided with all facilities to the Masters and the officials. Persons convicted for various offences were confined to gales and were not allowed to leave the cell except for carrying out of any urgent work. There was also a large building here the unloaded material was kept.

As soon as unloading operation was over, the ships had to leave the berth, thereby making a way for others. Cais da Fortaleza do Viso-rey was located between the river and the palace of the Viceroy. It was of about 70 passos of length and 200 f breadth. This quay was generally used by all Indiamen merchantships which enter the port. From the window of his palace, the Viceroy could see all anchoring and departure that take place

at this quay.⁵ In 1526, new rules for its administration were framed by Afonso Mexia, who was the Comptroller of Finance. under these new regulations a provision was made for the maintainance of a register of all the material that was acquired and used in the dockyard. The Clerk of the warehouse (Almazen) had to maintain a clear record of all annual income and expenditure in the register which was required to be produced before the Fietor of the city.⁶

Before recording any transaction in the register, the Clerk had to declare the total number of folios which the register contained on the very first folio. Every folio of the register was numbered and initialled. All material such as iron, lead, coir, gun-powder, oil, timber, sails, masts etc. received had to be recorded and signed with exact declaration of the day, month and the year.⁷ If any quantity of any material was given to any person, besides his name and designation and other details such as the name of the ship and the fleet in which he sailed from Lisbon to India, his nationality, parentage as entered on the register of birth had to be noted down. This was necessary because on many occassions the person had to be summoned in case of any problem relating to supply of the material.⁸

All record books had to be disposed in one arquã.⁹ However, inspite of these regulations many administrative malpractices continued specially in matters of awarding the contracts, as the Finance Comptroller was given over all charge and there were no checks on the procedure of procuring the material for the dockyard. Stealing and smuggling became almost routine. This was

followed by financial constraints and the shortage of skilled manpower. In 1622 the Viceroy was informed about the loss of 1 artillery piece, some falcons and breços from the dockyard. An inquiry was ordered into this and the Chief Justice, Pedro Alvares Pereira was asked to investigate the matter.¹⁰ In 1624 again some artillery pieces were stolen and taken on the other side of the river. The same judge was asked to conduct an inquiry.¹¹ As a remedy to this situation Nuno Vaz, a Portuguese office in Goa, suggested that the doors of the warehouse should have 2 keys, 1 of which should be in the custody of the Comptroller of Finance.¹²

Sub-standard quality material was supplied to the dockyard violating the basic terms of the contract. The authorities therefore, directed the dockyard officials, not to make any payment to the leases or to anyother person for the wood or nails before actually purchasing the same. This order was issued when it was found, that some material supplied to the shipyard was of inferior quality than what was laid down in the contract.¹³

When Conde de Linhares took over as the Viceroy of India, the shipbuilding at the dockyard came under the close watch of his office. He began to visit the dockyard regularly and personally supervised the fitting out of the fleets and monitored the equiping work of every Carrack, until they sailed to Europe in mid-February.¹⁴ All transactions were carefully recorded and maintained. All hardware material brought to the dockyard from outside Goa was examined with the help of the technical officials of this establishment. In 1682, 2 Charruas which sailed to Goa

carrying pitch, timber etc. in its holds were checked by the Guard-Mor of the dockyard in the presence of the custom officials.¹⁵

Personnel At The Dockyard:

The labour at the dockyard comprised of foreign, indigenious and Slave. Usually the Chief Technical officers such as Chief Masters and the Masters of various workshops were from Portugal. They were appointed by the King through Royal orders. The appointment letter stated the designation of the person, the year and the remuneration. The person appointed to head any workshop at the dockyard was prohibited from holding any other office in his private capacity. The appointee had to give a declaration of the same under oath.¹⁶

Some of the prominent Portuguese naval experts who worked at this dockyard were Antonio Fernandes, Master Caulker in 1588.¹⁷ In 1606 Bras Vinciente, Caulker and Francisco de Santo, Master Carpenter also worked in this establishment.¹⁸ In 1614 Jorge Marinho was appointed as Master Caulker.¹⁹ In 1616 Jeromio Luis was appointed by the authorities as Master Caulker²⁰ and Antonio Luis as Carpenter in 1624.²¹ The most excelled among them was Antonio Gonsalves, Master Caulker who worked for a period of 26 years in the Royal service. He evolved a method by which the cost of shipbuilding was reduced.²³ In 1630 Diogo Luis was appointed as Master Carpenter and in 1642 he was nominated to substitute Vicente Rodriguese.²⁴

To meet the Dutch challenge, Antonio da Costa was appointed as a Master Caulker with a view to equip the Galleons promptly.²⁵ In 1650, Manuel Fernandes was nominated as the Master Carpenter of the dockyard to substitute Valetim Themudo, who returned to Lisbon. It is difficult to say if this Manuel Fernandes was the same person whom D. Joaõ on 20th October 1656 appointed as Second Master of the Naus and Master of the Galleys.²⁶ In the years between 1625 - 35, there was even a demand for the services of Chinese gun-founders to cast iron guns at Goa.²⁷ The Chinese gun-founders from Macau were brought to Goa for imparting training to the Smithers in the art of casting iron. In 1626, the Council of Portugal at Lisbon wrote to the viceroy of India to procure from Macau salaried personnel who could teach the art of casting iron to the gun-founders of Goa.²⁸ In the years that followed many people from Brazil have been recruited in the dockyard in different workshops.

Indegenious Labour:

The Indegenious manpower played a crucial role in the Portuguese naval dockyard at Goa. The use of Indian shipwrights in building both inshore and oceangoing vessels was urged since 1503.²⁹ Like at Bassein, Cochin and Daman, large amount of local labour was employed in the dockyard in Goa. In Goa, large number of locals were employed from Panelim, Chimbel, Carambolim and from other neighbouring Villages.³⁰ In 1613 the Justicas of the northern fortresses were directed to arrange carpenters and other

artisans to work in the Royal Dockyard under Chief-Carpenter Valetin Themudo.³¹ The work of bringing timber from the forests of Goa was also entrusted to the locals who were provided with all necessary implements. In 1774, one Rama Chandra Shetti from Chorao was provided with saw blades cutters and other material for cutting the trees in the Province of Bardez.³² In 1659, there is a reference to a provision, under which the Viceroy at the suggestion of the Master of the dockyard, granted a monthly allowance of 4 xerafins to one family from Ribandar, who rendered valuable service to dockyard.³³

Slave labour:

The shipwrights and the dockyard workers were recruited from free white (and also convicts).³⁴ The slaves who were found guilty were sent to the galleys and were kept at Bhangasala.³⁵ The slaves were even purchased sometimes by the officials of the dockyard. In 1683 the Fragata Nossa Senhora de Milagres sailed with number of slaves from Mocambique to Goa. The carpenter and the caulker of the dockyard purchased some of them.³⁶ However, unauthorised use of slaves in any workshop of the dockyard was strictly prohibited.³⁷ Although the Jews were not allowed to work in any of the Portuguese fortresses, yet they were caught and put to galley to do all sort of hard work.³⁸ Usually the well bodied slave were employed to carry heavy material from the quay to the workshops, with hardly any regard for their safety.³⁹

All people, who were appointed to head any workshop of the dockyard had to take an oath on Holy Bible and the same had to be

recorded by the Clerk of the Matricula Geral.⁴⁰ The most striking feature of this Royal dockyard is that, it had a permanent staff unlike at Daman.

Remuneration Of The Officials Of The Dockyard:

In 1565, the remuneration of the officials of the dockyard was fixed as under.⁴¹

High usher of the Dockyard	.....	100//000
Warehouse keeper of the Dockyard	.....	60//000
Clerk of the Warehouse	.....	30//000
Muster keeper of the Dockyard	.....	30//000
Pilot Major of India	.....	80//000
Chief of the Dockyard	.....	60//000
Master of the Dockyard	.....	60//000
Master of the Smithy	.....	60//000
Master of the Foundry of the Dockyard	.....	40//000
Master of the cooper	.....	24//000
Master of the Rope-yard	.....	390//600
Master of the Caulkers	.....	35//800
Master of the Oars	.....	42//600
Master of the Turnery	.....	21//600
Master of the Repairs	.....	1 tanga per day.
Meirinho of the Dockyard	.....	16//320
Door Keeper of the Main gate	.....	15//120
Door Keeper of the Small gate	.....	16//320

To avoid surplus labour at the dockyard, a work estimate was made. The Carpenters, Ironsmiths, Caulkers etc. were enlisted depending upon the workload. This estimate was made in the presence of the Captain-General, Chief of the Navy and other personels which formed the Tribunal da Junta.⁴² After making an estimate of the work and the manpower required in the dockyard, the Tribunal da Junta would work out a general balance of all material belonging to the warehouse.⁴³

Infrastructure At The Dockyard:

The Dockyard being located on the bank of the river small ships were used for carrying the material from the warehouse to the anchored ships in the water. The finance comptroller who was initially the head of the dockyard had 2 meirinhos and 1 Clerk. He also had at his disposal 1 well equipped Manchua which was used by him either for visiting the ships or to go in the river for any survey work. This Manchua could carry only 8 or 9 people.⁴⁴ There were also other small oarships like Escaleres and Botes.⁴⁵ For embarking on the ship anchored away from the main quay, one small ship was kept reserved out of fourteen. The remaining ships were meant for the general service of the dockyard.⁴⁶ The sick workers were sent to the Royal Hospital for treatment, which was very close to the dockyard.⁴⁷ On every Sunday, the missionary priest used to visit the dockyard to impart religious instructions and to administer the Holy Sacrements to the convicts working over there.⁴⁸

Maintenance Of The Ships:

As soon as the ships came from Lisbon to India, (Goa), they were required to be taken to the Royal dockyard to check the eixos de estrincas, calceses the cabrestante and the paleamo.⁴⁹ When the ships were anchored they were to be covered with the sail cloth to protect all oily material on board from rain.⁵⁰ A person was entrusted with the task of draining out water which was accumulated on the mizzen sails. During the moon light, the sailors were instructed not to cover the whole ship but had to fold the covering on the deck without removing it completely. But if it was raining, then the whole ship had to be properly covered.⁵¹

During the night time, there had to be a small light which had to be properly fixed. One marinheiro was entrusted with the task of maintaining a strict vigil over the same and was not allowed to leave his place.⁵² In the same manner, the Officers responsible for guarding the ships were not allowed to smoke onboard, except at a place where a water tin was kept. No fire was allowed on the ship while it was anchored.⁵³

The prow of the ship had to be covered with the cloth till the curvatoens and sufficient weight was to be kept on in to prevent the same from flying at the impact of the wind.⁵⁴ During rains, much care had to be taken to prevent any damage to the ship out of water, as the salinity of the river decreases during this period. The mast and the calcēses had to be properly covered.⁵⁵ All the Navios, Fragatas or the Pallas which were anchored at the

beginning of the summer for any work, had to finish the same before the commencement of the winter.⁵⁶ The dockyard officials had to be present on the anchored ships when it rains to see if there was any leakage of the pitch at the costura and had to identify the portion immediately if any leakage was found. The concerned official had to bring the leakage to the notice of the commander of that ship, who would inform the Intendent General. The Intendent would summon the Caulker or Carpenter to carry out repairs without any delay.⁵⁷

The covers of the mast and of the gurupes had to be preserved well so as to be in proper shape. If any material was found damaged, it had to be either replaced or repaired promptly.⁵⁸ The draining pumps had to be maintained well for any emergency. The holds of the ship had to be cleaned regularly and the whole ship had to be dried up both internally and externally. Special care had to be taken not to spill any water on the deck. After the sunset the costado, conves and the castleos had to be closed down. During winter all the hatch ways had to be exposed for fresh air.⁵⁹ The person incharge of maintaining night watch was provided with two lanterns to see the amarracões, during night. The gurupes had to be checked and those old and damaged had to be either replaced or repaired accordingly.⁶⁰ Ships anchored either at Mormugão or at Old Goa had to be inspected by the Master of the dockyard to ascertain the condition of the caverna, apostura etc. of the ship.⁶¹ No ship was allowed to make a return voyage without obtaining permission from the authorities of the dockyard.⁶²

Technical fitness certificates had to be issued to the ship after carrying out inspection by the officials of the dockyard. The main job was to ascertain whether the ship fulfilled all the technical norms specially in regards to the dimension of the parts of the ship.⁶³ On March 5th 1737 the Clerk of the Treasurer and the Feitor along with the Chief Master of the shipyard inspected the Nau Nossa Senhora de Aparecida and declared that the said Nau was neither in a position to make a voyage nor it could be repaired.⁶⁴ Similarly in 1740, the Nau Nossa Senhora de Nazareth was examined both, internally and externally and declared that, the cadaste and the enchimentos required immediate repairs.⁶⁵

Quality Control Of The Material:

Care was taken to maintain high quality of the material that was procured for different workshops of the dockyard. No wood of any defect was to be purchased. A strict check was carried out of the same and if any defective material was found, then the defaulting person was punished.⁶⁶ The paos of the masts had to be selected in the presence of the Intendent and the Master of the mast. If the paos were found defective with any cracks or infested with wood worms, or if the same was lying unused for considerable time since felling, the officials had to be acquainted with different qualities of wood. After the fixing of the mast, the Commander of the Fragata had to make verification of the same and if he noticed any defect, the defaulting person was punished.⁶⁷ The wood meant for construction and repair had to be piled up

seperately according to the quality, price and the proportion. The piling was done in such a manner that even if a small piece was removed secretly it could be identified. All precautions had to be taken against fire and no fire was allowed anywhere close to the wood.⁶⁸ Coir which was acquired for the dockyard had to be weighed first and cleaned after shaking well. If any quantity was found wet, the same had to be dried up. The quality of this material had to be identified by competent people.⁷⁰

Supply Of food Provision To The Shipyard:

The Portuguese got most supply of the food provisions to the dockyard from Kanara. In 1525, Simao de Menezes was sent to Basrur and Bhatkal for obtaining rice.⁷¹ In the list of items delivered to the dockyard by Nagana Camotim in 1759, included 913 fardos of rice, coconut, etc.⁷² The dockyard had a store-house where all provisions were deposited under the charge of the Treasurer and the Record Keeper. The Treasurer of the store maintained all records of the provisions received and used and the same had to be placed before Revenue Council. Perishable items like wine, vinegar etc. were checked regularly. If any casks or barrel was found damaged, the same had to be replaced.⁷³ There was no seperate budget allocation for the maintainance of the dockyard. Proceeds obtained out of fines imposed for the violation of various rules were credited for the expenditure of the dockyard. For instance, an order was issued by which a fine amounting to 15,000 xerafines was imposed upon any official encroaching upon the estate rights of the orphans in Bengal. The same was used to meet the expenses

of the Royal dockyard.⁷⁴

On 9th of June, 1753, a major fire broke out in the main quay of the Arsenal which destroyed the Manchuas and the Pallas. This mishap was a result of the negligence and inadequate safety measures.⁷⁵ In 1753, Marques de Tavora issued an order to Captain General, prohibiting the display of fire-works on the feast of São João Baptista or on any other festive day. The area from Ribandar Custom till the Royal dockyard was declared as protective zone.⁷⁶ This order was issued to ensure the safety of the ships anchored at the dockyard as well as the gunfoundry.

The whole administrative and technical set-up of the Royal dockyard was restructured by Marques de Pombal by virtue of his decree of 1773. The office of the Finance Comptroller (Vedor de Fazenda), head of the dockyard was abolished and was replaced with that of the Intendent General of Navy along with the board known as Meza da Regista da Matriza presided over by him.⁷⁷ The shipyard was divided into five sections namely,

(i) The Intendent General of Navy (ii) The Almozarife
 (iii) The Arsenal with 11 workshops such as Caulking workshop (Oficina da Calafates); Cooper workshop (Oficina de Tonoaria); sails workshop (Oficina de Velas); winding workshop (Oficina de cordoaria); painting workshop (Oficina de pintores); smith workshop (Oficina de funileiros); casting workshop (Oficina de fundicao); saddler workshop (Oficina de Correirs) ; blacksmith workshop (Oficina de Serral haria); and Mansion & Potter workshop (Officina de Redreiros e Oleirose).⁷⁸ (iv) the dockyard, entrusted

with the work of shipbuilding and repair. It comprised of the Chief-Master. (Patrão-Mor), One under Chief-Master; Master of the shipyard and under Master of the shipyard; Master Caulker and under Master Caulker; Master Rope maker and under Master Rope Maker; Master Blacksmith; Master Locksmith; Master of Sails; Master of Mast and Master of Rudder. (V) The gun-foundry, entrusted with the work of casting guns, cannon balls etc.⁷⁹

Intendent general Of Navy:

The Intendent General of Navy was the chief of the whole establishment and had to furnish a detailed report of the day to day functioning of the Arsenal to the Governor of Goa.⁸⁰ Periodical checks of the warehouse of the dockyard were carried out to ascertain the quality and quantity of the material stored therein. An exact time limit was fixed for this purpose. From the beginning of October till the end of March the inspection was to be between 7.00 a.m. to 10.00 a.m. in the morning and from April to September, between 8.00 a.m. to 11.00 a.m. in the morning and from 2.00 p.m. to 5.00 p.m. in the evening.⁸¹ All expenditure books had to be submitted to the Intendent General every Saturday by the Treasurer of the warehouse.⁸² The Intendent General, would visit the ware-house of the food stuff (Armazens do mantimentos) twice every month to see the condition in which the food provision had been stored. No material was to be delivered to the ware-house without proper scrutiny of it by the Intendent in the presence of the concerned officials.⁸³

Quality control was another important task entrusted to him.

