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Baldwin, R. C. D.

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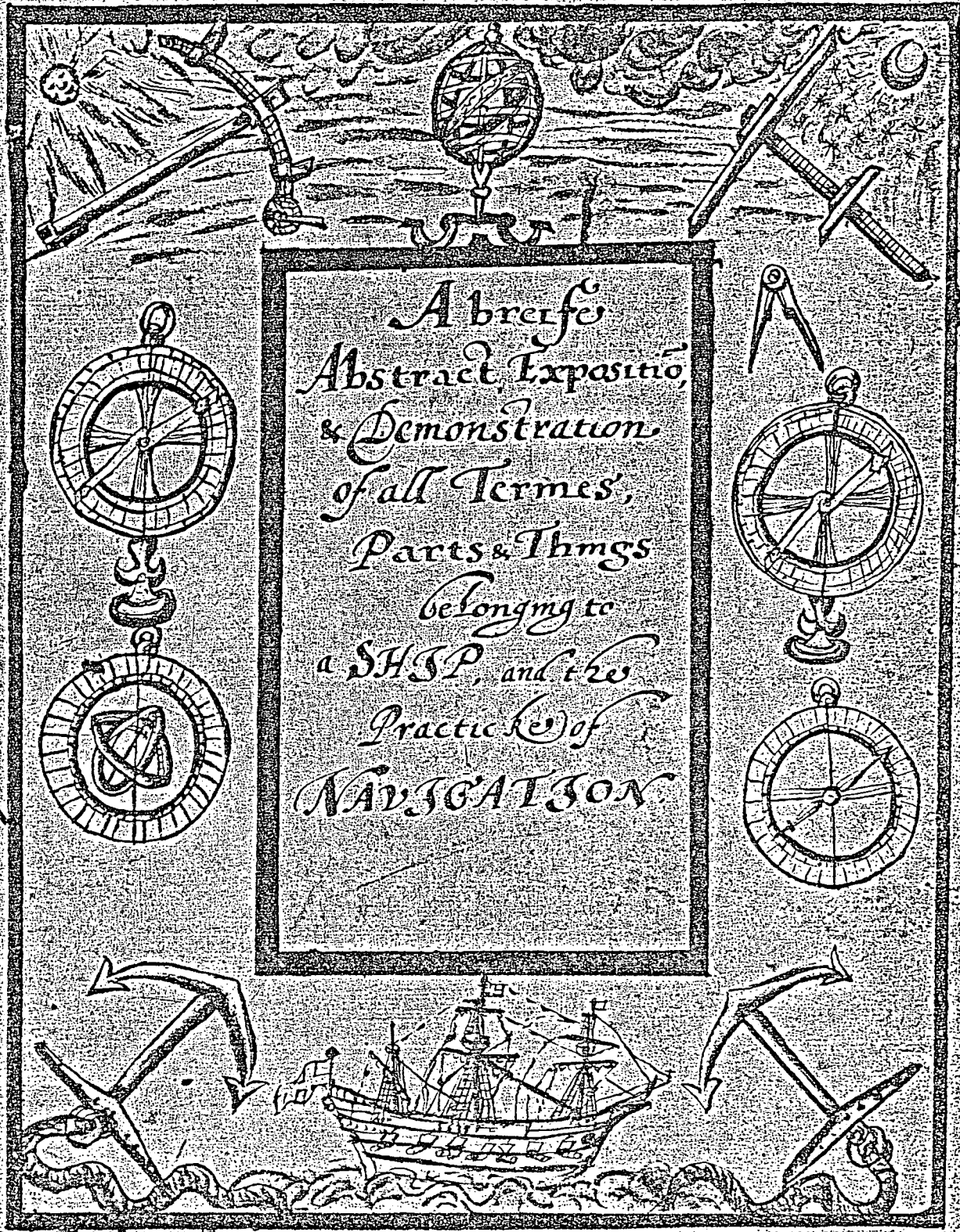
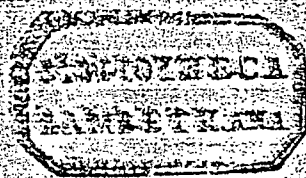


Fig. 1.



R.C.D.BALDWIN.

The Development and Interchange of Navigational Information
and Technology between the maritime communities of Iberia,
North Western Europe and Asia, 1500 - 1620.

M. Litt. Thesis - 1980

Volume II

Illustrations

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14. MAY 1984

Thesis
1980/BAK

FRONTISPIECE TO VOLUME II

Title page of Sir Henry Mainwaring's treatise on navigation, presented to George Abbot, Archbishop of Canterbury 1611-1633. The treatise is one of twelve known manuscript copies. It was compiled about 1623, but was not published until 1644.

Photocopy by courtesy of His Grace the Archbishop of Canterbury and the Trustees of Lambeth Palace Library
Bibliotheca Lambethana MS 91

OPPOSITE (Fig 2)

Frontispiece of the Light of Navigation by W J Bleau, Amsterdam 1612. This shows Dutch galleons flying the ensigns of the Dutch East India Company, (V O C). In the centre is the master of a navigation school, of which many similar examples sprang up in 17th century Amsterdam. These schools advertised widely, often criticising rival schools and teachers in their publicity.

On the right two mariners sit beside a magnetic compass and a running glass while examining a mariner's astrolabe. Charts and rutters are strewn on the floor. Next right two mariners are 'pricking a waggoner' or chart book. In front of them is a terrestrial globe, and beside it a celestial globe which another mariner is measuring while the master explains its use. Behind them two older men examine a chart, while two men further left examine the gradations of a cross staff. The two young pupils on the far left ignore an astronomer's astrolabe. The range of ages shows how widespread was Dutch enthusiasm for these new skills.

Photograph by Richard Nicolson of Chester



FIG. 2.

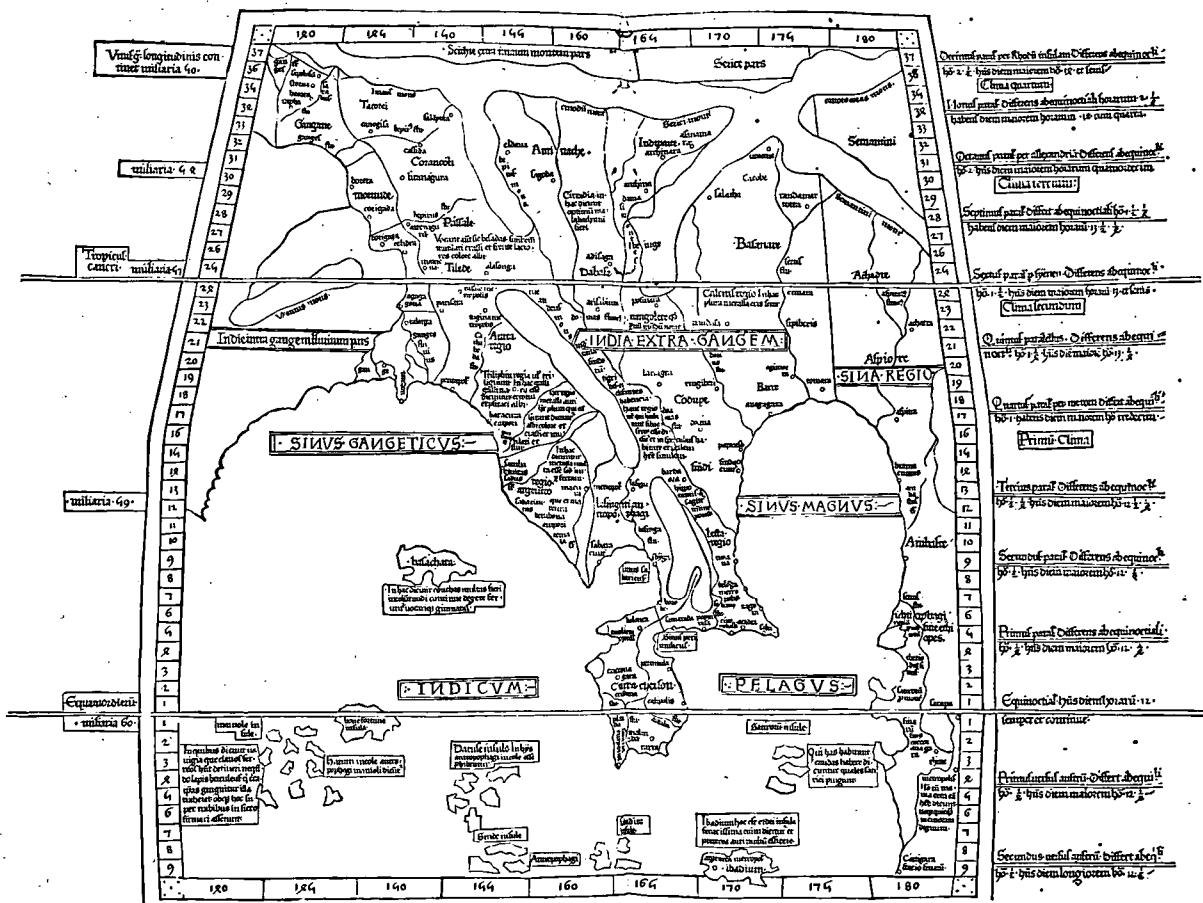


Fig. 3. A woodcut map showing Burma and East India from a German edition of Claudii Ptolemei Cosmographia, Leonard Hols, Ulm 1482. This map shows how difficult it was to interpret the medieval travellers' accounts, and reconciliation with classical learning before Portuguese sailors reached the area by the direct sea route. Photograph N.M.M.8560, by courtesy of the Trustees of the National Maritime Museum.

Fig. 3.

Itinerariū Portugallēsiū e Lusitania in Indiā z in
de in occidentem z demum ad aquilonem.

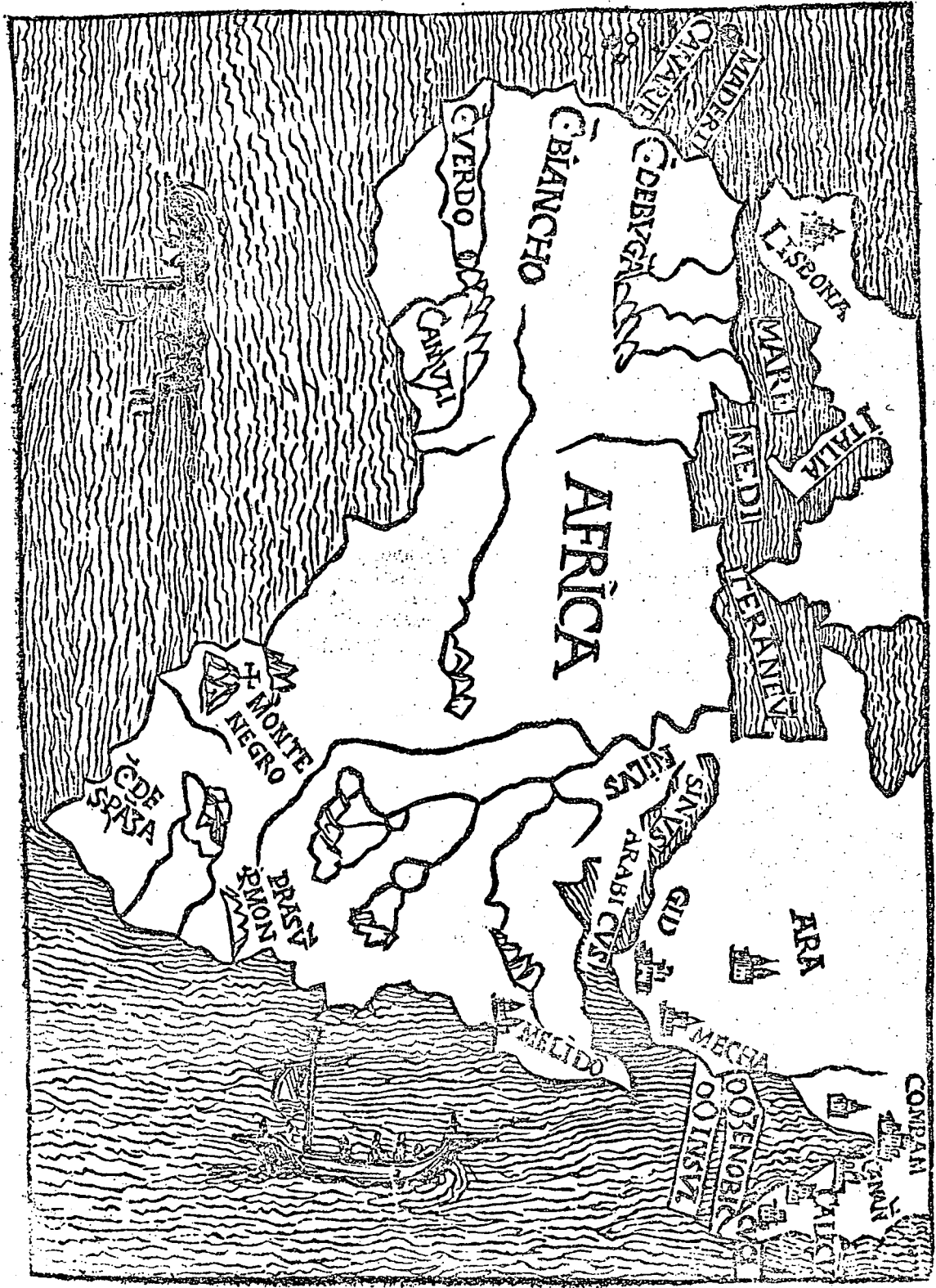


Fig. 4.



Fig. 5.

Representations of the African coast

Fig. 4. The woodcut map of Africa which formed part of the title page of Fracanzano de Montalboddo's first Latin edition of Paesi Nouamenti Retrouvati, translated by A. Madriganus, and published in Milan (J.A. Scinzenzler) in 1508. The book contained details of early Iberian voyages including Columbus' first three voyages, Vespucci's third voyage, and voyages by Alvise da Cadamosto, de Sintra, Pinzon, Cabral, Vasco da Gama and others.

For this edition 'Arabicus' was substituted for 'Persicus' in the Red Sea area, but otherwise this is identical with the first printed map of the African coast to be compiled in the light of Vasco da Gama's voyage.

Photocopy from The Celebrated Library of Boies Penrose, Southeby's Sale Catalogue, 9th Nov. 1971, lot 172

Fig. 5. Chart of the Atlantic signed by 'Bastiam Lopes' (Sebastião Lopes) who made it in November 1558. Note the great improvement of the alignment of Africa's coasts, but the persistent misalignment of North America's due to the fact that magnetic variation there had not been determined there with the care shown by D. João de Castro for the African coast.