Before making an entry of any material in the register, he would summon, the Chief-Master to check the quality and to declare the same under oath. Timber or any other material which comes to the dockyard had to be in conformity with the thickness and the length as laid down in the requirement order of the master of the dockyard.⁸⁴

On the eve of the departure of the ship, he along with the Chief Master and Clerk of the warehouse would visit the ship so as to ascertain whether the ship was provided with all necessary equipments.⁸⁵ Whenever any work was done, the Intendent General would ask the masters of the workshops to make the valuation of the work and the amount of material that has been used. He would also order the attestation of all the weights and balances.⁸⁶ The Intendent General was also empowered to conduct a test to Pilots of the homebound ships, which were not holding a certificate issued by the Chief-Cosmographer at Lisbon. The Masters of the ship were also examined for their knowledge of the navigational charts, needles and nautical instruments. If they were found fit, a certificate was awarded to them signed by the Mestre de Aula and the Intendent General.⁸⁷

Treasurer:

The Treasurer of the Arsenal was the most important officer, only next to the Intendent General in the whole set-up. He joined the service for a period of 3 years after furnishing a surety.⁸⁸ The Treasurer had to maintain a record of timber, hardwares, foodstuff and the petrechos of war. All foodstuff received and used

had to be recorded with utmost care. At the beginning of the folio of the register the name of the Treasurer and other details were to be noted down with all details.⁸⁹ A register of daily petty expenses of the week, starting from Monday to Saturday had to be maintained. At the end of the week, the Intendent would check the same with his Accountant. No entry could be made in the register by the Treasurer, without the consent of the Junta da Fazenda or the Navy. All money receipts had to be deposited in the coffer placed in the casa da armazen having 2 keys, with the Treasurer and other with the Clerk.⁹⁰ The Treasurer could not give timber or any material to any workshop without the consent of the Intendent. Whenever any material was given either to the Chief-Master or the Master of the dockyard, it had to be noted down by the Clerk of the treasurer in the Register of Income and expenditure. (Livro de Recieta e Despeza).⁹¹

At the time of construction or repair of a ship, the treasurer would open an account in a separate book in the name of that ship, so as to know the exact amount of the material used for that particular ship. On the return voyage of the ship all surplus foodstuff had to be handed over to the authorities at Royal dockyard.

The Chief Master, the Clerk of the ship, the Treasurer and his Clerk would examine all surplus stock, before depositing the same in the warehouse. If any amount of meat or fish was found in good condition, it had to be salted immediately.⁹² Every Master of the ship on his return voyage to Goa, had to deliver all the

anxarcias etc. to the Treasurer of the dockyard.⁹³ The Treasurer was also required to maintain a record of all armaments and would order the cleaning of the same.⁹⁴

Executor Of The Arsenal:

As soon as the ships of the Armada Crown sailed out, he would note down all the material which had been delivered to the Masters, Surgeons and other officials, of the ship. The Executor of the Arsenal had to take into possession the keys of the store holds of the ship no sooner the ship entered in the dockyard area.⁹⁵

Writers (Escriturarios):

The Writers had to do all transcription work regularly. At the time of the payment of the wages to the sailors, they had to assist the Clerk of the Treasurer. One of the Writers was entrusted with the work of looking after the records which were kept in the coffer of the Arsenal. An index book of all other books deposited in the safe had to be prepared by the writer.⁹⁶

Auditor (Contador):

The office of the Auditor was highly esteemed one and the person had to be of high integrity and good experience. He prepared the salary bills of all employees and also assisted the Meza de Intendentencia to make corrections in the expenditure books of the respective Treasurer.⁹⁷

The Clerks (Escrivaos):

The Clerks were required to be present in the Arsenal from morning till evening as laid down in the Regimento. All official transactions had to be recorded by them which included the sureties furnished by the Treasurer, Masters, Carpenters and Caulkers. A separate register was maintained by him, wherein, all the despatches and the passports issued by the Intendent had to be maintained with utmost care.⁹⁸

Chief-Master (Patrão-Mor):

The Chief-Master was the Chief technical officer of the dockyard, under whom there were Masters of different workshops. He was directly responsible to the Intendent of the Navy. He was appointed by the authorities at Lisbon. Ships under construction at the dockyard were regularly inspected by him to get himself acquainted with the work. During the wintering of the ships at Goa, he ordered for mooring of the ships with chains and anchors. He would visit the dockyard regularly, check the equipments and allot the work to the people in correct proportions. A strict watch was kept over the Masters, who worked in the different workshops. The Chief-Master was the main technical officer whenever an inspection of any ship was ordered by the Viceroy.⁹⁹

Whenever any ships of the Armada or of the Crown sailed from Goa, he would accompany the same till the bar of Goa. Whenever a ship was to be equipped it was his duty to check the weight of enxarcia right from small cable to the big one as every inch of

the same depended upon the tonnage of the ship. The Chief-Master would not order the opening of any camarote of any ship without the presence of the Intendent of the Navy.¹⁰⁰ He was also required to undertake search operations, for mooring and anchors in the river of Goa, twice a year, and was entitled to 1/3rd of the value of the material found. Whenever any ship anchor, at the yard, he along with other officers would visit the same and lockup the hatchways and the store room of the gun-powder.

Whenever any ship was to be repaired, the Chief-Master had to inform the Apontador to prepare a list of the people required for the execution of the work. Timely completion of the ship work and the safety of the hull were his prime responsibilities.¹⁰¹

Masters (Mestres):

The Masters of the dockyard had to be present in their respective workshops before their sub-ordinates reached. All the Masters of the dockyard resided within the premises for their easy availability. Each Master had to allot work to each person in correct proportion.

In the case of the carpentry workshop, the carpenters had to sign on the register stating the amount of wood which they take. The Masters would assist the Treasurer at the time of paying the wages to his people, specially when any deduction was to be made from the salary of any person in order to compensate the loss of the state Treasury incurred on account of his (person)

negligence. The Masters were forbidden from taking any private contracts or utilising the services of the carpenter or Caulker for his personal work.¹⁰²

Master Of The Masts (Mestre de Mastro):

The Master of the Mast would have sufficient knowledge and technical expertise. He along with the Chief-Master and the Master-Builder would check the quality and the utility of the mast at the time of purchasing. The mast had to be thoroughly checked to see if there were any cracks and the condition of the same had to be declared in writing.¹⁰³

Sail Master: (Mestre de Vela)

Smooth sailing of the ship depended upon the correct cutting and fixing of the sails. When any new fittings were to be made, the Sail Master would ask the Master of the Mast to provide him necessary measurements. On the return voyage he would check all the sails of the ship and carry out repairs wherever necessary.¹⁰⁴

Apontador:

The Apontador' was a person incharge of maintaining a muster-roll of all people working in the dockyard. He was required to be present in the yard with the muster-roll half an hour before other people entered for work. All the pages of the master-roll were numbered and initialed by the Intendent. The names of all the Carpenters, Caulkers and other officials working in the dockyard were recorded. Whenever the Chief-Master takes any person for

mooring the ship, the Apontador always accompanies him.¹⁰⁵

The Guards Of The Dockyard And The Guards Of The Nails:

The new order made a provision for 3 guards, who were entrusted with the task of maintaining a close watch over all the material within the premises of the dockyard. During night these Guards were posted at different sites. The Guards would not allow any ship to anchor during the night time at the dockyard quay except, those carrying timber for shipbuilding. If anything was found missing, the Guards were punished as per the rules framed by the authorities.¹⁰⁶

The Doorkeeper (Porteiro):

The Door - Keeper had to be present every day in the dockyard half an hour before the official time, to open the gate and had to remain there till all people leave the dockyard. After the entry of all people in the yard, he would close the gate and would not allow any person to enter inside. The Door - keeper would not allow anybody to carry any material from the dockyard without the permission of the Intendent or the Treasurer.¹⁰⁷

The Royal dockyard at Goa contributed immensely to the Portuguese colonial expansion. It not only met their defence and naval requirements, but also civil requirements. The 1773 restructured system continued till 1841, when it was once again reorganised by the order of the Governor-General Lopes de Lima, with new title as Regulamento Para o Arsenal da Marinha Exercito e Ribeira das Naos da Cidade de Goa.¹⁰⁸

REFERENCES

1. Barros, I. As Decados de Asia,
Liv II, Chap.IX, Lisbon, 1945-1946, p.99.
2. Fonseca, J.N. Historical And Archeological Sketch of the City of Goa,
Asian Education Society, New Delhi, 1986,
p.239.
3. Mathew, K.M. History of the Portuguese Navigation In India 1498-1600.,
Mittal Publications New Delhi, 1988,
p.303.
4. Laval Pyard Francisco Viagens de Francisco Pyrard de Laval
(Trans by I.H. de Cunha Rivara), Livraria Civilizacao, Porto, n.d.a. p.38.
5. Ibid., p.40.
6. Rivara Cunha Arquivo Portuguese Oriental,
Fas-5, Tipografia Rangel, Bastora, 1951,
p.77.
7. Ibid., p.78.
8. Ibid., p.79.
9. Ibid., p.78.

21. Ibid., fl.228.
22. PA, HAG, Mss.no.476, fl.138.
23. Petições Despachados do Conselho de Fazenda, (PDCF) HAG, Mss.no.1158, fl.235.
24. Souza, Op.cit., p.87.
25. Ibid., p.427.
26. Ibid., p.435.
27. Boxer, C.R. 'Asia Potentates And European Artillery'
In The Malaysian Branch of Royal Asiatic Society,
Vol.38, 1965, p.161.
28. Boxer, C.R. Estudos Para Historia De Macau Seculos XVI A XVIII,
Vol.I, Fundação Oriente, Macau, 1991,
p.108.
29. Rivara Cunha, Op.cit., Vol.IV,p.76.
30. Provisoes, HAG, Mss.no.1133, fl.89.
31. Cartas, Patentes, Provisões e Alvara (CPAA), HAG, Mss.no.7537, fl.50v.
32. Obrigações de Feitoria de Goa OFG), HAF, Mss.no.1603, fl.43.
33. CPAA, HAG, Mss.no.7536, fl.50v.

34. Boxer, C.R. The Portuguese Sea-Borne Empire 1415-1825,
Middlesex. 1973, p.211.
35. Bhangasala was a store house, but it was also used as a
prison house for the galley slaves.
36. CAF, HAG, Mss.no.2316, fl.117.
37. Instruções Para Service O Marinha (ISM), HAG, Mss.no.816
fl.13.
38. Rego Silva A. Documentação Para Historia das Missões da
Padroada Portuguesa do Oriente India,
Vol.IX, Agencia geral das colonias,
Lisbon, 1950-55, p.544.
39. Laval, Op.Cit., p.41.
40. VPL. Op.Cit., p.37.
41. Rego Op.Cit., p.567. This remuneration was however
changed following the decree of 1773, issued by Marques de
Pombal.
42. ISM, Op.Cit., p.19.
43. Ibid., fl.10.
44. VPL., Op.Cit., p.37.
45. Souza, A.B. Subsidios Para Historia Militar Maritima
da India,
Vol.II, Imprensa da Armada, Lisbon, 1956,
p.7.

46. ISM, Op.Cit., p.48.
47. VPL., Op.Cit., p.48.
48. Rego Op.Cit., p.244.
49. ISM, Op.Cit., fl.20.
50. Ibid., fl.23.
51. Ibid., fl.21.
52. Ibid., fls. 21v-22.
53. Ibid., fl.22v.
54. Ibid., fl.20.
55. Ibid., fl.22.
56. Ibid., fl.23v.
57. Ibid., fls. 24v-25.
58. Ibid., fl.26.
59. Ibid., fls. 33v-35.
60. Ibid., fls. 36-38.
61. CRP, HAG, Mss.no.7544, fl.63.
62. Correspondencia de Arsenal de Goa (CAGO), HAG, Mss.no.2663,
fl.10.

78. RRARG, Op.Cit., p.1.
79. Ibid., p.2.
80. Ibid., p.3.
81. Ibid., p.6.
82. Ibid., p.9.
83. Ibid., p.13.
84. Ibid., pp.14-16.
85. Ibid., p.18.
86. Ibid., p.23.
87. Ibid., p.30.
88. Ibid., p.32.
89. Ibid., p.34.
90. Ibid., p.60.
91. Ibid., p.67.
92. Ibid., p.69.
93. Ibid., p.70.
96. Ibid., pp.92-93.
97. Ibid.,p.96.
98. Ibid., pp.99-100.

99. Ibid., pp.84-86.
100. Ibid., pp.113-114.
101. Ibid., p.105.
102. Ibid., pp.106-113.
103. Ibid., pp.115-116.
104. Ibid., p.117.
105. Ibid., p.117-118.
106. Ibid., p.105.
107. Ibid., p.107.
108. Ibid., p.109.
109. Soares, J.P.C. Bosquejo Dos Posessoës Portuguesa No
Oriente,
Vol. I, Imprensa Nacional, Lisbon, 1851,
p.147.

CHAPTER VI

DIMENSIONS OF THE PORTUGUESE SHIPS

The early Portuguese vessels of exploration were of small tonnage and moderately equipped. After the discovery of the sea-route to India by Vasco da Gama, in 1498, the tonnage of the Portuguese India-ships went on increasing. This was mainly because of the fact that, the Portuguese ships such as Galleons, Galiota, Naus etc. sailed both as commercial and warships mounted with artillery pieces of different calibre. To ensure the structural safety every plank had to be in correct proportion to the general tonnage of the ship.

Along with the rise in tonnage the dimension of different parts of the ship also increased. The Portuguese naval architects while working out the structural plans laid more emphasis upon the tonnage of the ship. It is proposed in this chapter to examine the tonnage and dimensions of the Portuguese of the Portuguese oceangoing ships in brief. Tables showing the measuring units used by the ship builders have been put in Appendix 1-B.¹

The ships of 300 tons (t) and below were generally measured with spans in respect of the height and the width of the holds and rigging. But the length of the keel and the projection of the prow were measured with Palmos de Goa (pg) as in the case of the ship of 300t and above. All the ships of 150t to 200t with two sails having a prow, was equivalent to between one-third and one-quarter of the length of the keel, while the ships of 80t to 100t

with one sail having a prow was considered equivalent to a quarter-part of the length of the keel. If the ship was light and meant for war its width would be quarter-part of the length of the ship from the counter to a point of the prow which was called esfera (sphere). All ships of 150t to 300t having a prow was considered equivalent of between one-third and one-fourth of length of the keel.²

The keel length was a main factor which determined the dimensions of the ship and its various components. The process of calculating the tonnage was a difficult task as the difference between the dimension and the tonnage was not always same. One document of 1633 states that, a Nau of 18 rumos (r) to 20r was of 700t to 800t, but this length of the keel corresponds to 750t to 1050t in 1600 and 700t and 1000t before 1580.³ Another thing that is to be noted is that, the measurements given in the paper were not always strictly followed by the Masters of the dockyard. An example of measurements alterations may be cited here Master Valentine Temudo, who in 1623 built a ship of 20t and of 3 decks whose stem was fourth of the keel length and not third as laid down in the Order.⁴

In certain types of ships, specially in the case of Galleon and other warships, the measurement made by the scales were changed or altered to meet special requirements of the ship. In this way, the depth of the hold of the first deck was in general more than the calculated one. The Galleon of 200t with the keel of 12r would have been by calculation 10 pg of pontal but actually

it would have the pontal of more or less 13 palmos, because the deck was usually of more than a vao (8pg).⁵ The tonnage and dimensions of the various Portuguese ocean-going ships are as under :-

Caravelas :

The early Caravela used by Cadamosto was of 50t for exploration purpose. In 1497, the fleet of Vasco da Gama had a Caravela Berrio which was also of 50t.⁶ The tonnage of the Caravela went on increasing and by 1530, it was between 150t to 180t. Livro Nautico, a naval treatise mentions 2 types of Caravelas of different tonnage, namely, the Caravela of 150t to 180t which was round (Fig.23) and used as an auxillary vessel in the fleet and other was termed as antiga meia, the tonnage of which was more than Caravelas of the 15th century.⁷ The round Caravela at the end of the 16th century of 150t to 180t had a keel length of about 18mtrs., the stem height of 7mts. and the height of the stern post 5.5 mts. The same Caravela in the same century had a manga of 33 pg. (8.25m.) and the pontal of 12 pg. (3m.).⁸ The Caravela of 150t to 180t had a traquete of 98m while the Caravela of antiga - meia had 29m². The cevadeira in the case of the Caravela of 150t to 180t was 49m² while the same in the case of Caravela antiga - meia was 52m². The vela de cevadeira was however, little more in the Caravela antiga - meia whose yard had the length of 9.75m in place of 9m. The vela de gavea of the Caravela of 150t to 180t was 24m². The vela grande of the Caravela of 150t to 180 was of 123 m² and in the case of Caravela