British Museum Add. MS. 27303

Photograph from P.M.C. Vol. IV. plate 390.



Fig. 6.

This astrolabe dates from 1555. Its scale is graduated in zenith distances indicating Portuguese manufacture. The five tiny circles on the base were Lopo Homem's marks. The X cut on the aldade was probably to ensure that the same arm was always used, thereby avoiding the errors of eccentric mounting. On the reverse it bears the crude stamp of a Dundee shipmaster "ANDROW SMYTON 1688". It now belongs to Dundee Museum.

Diameter 222mm.
Thickness 16mm.
Weight 2900gms.



World Atlas by Diogo Homem, c.1558. B.M. Add. M.S. 5415. Fol.17v-18.
 Diogo Homem, son of Lopo Homem.

Fig. 7.



Fig. 8.

Fig.8. Use of the Astrolabe. Illustration taken from Pedro de Medina's Regimiento de Navegacion, Seville 1552.



Conservatoire National des Arts et Métiers

Fig. 9.

This astrolabe has degree markings for altitude heights indicating its Spanish origin. It bears two marks, probably those of the Casa de la Contratación of Seville, and the date 1563. It is now in Paris.

Diameter 197 mm.
Thickness 13-15 mm.
Weight 2943 grams.

Breue compendio de la sphaera y de la arte de
 nauegar con nuevos instrumentos y reglas exemplificado
 con muy subtiles demonstraciones: compuesto por Martin
 Cortes natural de burjalaroz en el reyno de Aragon y de
 presente vezino de la ciudad de Cadix. dirigido al inuictissi-
 mo y donarcha Carlo Quinto Rey de las Espanas etc.
 Señor Muestro.

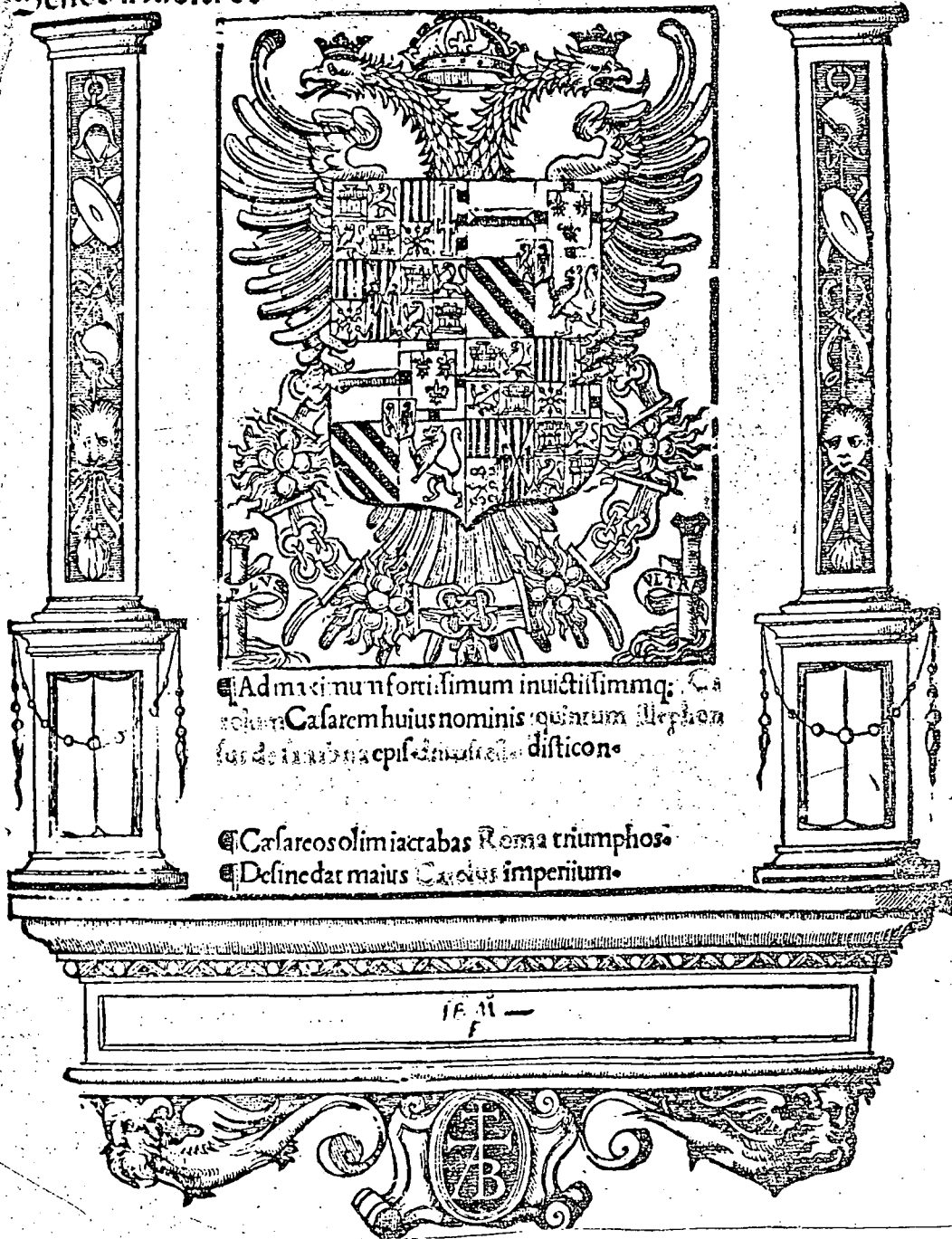


Fig. 10.

Woodcut of the Atlantic from Richard Eden's translation of Martin Cortes's *Breve compendio de la sphaera y de la arte de Navegar*, (see Fig. 10.). This the first English edition of the manual shows the lack of English experience at printing such maps for it is far smaller and inferior to the corresponding map accompanying the French edition of Cortes's manual translated by Nicolas de Nicolai, (Nicholas de Nicolay). The latter's map prepared for the edition published in Lyons was later sold separately in Venice from 1560.

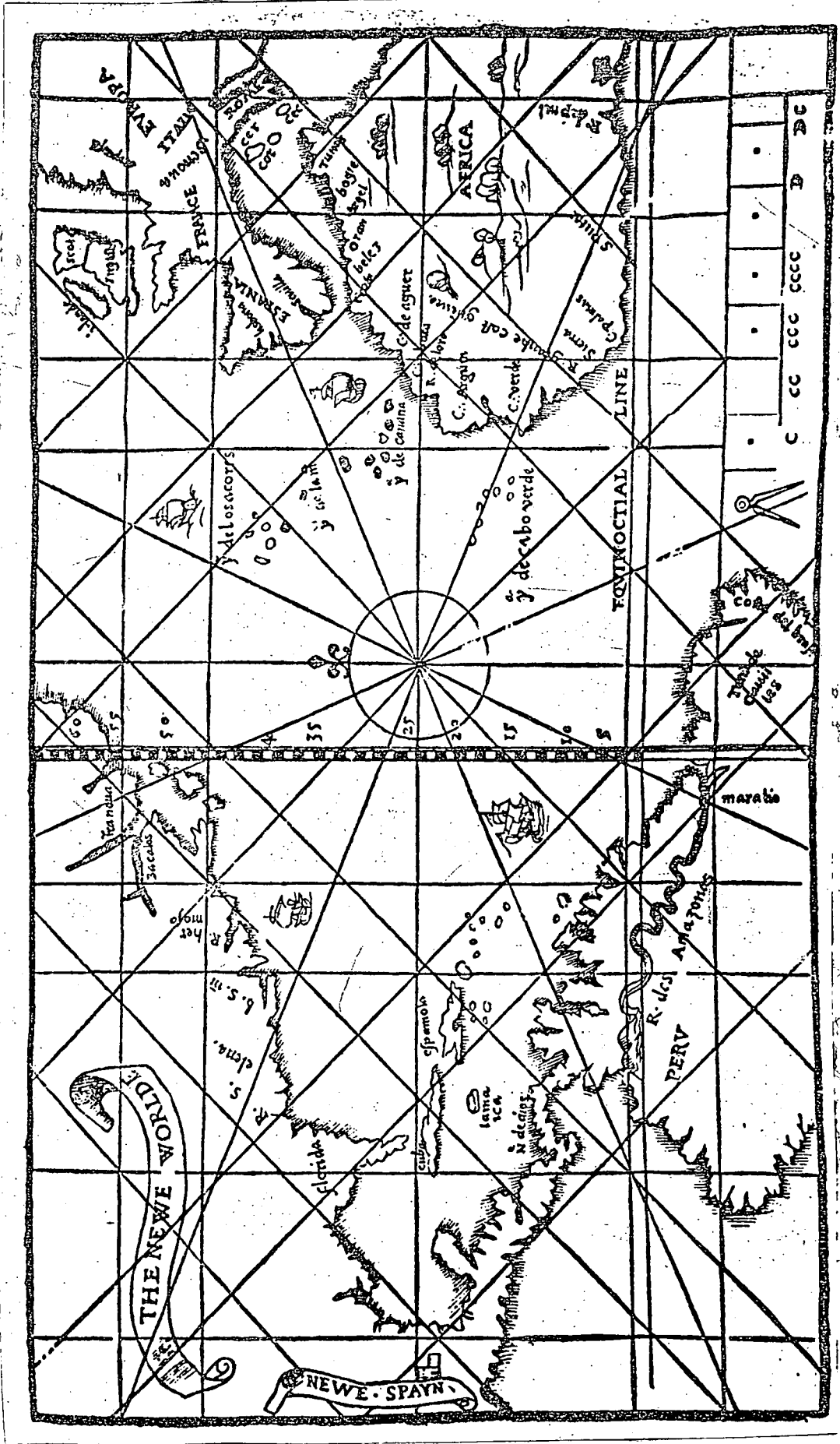


Fig. 11.



Fig. 12.

Fig.12. Engraved Map of the Guadalquivir Estuary and Cadiz, dated 1579. This was the work of Jeronimo Chaves, Cosmographer Major of the Casa de Contratación, Seville. Reproduction by Richard Nicolson of Chester.

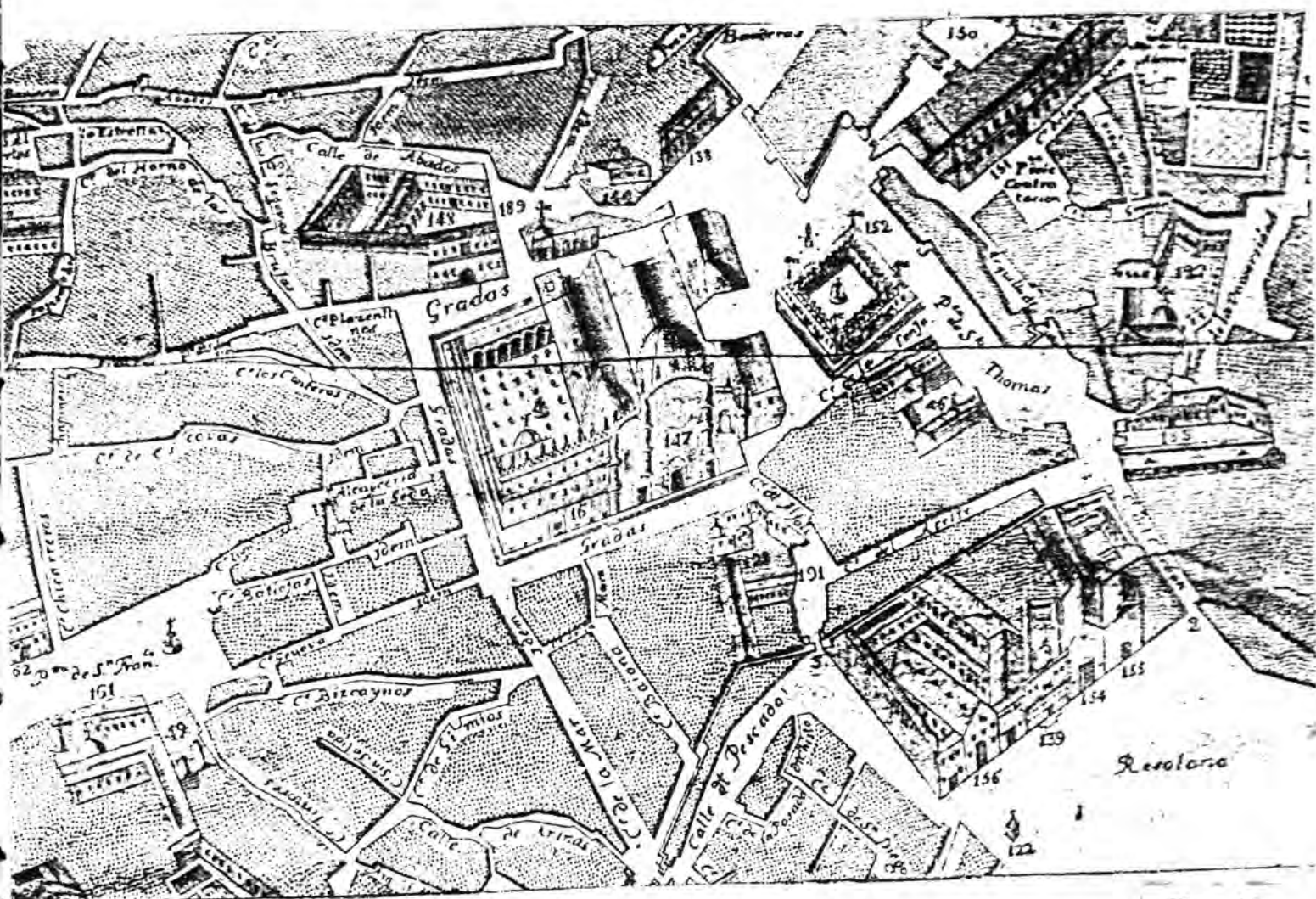


Fig. 13.

Fig.13. Plan of Seville's city centre showing; (151) the Casa de Contratación, (House of Commerce); (150)the Alcázar showing part of the royal palace; (152)the Market Place, (154) the Custom House; (161) the City Hall; (156) the buildings occupied by the oil warehouses, the spinners, and the Archivo de Indias since 1556 . The Cathedral(147) is shown with Giralda topped by a dome as it was until 1560 when a belfry was added.

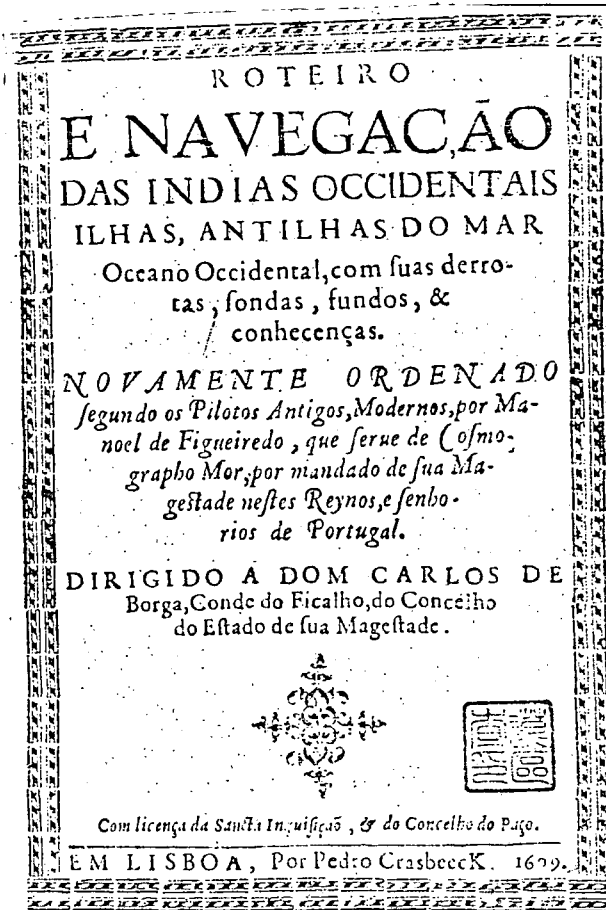


Fig. 14.

Title page from the first of a series of printed rutters by Manoel de Figuerido, published in Lisbon by Pedro Craesbeeck. This one covers the Atlantic and the West Indies, but also contains an engraved map of the world in two hemispheres at the end. Rutters covering Asian waters followed by 1611. Photocopy taken from the Celebrated Library of Boies Penrose Southeby's Sale Catalogue, 7 June 1971. Lot 65, p.32.



Title page of the first bibliography of travel to be published, Antonio de Leon Pinelo's *Epitome de la Biblioteca Oriental i Occidental, Nautica i Geografica*, first published in Madrid by Iuan Gonzalez in 1629. Note in particular the subjects shown on the illustrated book spines. Reduced reproduction from the Celebrated Library of Boies Penrose Southeby's Sale Catalogue, 7 June 1971. Lot 138, p' 97.

Fig. 15.

Fig. 16. Map of the East Indies from Giovanni Battista Ramusio's *Navigazioni et Viaggi*, 1550-1559. Ramusio justified the three volumes "seeing and considering that the maps of Ptolemy's *Geographia* describing Africa and India were very imperfect in respect of the great knowledge we have of those regions, thought it proper and perhaps not a little useful to bring together the narrations of the writers of our day who have been in the aforesaid parts of the world and spoken of them in detail, so that supplementing them from the descriptions in Portuguese nautical charts, other maps could be made to give the greatest satisfaction to those who take pleasure in such knowledge."

Ramusio's publications, while inspired by humanist scholarship, were in large measure the literary execution of research by Andrea Navegero (1483-1529), who had bought Spanish books on the Indies in Spain. Ramusio supplemented this through his correspondence with Oveido and Damiao de Gois. The latter supplied Tommaso Giunti, Ramusio's printer, with Portuguese descriptions of the voyage to India, including Alvares's *Verdada Informacam*, and another which Ramusio acknowledged in a letter of 14 February 1539.

In the event Ramusio's cartographic intentions were foiled by the fire which swept his printers shop in November 1557. The fire destroyed as he says the Asian maps intended for second volume. Finally published in 1559 this volume had a good woodcut of the Nile, and four large scale maps of parts of the world. These substitutes were supplied from engravings by Giacomo Gastaldi and based on Spanish maps.

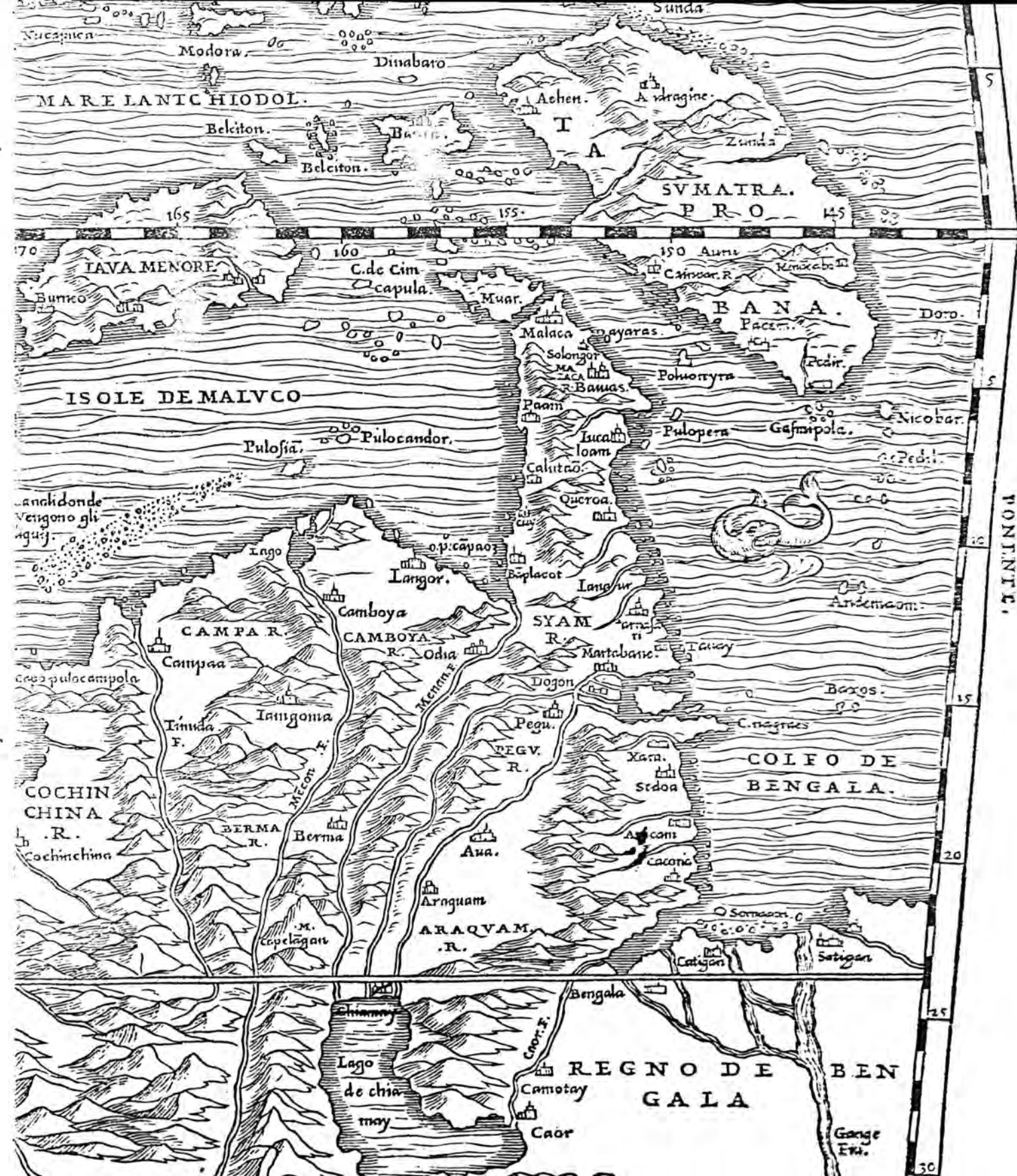
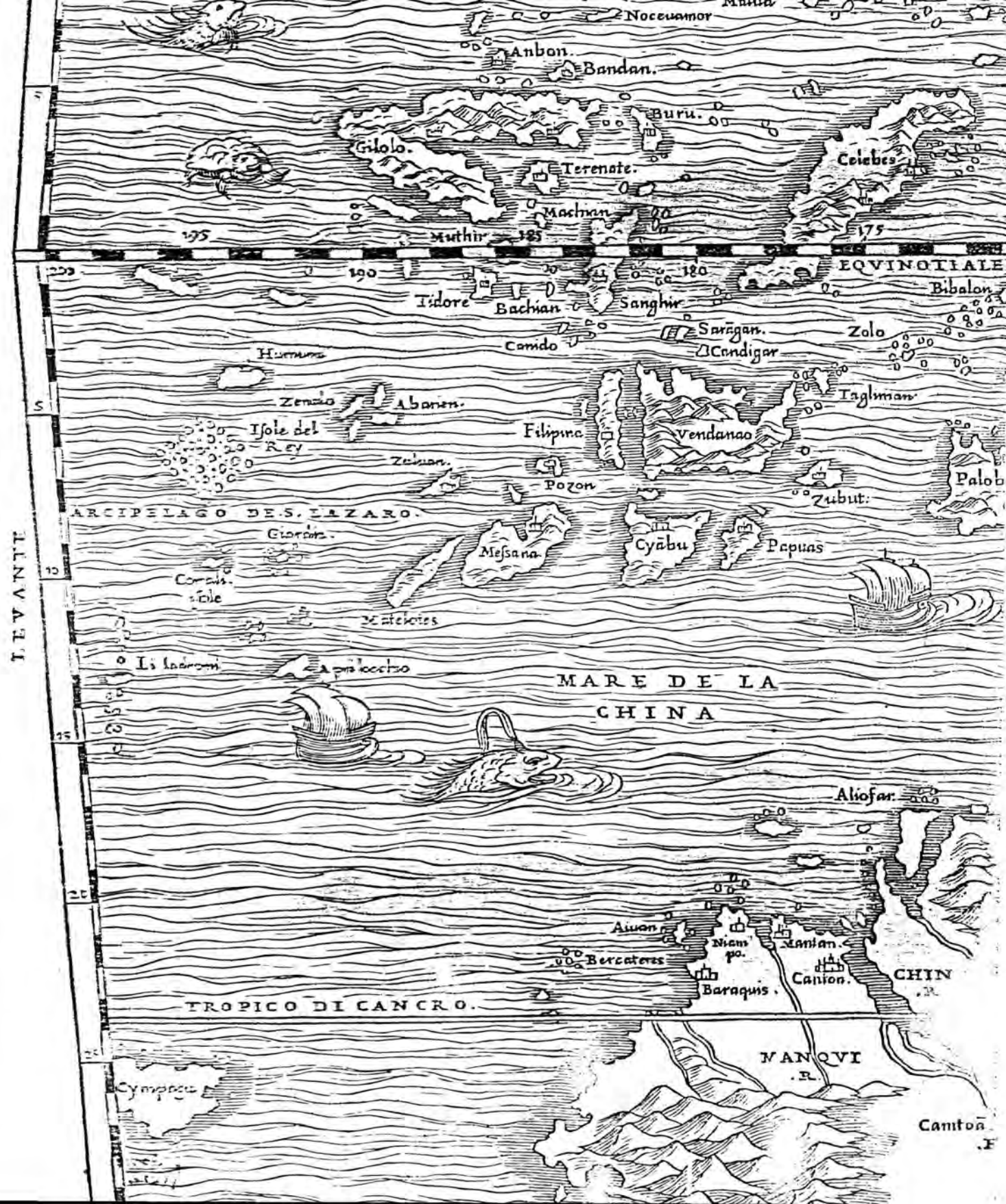




Fig. 17.

The Ambassadors by Hans Holbein the Younger. Holbein painted Jean de Dinteville (left) and Georges de Selve (right) in London in 1536. On the table (top left) there is a celestial globe, in front of it a cylindrical sun dial, (next left) is a fixed quadrant, and behind that a portable quadrant, a book and a polyhedral sundial, and (top right) a torquetum. Below is a terrestrial globe with the light falling mainly on Europe and Africa. To the right of this there lies a pair of compasses, a lute and some music books and rolls. Whilst these men and the associated items symbolise the latest scientific and humanist learning, Georges de Selve was also able to pursue a successful diplomatic and ecclesiastical career. Such diplomatic careers in the sixteenth century came to involve appreciation of such instruments as shown here and the use of others, especially charts, in navigation, for in the next twenty years diplomats were to be involved in matters formally connected with navigation or in commercial espionage in this area.



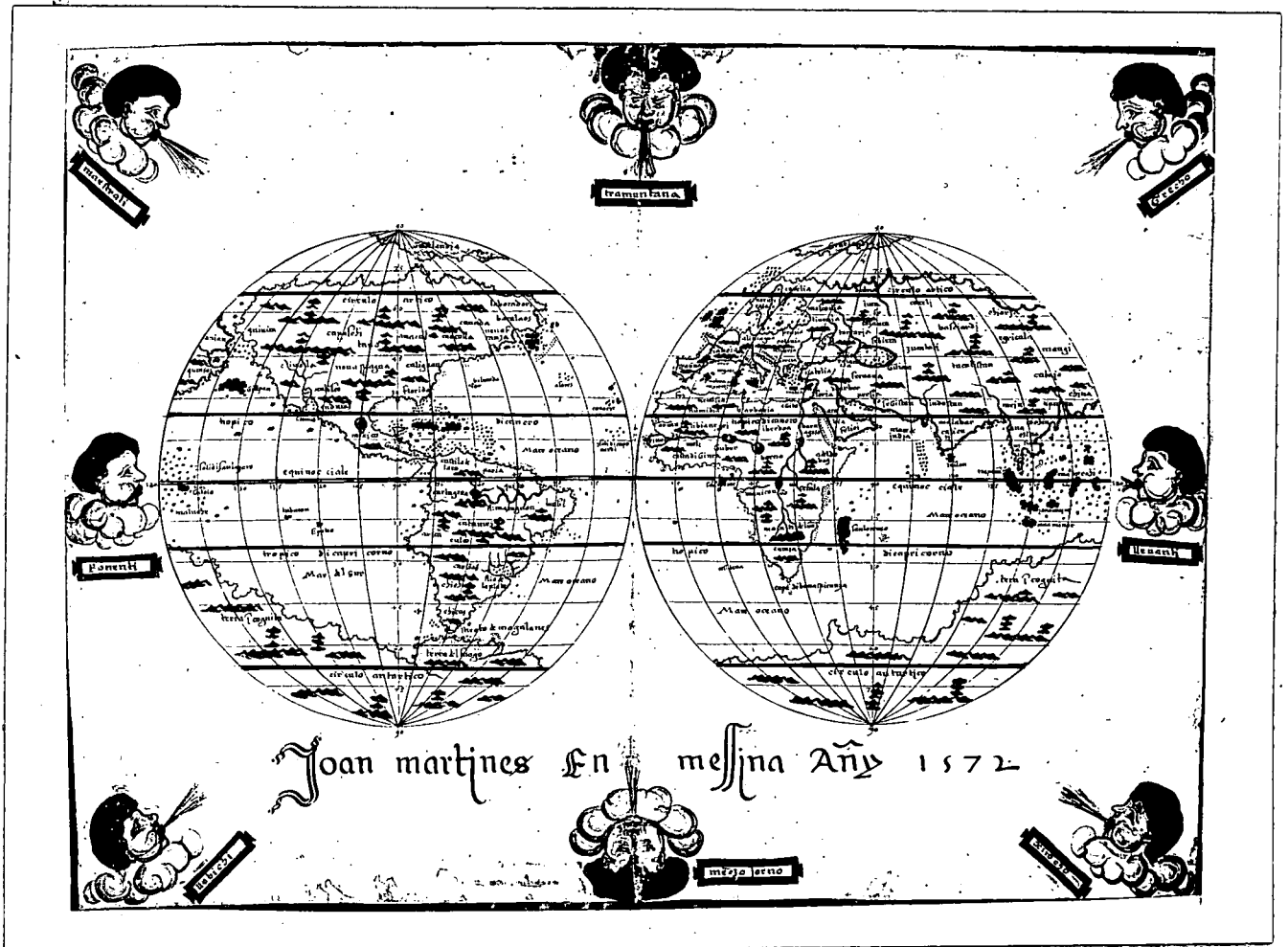
Fig. 18.