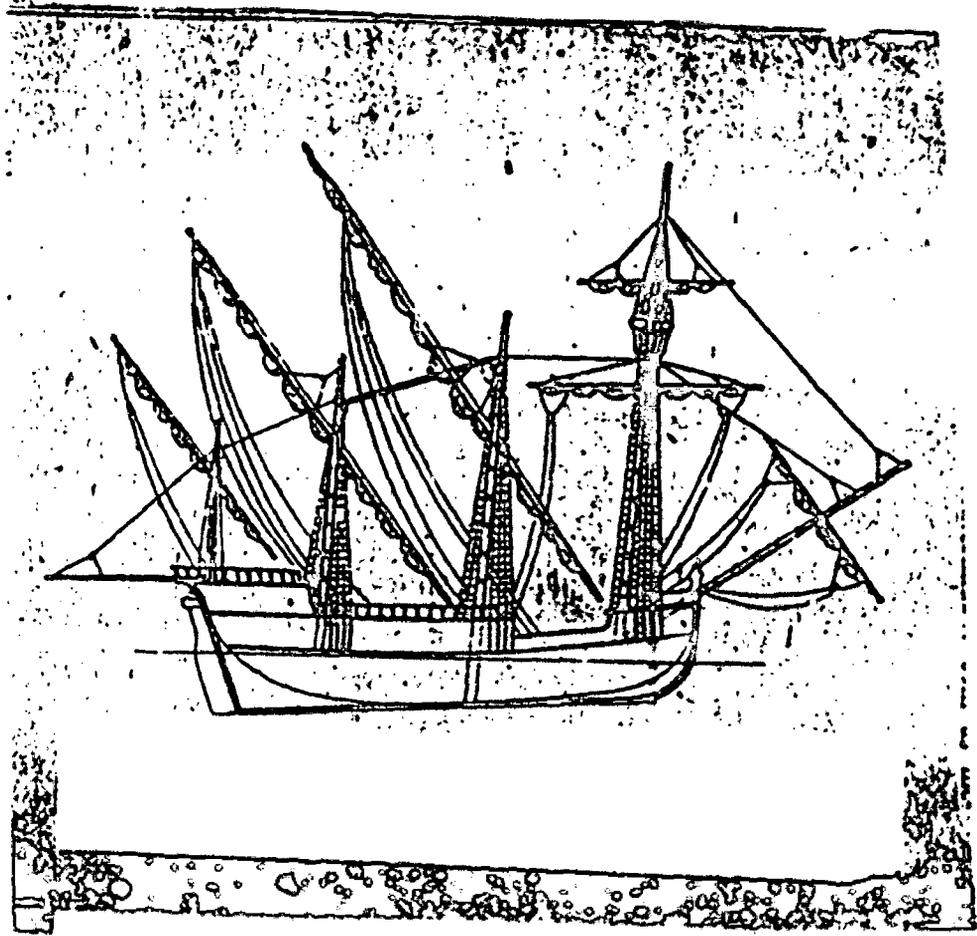


Fig. 23. Caravela of 150t to 180t During
the end of the xvith century.

antiga - meia it was 103 m². The vela de artimão in the case of the Caravela of 150t to 180t was of 92m² while in the case of the Caravela antiga - meia it was 66m². The vela de contra of 150t to 180t Caravela was 29m² and it was also same in the case of the Caravela antiga-meia.⁹ The Caravela had a main deck, small foredeck above forecastle, a half deck and above it an open quarter-deck. Basically, the Caravela had velame exclusively latten or triangular with 2 or 3 masts.¹⁰

Rigging Of The Caravela :

The prime use of the masts was to carry sails. The masts were single spars cut from the trunk of a tree. In sailing ships, the masts were normally taken through in the deck and their heels which are square off fitted into the steps in the keelson of the ship.¹¹ The early small Caravela used for fishing had only 1 mast. The main mast was of prow, followed by the stern termed as artimão and the mizzen mast. In the case of the Caravela of 2 masts, the mizzen mast was implanted on the keel half a distance between the main mast and couce de popa and also had the same inclination from the main to the vante. However, there are instances where this mast was implanted on Chapiteu as perpendicular at the keel by the topo do cadaste. For the Caravela of 3 masts there was 1 main mast in the same position like the one mentioned in the case of 2 masts Caravelas, implanting the mizzen mast on the keel to half a distance between the main and the couce de popa.¹² The Caravela of 4 masts had the same 3 latten masts in the same position and carry at the prow a

foresail mast inclining 35° towards the vanté in relation to the keel. This Caravela carried the gurupes mast. The latter Caravela never carried the gurupes. In the case of round Caravelas the foresail mast had gavea and the mastareu de proa. By the turn of 1600 to 1625 this Caravela began to have topo de gurupes and 1 mastareau de sobrecevideira which was an unique feature of the 17th century.¹³ The rigging of this Caravela was different because of the existence of 1 mast at the prow known as foremast. The length of the main mast was that of the keel i.e. 12 rumos of keel, 12 braços of mast with the thickness of $2\frac{1}{2}$ pg. on garganta. The foresail mast had the length of 10 braços, while the gurupes would be of the same length as that of the foresail mast. The mastro do artimão had a length of 8 braços, while the length of mastro de contra was of 5 braços.¹⁴

The yard of a Caravela was a large wooden spar crossing the masts of it horizontally or diagonally, from which a sail was set. Yards crossing the masts of a square-rigged ship horizontally were supported from the mast heads by slings and lifts and were held to the mast by a truss. The yards could be turned at an angle to the fore and the aftline of the ship in order to take the greatest advantage of the wind direction in relation to the required course of the vessels.¹⁵ The Caravela had 3 yards, namely the mainyard, foresail yard and verga de cevadeira. The main yard had a length of 16 braços and the thickness of half of that of the main mast. The length of the foresail yard was 7 braços while the thickness was $1\frac{1}{2}$ of the foresail. The length

of the verga de cevadeira was 7 braços while that of the mizzen yard was 14 braços with the thickness of half that of the mast at the centre. The length of the verga de contra was of 8 braços and the thickness was as much as that of the mast at the centre.¹⁶ The latten mast Caravela carried the yards in which the Caravelas are proportionally very much longer than in the case of latin ship of that period which was an unquie feature of this rigging in Portugal. The foresail mast had a foresail yard and the mastareu de proa had a gavea de proa.¹⁷

The dimensions of the stem, stern and the caverna-mestra of 150t to 180t Caravela were as under:-

The stem had the height of 29 pg. and the breadth of 2/3rd of its height and have 18 palmos. The stem carried 3 paos. The stern which was put on the couce de popa had a height of 22 pg. and the breadth of 7 palmos with the thickness of 1 pg. It carried 2 paos. The caverna mestra was laid before 8 palmos from the centre of the keel because at the centre of the keel, a pully for the main mast was placed. The Caravela of 150t to 180t would have 12 pairs of caverna which would be 24. The number of the pairs depended upon the rumos of the keel.¹⁸

Galleon :

In Portugual there were Galleons from 200t upto 500 - 600t as permitted by rule. The Galleons had usually 2 decks with a prow. The number of sail differred. The Galleon of bigger size were equipped with 4 masts, 2 round infront and 2 latten in the

rear.¹⁹ The keel length of the Galleon of 1550 - 1880 was more than that of the Carrack.²⁰

The measurement of the Galleon of 200t was given as 12 rumos from esquadria to esquadria, 6 on each side. The largura from boca was about 28 pg. and from the pontal 13 palmos, because on this deck the artillery was installed. The rodas had a height of 26 pg. The length of the Galleon of 350t was 14 1/2 rumos from esquadria to esquadria while the height of the stern was 34 palmos and the lancamento was one-third of the height of the stern.²¹

The Galleon had main mast, foresail mast, mastro de aritimão, mastro de gavea and mastro de contra. The length of the main mast was that of the keel length i.e. 18 while that of the foresail mast was of 15 braços. The length of the mastro de aritimão was 12 braços, with the thickness to half of the main mast. The length of the mastro de gavea was 1/3rd of the main mast while mastro de contra had a length of 8 braços and thickness of less to 1/4 of the artimão.²²

The main yard of the Galleon would be of such length, that it would be 3 times of the bocca of the Galleon with the thickness of 1/2 of the main mast. The foresail had a length of 2/3rd of the mast. The verga de cevadeira was 2/3rd of that of the foresail yard. The verga de aritimão had the length of 1/3rd of the foresail yard and the thickness of 2 dedos less than the main yard.²³

The caverna mestra had 2rs. before from the centre of the keel because at the centre of the keel, the mast was fixed. The Galleon of 500t would have 18 pairs of cavernas and 72 braços.²⁴

Galiotea of 18 Benches :

Basically, the Galiotea would have the length of 44 goas from above of roda where it would nail the sinta. From covado to covado the depth of the Galiotea was 10 palmos and the bocca from where it would nail the sinta above the canto was 18 palmos.²⁵ The height of the stem was given as $9 \frac{1}{2}$ palmos and the breadth as 15. The hold had the height of 7 palmos and $\frac{1}{3}$ rd. Whenever there was a need to put the keel on the atacadas the height of the atacadas of the poop was 5 palmos and from where it would lay the caverna mestre at the height of 2 palmos.²⁶

Fragata :

As regards to the dimensions of the Fragata, the length from stem to stem was $8 \frac{1}{2}$ goas with the width of $6 \frac{1}{3}$ palmos. The almogana of the prow was laid at a crossing distance measuring $6 \frac{1}{3}$ pg. from the corner of the stem.²⁷ The Fragata of 8 goas had the width of 6 pg. and the bottom of 5 palmos de goa. From graminho the dimension of this Fragata was $1 \frac{1}{4}$ th of the palmo escaco which would be divided into 9 parts, 4 towards the prow and 5 towards the poop. The graminho would have more height towards the poop. The Fragata of 10 goas with the width of 7 pg would have the bottom of 5 palmos de vara.²⁸ The height of the roda de proa was given by Manuel Fernandes and 5 palmos de vara

and the poop by 5. The sinta was nailed to the prow at the height of 4 pg.²⁹

Nau :

The Nau was an important vessel which played a crucial role in Portuguese maritime expansion. The Nau of the 15th century was a prototype of the high side ship which continued to dominate till the middle of the 19th century. The Nau underwent some structural changes both in terms of tonnage and dimension. During the 14th century the Nau of 2 masts appeared and in the second half of the 15th century the Nau began to have 3 masts, 2 of which were round rigged and 1 latten with the castles totally integrated on the casco.³⁰ (Fig.24) The Naus of Vasco de Gama, Saõ Gabriel and Saõ Raphael were of 120t and 100t respectively.³¹ But after less than 20 years the tonnage of India Nau went on increasing. The Naus of Carreira da India which were called Nau Grossas of 300t to above with a keel of 20,02m. with much common tonnage of 450t and 500t to 600t to 700t with the keel length of 17r to 18r by the middle of the 16th century appeared . By the first half of 17th century, the Naus of 650t (Q=7, 5R=26,95m.) and of 700t (Q=18, R 1 27,72m.) was very much common.³² In 1570, D. Sebastiao issued a decree by which the upper tonnage limit was fixed as 450t and the number of the decks to 3.³³ (Fig. 25) However, this order was not strictly followed. The arrangement of the Nau of 3 decks was as under :-

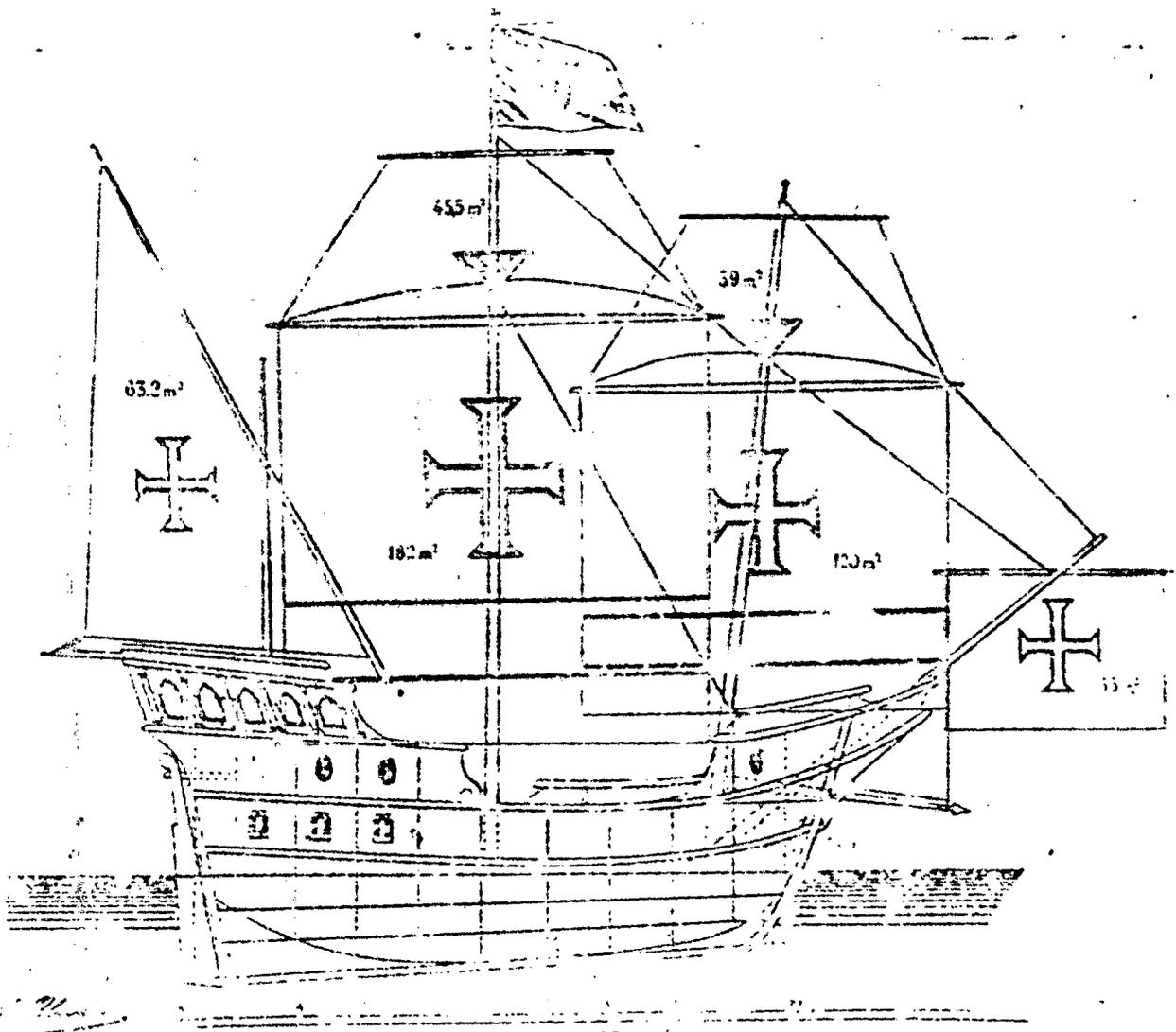
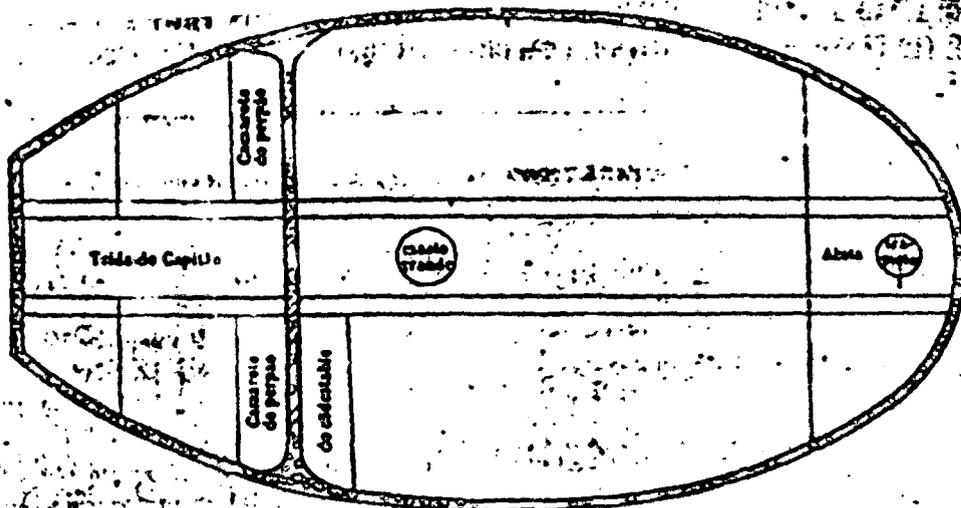
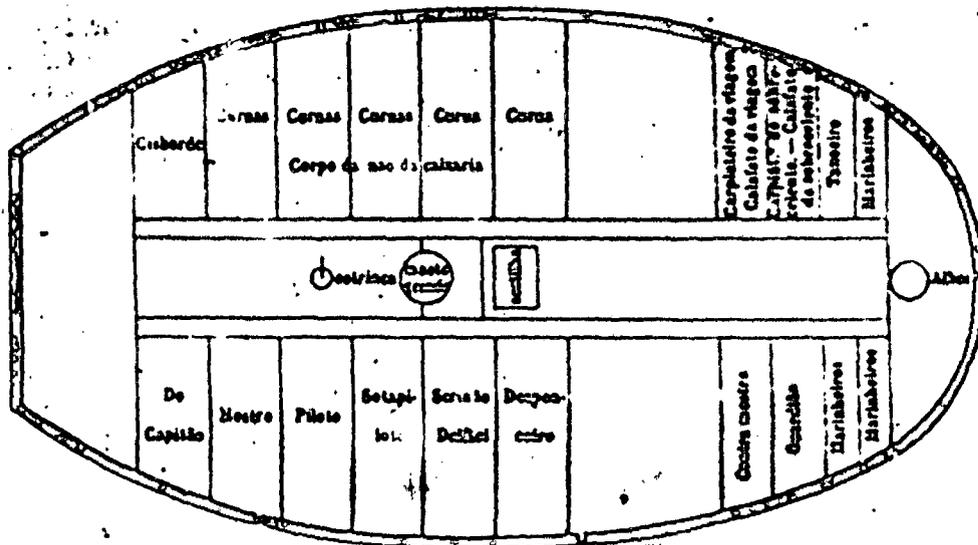


Fig. 24, Portuguese Nau of the xvth century



1ª Cuberta.



2ª Cuberta.

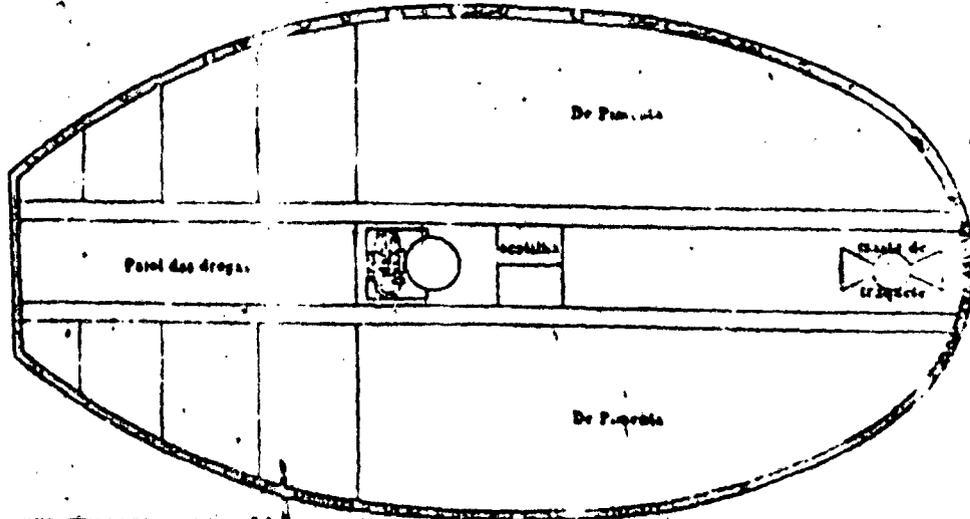


Fig. 25, The Naue of three Decks

First Deck or Upper Deck :

Tolda de Capitão	-	Quarter
Camarotes de Perpao	-	Steerage
Masto Grande	-	Main Mast
Traquete	-	Bits

Second Deck or Middle Deck :

Ceisbordo	-	Ballast Port
Corpo da Nao da Caixaria	-	Baggage Room.
Caruas	-	Kness.
Carpenteiro de Viagem	-	Carpenter
Calafate de Viagem	-	Caulker
Carpenteiro de Sobreceleste	-	Caulker Mate
Tanoeiro	-	Cooper
Marinheiros	-	Sailors
Alboi	-	Foremast
Estrinca	-	Hatchway
Escotilha	-	Main Hatchway
Sota Piloto	-	Second Pilot
Escrivão	-	Clerk
Dispenseiro	-	Steward
Contra-Mestra	-	Boatswain
Guardiaö	-	Bosun's Mate

Third Deck or Lower Deck :

Paiol das Drogas	-	Storeroom for spicies
Paiol de Pimenta	-	Storage place for pepper
Arca de bomba	-	Pumbwell
Masto de Traquete	-	Fore mast

As regards to the flooring of the Nau, it had 1 or 2 decks, castle prow with proper castle and sentry box with its mareagem and the castle poop with quarter-deck and chapiteu with its mareagem. The free space between the quarter-deck and the castle was convés. The space found (Chapiteu, Convés and Guarita) was protected by the xeratas. The xeratas which were used for defense against the falling of the masts and the yards were made out of net.³⁴ By the first quarter of the 16th century, the Nau began to have at the prow more than 1 pavement. Towards the end of the second quarter of the 16th century, the quarter-deck and later on chapiteu were provided with varandhas from one side to another, from the poop with its telhado. The third deck appeared by the middle of the 16th century and was formed by the pavements of the quarter deck and of prow castle.³⁵ The fourth deck appeared by the fourth quarter of the 16th century.³⁶ The castles of all the Naus had the same number of pavements. On the prow castle, there was a castle, the guarita and the sobreguarita all with windows which was a special feature of that period. The same was however, vanished by the third quarter of the 16th century. On the castle poop there was a tolda, the tolda dos bombardeiros, the alcacova and the chapiteu.³⁷

The Nau of high tonnage with high castles at the prow and the poop were equipped with 3 masts, namely foremast, main mast and mizzen mast. The first 2 were carrying round sail normally, papafigos and gaveas and on the mizzen 1 bastardo. Besides these sails it also had the gurupes and round sail called cavadeira.³⁸ Basically, the Nau of 4 decks would have a keel of $17\frac{1}{2}r$ from

esquadria to esquadria. The cadaste measures about 44 palmas and would have the length of 13 palmas.³⁹ Manuel Fernandes, Master Carpenter, in his work, Livro de Tracás, states that, the main mast of 4 decks Nau should have a length of 18 braços and the thickness of tamborete $4\frac{1}{2}$ palmas redondas esforçados. The foresail mast was of the length of $15\frac{1}{2}$ braços and the thickness on tamborete 3 palmas de Goa esforçado. The mizzen mast had a length of 10 braços from lais to lais with the thickness of 2 palmas redondas esforçados.⁴⁰

As regards to the yards of the Nau, the verga de cavadeira was given as of 9 braços from the lais to lais and on the tamborete the thickness was of 2 palmas redondo esforçado. The foresail yard had a length of 13 braços and the thickness of 2 pg., while the mizzen yard, the length was given as 13 braços with the thickness of 1 palmas on ostaguardar.⁴¹

The stern post was the aftermost timber in a wooden ship forming the stern of a ship and joined to the keel by scarfing the wood. João Baptista Lavanha, the great Portuguese naval architect, states that, the dimension of the stern post as the height in perpendicular equal to $\frac{2}{5}$ of the keel and width of $\frac{1}{27}$ th that of the height.⁴² In the case of the Nau of 3 decks of Manuel Fernandes the rules of Lavanha were applied for the stern posts. The width in the Livro Nautico, was given as $\frac{1}{4}$ th of the height in the case of Nau. Manuel Fernandes states that the width of the Nau of 4 decks as 13 pg.⁴³

Stem was the foremost timber, forming the bow of a vessel joined at the bottom of the keel by scarfing the wood. In wooden ships, all timber strakes were rabbeted to the stem.⁴⁴ There were 5 rules discussing the plan of the stem. However, it is proposed here to examine only 3, namely of Fr. Fernando Oliveira, a General rule and the Rule of Lavanha.

i) According to Fr. Fernando Oliveira, the stem is formed by one unique arch of circumference of the radius equal to breadth. In the plan of Fr. Fernando Oliveira, it was equal to the height according to which the stem was $\frac{1}{4}$ th of the circumference till the 3rd deck. Oliveira however, admits certain variations in the height of the stem between 3 pg more and 3 pg less, depending whether it was a warship or merchantship. From the 3rd deck to above, the stem rises straight towards the vante.⁴⁵

ii) The General Rule written in the Livro de Tracas and applied to the ships of 800t, defines the three points of the arch namely, the height of the capelo, the width and the centre of the quadrante arch of the radius equal to $\frac{4}{9}$ th of the height and the centre on the vertex of esquadria. This design was applied to the Galleon of 400t and in the Patacho of 11 rs.

iii) Lavanha states that, to complete the stem the following three points were required :-

a) The couce de Quilha the points of the height marked on perpendicular from the width and which was $\frac{5}{6}$ th of the total height of stem.

b) The point of meia - lua of radius equal to 1/27th of total height and

c) Centre on the vertex of the square of the stem.⁴⁶

Lavanha further states that the height of stem as half of the length of the keel and the breadth to 1/3rd. Fr. Fernando Oliveira describes the height and breadth as equal to 1/3rd of keel, measuring the height on the 3rd deck, depending whether it was a warship or merchantship. Lavanha gives the total height till the capelo da roda while Fernando Oliveira measures it till the 3rd deck. The stem was high in the case of warships.⁴⁷

Master Valentim Temudo, giving the measurement of the breadth states that, the breadth should be of $\frac{1}{4}$ th of the keel so that the hatchways remains intact and protected.⁴⁸

Caverna of the Ship :

A caverna or rib of a ship was running from the Keel to the side-rail. A ships frame form the shape of the hull and provide the skeleton on which the hull was secured.⁴⁹ All ribs or cavernas including the mareagem of the Portuguese Galleons of 350t, 300t and 200t and of the Caravela were designed with 1 or 2 archs only. The plan of the ribs of the ship was always determined by the following factors.

Manga-Boca maior.

Largura de fundo de covado a covado.

Pontal de Primeira Coberta

Altura da Manga.⁵⁰

Lavanha gives the number of the cavernas from the bottom of the ship as 11,5 for each side. The maximum number of cavernas was 7 and 11 incase if the ships were of large dimensions. The amount of the pairs of the caverna depended upon the amount of the rumos of the keel, which had to be measured from the bottom. However, insome ships, specially designed by Manuel Fernandes, the number of cavernas was always less to the rumos of the keel.⁵¹ All the cavernas are graminated which define the position of the almogamas determining the form of the depth and in this way the whole of hull.⁵² The cavernas were based on 2 plans one circumference and the second oval.⁵³ Initially, the caverna were accepted as nailing to the keel. Till the end of the 16th century the caverna do fundo were all graminated giving it a term madeira le conta. The number was as much as double of the keel measuring in rumos. One Nau of 17,5r of keel was having 35 cavernas do conto or pairs because each caverna and the malha had the same measure and in this way forming one pair. At the end of the 16th century the number of caverna da conta rosed from 5 to 11.⁵⁴

Structural Difference Between

The Galleon And The Nau :

To know the structural difference between the Galleon and the Naus, we have to take into considerations the main dimensions as well as rigging of the Nau of 600t and the Galleon of 500t. The keel of the Nau of 600t was of 17 rumos while that of the Galleon of 500t was 18 rumos. The breadth of the prow of the 600t Nau was 35 pg. while that of the Galleon of 500t was 30 pg. The breadth

of the poop of the Nau of 600t was $10 \frac{1}{2}$ pg. while that of the Galleon of 500t was 52 pg. In the case of the Nau of 600t, the height of the stem was 50 pg. and in the case of the Galleon of 500t it was 45 pg. The height of the stern post of the Nau of 600t was 42 pg. While that of the Galleon of 500t was 57 pg.⁵⁵ As regards to the rigging, the Galleon of 500t had 4 masts, main, fore sail, mizzen and the contra artimão. The Nau on the other hand had only 3 masts, besides of gurupes, namely, main foresaid and mizzen.⁵⁶

Measurements of The Nau of 600t And the Galleon
of 500t During the XVI Century

	Quilha	Manga	Pontal	Esloria	Altura da Roda	Altura do Cadaste	Lanca mento da Roda	Lancamento do Cadaste
Nau of 600t	17 R (26.18m)	50pg (12.80m)	14pg (3.58m)	147pg (37,63m)	50pg (12,80m)	42pg (10,75m)	35pg (8,96m)	10pg (2,56m)
Galleon of 500t	18 R (27,72m)	52pg (13,31m)	13pg (3,33m)	154pg (39,42m)	45pg (11,52m)	37pg (9,47m)	30pg (7,68m)	9pg (2,30m)

R = rumo (6pg = 1,54m).

Pg = palmo de Goa (9,256 m).

REFERENCES

1. Barata, J.P. Estudos Arqueologia Naval,
Vol.I, Imprensa Nacional Lisbon, 1989,
p.192.
2. Ibid., p.194.
3. Ibid., p.164.
4. Ibid., p.165.
5. Ibid., p.163.
6. Fonseca, Q. A Caravela Portuguesa,
Coimbra, 1936, p.392.
7. Ibid., p.339.
8. Ibid., p.421.
9. Ibid., p.339.
10. Ibid., p.421.
11. Kemp, P.(ed) The Oxford Companion To Ships And the Sea,
Oxford University Press, London, 1976,
p.533.
12. Fonseca, Op.Cit., p.443.
13. Barata, J.P. Estudos Arqueologia de Naval
Vol.II, Imprensa Nacional, Lisbon, 1989,
p.26.

14. Fonseca, Op.Cit., p.443.
15. Kemp, Op.Cit., p.959.
16. Mendonca, H.L. de Estudos Sobre Navios Portugueses Nos Séculos XV & XVI,
Typografia da Academia Real da Ciéncia,
Lisbon, 1892, p.90.
17. Barata, Vol.II, Op.Cit., p.27.
18. Fonseca, Op.Cit., pp 313-315.
19. Mathew, K. M. History of the Portuguese Navigation In India, 1498-1600,
Mittal Publications, New Delhi, 1988, p.27.
20. Fernandes, M. Livro De Tracas De Carpentaria com Todas os Modelos E Medidas Para fazer toda a navegacão assy d Alto Bordo Com o Remo, 1616
Biblioteca da Ajuda, Lisbon, 1616,
fl.14.
21. Ibid., fl.11.
22. Mendonca, Op.Cit., p.90.
23. Ibid., p.96.
24. Ibid., pp.96-98.
25. Fernandes Op. Cit., fl.57.

26. Ibid., fl.35v.
27. Mendonca, Op.Cit., p.30.
28. Fernandes Op. Cit., fl.58.
29. Ibid., fl.59.
30. Mendonca, Op.Cit., pp.97-98.
31. Barata, Vol.I, Op.Cit., p.251.
32. Oliveira, B. Os Navios de Descobrimentos,
Ministerio da Marinha, Lisbon, 1940,
pp.18-19.
33. Barata, Vol.I, Op.Cit., p.252.
34. Vasconcelos, Subsidios Para Historia Da Carreira Da
F.de India No Tempo Dos Felipe,
Agencia Geral do Ultramar, Lisbon, 1969,
p.23.
35. Barata, Vol.I, Op.Cit., p.87.
36. Ibid., p.262.
37. Barata, Vol.II, Op.Cit., p.282.
38. Ibid., p.283.
39. Ibid., fl.8.
40. Fernandes, Op.Cit., fl.2.

41. Mendonca, Op.Cit., p.87.

42. Kemp , Op.Cit., p.833.

43. Barata, Vol.I, Op.Cit., p.168.

Livro Nautico is the collections of the manuscripts containing systemetically the various phases of the construction of the nau of 600t, galleon of 500t, 2 Caravelas and 7 galleys. It also contains the dimensions and some rules of general proportion. Ibid, p.158.

44. Ibid, p.168.

45. Ibid., p.169.

46. Ibid., p.168.

47. Ibid., p.164.

João Baptista Lavanha was nominated as a Chief Cosomographer in 1591 and in 1618 as Chronicler in Chief of Portugal. Leitão, H.L. Viagens do Reino Para India E da India Para Reino (1608-1612), Vol.2, Agencia Geral do Ultramar, Lisbon, 1958, p.25.

48. Ibid., p.165.

Valetim Temudo was nominated as a Chief-Master of the naval dockyard at Goa on 26th March 1608.

49. Souza, V. Trabalhos Nauticos, Vol.I, Typographia da Acadamia Real das ciencion, Lisbon, 1898, p.93.

50. Kemp , Op.Cit., p.250.
51. Barata, Vol.I, Op.Cit., p.174.
52. Barata, Vol.II, Op.Cit., p.170.
53. Ibid., p. p.179.
54. Ibid., p.174.
55. Barata, Vol.I, Op.Cit., p.296.
56. Mendonca, Op.Cit., p.87.
57. Ibid., p.30.

CHAPTER VII

Conclusion

The Portuguese commercial and political domination was largely on account of their naval superiority. The Portuguese rigged and equipped their Galleons, Naus, Fragatas etc. Keeping in mind the needs of the eastern voyage and warfare during the early days of their voyages, the Portuguese Captains were instructed to carry surplus naval spares to under take necessary repairs during the voyage.

During the 15th and 16th centuries Portugal was the only European country where economic, technical and military factors favoured the conception of the round ship. This ship was designed to meet the technical needs of the long voyage on the high seas. The installation of the artillery onboard the Portuguese vessels was mostly in proportion to general tonnage of the ships, though there were variations sometimes.

The Indian coastal vessels like the Catur, Charrua, Parau, Patmarins etc., were used by the Portuguese as auxiliary vessels to maintain the supply line of the Portuguese maritime trade. They preferred the use of country crafts on account of hydrographical reasons specially where the navigation in the creeks was involved. The loading of the Lisbon-bound ships at Goa depended upon the operation of these local crafts which were sailing in convoys. The Captains were instructed to avoid delay at any port in order

to ensure timely arrival and loading of the Lisbon-bound ships at Goa.

The main objective of the policy of "controlled navigation" introduced by means of Cartaz and the Cafilas was to ensure firm support for their eastern naval enterprise. Debarring the native merchants from trading with certain items and the control over their naval artillery was meant to ensure the safety of the Portuguese maritime domination.

The Portuguese shipping policies in India underwent a change during the 17th and 18th centuries due to the appearance of other European powers in the Indian Ocean. They could maintain their supremacy as long as they could effectively equip their navy with adequate number of ships and manpower. The Captains sailing from Lisbon were instructed to pursue the navigation at Cochin and Goa depending upon the position of the Dutch ships. They were further instructed to avoid any open and direct confrontation with the Dutch forces. During the 17th century the Portuguese naval strength in Goa was so low that, it was just equivalent to 120, a crew of the Indiaship. On many occasions, the Governors were compelled to wait for the arrival of ships from Lisbon to undertake any defensive naval exercise. It was only during the late 18th century a provision was made for maintaining a standing navy in Goa.

Right from the inception of the Portuguese rule in Goa they emphasised the need of having well equipped naval installations at all strategic points guarding the river passes. The erection of

these installations was ordered taking into consideration the firing range of the cannons and the distance involved from the bar of Goa till the naval dockyard at Old Goa. The Portuguese had to defend their hard-won possessions with the help of forts and fortresses built at strategic points in Goa. Indigenous manpower was used for manning the defense of these naval installations.

The garrisoning of these naval installations was the direct concern of the State and the Revenue Council was entrusted with the task of equipping these fortresses. The number of fire pieces that were to be installed was determined by the Revenue Council depending upon the location and importance of the fort.

The Portuguese sought solution to the problem of the shortage of manpower by sending to India people of all kinds including the convicts. Profit motive was the main factor inspiring many to sail to India without taking into account the basic requirements of such a long and hazardous voyage. The missionary reports frequently pointed out various anomalies in the organisation of the eastern voyage. The Crown issued orders and regulations about the number of people sailing to India, but little or no notice was taken of these orders by the Captains of the ship. The number of people sailing to India was never in proportion to the availability of the food and medical provisions onboard. The ships no doubt had medical facilities but they were not effective in controlling the disease onboard. This was mainly because the medical supply was of general state and no medical examination of the people sailing to India was undertaken at Lisbon. Moreover,

the slaves and the convicts who were put on the ships were sometimes the carrier of infectious diseases and there is no specific reference to any order regarding their treatment. Another thing that is to be noted is that there was no Regimento given to any person who was incharge of preparing meals for sick. Though food was served under the medical advice, yet there were no specific instructions regarding the system of preparation, of meals, maintenance of the cooking area onboard and so on.