Sebastian Cabot . This engraving by S.Rawle was prepared as a copy of another portrait by Holbein in 1524. The original portrait was lost in the great fire at Pittsburgh in 1845, though a poor copy painted about 1841 survives in the New York Historical Society. N.M.M. Neg. 1970



Fig. 19.

Oil painting after Hans Eworth of Phillip and Mary painted in 1555, suggesting through the riverine wharves visible through the window the economic background to the diplomatic alliance of their marriage which did much to facilitate the transfer of navigational from Spain to England.
30" x 39" N.M.M. Neg. 1441.



Planisphere by Joan Martines, a cartographer of Portuguese extraction but working in Messina in 1572. This planisphere drawn on vellum and completed in watercolour and ink, shows some similarity to the planispheres of his Venetian contemporary Battista Agnese. National Maritime Museum MS.33/9925. N.M.M. Neg. 1116.

Fig. 20.



. Mariners using astrolabes both in the bow and stern , and two others each holding a cross-staff prior to use ,perhaps as a check on observations with the astrolabes.It was far less strain to use these instruments at night for this avoided the problems of observing a bright sun, but it needed a good celestial knowledge. Illustration from a book written by the French Cosmographer Royal, Andre Thevet, La Cosmographie Universelle, P. Hullier, Paris, 1575.

Fig. 21.

Photograph by Liverpool City Libraries.



Fig. 22.

Abraham Ortelius from Theatrum Orbis Terrarum, 1579 edition.
This edition contained 110 maps of the world. Published by
C. Plantin in Antwerp.
Reproduction by Richard Nicolson of Chester.



Map of the Far East from Ortelius's Theatrum Orbis Terrarum, 1584. Fig. 23. Plate 119 engraved by Aegidius Coppens Diesth N.M.M.Neg. 3980.

Fig. 25.



Part of the Chart of the East Indies from Linschoten's *Reyghescript* 1595. This chart engraved in Holland was based on Portuguese charts. Just off the top of this copy is a scale in both Spanish and German leagues. It is suggested that Linschoten suborned Bartholomeo Lasso in Goa to get the original map from which Van Langren engraved this chart. Photocopy from R.A. Skelton, *Explorers Maps*, Spring Books, Hong Kong, 1970, p. 145.

Illuminated letter from King James I of England to the Emperor of China, Dated at the Palace of Westminster 7th February 1613, (1614 on modern criteria). It was probably written by Edward Norgate. It was used in the establishment of formal diplomatic relations with China in 1616.
Photocopy from the Celebrated Library of Boies Penrose, Sotheby's Sale Catalogue, 11th November 1971. Lot 290 p.112.

JAMES BY THE

Grace of Almighty GOD, the Creator of Heaven, and Earth, King of Great Brittain, France, and Ireland,

Prince of the Christian Faith, &c. &c. &c.

To the High and Mighty Monarch, the great Emperour of China, &c. &c. &c.

The Report of the greatness of your power and dominion, on those Eastern parts of the World, hath stirred up a

great desire in our Subjects to undertake a Voyage, into your Country, to purchase your rich Goods, and to see the

setting of a Trade and Commerce with your people, as they have already done with divers other Nations, as you

well know, and we will not be ignorant of, as we have already seen, and are desirous to see, and to have the

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Fig. 26.

JAMES R.

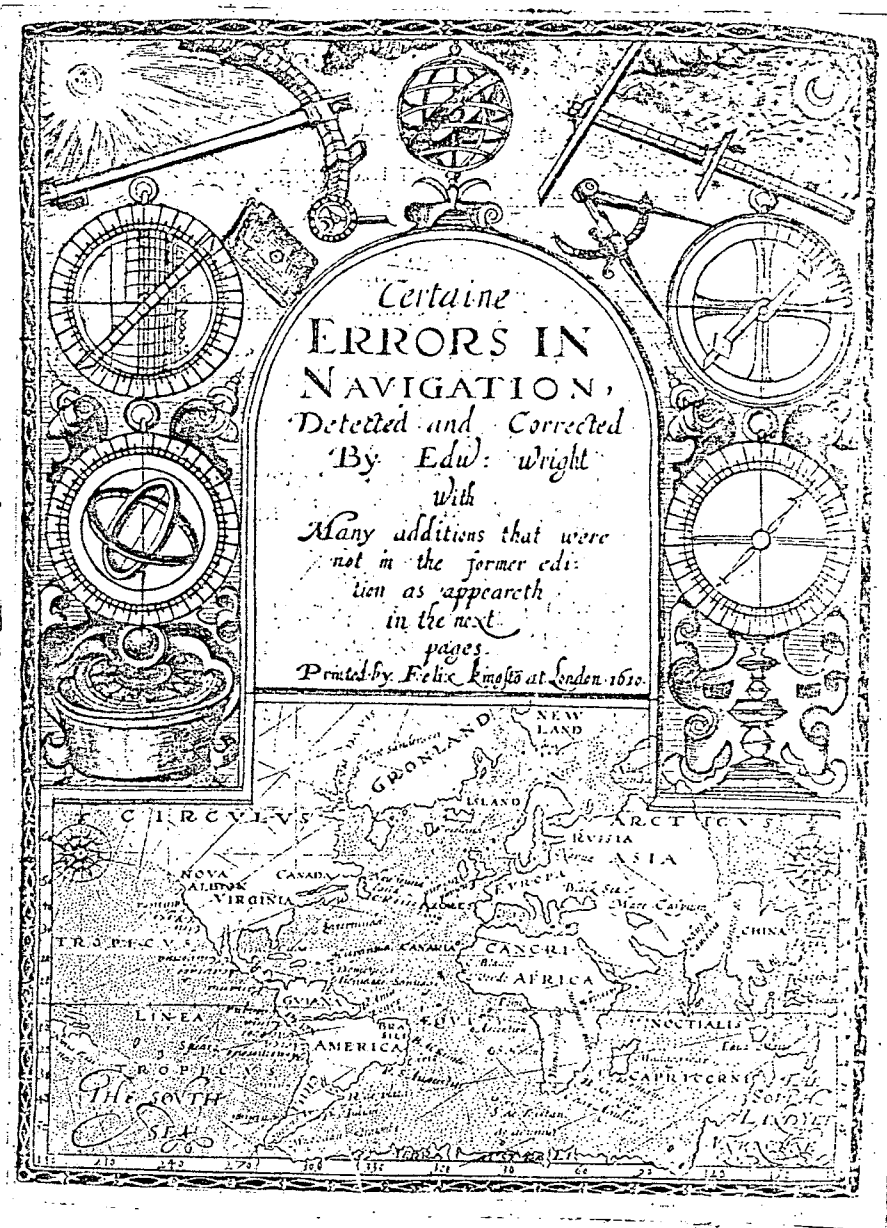


Fig. 27.

- Title page of Edward Wright's Certaine Errors of Navigation (2nd edition). The first edition contained some important original ideas of Edward Wright's, but in large measure it was simply a good translation of Roderigo Zamorano's manual Compendio del Arte de Navegar. The translation is based on the second edition of Zamorano's work printed in Seville in 1588. Note the similarity of the title page to that drawn by Sir Henry Mainwaring for his navigation treatise presented to George Abbot, about 1623. Bibliotheca Lambethana MS.91. (See Fig.1.)



Fig. 28.

- Italian Mariner's Compass at the National Maritime Museum, (c.82/52-126) probably made about 1580. It shows a 32 point compass, but is probably of higher quality than usual for it is mounted in an ivory case, where normally manuals describe wooden boxes as standard.

Edward Wright in Certain Errors of Navigation, (shown opposite) in Chapter 17 describes a wooden box within two hoops of brass "fastened within a square box...in the midst of the pup(Poop) of the ship where the bittacle standeth". Wright continues to say "And alwaies in guiding the shippe, you must take heed that the saidpoint be continually ioyned with the winde of the rose towards which you intend your course!

Size ;diameter 108cms.
N.M.M.Neg. A1763a

Declination tables from a navigational notebook started in 1596 and finished in 1616. It contains tracts on pure mathematics and its navigational application, practical guidance on seamanship, sailing instructions for the coast from North Foreland to Tilbury, sketches of Tilbury (from which point the East India Company Pilot was responsible for further passage), and dated logs for courses followed by the Foresight. Other passages deal with North American and Caribbean giving distances, compass variation, coastal profiles and latitudes, and some details of Drake's last voyage. It also contains details of a variant of the Backstaff called the Doble Radius.

The Declination tables are headed thus:-

This table sheweth the declination of the sun upon every severall degree of the Eclipticke throughout all the foure quarters of the zodiacke by which table you may make tryall of the former table of declination if you doubt of any parte thereof as followeth, viz,"

The reference to an earlier set of tables is to those in Edward Wright's Certaine Errors in Navigation, 1599, and like those these tables assume the greatest obliquity of the sun is 23°-30'. It is likely that Edward Wright was the writer of part of this notebook. Others identified as contributing part are Richard Wright, scrivener and Secretary to the East India Company, (his signature appears on the preliminary binding stub, Audrie Wright who gave a receipt mentioning Sir Thomas Smith, (first Governor of the East India Company, and in whose house Edward Wright lectured on navigation) and the ship Hector used by the East India Company. Others mentioned in the notebook are Sir William Romney, (second Governor of the East India Company), and Mr. Fox, (who is probably Luke Fox the navigator.

The notebook also contains items which have commercial significance, like "a Metson for the Agewe", and a recipe for curing Tobacco. Taken together with other information on the Wright's, this notebook seems to form part of those official records of the East India Company recording commercial and navigational matters about which its Court was so anxious and for which Richard Wright was initially responsible. (see Volume Ip.273-4)

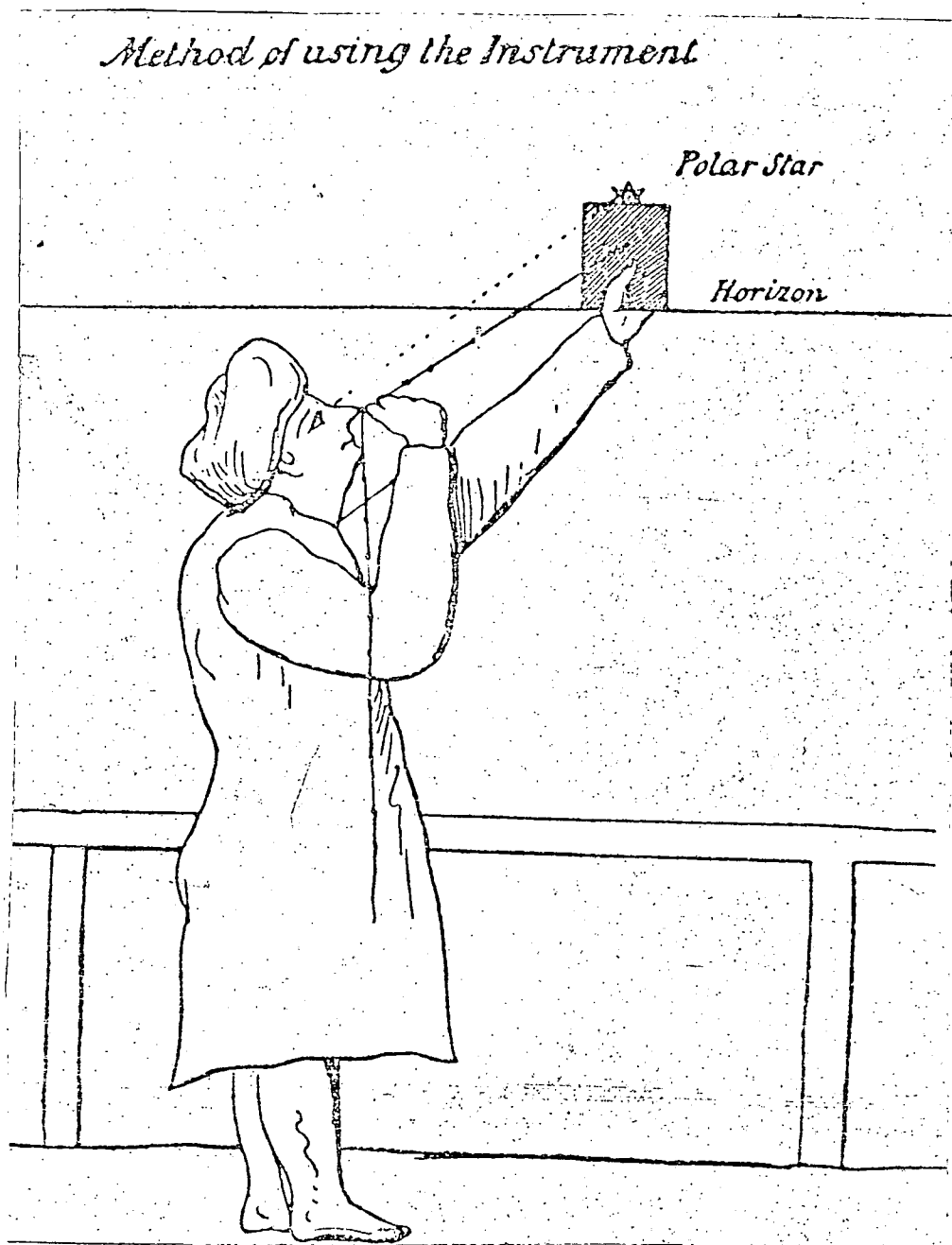
Illustration taken from The Celebrated Library of Boies Penrose, Southeby's Sale Catalogue (9 November 1971, Lot 294, p.116-7)

h	g	II
m	m	h
0	0	30
1	21	29
2	43	28
3	1	27
4	12	26
5	20	25
6	27	24
7	33	23
8	38	22
9	43	21
10	47	20
11	51	19
12	55	18
13	59	17
14	62	16
15	65	15
16	68	14
17	71	13
18	74	12
19	77	11
20	80	10
21	83	9
22	86	8
23	89	7
24	92	6
25	95	5
26	98	4
27	101	3
28	104	2
29	107	1
30	110	0

This Table sheweth the declination of the Sun upon every several degree of the Equinoctial throught out all the four quarters of the Zodiac by which table you may make tryall of the former Table of declination of you doubt of any parte thereof as followeth (viz)

Ex: 23^d of July 1612 the plate of the Sun is 23 degrees of Cancer & find Cancer in the foot of the table before found to be 23 degrees of the equinoctial in the first column and the figure 23 is against 23 in the column opposite & standeth 1021 degrees 32 m being the declination of 23 degrees of Cancer & the Sun being in so many degrees of the same sign. But if the plate of the Sun have odd minutes thereof you must take the difference between the nearest degrees of declination and work by the proportionall partes of 60 minutes to 1 degree as for example 23^d 12 of Auguste 1613. the true plate of the Sun is 8 degrees 12 m of Virgo & find Virgo to be in the foot

Fig. 30.