The authorities in Lisbon realized the importance of India-built ship for equipping their navy rather than depending upon those sailing from Lisbon. Accordingly instructions were given to their counterparts in Goa. The Portuguese preferred the use of teak for the hull. Teak was an exceptionally hard-wood that contributed to the longevity of Indian ships. The Kanara coast provided all necessary material for ship building, which was bought to Goa in the ships of the Northern and Southern Fleet. The Governors were authorised even to divert the funds from cabedal for meeting the cost of shipbuilding and repair at Goa dockyard. The financial constraints and the urgency to raise the required number of vessels brought the Portuguese in close contact with the local traders.

The Portuguese shipping in India was supported by the indigenous shipbuilding centers which they acquired by means of conquest. The naval dockyard at Old Goa was an important Portuguese naval establishment in the whole of Estado da India. At this dockyard large and small ships were built for high-sea

sailing and for inshore - navigation respectively. The administrative changes introduced by the authorities reflect the predominant role it played in the naval defense of the Portuguese in the East. Unlike the other Portuguese dockyards in India, this dockyard had a permanent recruit comprising of the foreign, indigenous and slave. Experts from this dockyard were sent even to Bassein and Daman. If any ship was to be purchased by the Portuguese either at Bassein or Daman, technical experts from Goa were summoned to make the inspection and the valuation of the ship.

The presence of the foreign artisans in the dockyard resulted in the adoption of certain techniques in the Portuguese shipbuilding. A case may be cited here that of laying the strakes for hull protection.

Very often variations in the tonnage and the dimensions of the ship were noticed. This was account of the non availability of the wood of sufficient size for putting up vital components of the ships. The English adopted during the 18th century designs and the techniques of the Portuguese shipbuilders.

PORTUGUESE NAVAL MEASURING UNITS

- A goa A measuring unit which was used for measuring the keel of the small ships such as bergantins, fragatas, bateis etc.
- O palmo de goa A basic unit which was used to measure the bocas, height of the decks, etc.
- O palmo de vara A common measurement used in the naval construction to measure the boca, the height of the decks and the mareagens of the ships of below 300t.
- A braça marítima, A unit used in naval construction, primarily for taking the length of the masts and the yards.

Source :

Barata, J.G.P., - Estudos de Arqueologia Naval
 Vol.II, Imprensa Nacional,
 Lisbon, 1989, p.191.

APPENDIX I-BMEASURING UNITS USED BY THE PORTUGUESE SHIPBUILDERS DURING
15th & 16th CENTURIES AND ITS EQUIVALENT IN METRIC DECIMAL SYSTEM

Name of the Unit	Corresponding/Equivalence	Metric Decimal System
Angula	English Inch	0,0254 m.
Braca Maritima	8 palmos craveiros	1,760 m.
Covado real (V.goa)	3 palmos de goa = 1/2	
Goa	rumo = 3.5 palmos craveiros	0,770 m.
Palmo craveiro comum, ordinario, redondo, Singelo de vara	1/5 of vara = 1/10 of m, braca comum = 1/8 of braca maritima = 1/7 of rumo = 8 polegadas comuns = 6 polegadas de goa	0,220 m.
Palmo de goa	1/3 of goa = 1/6 of rumo = 7 polegadas de goa = 10 English inches = 1 palmo craveiro + 1 polegada de goa	0,256 m.
Parea - largura do tonel (Fr.F.Oliveira)	4 palmos de goa = 2/3 of rumo.	1,026 m.

During The 16th and 17th Century

Name of the Unit	Corresponding/Equivalence	Metric Decimal System
Pipa	1/2 tonel	6341
Polegada de Goa	1/7 of palmo de Goa = 1/6 of palmo craveiro	0,0366 m.
Rumo	2 goas = 6 palmos de Goa = 7 palmos craveiros	1,540 m.
Talha - height of tonel(Fr.F. Oliveira)	rumo	1,540 m.
Tonel		
Tonelada	2 pipas	12681

Source :

Barata, J.P. Estudos de Arqueologia Naval,
Vol.II, Imprensa Nacional,
Lisbon, 1889, p.192.

APPENDIX IIWEIGHTS AND MEASURES**Measures of Capacity**

Alqueiro	Old Portuguese measuring unit of capacity of about 13 litres.
Almude	26 almudes corresponds to 1 Portuguese pipa of wine.
Arratel	Old Portuguese measure of about 16 oncas.
Canada	3 English pints.
Candil	16 arrobas.
Fardo	25-35 corjas.
Onça	Old measuring unit of about 1/16 of arratel.
Qartilho	Old measuring unit of capacity equal to 1/4 of Canada.
Quintal	A measuring unit corresponding to about 60 kilograms.

Measures Of Length

Palmo - The Portuguese span measuring 8 polegadas.

Vara - 5 palmos, about a yard.

Source :

Pinto, C. Trade And Finance In Portuguese India,
Concept Publishing Co., New Delhi, 1994.
p.23.

Boxer, C.R. The Great Ship From Amacon of Macau
And The Old Japan Trade,
Centro de Estudos Historicos Ultramarinos,
Lisbon, 1963, p. 161-63.

APPENDIX III

TRACA DE UMA NAO DA INDIA ORDENADA POR GOCALO ROIZ
CONFORME A NAO CONCEICAO.

Terà esta Nao de comprimento de quilha desasete Rumos e meyo . Tera de lançam^{to} trinta e seis palmos para a Proa, e rodar, levantandose à esquadria cincoenta e um palmos, e com um cordel se tirará atravessa q̃ ha do couce da roda ao termo dos dittos 51 palmos; e cõ este cordel selançará ditta roda. O codaste tem corenta e dous palmos por esquadria, e hade lançar entre o terço e o quarto.

O Gio ha deser de vinte e nove palmos de comprido de m^{ra} q̃ atravessado no codaste seja de catorze palmos e meyo p^a cada banda. Tem de delgado desasete palmos pella esquadria.

Os pees mancos rodaraõ de m^{ra} q̃ na segunda cuberta teraõ detravessa trinta e um palmos; e por este ponto, e pellos pontos onde elle encabeçae do cabo do Gio, rodaraõ a olho com um cordel, pondo pregos onde pareça, q̃ for melhor e mais fermosa roda, como cumpre à navegação.

Esta Nao hade ter de boca na mayor largura, q̃ he na terceira cuberta, no chaõ cincoenta, e dous palmos, ha deter de fundo catorze e meyo, ha deter na primeira cuberta no chaõ, corenta, e dous palmos, ha deter na segunda no chaõ, corenta e oito; a derradeira cuberta ha de recoiherpara dentro na caverna mestra, em altura de sette palmos, quanto a terceira debaixo lança para fora de mais dos corenta, e oyto palmos, q̃ a segunda cuberta.

mo Pellos tres pontos das mayores larguras, das tres
daõ as primeiras cubertas, e pello ponto do covado, q̃ he o fim
vernas dos catorze palmos e meyo do fundo, se deita a roda,
tomando atravessado do ditto ponto do fundo te opontoda
mayor largura, ecõ esta travessa se roda, e se tomaõ todos
os dittos pontos, e depois lhe daõ p fora à olho obojo,
p^a ajudar fundo da Nao, o q̃ sera um palmo
ordinario escasso, e este palmo se tomarà perto do
fundo.

pares Ha de ter esta Nao quinze pares, q̃ são trinta cavernas, fora
caver- a mestra, ese a grossura das madeiras for menos do q̃
s de convê p encher a conta das cavernas, se lhe pode meter
ita mais uma Caverna de um ponto, cu duas, p^a as
Almogamas hirẽ em seu lugar, o ql lugar he a terça
parte de esquadria a esquadria.

pares Para as outras Cavernas, se repartira a forma da Caverna
caver- mestra q̃ he a metade della, q̃ são sette palmos em quarto
com em cinco partes, e as duas destas cinco p^a abanda da
inição quilha se repartiraõ em quinze pares das outras cavernas
com diminuição.

minho O graminho de Popa terà de altura a fora o pee, q̃ he de
popa uma polegada, tres palmos e meyo de Goa, onde setê tantos
pontos nelle marcados com diminuição, como estaõ na Caverna;
porẽ são mais altos, porq ficaõ em maior espaço.

minho O graminho de proa terà dous palmos de vara ao dar a mesma
proa conta, e os pontos conforme a sua grandesa, e por estes
Graminhos se galivaõ eselavraõ todas as cavernas e
braços Esta madeira de conta ha deser toda abraçada no

chaô; e da seista avante, e da sexta à re haõ deser
embaçadas as outras tè as Almogamas com uma saltareilha,
a q̃ sefaz repartindo a conta da caverna em seis partes, e
dellas tomando uma p^a asaltareilha e nella se haõ de por nove
pontos, com diminuiçãõ pella ordem dos pontos dos graminhos.
Para q̃ quanto recolhe a forma por baixo, tanto, vaõ
botando os braços p^a fora, multiplicando p^a as cabeças
cada vez mais, Ha de ter esta nao de Poraõ de sobre
a Caverna à esquadria catorze palmos de Goa.
Tem logo sobre a pr^a cuberta sette palmos e tres dedos e as
outras seguintes a mesma altura atraves da escotilha. Em
Lisboa a 5 de Mayo de 1598.

Gonçalo Roiz

J. Baptista Lavanha

T R A N S L A T I O NSKETCH OF A SHIP OF INDIAORDERED BY GONCALO ROIZ ON THE PATTERN OF THE SHIP CONCEIÇÃO

This ship will have a keel of seventeen and half Rumos in length. It will have a lancamento of thirty six spans towards the stern and turn round, rising up fifty one spans measured square and with a string it will be taken the travessa which is from the extreme (couce) of the wheel till the end of the said 51 spans and with this spring the said wheel will be set. The stern post (codaste) will have forty spans measured square, and it will lie between the third and fourth.

The Gio will be of twenty nine spans in length, so that while crossing the stern post it will be fourteen and half spans on each side.

It will have a delgado of seventeen spans measured square. The pees mancos will turn round in such a way that at the lower deck they will have a travessa of thirty one spans and through this point and through the points wherein it lengthens (encabeca) and from the end of Gio they will turn round roughly with a string and the nails will be put where it is found best and the wheels look nice, as it is convenient for the navigation.

The ship will have an entrance at its largest width, which is at the orlop deck on the ground, having fifty two spans it

will have a bottom of fourteen and half, and a middle deck on the ground of forty two spans, the lower deck on the ground being forty eight, the last deck will recede inwards in the main rib, at a height of seven spans; as for the orlop deck it will put out forty eight spans more than the lower deck.

HOW THE RIBS TURN ROUND - It is through the three points of largest widths, of the three middle decks and through the ponto do cavado which is the extreme end of the fourteen and half spans from the bottom, that the wheel is set, laid across the said point at the bottom upto the point of largest width and with this travessa is turned around and all the said points are taken and then the bulge is roughly given to it to support the bottom of the ship which will be hardly one ordinary span and this span will be taken near the bottom.

FIFTEEN PAIRS OF RIBS AT THE BOTTOM (Cavernas de conta)

This ship will have fifteen pairs, that is, thirty ribs, besides the main rib and, if the thickness of the timber is less than what it is appropriate to fill up the bottom of the ribs, then another Rib or two of one point can be put, so that the last ribs (almogamas) can fit at the proper place, which place is one third measured square.

FIFTEEN PAIRS OF RIBS WITH DIMINUTION -- As far as other Ribs are concerned, the form of the main Rib will be divided, being half of it and this is seven spans in a quater, into five parts and two

out of these five, towards the keel will be subdivided into fifteen pairs of other ribs with diminution .

MARKING-GAUGE OF STERN (Graminho de Popa) -- The marking-gauge of the stern will be of one inch and will have a height of three and half spans of Goa, where it will have as many points marked with diminution, like those at the Rib, but they will be at a higher height, since they are in a bigger space.

MARKING-GAUGE OF THE STEM (Graminho da Proa) -- The marking-gauge of the stem will have two spans of vara while giving the same conta and will have as many points as required according to its size (grandeza) and with these marking-gauges (graminhos) all ribs and arms are moulded and set.

This timber of conta will be held (embracada) on the ground and from the sixth rib onwards other timbers will be held (embracadas) till the last ribs (Alomogamas) with a saltarelha, made by dividing the conta of the rib into six parts and taking one out of them for saltarelha and thereon nine points with diminution will be marked, according to the order of the points of marking-gauges (graminhos), so that the form recedes underneath as much as the arms put out, multiplying to the heads more and more. This Ship will have over the Rib a Bilge (Poraõ) of fourteen spans of Goa measured square.

Immediately over the middle deck it will have seven spans and three fingers (dedos) and the others that follow will have the

me height through the hatchway (escotilha). At Lisbon, on 5th
y, 1598.

Goncalo Roiz

J. Baptista Lavanha.

Source :

Barata, J.G.P.,

Estudos de Arqueologia Naval,

Vol.I. Imprensa Nacional, 1983,

pp. 234-235.

APPENDIX. IV

SOBRE O MODO DE SE FABRICAREM AS NAOS
DE TRES CUBERTAS P.¹^a A VIAGEM
DA INDIA E OS RUMOS QUE TERÃO,
ME PARECE O SEGUINTE

Tenho dito e appontado por outro papel que fiz por mandado de Sua m.^{de} o anno de 605, onde mostrey ser mais util a viagem da India a fabrica de tres cubertas que não as de quatro, e se verá como foy m.^{to} util mandar sejão as naos de tres cubertas.

Primeira m.^{to} por q a gente do mar que nos tempos atraz auia, herão em vigia, e experimentados na nauegação e viagem da India, em m.^{to} diferente grao da q.oje ha (¹) e naquelle tempo por Regim.^{to} se mandaua q as naos fossem de quinhentas toneladas, e de quattro cubertas que hera hua fabrica e feito de naos q.com m.^{to} trabalho, e risco faziam esta nauegação, por serem cuttas, e alterosas, comtudo a gente do mar que nellas navegaua com sua industria, vigia e trabalho, hião, e vinhão a saluam.^{to} e poucas se perdião.

Por cujo respeito e plas razões que então se disserão, pareceo se fabricassem naos de tres Cubertas, e não de quattro, e se as de quattro Cubertas se fabricarão de dezoyto e de dezanoue, e de dezanoue Rumos e meyo, as de tres Cubertas se deuem fabribar de dezoyto rumos som.^{to} proq. se se teue por inconueniente fabricarenses naos de tanto porte e tão grandes p.^{as} nauegarem gente da navegação q. oje ha tão differente no curso como se disse no papel que então se fez da que antigam.^{to} auia e navegaua em naos de menos Rumos, e de menos tonelladas, e de quatro Cubertas

que com m.^{to} trabalho hiäi e vinhão a saluam.^{to} pura forsa e cuidado da dita gente.

Por onde as naos de tres Cubertas que se quizerem fabricar deuem ser como aquellas q. abaixo se porão por exemplo q: forão e vierão a saluam.^{to} e só hua se perdeo e serey ainda de parecer sejão de mais rumos e porte como em outro capitulo direy.

E não naos de tres Cubertas de vinte rumos que posto he menos hua Cuberta tem a tolda até o pé do Masto e p.^a ellas são necessarios os memos mastos, vergas, velas, enxarcias, ancoras, amarras, e os mais massames e gente da nauegação que era necessairio p.^a as de quatro Cubertas, e se não poupa cousa alguma nem vtilidade a faz.^a de S.M.^{de} nem p.^a a nauegação pois virão arquiari mais toneladas q as de quatro Cubertas, porque quando se arqueão as naos, ou Galeões, posto que sejão de tres e quatro Cubertas som.^{te} se arqueão o fundo da nao ou Galeão, que chama o porão, e a cuberta sobre o porão q. he a primeira cuberta, e se não arquea mais cousa alguma E poraqui se verá he fabrica contra o intento que Sua M.^e teue em mandar q fossem as naos de tres cubertas, e cão de quattro.

E p.^a poderem seruir depois de não estarem p.^a fazer viagem á India, darmada nestas Costas, ou Ilhas, q he o intento que tambem se teue, não ficão sendo de proporsão p.^a poderem seruir, porque pr.^a cada hua dellas he necessario tão grande fabrica que ninhu dinhr.^o bastara pr.^a tanta despesa, e por o custo que cada anno se faz com o Galeão Capitania da Armada, que se não pode escuzar se vee por experiencia ser isto assy.

Por cujo respeito assy pra nauegação da India; e depois poderem seruirem darmada; e nauegarem cõ mais comodidade, hande ser do porte, rumos, e toneladas q fiquem sendo de menos despesa e mais utis pr.^a hua e outra nauegação.

E que com o q hauiam mister as naos de quatro cubertas q até agora se fabricarão, como auerão mister as que se querem fazer de tres cubertas de vinte Rumos as emxarceas q lhes havião de seruir p.^a masto e traquette possão serur de masto grande, q he couza incomportavel ser necess.^o emxarcear hua nao destas de quatro cubertas, E as de tres de tantos rumos com seis centos e cinquenta q.^{es} E, settencentos de emxarceas afora as amarras como poderão nauegar comtanto pezo nos Mastos e bem pode ser q as naos que desaparece, que m.^{tas} vezes se cuida ser por causa do fogo, sem se ter noticia dellas seja por sesobraerm com tanto pezo em sy nos mastos e mastareos, de emxareas e não poderem amaynar, nem villas da gauea, e nem as mais vellas com a breuidade que conue quando lhes dá o tempo e com o m.^{to} pezo da emxarcea nas Cabecas se irem ao fundo.

E assy ja que se mandão fazer naos de tres Cubertas, conuem sejam manuaueis, E que p.^a a despesa e menos emxarceas, velames, e com mais faseis mastos fiquem seruindo pr.^a viagem da India, e depois possão seruir nas Armadas da Costa e Ilhas.

Por cujo respeito me parece será muy util á dita nauegação fabricarensẽ naos de tres cubertas nesta forma que sejam de dezoyto rumos de quilha, e quinze palmos de pontal, e sette palmos e dous tersos de cubertas e trinta palmos de roda, e catorze

palmas de Cadaste de lançam.^{to} e a boca sera conforme a este cõprimento e altura na qual ficão alcansando duas cousas.

A primeira he comprim.^{to} de nao que vira arquear perto de oytocentas toneladas, sobre o qual fundam.^{to} se fabricão tres Cubertas som.^{to} com tolda até o pé do Masto q. fica sendo nao de porte bastante pr.^a Pim.^{ta} e carga, e poder pelejar q. he o q. Sua M.^e pretende, e de menos trabalho pra gente da nauegação.

A segunda q as naos deste porte, e comprim.^{to}, e fabrica ficão sendo de pouco trabalho, e menos tormentosas no mar, porq hua nao curta como antiga, .^{te} se fabricauão de quinhentas toneladas, e de quattro cubertas tomava hu marsom.^{te} e não auia masto do traquette, e goroupés que bastasse, e se tomar dous mares ficará sempre nauegando commenos detrimento, e será sempre bonansoza sua nauegação, isto sendo de tres cubertas na forma e comprimento q fica dito, e sendo mais comprim.^{to} de quilha e lançam.^{to} de Roda, com m.^{ta} facilidade alquebrara com tão grandes mares como nesta nauegação da India; isto quanto a nauegação.

E q.^{to} á carga daqui pra India as naos de quatro cubertas he no porão, e primeira cuberta, e alguns rumos que se tomão da segunda cuberta p.^a agua agoa, vinhos e Carnes q logo se gastão, isto mesmo se faz nas naos de tres Cubertas, só p.^a os soldados fica de mais comodo as quattro Cubertas, mas temos uisto por experiencia naos de tres Cubertas do porte q fica dito poderem levar pra India tanta gente como as de quattro cubertas, como se poderá uer pelos liuros dos assentos, e as mesmas camaras e camarottes se fazem nellas.

E da Jndia pro Reyno a carga da Pim.ta que he a que S. M.^{de} pretende, vem no Porão, e primeira Cuberta do Mastro a proa q sendo do porte e comprimento q fica dito trará m.^{to} mais de seis mil quintaes e da Arca da Bomba a Ré he o Payol da Drogas, e na outra Cuberta he o lugar das liberdades, Caixaria e Camaras dos Of.es esta he a forma da carga q a nao de quatro Cubertas traz tudo o mais he grangearia de Bombard.^{os} Mestres, Pilotos, officiaes, e Capitães, que havendo de fazer sua m.^{de} naos p.^a elles he bem que sejam de tamanho, e maneira que elles quizerm.

E por experiencia se pode ver da nao Nossa S.^{ra} do Castelo de tres Cubertas fabricada no Porto q. foy por Capitania a Jndia e que não hera dos rumos q. fica dito, daqui leuou quasy tanta gente como as de quatro Cubertas, e de lá pra quá rendeo perto de quarenta contos de direitos, e trouxe cinco mil quintaes de Pim.^{ta}

E o q oje se tem visto he q naos de quattro Cubertas tão grandes como se fabricauã trazião tres mil q.^{es} de Pim.^{ta} em seus lugares q.. he o porão e prim.^{ra} cuberta do mastro a Proa como se diz atras, aonde não pode por Regim.^{to} vir outra fazenda senão Pimenta, e o mais vem carregada de lastro pr.^a poder nauegar por a Pim.^{ta} ser leve e vir pouca, e os direitos rendem menos de trinta contos.

Por maneira q. assy pra viagem e nauegação della como pra importancia da Pim.^{ta} E direitos, e leuar gente a Jndia fica dito qual he de mais vtilidade, e de menos despesa.

TRANSLATIONON THE MODE OF BUILDING SHIPS OF THREE DECKS FOR
THE INDIA VOYAGE AND THE RUMOS THAT THEY WOULD HAVEI HOLD AS FOLLOWS.

I have said and pointed out in another report sent under the order of Your Majesty, year 1605, wherein I have shown that building three decks and not four decks is more advantageous for India voyage and it will be found out how it was very useful to dispatch/send three decks ship.

Firstly, because the sailors at that time were keeping watch, and experienced in the navigation and voyage to India, in a very different degree than now are available, and in those times the regulations determined that the ships shall be of 500 tonnage and four decks, which were of the same make of the vessels that were sailing over there with much hard work and risk as they were short and shaky. However, the sailors navigating thereon, by dint of their industriousness, watch and hard work were going, coming and saving themselves and few ones were being lost.

In that regard and for reasons which were put up at that time, it was felt that three deck ship may be built, and not four, and if four decks were built of 18 or 19 and if of 19½ rumos, those of three decks should be of 18 rumos only because it was inconvenient to build ships of much capacity and so large. The mariners voyaging nowadays were so different in their route as it was pointed in the paper which was prepared in regard to those

which were available formerly and voyaging in ships of less rumos and of less tonnage, and four decks which with much hard work were going and returning and saving themselves, mainly because of their strong will and carefulness.

Hence, the vessels of three decks which are proposed to build up should be such as those which went and came back saving themselves, and only one was lost, and I will even hold that they have more rumos and capacity.

And not the ships of three decks and twenty rumos, since one deck has quarter-deck till the foot of mast and they require the same masts, yards, sails, shrouds, moorings, anchors and other tackling and mariners which were required for four deck ship, does not diminish in the least the utility to the Treasury of Your Majesty nor to the navigation as since they will have greater tonnage capacity than four deck vessels because when they are weighed to the Naus or Galleons, the load/capacity of the three and four decks would be only the bottom of Nau or Galleons which was called the hold (poraö), and the deck on the hold would be the first deck and not bear/carry anything. Here from it will be seen that it is build contrary to Your Majesty's intent that the ships shall be of three decks and not four and so that they may be utilized, after they cannot sail to India, for the coastal navigation, which was also the purpose in view, they may not be of such proportion (size, capacity), so as to be useful because for each of them of such a big work, that no amount would be suffice for so much expenditure and from the cost that each year is spent

on Captain Galleon of Navy it cannot be avoided, but to see that so it is.

So much in regards to navigations towards India and thereafter to be useful to the navy, and voyaging more easily they shall be of such rumos and tonnages as may be less expensive and more useful for any sort of navigation. And as required for the ship of four decks which were built up so far, as three decks that will be built will require 20 rumos and shrouds which will severe them for the mast and for the foresail that would severe as main mast. These requirements were not suited for the ships of the four decks. Those of three requiring so many rumos with 650 quintals and 700 of shrouding with so much weight on their mast, would be lost. It is quite possible that the ship which vanish often presumed fire as the cause, which goes unnoticed either because they were so much overloaded on the mast and the top mast that they could neither fizzled the sails of gavea nor other sails as quickly as possible with in the short time and sinking with the weight of the shrouds on the cross of the anchor.

In that regard I feel it will be very advantageous for the said navigation (India), which will be eighteen rumos at keel and fifteen palmos at depth and seven palmos and 2/3 of decks and thirty palmos of stem and fourteen palmos of stern length and the extreme width of the ship will be according to this length and height in which two things were achieved.

The first is the length of the vessel which will weigh near 800t on which the foundations of only three decks will be put .

with quarter-deck till the feet of the mast which will not be sufficient for the pepper and other cargo and could use for combat that is what Your Majesty desires, and for less work to the crew.

The second that, the ships of this capacity and length, required less work and less subject to storms at sea, because it is not so short as was built formerly of 500t and four decks would only take to the sea and these would not carry foresail mast and the enough bowsprit and if it sails twice, it would always sail with less damage and its sailing will always be fair, it being of three decks in the form and length as it was said and having longer keel and stem, it will great ease cross over so large seas as large seas as that of souling to India.

In relation to the load from here (Lisbon) to India, the four deck ships had the hold, the first deck and some rumos which would be taken from the second deck for some water, wine and meat which finish fast, as it happens in the three decks ship, only for the soldiers the four decks is more comfortable but we have seen by experience three decks ship which can transport to India as many people as the four deck as it can be seen from the record books and the same type of cabins and rooms made therein.

And from India to Portugal the pepper cargo which is desired by Your Majesty will be housed in the hold and the first deck from mast to the prow which being as long and wide as mentioned earlier would carry more than 6000 quintals and from the pump well to the stern there will be a store room for medicines while the other

deck will house the liberty chests, boxes and the cabins of the officer. This is the form of the load which four decks ship brings all and the rest is the collection of bombardiers, Masters, Pilots, Officers and Captain who were building ships for them through Your Majesty of the suitable size and form desired by them.

It can be seen from experience of the Nau Nossa Senhora de Castle of three decks built in Porto, sailed to India as captain ship and was not of the rumos as said before, carried from here as many as people carried by the four decks and on the return voyage brought 500 quintals of pepper. What now has been seen is that, the four decks ship was so large that they will bring the pepper cargo of 300 quintals housed in the hold and on the first deck from the mast to prow as said before, where it is not allowed by regulations to bring any other goods than pepper and the rest comes loaded in the form of ballast because the pepper comes in less quantity.

In this manner for the voyage and navigation of the ship as well as for the value of the pepper and the people sailing to India, it has been said what is more useful and less expensive.

Source :

Vasconcelos, F.de. Subsidios Para A Historia
Da Marinha Portuguesa,
Imprensa da Armada, Lisbon,
1928, pp. 23-25.

RIGGING MATERIAL OBTAINED FROM KANARA BY THE PORTUGUESE
IN 1726.

1. Sinco Vellas.
2. Dezasseis Pipas de Artilheiro de ferro de calibre 3 lbs.
3. Quatro Ancoras de Ferro.
4. One ancorte.
5. Duas amarras aligadas.
6. Hua lancha com seus remos, maitro e vergas .
7. Quienhentas e Sincoenta ballas de ferro.
8. Hum cabrastante com seus Barras.
9. Dois taboeus de sobrecelentes.
10. Dois panelas de polvora.

Translation

1. Five Sails.
2. Sixteen pipas of artillery of 3 pounds calibre.
3. Four Iron Anchors
4. One small Anchor
5. Two connecting hawseers
6. One lancha with oars, mast and yards.
7. Five hundred and fifty iron balls.
8. One capstan with its Barras.
9. Two large spare planks.
10. Two pots of gun powder.

Source: Assentos Conselho de Fazenda,

HAG. Mss.1174 - fl.23.

MEDICAL ITEMS SUPPLIED TO THE NAU NOSSA
SENHORA DA CONCEIÇÃO SAILED IN 1772.

24	Glass flasks.
2	Clay flasks.
30	Clay pots.
1	Glazed tea pot.
18	Boxes
10	Earthen salt water trouts.
12	Small cloth bags.
1	Brass balance
2	Sryings
1	Brassbox
1	Curved knife
1	Cross-cutter saw.
1	Needle
1	Filler
2	Flasks of aquavitae.

Source :

Obrigaçoens de Feitoria de Goa.

HAG, Mss.no. 1603, fl.90.

RIGGING CERTIFICATES ISSUED BY THE REVENUE COUNCIL TO
THE SHIPS IN GOA 1707 -1775

Type of the Ship	Name of the Ships	Year
Fragata	São Francisco Xavier	1707
--	Nossa Senhora de Conceição	1709
--	Nossa Senhora de Neves	1709
Nau	Nossa Senhora da Gloria	1709
Fragata	Nossa Senhora de Batalha	1710
Fragata	Bom Jesus de Moreagão	1713
Fragata	São Bom Ventura	1714
Fragata	Nossa Senhora da Viztação	1716
Nau	Nossa Senhora de Piedade das Chaga	1718
Palla	Santa Catherina	1718
Fragata	Nossa Senhora de Anna	1720
----	Nossa Senhora da Luiz	1720
Nau	Nossa Senhora da Brotas	1721
----	Nossa Senhora da Estrella	1722
----	Nossa Senhora da Livraminto	1726 (Mormugão)

Type of the Ship	Name of the Ships	Year
Nau	Nossa Senhora de Mae Deus	1732
--	Nossa Senhora da Aparecida	1735
--	Nossa Senhora da Estrella	1736
--	Nossa Senhora de Rosario	1740
--	Nossa Senhora de Nazareth	1740
Palla	Santo Inacio	1741
Pataxo	Chinco Chagas	1742
Nau	Nossa Senhora de Arrabida	1744
Pataxo	Nossa Senhora de Atalhaia	1757
Nau	Santo Antonio & Saõ Joaquim	1771
Palla	Nossa Senhora de Piedade	1775

Source :

Assentos Conselho da Fazenda, HAG, Mss.no. 1174, 1175,
1176, 1177.

GLOSSARY

Alcáçova	It is located on the poop castle of the ship.
Alfandega	Custom House.
Almogamas	The last balizas with the Chaõ de Caverna which was limiting the depth of a ship to afore and aft.
Almoxarife	An Officer in charge of the warehouse.
Amantes	A name given to the cable or rigging with which the yards of the Galley were raised.
Apostura	The last braços of each baliza of the wooden ship. The junction of braços and of the haste.
Aposturagem	Riders.
Armada	Fleet.
Armazen	Ware house
Armeiros	A person incharge of repairing the arms on ship, during the voyage.
Artimão	A name given to the mizzen sail of the Galleon and of the Caravela.

Alacadas	Wooden plugs which are nailed on the costado to push the planks at its proper place.
Balizas	Curved pieces of wood having their lower portion joined to the keel.
Bandeira	Flag.
Bastardo	A general term given to the triangular sails of latten rigging.
Bastardo Vela	A quadrangular sail.
Boca	Major width of the ship.
Boca de Fogo	Artillery piece.
Boca de Lobo	A circular or semicircular hole on the tolda to pass the cables fixing the masts, etc.
Bombardeiros	Gunners
Braços	The squarring cables fixed on the laises of the round yards to move them horizontally. It could be single or double. Each yard had two cables.
Cadeias	A name given to a stitching point of a sail
Cadaste	Stern.

Cabeça	The end point of any wooden piece used for naval construction.
Cabedal	Money allotted to buy pepper.
Cachapana	Latten Triangular or quadrangular sail, which was put on the main mast of the Caiques of Algarve to replace the usual sent.
Cafilas	A group of small ships sailing with cargo.
Cais	Quay
Calado	It is a distance much below from the point of the keel to water line.
Calces	The rectangular section on the point above mast which was immediately failed atromä.
Calçoens	Same as calces.
Camelo	An old artillery piece.
Camorete	A ships compartment.
Capelo	A rectilinear piece that connect the foot of the stem.
Carreira da India	A round voyage from Lisbon to India.
Cartaz	Sailing permit.

Casa de Polvora	Gun foundry.
Casco	Hull of a ship.
Caverna	Ribs.
Conselho de Fazenda	Revenue Council.
Cóntra Cadaste	The reinforcing joining beam of the stern to the keel.
Couce de Popa	The lower end point of the keel which joins the stern.
Couce de Roda	The lower end of the stem which joins the keel.
Costado	The lateral part and the external of the navio.
Costura	The junction of two planks.
Covado	It is a part of Caverna.
Curvatões	Two strong pieces of wood placed upon the romã of the mast in the direction o poop prow, one side to another side of calcës and was fixed conviently.
Escovens	Circular openings made in the costado of a ship close from the stem where they operate the anchors.

Esperas	A small artillery piece.
Espingards	Shot guns.
Esporaö	A strong piece of ride pole which was projecting from prew above the water line.
Estrinca	'Molinete ' of old ships used in manoeuvring the yards and the masts.
Fazenda	Finance.
Feitor	Factor.
Fidalgos	Noble class.
Forqueta	A iron piece in the form of pitchfork tied on the alcatrate of a ship.
Garganta	A name given to a delegate part of the mast which was below romä.
Gavea	Topsail.
Gio	They are called popas de carro or quadradas, many curved pieces deposited horizontally nailed on contracadaste.
Guard-Mór	An officer entrusted with the supervisory functions on the ship.
Gurupes	Hatchways.

Joanetes	The sails where are above the gaveas.
Junta da Fazenda	Revenue Board.
Laises	Any end point of the yard which has the cylindrical shape.
Liame	A general term used for the pieces which constitutes the skeleton of the ship.
Livro da Recieta e Despeza	Register of income and expenditure.
Malha	Bowline Knot.
Manga	A piece with tabular form.
Marinheiro	Sailor.
Mastareu de Gavea tope	Top mast.
Mastareu de Proa	Masting of the prow.
Mastreaçaõ	Joint of masts, masting and its accessories.
Mastro	Mast
Mastro de Artimaõ	This was located between the main mast and the mizzen.
Mastro da Gavea	Main top mast.
Mastro do Gurupes	Bowsprit.

Mastro de Mizzen	Mizzen mast.
Mastro do Traqueto	Foresail mast.
Matricula Geral	General enrolment.
Meia Leua	A piece of wood or of metal with the shape of half moon.
Meirinho	A ship official.
Meza de Intendencia	Board of Intendency.
Misericordia	House of Mercy.
Mocadaö/Macadam	Master of The Galiota, Manchua or other ships.
Moitoës	Piece of Poleame.
Paiol	Store room of the ship.
Pano Redondo	Round sail.
Paos	An old term used generally to designate the masts and mastings.
Papafigos	Any sails, main or foresail of the round ship which are reckoning from below on the main mast and on fore mast respectively.
Poleame	Assemblage of the wood or of iron pieces meant for passing the cables.