The traditional use of a kamal demonstrated by an Arab mariner, c. 1850. From Congreve, *A Brief Notice of some Contrivances practised by the native mariners of the Coromandel Coast in navigating, sailing and repairing their vessels. Madras Journal of Literature & Science*, xvi, 1850.

Somnium Scipionis. Fo. I.
 SOMNIVM SCIPIONIS EX
 CICERONIS LIBRO DE REPUBLICA SEXTO EXCERPTVM.



Arabs using (from left to right), a fixed Quadrant, a standing staff, a water level or sighting level, (centre), and a portable Quadrant (right). A European style Carrack lies in the bay near the town which is being wrecked by an earthquake. These men are probably not local scientists because of their evident detachment from the fate of the town, while the conjunction of symbols for wind, sun, stars, sea, and the ship suggest the concerns of a mariner. This woodcut was in fact engraved by Roigny who moved in such circles in Paris and Rouen. Photocopy from folio (1) of *Somnium Scipionis ex Ciceronis Libro de Republica Sexto Excerptum*, Jocodius Badius, Paris, 1524. This edition now in St Chad's College Library, Durham, is typical of many editions of Macrobius used to teach cosmography.

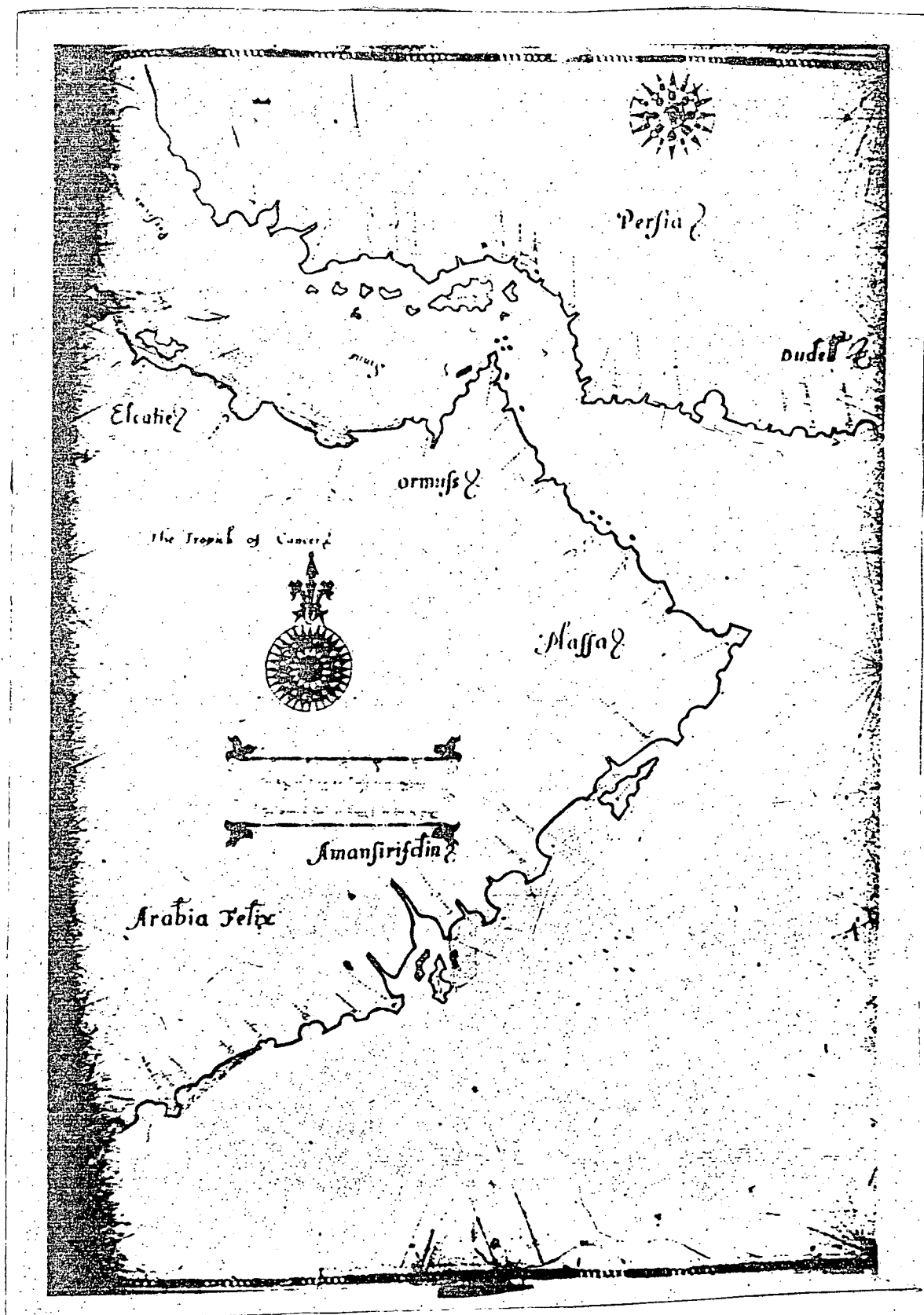


Fig. 32.

Part of a chart of the Arabian coast from the Sea Atlas drawn by Martin Llewellyn of London about 1598. The large scale, colours, and script though not so evident in this copy are the outstanding features of this atlas now in Christ Church College Oxford. Reproduced from The Times, 9 September 1975, p.1.



Fig. 33.

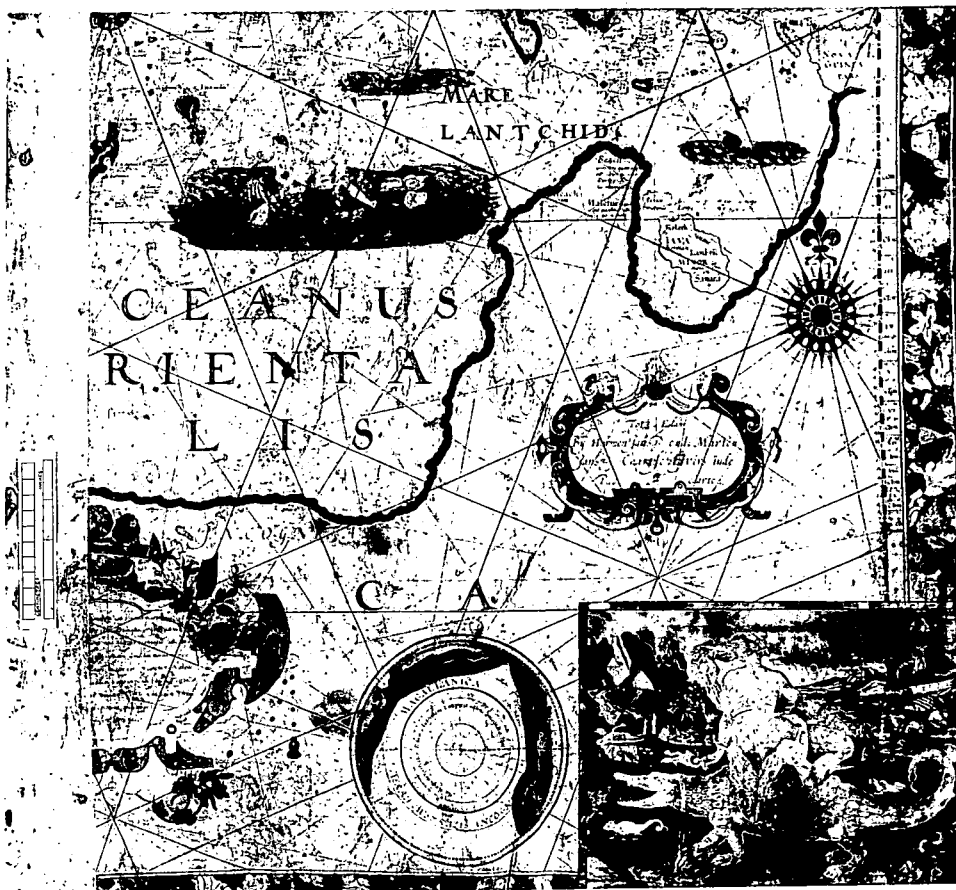
Self-portrait of Manuel Godinho de Eredia. Photograph from P.M.C. Vol IV. p40.



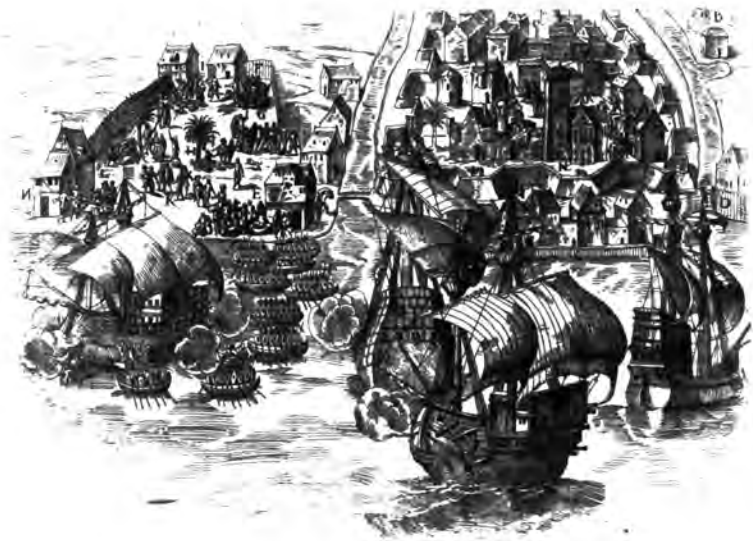
Fig. 34.

Fig.34. Chart of Java Minor from an atlas prepared by Manuel Godinho D' Eredia in 1613-1615, Fol64r. The cartouche reveals he was appointed discoverer of Java Minor by the Viceroy Aires de Saldanha, and given the title of Administrator on 26 April 1601. Photograph from P.M.C. Vol. IV, Plate 419.

Fig. 35.



One of three fragments of a vast chart by Harmem Jansz and Marten Jansz, now preserved in the National Maritime Museum, Greenwich, and showing clear resemblance to Eredia's charts. This one is thought to have been made shortly after the Dufkyen was dispatched from Bantam in November 1605 'for the Discovery of the land called Nova Guinea'. N 32-cc1/P40
N.M.M. Neg. A6788B.



Compositio de iudicio Haveli. Stadt Bantam in der Insel Java, welche die Holländische Schiffe kamen. Und also
 man alle die den jenseitigen Bantam als durch die Bantam in der Haveli erfährt. Wird. Anno 1618.

Fig. 36.

The Capture of Bantam by the Dutch in 1597. In 1618 the Dutch built a hydrographic office for the Dutch East India Company on this waterfront, but shortly afterwards this office was moved to Batavia.

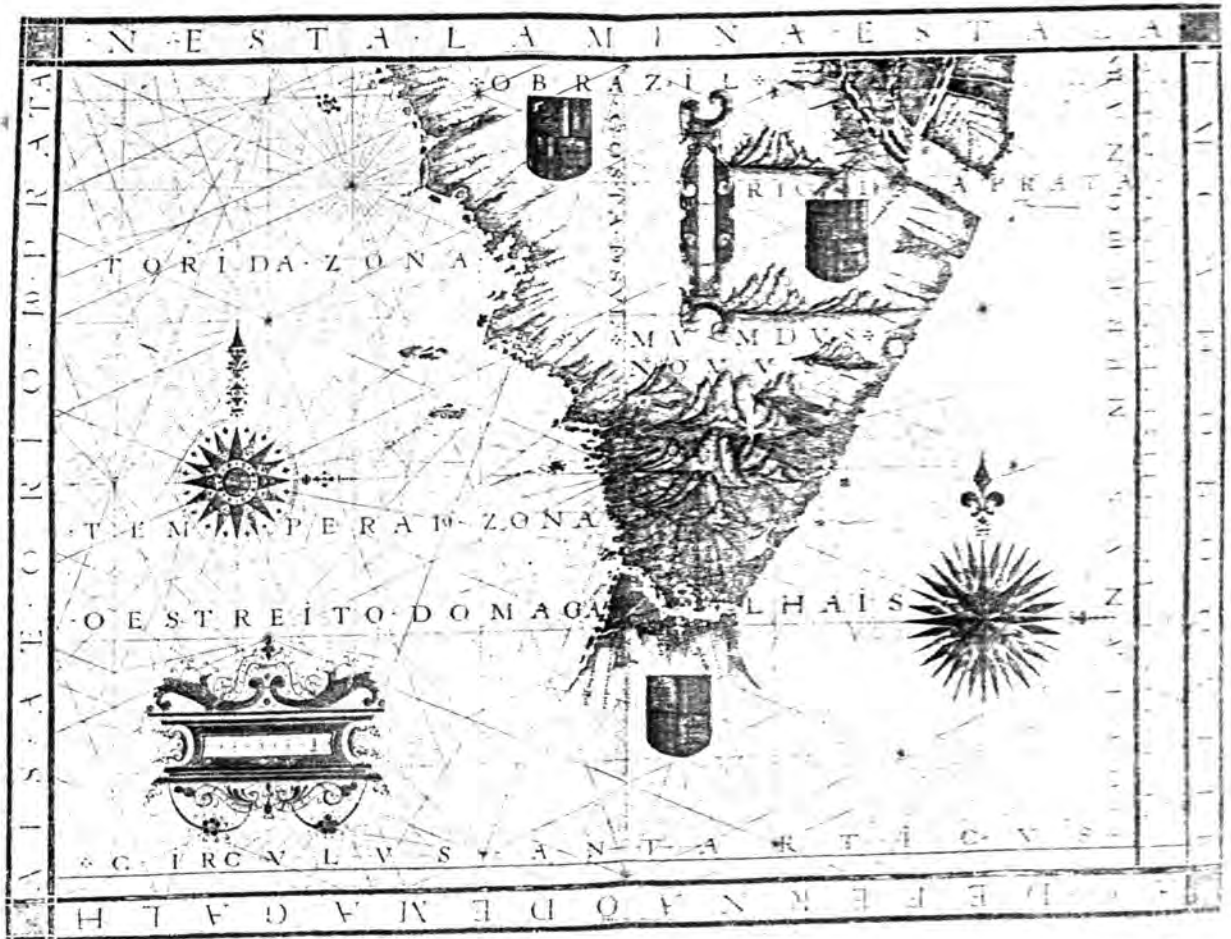


Fig. 39.

Chart by Vaz Dourado of the Straits of Magellan, (fol. 3) of *Universalis et integra totius orbis. Hydrographia ad verissimam Luzitanorum traditionem descripto Fernando Vã*. It was probably made in Lisbon by Vaz Dourado on a visit to Lisbon in 1575. On the fly-leaf of this atlas is written;- " This book of charts which is the property of the Board of Admiralty of Great Britain which was purchased from Mr. Henry Chapman on 10th April 1792." Henry Chapman had probably acquired in the chaos following the Lisbon earthquake of 1755.

Now in the British Museum, Additional Manuscript 31317.

Photocopy taken from *Sir Francis Drake, An Exhibition to commemorate Francis Drake's Voyage around the World, 1577-80*, British Museum Publications, London 1977. Exhibit 13, page 26.

Fig. 40.

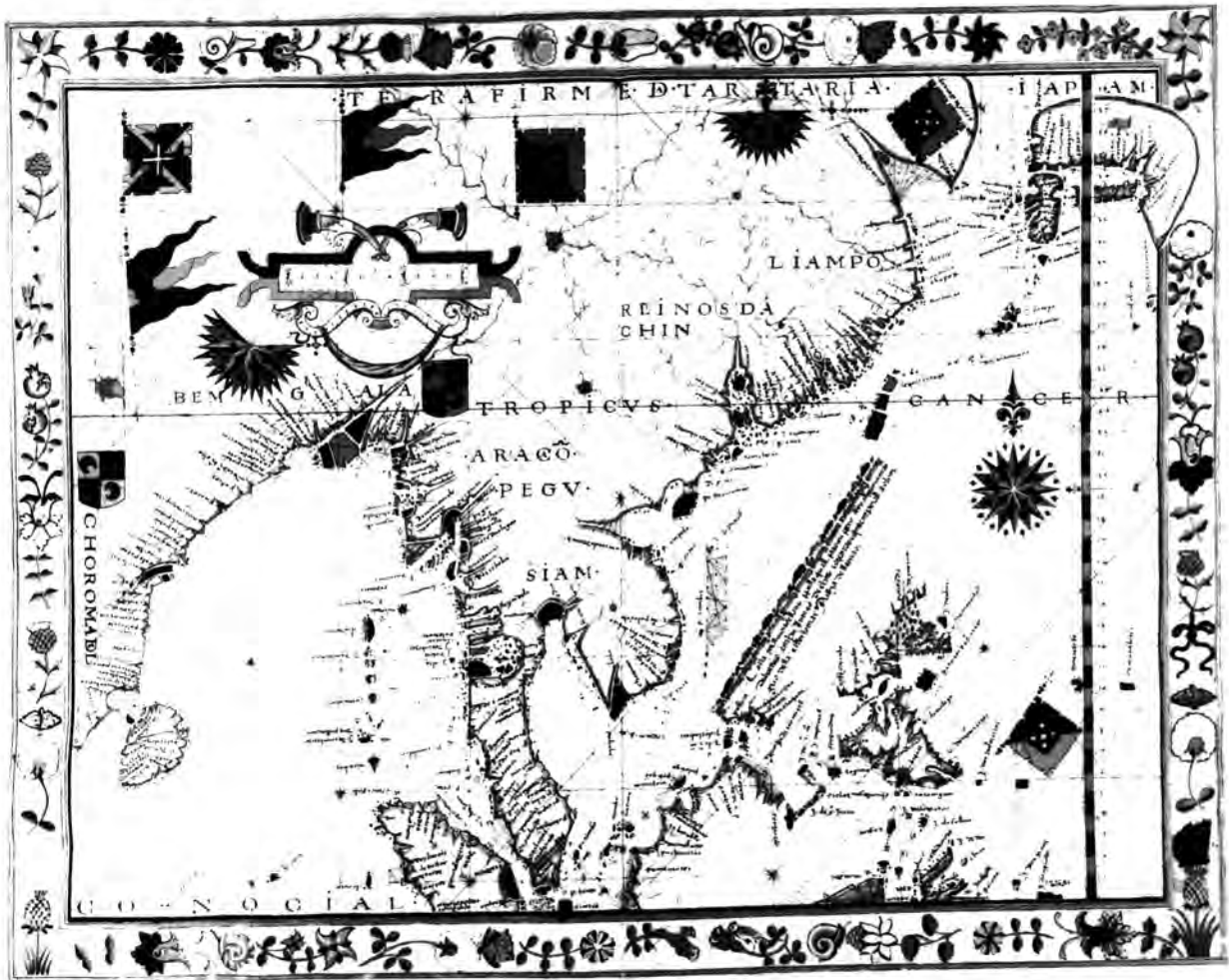
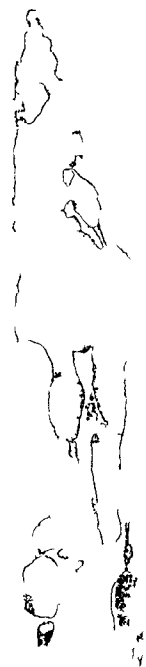


Chart of the East of Asia by Vaz Dourado from an atlas made in 1570. Note also the distinctive 'Lobster shaped' representation of Japan, also evident in the atlas described in Fig 38. Similar representations were used by Lazaro Luis and supercede the form adopted by Lopo and Diogo Homem. This atlas is now in the Huntington Library, San Marino, H.M. 42 . This photograph of folio 12 is taken from P.M.C. Vol III, Plate 270.

Chart engraved by Jodocus Hondius showing the Courses taken by Drake and Cavendish on their circumnavigations of the world. This world chart was first published about 1595, and added to Hakluyt's Principall Navigations in 1599. Sometimes known as the Hondius Broadside on account of the accompanying Dutch texts. This text is based on Hakluyt's Principall Navigations of 1589, but Hondius has in fact misinterpreted Hakluyt on the respective courses of Drake and Cavendish. Hondius's information should not have been in error because he had access to sources of such data during his sojourn in London from 1583-4 to 1593. The fact Hondius made errors not seen on the Molyneux globes of 1592 suggests it was Molyneux, not Hondius who took the copper plate engravings to the Netherlands, the removal taking place about 1596-7.
British Musuem, M.T. 6.a.2.
Size 21½" x 15.

Fig 43



o

Handwritten marks or scribbles in the top right corner of the page.

1591



Oil painting by Marcus Gheeraerts the Younger,
(fl. 1561, d. 1635)
Painted in 1591

Sir Francis Drake, 1540-1596.

Printed in Great Britain for the Trustees of the National Maritime Museum
Her Majesty's Stationery Office by
Wisbech Dd. 125304

Produced without the permission of the Trustees of the National Maritime Museum

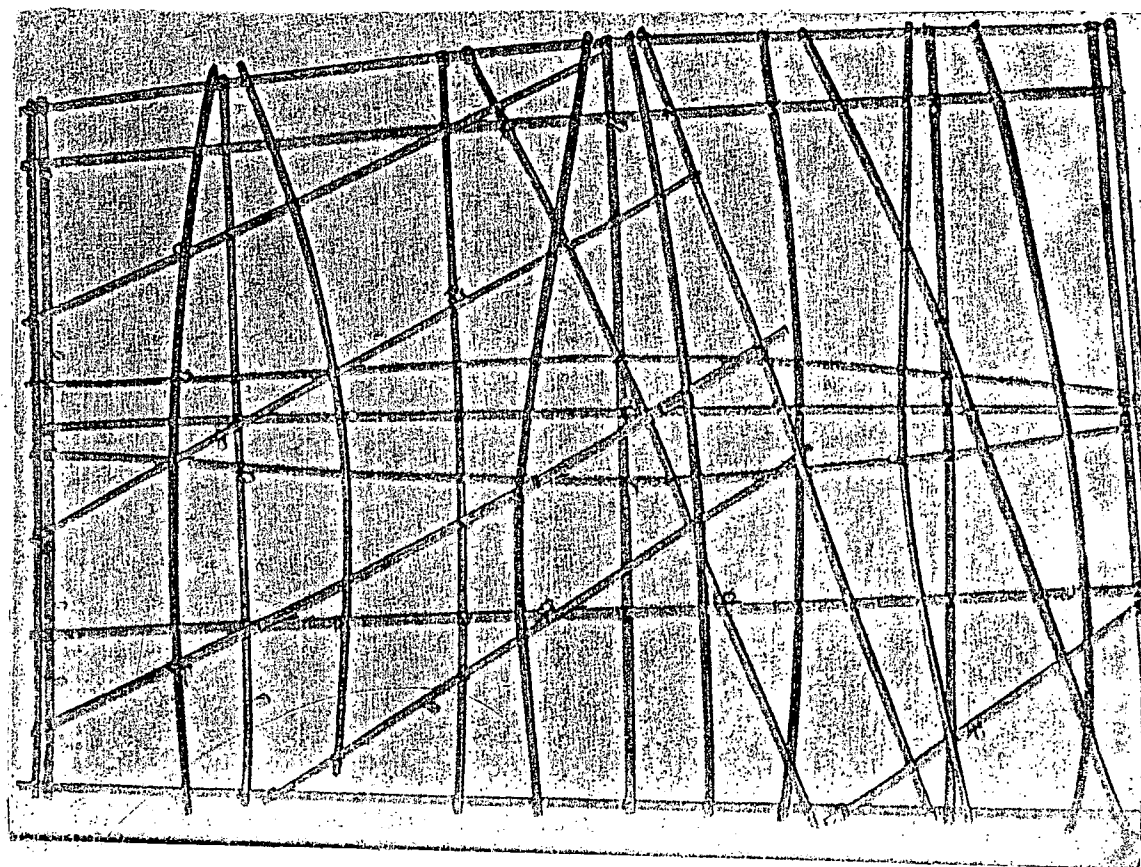


Fig. 44.

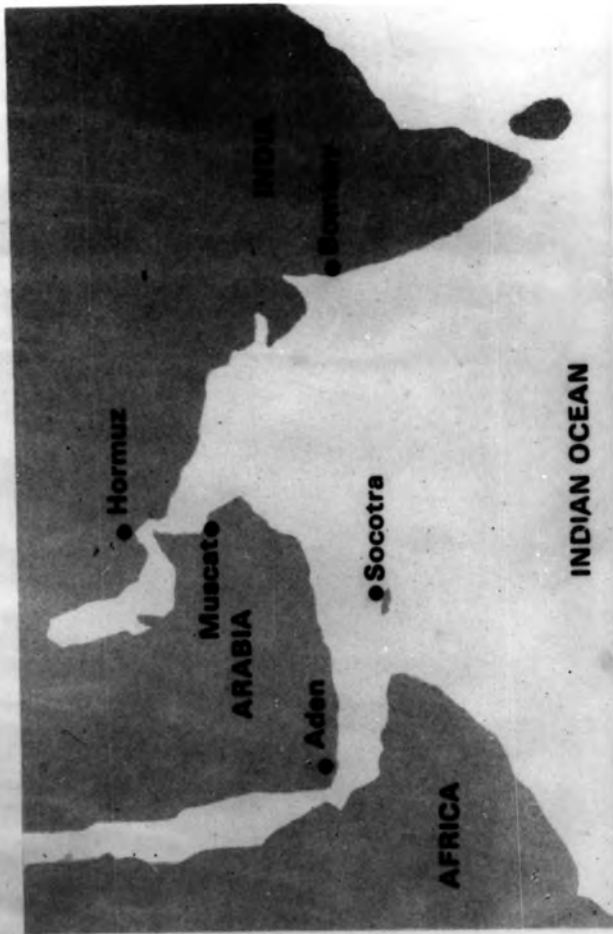
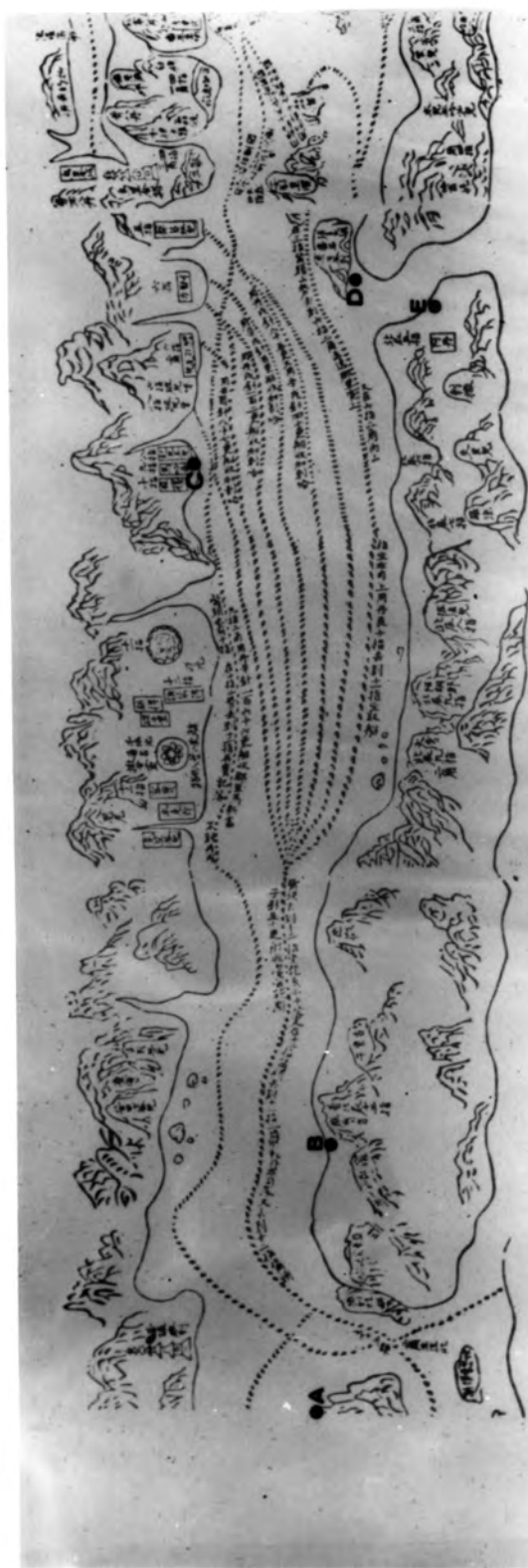
A Micronesian navigational aid, popularly known as a 'stick and stone chart. The purpose of these palm ribs bound with sennit was to represent the pattern of the Pacific swells by which these islanders traditionally navigated. The bonded stones represent islands and are a distinguishing feature of the Meddo and Rebbiblib types. (See page 396)



Fig. 45.