Pontal	Depth.
Pontal de Premeira Cuberta	Depth of the first deck.
Poräo	Any packed space found between the sobrequilha and the first deck and was used for keeping the ballast etc.
Portinhola	A rectangular openings put up on the costado of the ships to place the artillery.
Pretrechos	Armament, war ammunition.
Provedor	Purveyor
Quilha	Keel
Regimentos	Standing orders
Roda de Proa	Stem
Romä	A thick part of the mast on the proximity of its upper end and on which placed the curvatoes.
Sarangue	An officer corresponding to contra mestre.
Saltareilha	A scale of height which was used in old naval construction.
Sobrados	Floor

Sobre Quilha	Strong wooden planks or the series of planks placed above the ribs and nailed to the keel to join it and for strengthening its joints to the keel.
Taboado	Set of planks of costado, of pavement etc.
Tamborete	Reinforcement planks.
Tandel	Indian name for Pilot.
Telhado	Deck ship with pavement.
Topo do cadaste	Top of the stern.
Tribunal de Junta	Judicial Board.
Traquete	Round sail which was fixed on the yard.
Vela	Sail
Velacho	Foretop sail
Velame	The assemblage of the sails of the ships.
Vela de Artimaö	Mizzen sail
Vela de Gavea	Round topsail
Verga	yard
Verga de Cevadeira	The yard which was crossing from below the hatchways and rounded to the sail.

- Verga Grande The first yard of mainmast on which the main sail was fixed.
- Verga de Mizzen The yard where the quadrangular latten sail was fixed.
- Xeratas A net horizontally placed to cover the quarterdeck and the conves of the Nau and Galleons during the combate.

BIBLIOGRAPHY

I. UNPUBLISHED PRIMARY SOURCES

Alfandega (1779 - 1780) 1 Vol.

Assentos Conselho de Fazenda (1650 - 1740) 10 Vols.

Alvaras e Provisões de Sua Magestade (1610 - 1625) 7 Vols.

Cartas, Patentes E Alvaras (1557 - 1664) 20 Vols.

Cartas, Patentes E Provisões (1605 -17752) 6 Vols.

Cartas, Regias E Provisões (1176 - 52) 1 Vols.

Instruções Para O Intendente Geral da Marinha (1774) 1 Vol.

Livro da Cartazas (1784 -1782) 5 Vols.

Livro de Correspondencia de Kanara (1647 - 1769) 2 Vols.

Obrigações de Feitoria de Goa (1772 - 1774) 2 Vols.

Petições despachados da Conselho da Fazenda (1682 - 1761) 32 Vols.

Provisões, Alvaras e Regimento (1515 -1596) 2 Vols.

Provisões de Visoreis (1602 - 1631) 3 Vols.

Regimento E Instruções (1564 - 1779) 24 Vols.

Registo de Alvaras e Cartas Regias (1610 - 1645) 7 Vols.

Registo Gerais (1769 - 1775) 2 Vols.

II. PRIMARY PUBLISHED SOURCES

- Aiya, V.N. The Travancore State Manuel,
Vol.I, Asian Educational Services,
New Delhi, 1969.
- Albuquerque, A.de Cartas Para El - Rei D.Manuel-I,
Livraria Sa da Costa, Lisbon, 1942.
Cartas de Afonso de Albuquerque,
7 Vols., Lisbon, 1884 - 1915.
- Albuquerque, A. de Commentaries de Grande Afonso de
Albuquerque,
4 Vols., Imprensa Universidade, Coimbra,
1922.
- Andrade, J.F.O. Vida da Dom Joaõ de Castro
Lisbon, 1834.
- Aguelor, M. de Advertencias de Naveguantes,
Arquivo de Casa Cadaval, 1640.
- Barros, J. de Decadas de Asia,
4 Vols., London 1945-1946.
- Biker, J.f.J.(ed) Colleçaõ de tratradose concertos de Pazes
que o estado da India Portugese fez com
os reis e Senhores em que teve relaçoens
nas partes da Asia, Africa Oriental
desde o principio da conquista até

- ao fim do seculo XVII,
14 Vols., Lisbon, 1881 - 1887.
- Boxer, C. R. The Tragic History Of The Sea,
Hakluyat Society, London, 1959.
- Britto , B.G.(ed) Historia Tragico - Maritima,
4 Vols., Lisbon 1904.
- Bulhão Pato, R.A.de Documentos Remittidos da India ou Livros
(ed) das Monçoes (1605 - 1619).
2 Vols., Archivo Nacional da Torre da
Tombo , Lisbon 1880 - 1935.
- Cabral, P. A. The Voyage Of Pedro Alvares Cabral To
Brazil and India,
London, 1938.
- Castenheda, F.L. Historia de Descobrimientos e Conquista da
India Pelos Portuguese,
9 Vols., Lisbon, 1924-1933.
- Castro, J. de Roteiro de Lisboa e Goa 1538.
(Notes by A.F. Da Costa), Agencia
Geral de Colonias, Lisbon, 2nd ed. 1940.
- Roteiro de Goa A Dio (1538 - 1539).
(Notes by Diogo Kopka), O Porto 1843.
- Cordeiro, L. de (ed) Registo da Casa da India,
2 Vols., Lisbon, 1945.

- Chumvosky T.A. (e d) The Three Unknown Roteiros Of Ibn Madiid, The Arab Pilot Of Vasco da Gama,
Academy of Science, Leningard 1958.
- Dias, C. M. Historia da Colonizaçãõ Portuguesa do Brazil,
Porto, 1921.
- Falcaõ, L.F. de.(ed) Livro em que se contem toda a Fazenda e Real Patrimonio das Reinos de Portugal India, e Ilhas Adjacentes (1612),
Imprensa Nacional, Lisbon, 1859.
- Felner, R.J.C. Subsidios Para Historia da India Portuguesa,
Nova Goa, 1951.
- Fernandes, M. Livro de Traca de Carpintaria com Todos os Modelos e Medidas para fazer toda a navegaçãõ assy d Alto Bordo Como Remo, 1616.
Biblioteca da Ajuda, Lisbon, 1616.
- Figueiredo, I.de Armada Portuguesa Em Porto de Mar, Luistania - I,
Lisbon, 1924 - 1925.
- Fonseca, Q. de Diario de Navigasaõ de Carreira da India 1595, 1596, 1597, 1600, 1603,
Lisbon, 1938.

- Gerreiro, F. Relaçãõ Annual coisas que fizeram os Padres no seus Missões Nos Annos de 1600 a 1608,
3 Vols., Coimbra 1936 - 1942.
- Goes, D. de Chronico de El-Rei D. Manuel,
Vol.I, Biblioteca Classica Portuguesa,
Lisbon, 1909.
- Laval , Francisco Viagem de Francinsco Pyrard de Laval
Pyrard de . (1601 -1611)
Trans. J.H. de Rivara Cunha,
Livraria civilizaçãõ, Porto n. d. a.
- Linhares Conde, de Diario de 3õ conde de Linhares Vice-rei da India,
Biblioteca Nacional, Lisbon, 1937.
- Luz, F.P.M. Livro da Cidade E Fortalezas Que a Coroa de Portugal Tem naus partes da India e dar capitancias,e mais cargo que nelas, ha e e da importancia della,
Centro De Estudos Historicos da Ultramarinos, Lisbon, 1960.
- Martins, Oliveira Portuguese Nos Mares
Vol. 2, Guimaraës & Co., Lisbon, 1954.
- Mauny, R. Les Navigations Medievales Sur les Cotes Sahariennes Anterieures, a la decouverte

- Portugais (1434),
Centro de Estudo Historicos de
Ultramarinos, Lisbon 1960.
- Perreira, A.B. de (ed) Arquivo Portugese Oriental,
10 Vols., Rangel Press, Bastora, 1937 -
1940.
- Pereira, A.B.de (ed) Arquivo Portugese Oriental,
10 Vols., Rangel Press, Bastora, 1937-1940.
- Pico, M.A.T.C. A Terminologia Naval Portuguesa Anteriora,
Lisbon, 1962.
- Pires D. & Biaö.A. Diario de Viagem de Vasco da Gama,
Livraria Civilizaçãõ, O Porto, 1945.
- Pires, D. Esmeraldo Situ Orbis de Duarte Pacheco
Pereira, Lisbon, 1954.
- Pissurlincar, P.S.S
(ed) Regimentos dos Fortalezas da India
Typografia Rangel, Bastora, 1951.
- Assentos de Conselho de Estado,
5 Vols. , Typografia Rangel, Bastora ,
1953 -1957.
- Rebello, J.J.Britto
(ed) Livro da Marinharia de Joaõ de Lisboa,
Lisbon, 1907.

Regimento de Regio Arsenal e Rebeiro da Naus da Cidade de Goa,
Regia Oficina Typografia, Lisbon, 1773.

Relaçãõ das Guerras da India desde o anno de 1763 até 1740,
A.I. de Fonceca, Lisbon, 1774

Rego, S.A. da Documentaçãõ para a Historia das Missões
 do Padroado Portugese do Orient India
 12 Vols. , Agencia Geral das Colonias,
 Lisbon, 1947.

----- Documentaçãõ Ultramarina Portuguesa,
 12 Vols., Centro de Estudos Historicos de
 Ultramarinos, Lisbon, 1962.

Rebeiro, L. Registo da Casa da India,
 Agencia Geral do Ultramar, Lisbon, 1954.

Rivara Cunha Archivo Portugese Oriental,
 6 Vols. , Asian Educational Service,
 New Delhi, 1992.

Sanceu, E.(ed) Cartas de Martim Afonso de Soza (1534-39)
 Coimbra, 1961.

Silva, A.A.B. Noticia Sobre a Nau S.Gabriel Em que Vasco
 da Gama foi pela Primeira veza a India,
 Typografia da Academia Real das Ciencias,
 Lisbon, 1842.

- Wheeler, J.T. (ed) Early Travels In India of 16th and 17th Centuries,
Deep Publications, Ludhiana, 1975.
- Xavier, M. (ed) Compendio Universal dos Todos Viro-reis, Governadores, Capitaes Gerais, Capitaes-Mores, Capitaes de Naus, Galles, Urcas 7 Caravelas que partiu de Lisboa para India Oriental e Tornaro da India para Portugal XVII Seculo,
imprensa Nacional, Goa, 1967.

III. SECONDARY SOURCES

- Ahmed, A. Indo - Portuguese Trade In Seventeenth Century (1600 - 1663),
Gain Publishing House, New Delhi, 1991.
- Albuquerque L. de Um Roteiro Primitivo de Cabo da Boa Esperança Até. Moçambique,
Junta de Investigações do Ultramar,
Coimbra, 1970.
- Diario da Viagem de D. Alvaro de Castro Ao Hadramante e Em 1548,
Junta de Investigações do Ultramar,
Coimbra, 1972.
- Ciencia e Experiencia nos Descobrimientos Portugueses,
Instituto de Cultura e Lingua Portuguesa,
Lisbon, 1983.
- Apte, B.K. A History Of The Maratha Navy And Merchantship,
Government of Maharashtra Publication,
Bombay, 1973.
- Arasaratnam, S. Merchants, Companies & Commerce on The Coromandel Coast,
Oxford University, New Delhi, 1986.

- Baiaö, A. R. O Manuscrito Valentine Fernandes,
Academia Portuguesa de Historia, Lisbon,
1940.
- Ballard, G. A. Rulers of Indian Ocean,
University Press, London, 1927.
- Banger, M.k. 'Ancient Shipbuilding In India - A
Historical Prespective'
In Studies in Maritime History
Mathew, K.S. (ed), Pondicherry, 1991.
- Barbosa, A. Novos Subsidos Para a Historia da Ciencia
Nautica Portuguesa,
Porto, 1948.
- Barata, J. G. P. de O Livro Primeiro da Architectura Naval de
Joaö Baptista Lavanha,
Ethnos IV, Lisbon, 1965.
- Relações Entre as Tecnicas de Construção
Naval Portuguesa do Século XVI e dos
Mestres Construtores,
Pova de Varzim, Lisbon, 1968.
- O Traçado Das Nause Gatoës Portugueses da
1550 - 80 A 1640,
Junta de Investigações do Ultramar, Coimbra,
1970.

- A Ars Nautica de Padre Fernando Oliveira,
Encyclopedia de Conhecimentos Maritimos e
Primeiro Tratado Cientifico de Construçaõ
Naval,
 Centro de Estudos de Marinha, Lisbon, 1972.
- The Portuguese Galleon 1519-1625,
 National Maritime Musuem, Greenwich, 1981.
- Estudos de Arqueologia Naval,
 2 Vols., Imprensa Nacional, Lisbon, 1989.
- Barros, E.E.de As Gales Portuguesa do Seculo XVI,
 Lisbon, 1930.
- Construçaõ Naval,
 Vol.II, Lisbon, 1947.
- Traçado e Construçaõ das Naus Portuguesa
dos Séculos XVI e XVII,
 Lisbon, 1933.
- Barker, R Prespectives On The 15th Century Ship
 Vol.II, Comissãõ Nacional Para As
 Comemorações do Descobrimentos, Lisbon,
 1989.
- Botelho, J.J.T. Historia dos Portuguese Em Moçambique,
 Lisbon, 1933.

- Botelho, J.N.R. Diccionario das Moedas, Pesos, Medidas e
Imformaçoës Commerciaes de Todos as
Paizes,
Lisbon, 1890.
- Bouchon, G. 'Sixteenth Century Malabar And The Indian
Ocean',
In India And The Indian Ocean,
Gupta A Pearson M.N. (ed), Oxford
University, New Delhi, 1987.
- Regent Of The Sea,
Oxford University, New Delhi, 1988.
- Bowditch, N. Bowditch's Coastal Navigation,
Arco Publishing, New York, 1979.
- Boxer, C.R. Fidalgos In The Far East 1550-1773,
Martinus, Nifhoff, Hague, 1948.
- Glimpses Of The Goa Archives,
BSDAS, 14, No.2, 1952.
- An Introduction To The History Tragico-
Maritima,
Lisbon, 1957.
- Four Centuries Of Portuguese Expansion.
A Succinct Survey, Bertely, 1969.

Carreira da India,

Centro de Estudos Ultramarinos, Lisbon,
1961.

The Great Ship From Amacon Annals Of Macau
And The Old Japan Trade,

Centro de Estudos Historicos Ultramarinos,
Lisbon, 1963.

Portuguese Society In The Tropics : The
Municipal Council Of Goa, Macau, Bahia And
Luanda 1510-1800,

Minnesota, 1965.

Further Selection To The Tragic History Of
The Sea 1559 - 1565,

CUP, Lisbon, 1967.

The Portuguese Sea-Born Empire 1415-1825,

Middlesex, 1973.

Portuguese India In The Mid-Seventeenth
Century,

Oxford University, New Delhi, 1980.

From Lisbon To Goa 1500-1700: Studies In
Portuguese Maritime Enterprise,

Variorum Reprints, London, 1984.

- Andre Furtado de Mendonça,
 Centro de Estudos Maritimo de Macau,
 Macau, 1989.
- Estudos Para A Historia de Macau,
 Fundação Orient, Lisbon, 1991.
- Barasio, A. A Acçaõ Missionaria no.Periodo Henriqueuo,
 Centenary Publications, Lisbon, 1958.
- Britto, N. Caravelas Nau e Gales de Portugual,
 Livraria Lello, Porto, 1960.
- Cabrera, H.L. Construcciones & Preparaciones Navales em
Canaries em Los Siglos XVI & XVII,
 Leio Palmes, Madrid, 1985.
- Campos, J.J.A. History Of The Portuguese In Bengal,
 Butterworth & Co., Calcutta, 1919.
- Campos, J. M. O Infant D. Henrique e Os Descobrimientos
dos Portuguese,
 Lisbon, n.d.a.
- Carmona, A.L.B. Lorchas Juncos Eoutros Barcos Usadas no
Sul da China,
 Centro de Estudos Maritimos de Macau,
 Macau, 1992.

- Carvalho, J.B. La Traduction Espagnole Du de Situ Orbis de Pomponivs Nela Par Maitre Joan Faras Et Les Notes Marginles de Duarte Pacheco Pereira,
Junta de Investigaçoës Cientificas do Ultramar, Lisbon, 1974.
- Castilho, A. de Commentario de Cerco de Goa e Chaul no Anno 1570 Sendo Viso-Rey D,Luis de Ataide,
Oficina Joaquiniam de Musica, Lisbon,1936.
- Castilho, J.D. A Ribeira de Lisboa,
Lisbon, 1956.
- Castlereagh, D. Encylopaedia Of Discovery And Explorations The Great Age Of Exploration,
4 Vols., Aldus Book, London, 1971.
- Correira, S. G. Historia da Colonizaçaõ Portuguesa Na India,
6 Vols., Agencia Geral Das Colonias, Lisbon, 1948 - 56.
- Cortesaõ, A. The Mystery Of Vasco da Gama,
Junta de Investigaçoës do Ultramar, Coimbra, 1973.
- Cortesaõ, A. & Albuquerque, L. Castro de Obras Completas,
Coimbra, 1968 - 1970.

- Cortesaö, J. Os Portugese Nos Descobrimientos do
Estados,
Lisbon, 1949.
- A Politica de Sigilo nos Descobrimientos
Centenary Publications, Lisbon, 1960.
- Os Descobrimintos Portugese,
Livros Horizonte, Lisbon, 1976.
- Costa, F. A. Roteiros Portuguesa Ineditos da Carreira
da India do Século XVI,
Lisbon, 1940.
- A Marinharia dos Descobrimientos,
Agencia Geral do Ultramar, Lisbon, 1960.
- Costa, M.G. Descobrimientos Conquistas Imprensa
3 Vols., Imprensa Nacional, Lisbon, 1929.
- Coutinho, Gago A Nautica dos Descobrimientos,
2 Vols., Agencia Geral do Ultramar,
Lisbon, 1952.
- The Warships In History,
London, 1966.
- Danvers, F.C. The Portuguese In India,
2 Vols., Asian Educational Service,
New Delhi, 1988.