A Chinese mariner's compass in a red lacquered wooden box made c.1760. This follows the traditional pattern of design and shows 24 divisions. It is 4.35" in diameter and makes interesting comparison with the compasses shown in Figs. 28 and 55. This one comes from the Gabb collection at the National Maritime Museum. (Nav 37/-37C)
N.M.M.Neg.4158.

Fig. 46.



Above : Chinese sea chart drawn after the expedition of Cheng Ho in the early 1400's and printed in 1621. It shows India (top) and Arabia and Africa (bottom) separated by a rather narrow Indian Ocean. Some of the ports shown on the chart are also indicated on the modern map (right) and are keyed below :

- A : Hormuz
- B : Muscat
- C : Bombay
- D : Socotra
- E : Aden

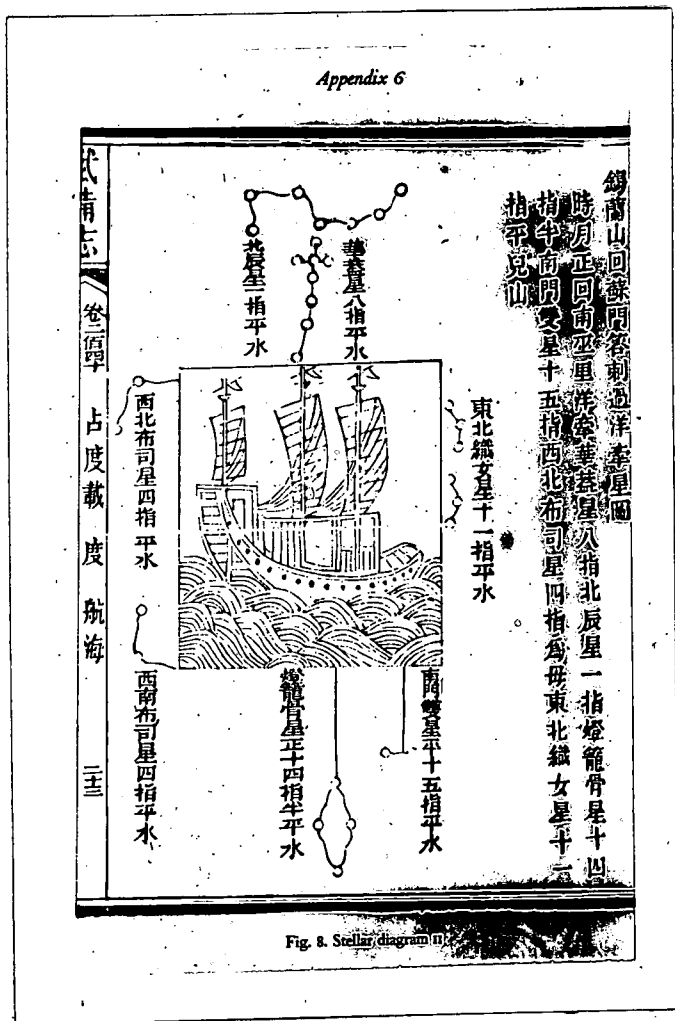


Fig. 47.

Fig.47. A Chinese navigation diagram from the Wu Pei Chih showing the Stellar altitudes to be maintained on a voyage from Ceylon to Sumatra.

The necessary altitudes are given in 'chih' (finger breadths). They are shown in relation to the ship thus:

Top- The Pole Star to be 1 chih above the horizon, and the Hua Kai 8 chih.

Left- In the North West the 'Pu ssu' stars (the Orion?) showing 4 chih above the horizon.

Bottom Left- In the South West the 'Pu ssu' stars showing 4 chih above the horizon.

Below- The Southern Cross showing $14\frac{1}{2}$ chih above the horizon. The twin stars Centaurus and showing 15 chih above the horizon.

Right- In the North East the three stars, and in Lyra showing 11 chih above the horizon.

These diagrams in the Wu Pei Chih, produced 1621, were subsequently presented to the Emperor. See Vol.I 'Chinese Interchange' p.447. Photograph from collected translations in J.V.Mills' edition of, Overall Survey of the Oceans, Hakluyt Society Extra Series No.42, Appendix 6.

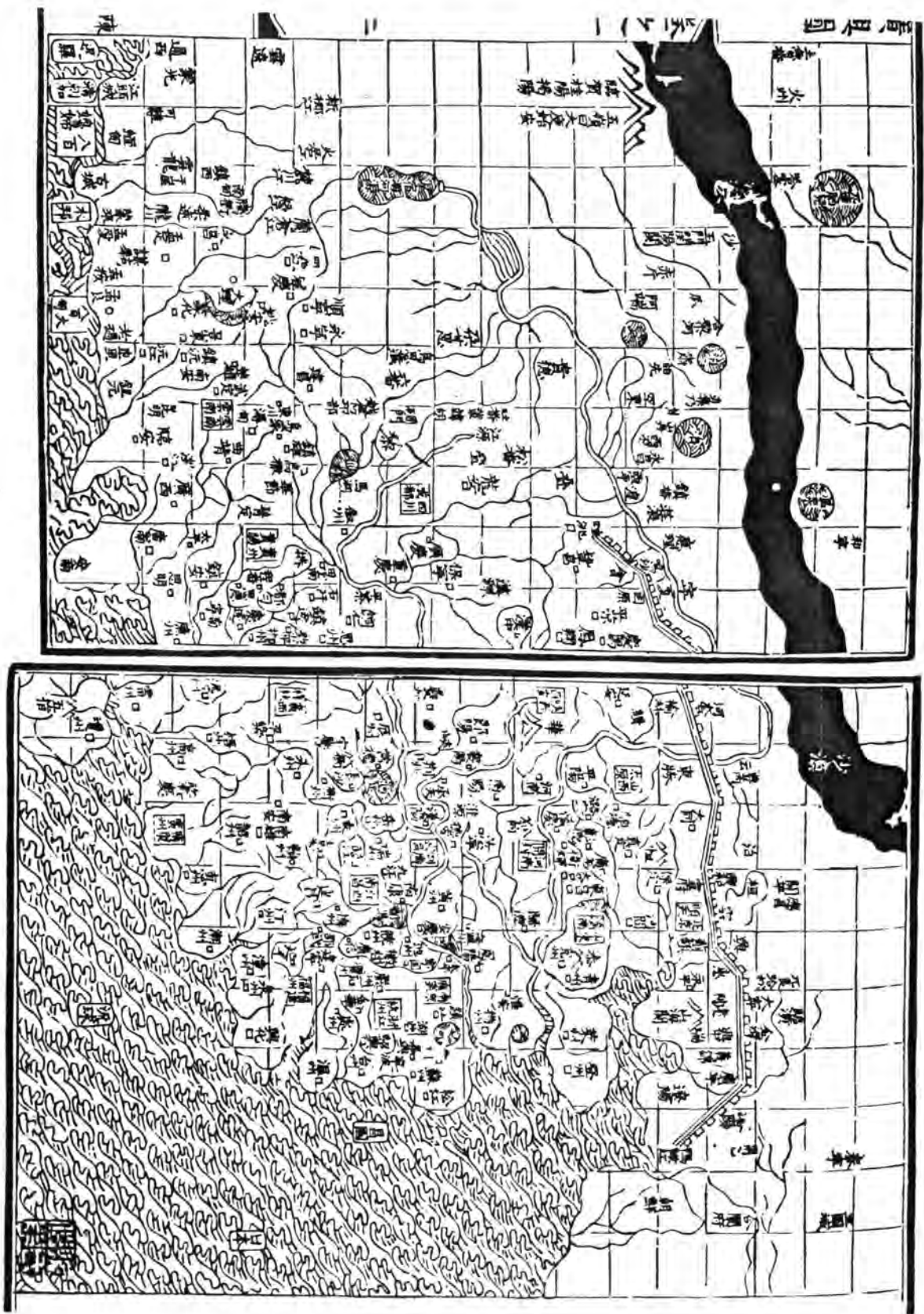
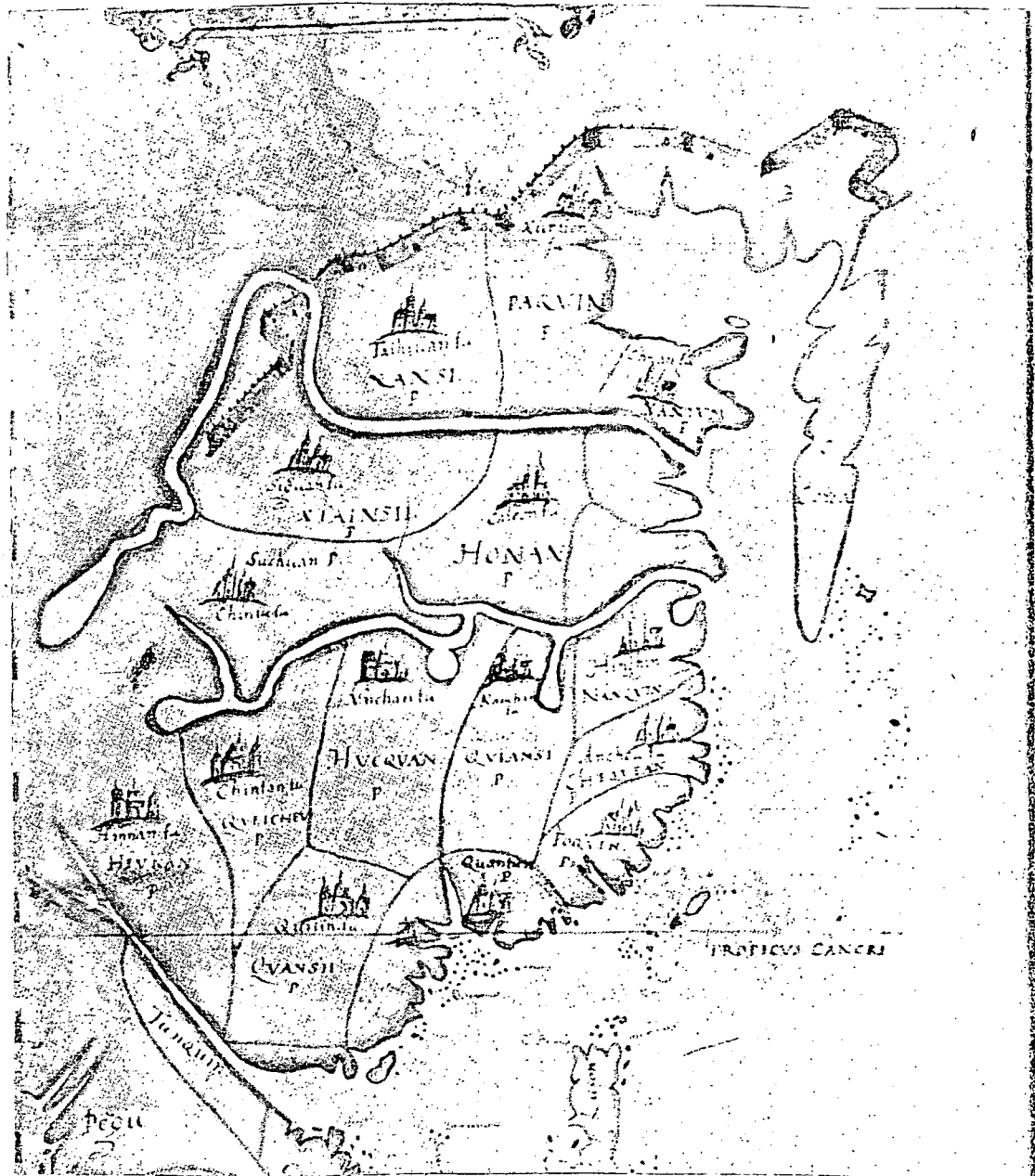


FIG. 48.

Two pages from Kuang Yu Tu (Enlarged Terrestrial Atlas, begun by Chu Ssu-Pen about 1315 and enlarged by Lo Hung-Hsien c. 1555. The general map of China has a grid scale of 400 li to the division. The black band in the North West represents the Gobi Desert. A map deriving from this was printed by Purchas. (See Fig. 49.) Photocopy of Fig. 231 in J. Needham Science and Civilisation in China, Vol. III.

Fig. 50.