-
- Report To The Secretary Of State For India
In Council On The Portuguese,
Asian Educational Service, New Delhi, 1992.
- Diffie, B.W. & Winius, G. de Foundations Of The Portuguese Empire 1415 - 1580,
University Of Minnesota Press, 1977.
- Dinis, D. A. J. Estudos Henriques,
Acta Universitatis Conimbrigensin,
Coimbra, 1960.
- Disney, A.R. Twilight Of The Pepper Empire,
Harvard University Press, Cambridge, 1978.
-
- 'The World Of Long - Distance Voyaging In
The XVI century. The Lisbon - Goa Fleet of
1629 as a case study',
In Studies in Maritime History,
Mathew, K.S.(ed), Pondichery, 1991.
- Dodwell, H. H. The Cambridge History Of India 1497 - 1558,
S. Chand, New Delhi, 1968.
- Dommingues, F.C. A Caravela Quatrocentista Nos Fontes da Arqueologia Naval Portuguesa,
Commissaõ Nacional Para As Comemorações
Descobrimientos, Lisbon, 1989.

- Dorta, A.L. A Viagem de Pedro Alvares Cabral ao Brazil,
Porto, Livraria Civilizaçãö, n.d.a.
- Duffy, J. Shipwreck And Empire: Being An Account Of
The Portuguese Maritime Disaster In A
Century Of Decline,
Harward University Press, Cambridge, 1955.
- Duarte, L. M. &
Pizarro, J.A.S. Os Forcados da Gales Os Barcos de Joaö de
Silva e Gonçalo Falaçaö na Conquista de
Arzila - em 1471,
Commissaö Nacional Para As Comemoraçöes dos
Descobrimentos Portuguese, Lisbon, 1989.
- Esparteiro, A.M. Diccionario Ilustrade de Marinharia,
Livraria Classica Editorial, Lisbon, 1943.
- O General dos Galöes do Estado da India
Antonio de Figueiredo e Ultramar (1678 -
1751),
Centro de Estudos de Marinha, Lisbon.
- Portugal no Mar (1608 - 1923),
Grafica Santelmo, Lisbon, 1954.
- Tres Séculos No Mar,
4 Vols., Ministerio de Marinhas, Lisbon.
- Ferrand, G. O Polito Arabe de Vasco da Gama e os
Conhecimintos dos Arabes no Seculo XV,
Lisbon, 1925 - 26.

- Filgueiras, O.L. Entre Normandes e Arabes.
Porto, 1963.
- Barcos da Costa Norte,
Porto, 1965.
- Filgueiras, O &
Barros, A. O Caique de Algarve E A Caravela Portuguesa,
Junta de Investigações de Ultramarinos,
Coimbra, 1970.
- Fonseca, J. N. Historical And Archaeological Sketch Of The City Of New Delhi,
Asian Educational Services, New Delhi,
1986.
- Fonseca, Q. Ementa Historico da Naus da Portugal,
Lisbon, 1926.
- A Caravela Portuguesa e A Proiridade Technicadas Navegaçoës Henriquinas,
Coimbra, 1934.
- A Caravela Portuguesa,
Coimbra, 1934.
- Os Navios de Infante D. Henrique,
Centenary Publications, Lisbon, 1960.

- Freitas, M.C. P.G. Madeiras da India Portuguesa,
Junta de Investigações de Ultramar,
Lisbon, 1963.
- Gamble, J.J. A Manual of Indian Timber,
Dehra, 1972.
- Godinho, M. Mito E Mercadoria, Utopia E Pratica de
Navegam Séculos XVI & XVII,
Lisbon, 1990.
- Gomes, A.S. Carpinterios da Rebeira,
Imprensa da Universidade, Coimbra, 1931.
- Gonsalves, J. Noticias Para O Historia das Armadas da
India,
Lisbon, 1943.
- Gracias, J.B. Medicine In Goa. In XVI - XVII Centuries
Tipografia Rangel, Bastora, 1941.
- Gracias, F.S Health And Hygiene In Colonial Gaa, 1510 -
1961,
Concept Publishers, New Delhi, 1994.
- Gune, V.T. Assentos de Conselho da Fazenda,
Vol.I, Part I, Govt.Printing Press, Panaji
1979.

- A Guide To The Collection Of Records From
 Goa Archives,
 Govt. Printing Press, Panaji, 1973.
- Gupta, A.D.& Pearson, India And The Indian Ocean 1500-1800,
 M.N. Oxford University Press, New Delhi, 1987.
- Harper, L. A. The English Navigation Laws,
 New York, 1939.
- Herculano, A. Historia de Portugal,
 Livraria Tavares Cardoso, Lisbon, 1901.
- Hourani, G. Arab Seafaring,
 Khayats, Oriental, Beirut, 1951.
- Hunter, W. W. A History Of British India
 Vol.I, Longmans Green & Co. London. 1899.
- Iria, A. Da Navegação Portuguesa No India no Século
 XVII,
 Lisbon, 1963.
- As Caravelas da Infante e Os Caiques do
 Algarve,
 Lisbon, 1963.
- Leitão, H.L. Viagens do Reino Para India E da India
 Para Reino (1608-1612),
 3 Vols., Agencia Geral do Ultramar,
 Lisbon, 1958.

- Leitão, H.L. & Lopes Dicionario da Linguagem de Marinha Antiga E Actual,
Centro de Estudos Historicas Ultramarinos,
Lisbon, 1970.
- Ley C. D. (de) Portuguese Voyages 1483 - 1663,
J.M. Dent, New York, 1947.
- Lobato, A. Antonio de Saldhana: His Life And His Achievments,
Centro de Estudos de Historicos Ultramarinos, Lisbon, 1962.
- Lobo, F.M.C. da Portugal - A Accaõ Maritimo dos Portuguese,
Imprensa Nacional, Lisbon, 1929.
- Lopes, M. Padre Fernando de Oliveira e Sua Obra Nautica,
Lisbon, 1898.
- Lucena, J. de Historia da Vida da Padre Francisco Xavier,
2 Vols. Lisbon, 1952.
- Machdo, A.R. Viagens de D.Joaõ Castro,
Lisbon, 1940.
- McPherson, K. The Indian Ocean: A History Of People And The Sea,
Oxford University Press, New Delhi, 1993.

- Major, K.H. (Trans.) The Life Of Prince Henry The Navigator,
Frankcass, London, 1967.
- Marques, P.A. Origen e Desenvolvimento da Cartographia
Portuguesa, Na Epoca dos Descobrimentos,
Imprensa Nacional, Lisbon.n.d.a.
- Martin Francois India In The 17th Century (Social,
Economic And Political)Memoirs Of Francois
Martion (1670 - 1694),
Tran.and annnotated by Lotika Varadara Jan.
New Delhi, 1981 - 85.
- Marjay, F.P Portugal And The Sea,
Livraria Bretrand, Lisbon, 1957.
- Marques, J.M.S. Descobrimentos Portugueses (1416 - 1500),
Vol.III. Instituto de Alta Cultura,
Lisbon, 1971.
- Os Filhos de D. João I.
Livraria Chardron, Porto, 1983.
- Mathew, K.M. History Of The Portuguese Navigation In
India 1498 - 1600
Mittal Publications, New Delhi, 1988.
- Mathew, K.S. Portuguese Trade With India In The
Sixteenth Century,
Manohor Publications, New Delhi, 1985.

- Mendes, A.L. India Portuguesa - Breve Discripcaõ das Possessões Portuguezas Na Asia,
Vol.I Imprensa Nacional, Lisbon, 1866.
- Mendonca, H.L.de Estudos Sobre Navios Portuguese Nos Séculos XV e XVI,
Ministerio da Marinha, Lisbon, 1971.
- Portugal - Navegaçaõ dos Portugueses,
Lisbon, 1929.
- Menezes, A. Goa - A Brief Historical Sketch,
AMA Publications, Panaji 1950.
- Menezes, J.V. Armadas Portuguesas, Alimentaçãõ E Abastecimento de Meados do Século XIV a Meados do Século XVI,
Editoria Resistencia, Lisbon, 1980.
- Menon, K.P.P. History Of Kerala,
Asian Educational Society, New Delhi, 1982.
- Monteiro, J.R.V. A Viagem De Regresso da India da Nau "São Pantaleaõ" No Anno de 1596,
Junta de Investigações Cientificas do Ultramar, Lisbon, 1974.
- Moraes, G.M. A History Of Christanity In India,
Manaktala & Sons, Bombay 1964.

- Moreira, A. The Spirit Of Prince The Navigator And Portugal's Present Overseas Policy,
Agencia Geral do Ultramar, Lisbon, 1960.
- Morse, S. Rulers Of India Albuquerque,
Clarendon Press, Oxford, 1892.
- Nambiar, O.K. Portuguese Pirates And Indian Seamen,
M. Bhaktavatsalam, Bangalore, 1955.
- Nemesio, V. Vida e Obra do Infante D. Henrique,
Centenary Publications, Lisbon, 1960.
- Oliveira, J.B.de Influencia de Infante D. Henrique nos Progresso da Marinha Portuguesa Navios e Armanentos.
Imprensa Nacional, Lisbon, 1894.
- Modelos de Navios Existentes na Escola Naval,
Lisbon, 1960.
- Panikkar, K.M. Malabar And The Portuguese
D.B.Taraporewala, Bombay, 1931.
- Asia And Western Dominance,
London, 1955.
- India And The Indian Ocean,
George Allen & Unwin, Bombay, 1971.

Parry, J.H.

The Age Of Recinnaissance,

New York, 1961.

The Spanish Seaborne Empire,

New York, 1966.

Pearson, M.N.

Merchants And Rulers In Gujrat,

Munishiram Manohar Lal, New Delhi, 1976.

Coastal Western India,

Concept Publishing Company, New Delhi,
1981.

The New Cambridge History Of India,

Orient Longman, New Delhi, 1990.

Pereira, J.C.

Para a Historia das Alfandegas Em Portugal
No Inicio do Século XVI Vila do Conde -
Organizaçao e Movimento,

Universidade Nova de Lisboa, Faculdade
de Ciencias Sociais e Humanas, Lisbon,
1983.

Periera, L.S.

Duarte Pacheco, Precussor de Cabral,

Porto, 1923.

Arte de Navegardos Portugueses,

Porto, 1923.

- Pereira, G. An Outline Of The Pre - Portuguese History of Goa,
Diario de Noite Press, Panaji, 1973.
- Pimental, M. Arte de Navegar e Roteiros dos Vaigens e Costas Maritimos de Guine, Angola, Indian e Ilhas,
Lisbon, 1947.
- Pina, L.de Subsidios Para Historia da Medicina Portuguesa Indiana do Século XVII,
Aranjo Sobrinho, Porto, 1931.
- Pinto, C. Trade And Finance In Portuguese India,
Concept Publishing Company, New Delhi, 1994.
- Pinto, J. Portuguese Slavery In India,
Himalaya Publishing House, Bombay, 1992.
- Pires, A.T. Caravelas do Descobrimentos
Centro de Estudos de Marinho, Lisbon, 1980.
- Pires, B.V. A Vida Maritima de Macau No Seculo XVII,
Instituto cultural de Macau, Macau, 1993.
- Pires, D. de The History Of Portuguese Discoveries,
Centenary Publications, Lisbon, 1968.

- Prestage, E. Viagens Portugueses de Descobrimientos,
Livraria Portugalia, Lisbon, 1948.
- Descobridores Portugueses,
Imprensa Portuguesa, Porto, 1943.
- Qaisar, A.J. Indian Response To European Techonology
And Culture,
Oxford university, New Delhi, 1982.
- Rego, S.A.da Viagem Portuguesa A India Em Meados do
Século XVI,
Academia Portuguesa da Historia, Lisbon,
1956.
- O Padroade Portugues no Oreinte a Sua
Historiografia (1828 - 50),
Academia Portuguesa da Historia, Lisbon,
1978.
- Ribeiro, A. Peregrinaçõ de Fernaõ Mendes Pinto
aventuras extra ordinarias de um
Portuguese no Oriente,
Livraria Sa da Corta, Lisbon, 1952.
- Ribeiro, O. Aspectos e Prablema da Expansão Portuguesa,
Fundação da Casa de Braganza, Lisbon, 1955.
- Rogers, F.M. Profosta De Terminologia Nautica
Internacional Umforme, Em Lingua
Portuguesa,

Junta de Investigaçoës do Ultramar,
Coimbra, 1970.

- Rothermund, D. Asian Trade And European Expansion In The Age Of Mercantilism,
Manhor Publications, New Delhi, 1981.
- Roy, A.C. A History Of The Mughal Navy And Naval Warfare,
The World Press Ltd, Culcutta, 1972.
- Sanceau, E Indies Adventure,
Blackie & Son Ltd, London, 1936.
- D. Henrique O Navegador,
Livraria Civilizaçãö, Porto ,1956.
- Good Hope The Voyage Of Vasco da Gama,
Academia Internacional da Cultura Portuguesa, Lisbon, 1967.
- Santarem, V. Memoria Sobre A Prioridade dos Descobrimentos Portuguesa Na Corta de Africa Ocidental,
Centenary Publications, Lisbon, 1958.
- Scammell, G.V. The World Encompassed The First European Maritime Empire 800 - 1650,
Methum, London, 1981.

- Schurhammer, G. Francis Xavier His Life , His Time,
Jesuit Historical Institute, Rome, 1983.
- Serjeant, R.B. The Portuguese Off The South Arabian Coast
London,, 1963.
- Shastry, B.S. Studies In Indo - Portuguese History,
IBH Prakashana, Bangalore, 1981.
- Skelton, R.H. The Seaman And The Printer,
Junta de Investigaçoës do Ultramar,
Coimbra, 1970.
- Soares, J.P.C. Bosquejo das Possessoës Portuguesas No
Oreinte,
2 Vols., Imprensa Nacional, Lisbon, 1851.
- Souza, L.de A Ciencia Nautica do Pilitos Portugueses
Nos Séculos XV e XVI,
Lisbon, 1972.
- Souza, T.R.de Goa-Based Portuguese Sea - Borne Trade In
The Early Seventeenth Century,
Vikas Publishing House Pvt. Ltd,
New Delhi, 1976.
- Indo-Portuguese History: Old Issues New
Questions,
Concept Publishing, New Delhi, 1985.

- Souza, V. Trabalhos Nauticos dos Portugese no Seculo XVI e XVII,
2 Vols. Lisbon, 1898.
- Sridharan, K. A Maritime History Of India,
Ministry of Information & Broadcasting,
New Delhi, 1965.
- Swartout, H.O. The New Modern Counsellor,
Pacific Press Publishers Association,
California, 1959.
- Telles, R.H. Fortalezas de Goa E Suas Legendas,
Typografia Rangel, Bastora, 1954.
- Tibbets, G.R. The Navigational Theory Of The Arabs In The 15th and 16th centuries,
Junta de Investigações de Ultramar,
Coimbra, 1969.
- Truyol Y Serra, A. Los descumbrimentos Portugueses del siglo XV Y los albores de la sociedad mundial,
Universidade de Lisboa, Lisbon, 1961.
- Ure, J. Prince Henry The Navigator.,
Constable, London, 1977.
- Vasconcelos, F.de Subsidios Para A Historia da Marinha Portuguesa,
Imprensa da Armada, Lisbon, 1928.

- Subsidios Para Historia da Carreira da
India No Tempo dos Felipe,
Agencia Geral do Ultramar, Lisbon, 1959.
- Velho, A. As Pinturas Artistica das Armadas da
India,
Lisbon, 1941.
- Roteiro da Primeira Viagem de Vasco da
Gama (1497-1499),
Agencia Geral do Ultramar, Lisbon, 1960.
- Ventura, M.S. Vida e Obra de Pedro Nunes,
Instituto de Cultura e Lingua Portuguesa,
Lisbon, 1985.
- Villiers, J. & Earle Albuquerque: Ceasar Of The East,
(Trans & ed) Aris & Phillips Ltd, England, 1990.
- Winius, C.D. The Fatal History Of Portuguese Ceylon,
Harward University, Massachussets, 1971.
- Xavier, P.D. Goa - A Social History,
Rajhauns Vitaram, Panjim, 1993.

LIST OF JOURNALS

1. Anais do Club Militar Naval, Imprensa Nacional, 1915, 1928, 1937.
2. Arquivo Historico da Marinha, Lisbon, 1933 & 1936.
3. Arquivo Historico de Portugal, Vol. IV, 1939.
4. Boletim da Agencia Geral dos Colonies, 1926 & 1951.
5. Boletim de Centro Estudos Maritimos de Macau, 1988.
6. Boletim de Instituto Menezes Braganza, Panaji, 1983.
7. Boletim Geral do Ultramar, Lisbon, 1956, 1959, 1960.
8. Boletim da Sociedade de Geografia de Lisboa, 1898, 1946, 1948, 1959, 1976, 1984, 1987.
9. Geographical Review, Vol. 31. 1941.
10. Harvard University Library Bulletin, Vol V. No. I, 1957.
11. Indica, Vol. I No. 2, 1964; Vol XXVII, No. 1, 1990.
12. Indian History Congress, volume number 30, 1968.
13. The Indian Economic And Social Review, 1986.
14. Journal Of European Economic History, Vol. 20 No. 1 1991.
15. Journal Of Malahysian Branch Of the Royal Asiatic Society, Vol. 38, 1965.

16. Mare Libirun
17. Mariner's Mirror Vol.2, 1925; Vol.68, 1982; Vol.69, 1983.
18. Purabhilekhi - Puratatava, Vol.II, No.2. 1984, Vol.III, No.1, 1985.
19. Quarterly Review Of the Society for Nautical Research, Vol. 24 No.1, 1934.
20. Reuniaö Internacional, Lisbon, 1989.
21. Revista da Armada, Lisbon, 1979.
22. Revista de Cultura de Macau, 1992.
23. Revista de Guimaraes, Lisbon,1961.
24. Revista de Juridica de Macau, April - June 1988.
25. Revista de Universidade de Coimbra, Nov. 25 1978.
26. Studia, No.11, 1962; No.33, 1971; Centro de Estudos Historicos de Ultramar, Lisbon.