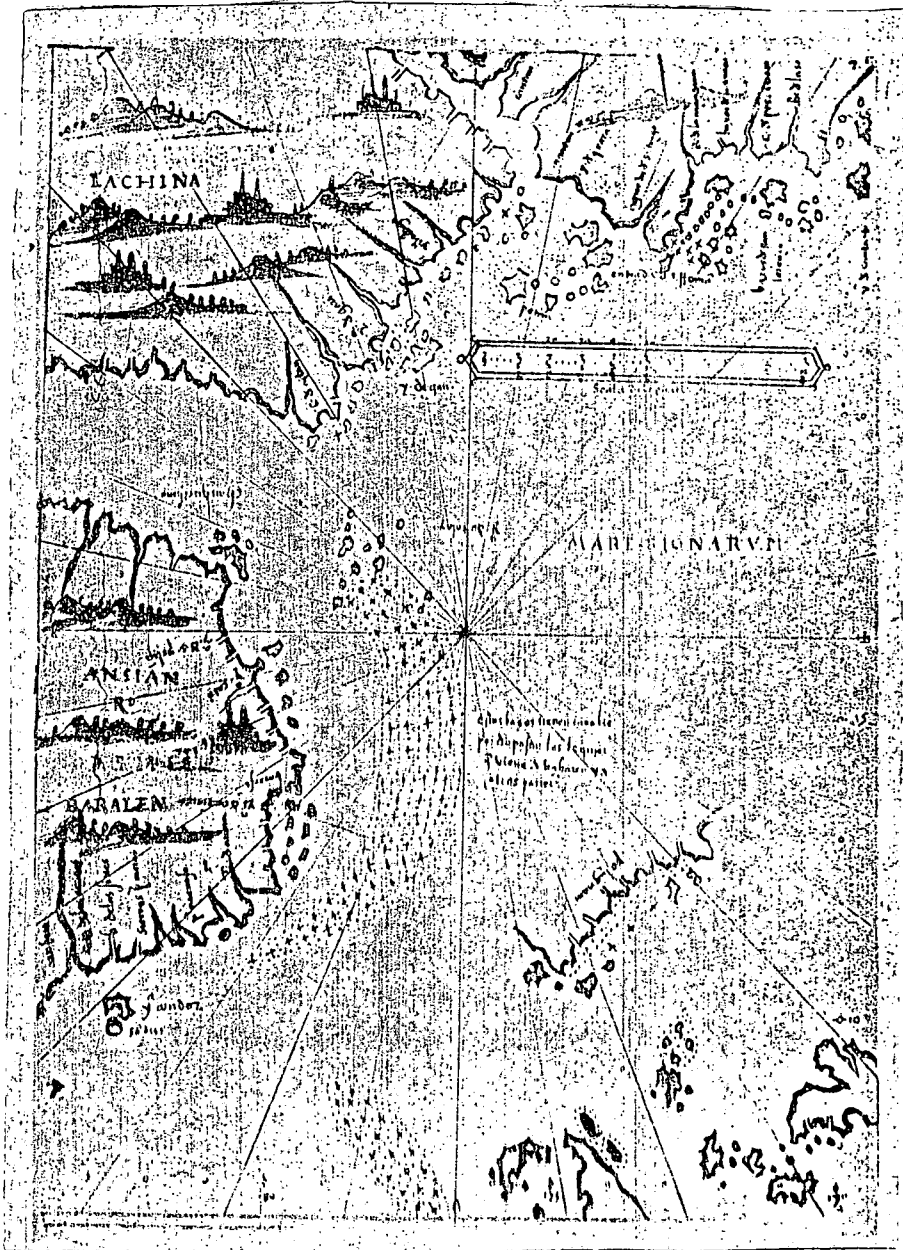


An anonymous manuscript map of China identified only by the caption "From Madrid A° 1609". It was probably drawn by an English agent in Madrid, possibly a diplomat. It may well have been based on the atlas presented to Phillip II in 1574 by the Governor of the Philippines. This map bears a striking similarity to the first and second editions of *Huang ming yu t' chi t'u*, dated 1531 and 1536 respectively. There is also some similarity with Fig. 48, has been preserved in the Archivo de Indias in Seville.

British Museum Cotton MS. Aug. I. ii, 45

Photocopy taken from R.A. Skelton, *Explorers' Maps*, Spring Books, London, 1970, p. 168.

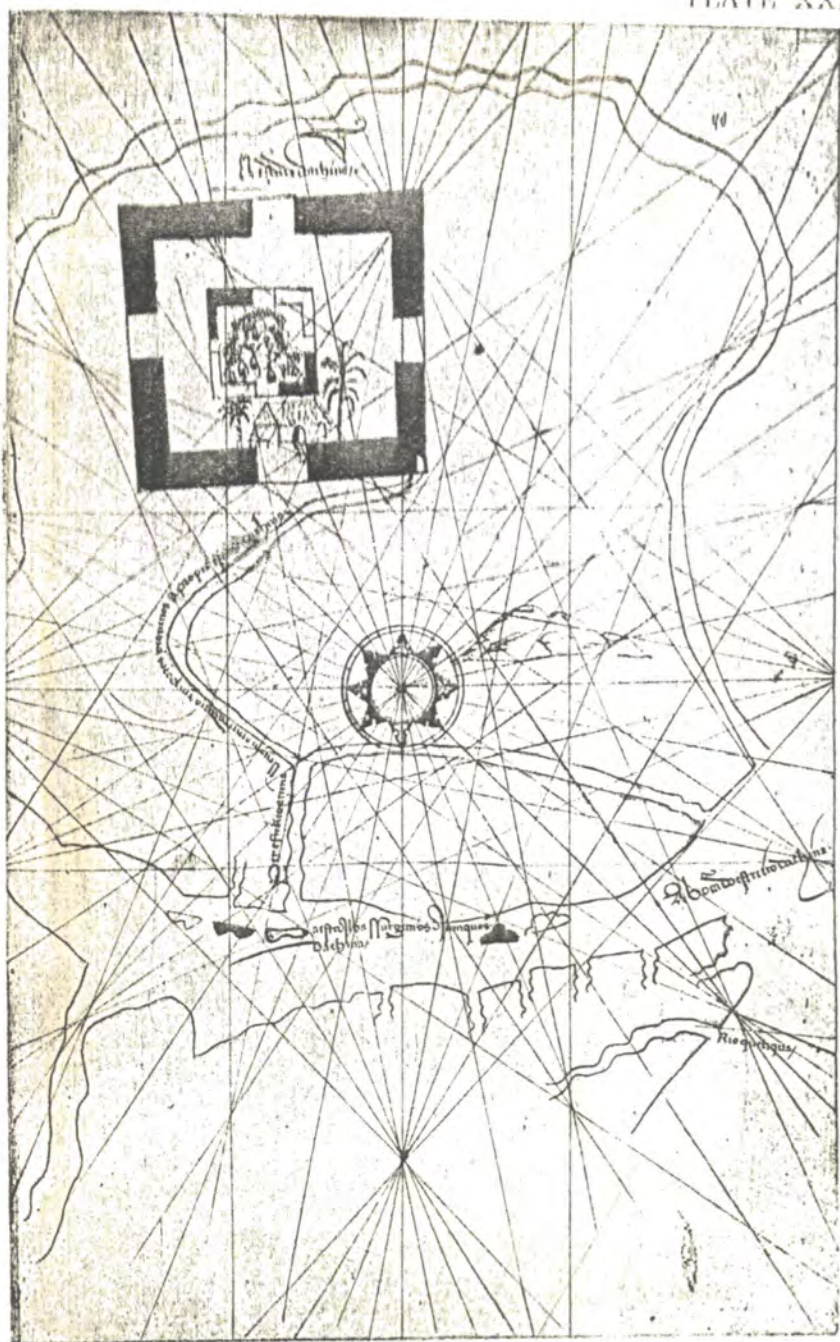
Fig. 51.



Map from The 'Isolario' of Alonso de Santa Cruz as amended by Garcia de Cespedes for Philip III. Reproduced from Plate 103 of Blaquez's facsimile edition of the Isolario General de Todas las Islas del Mundo. Caracas, 1920.

Fig. 52.

PLATE XXI



Rodrigues chart of the Canton River, c. 1515. (fol. 40). This chart does not show the city at Canton, but carries a schematic plan of the Imperial city of Peking.

Reproduced from the *Suma Oriental* of Tome Pires in the Hakluyt Society edition edited and translated by A. Cortesão, 2nd Series cxxxix, Cambridge, 1944. Opposite page 140.

方赤道地平公晷儀

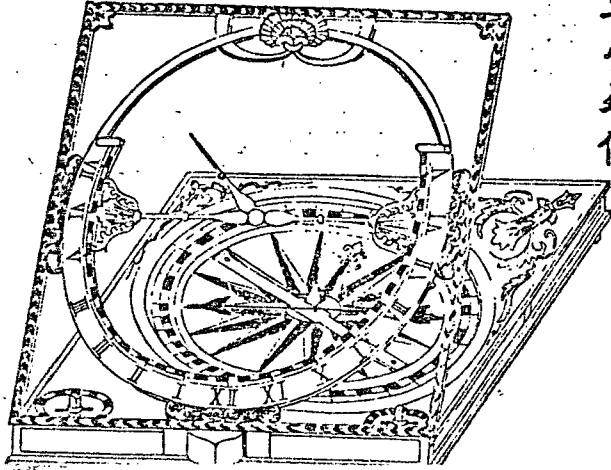


Fig. 54.

Illustration of an Equatorial sundial from the collection of Jesuit astronomical instruments in the Huang Ch'ao Li Ch'i Thu Shih. This sundial has been categorised by Needham as of Chinese Type B. Illustration from J. Needham, Science and Civilisation in China, Volume III, p.312.

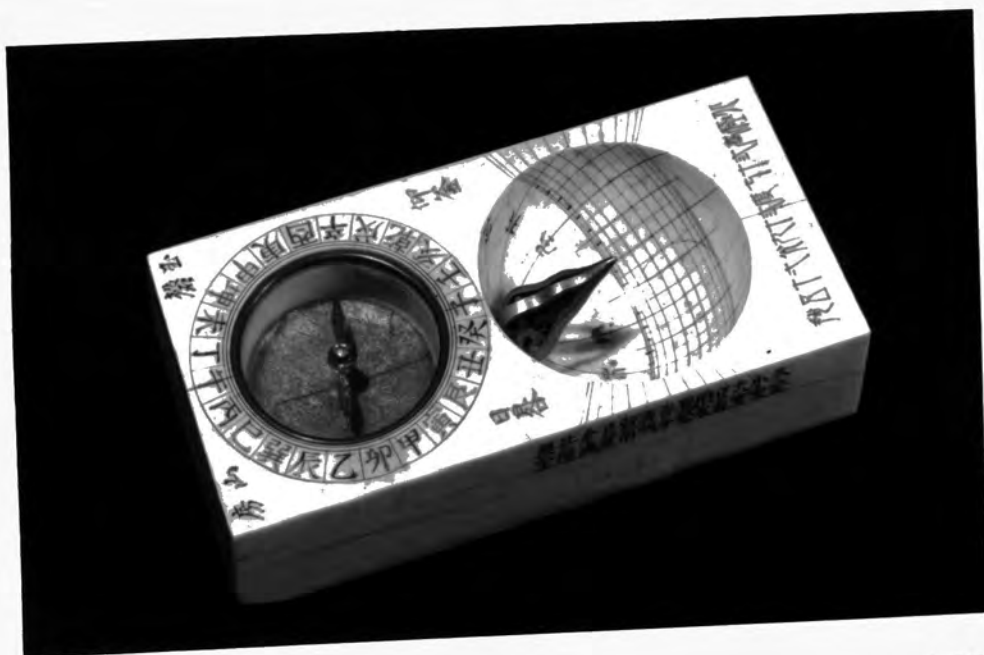


Fig. 55.

A traditional type of ivory scaphe dial from Japan c. 1879. Note the 24 compass divisions and its small size 1.6x3.3 x 0.8 inches. It was made for use in latitude $37^{\circ}-35'-15''$ N. (i.e. made in Fuku Sima). Now in the National Maritime Museum's Astronomy collection 37/1420. Photograph from N.M.M.Neg. A5161.

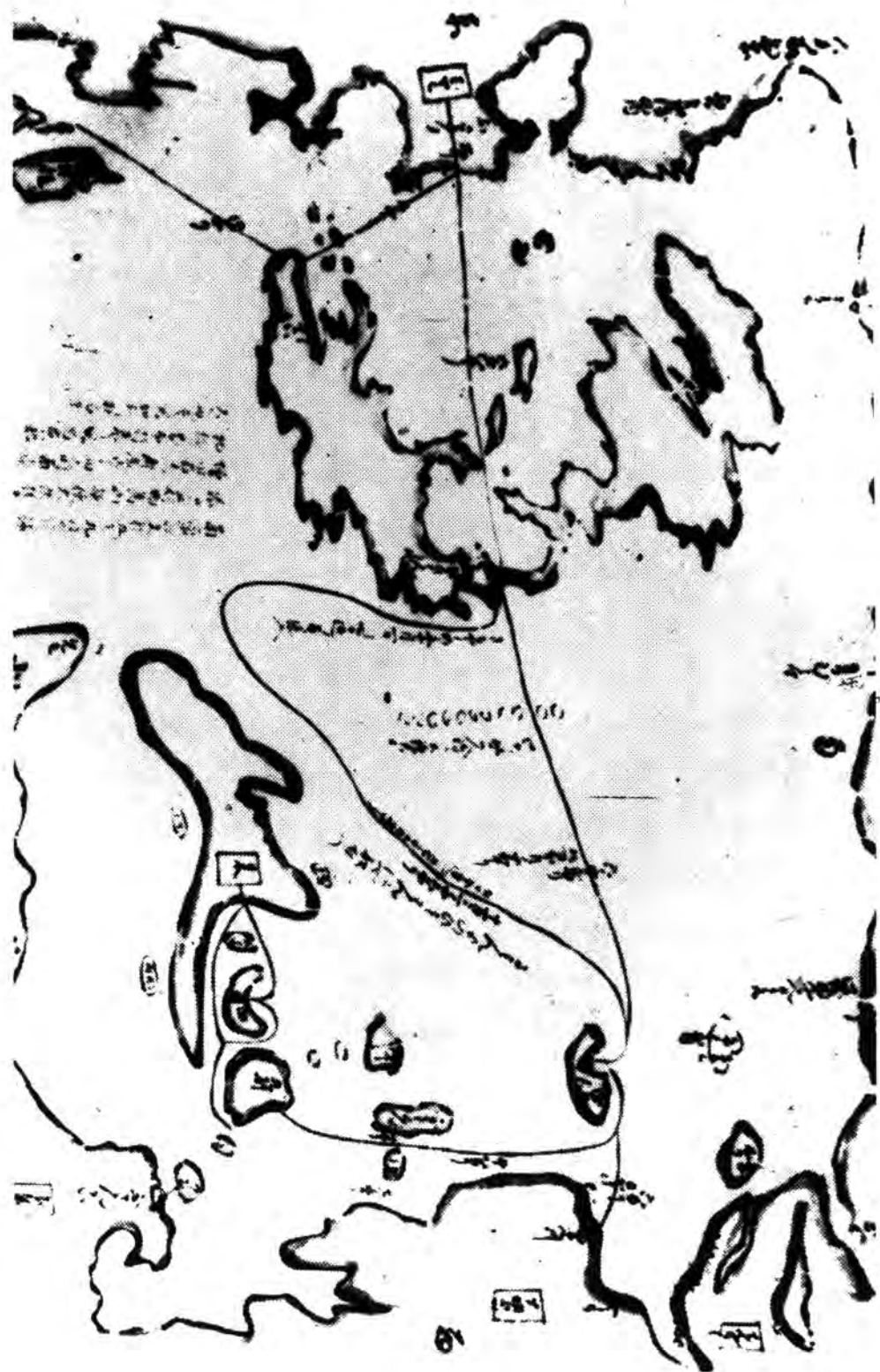


Fig. 56.

Fig. 57.

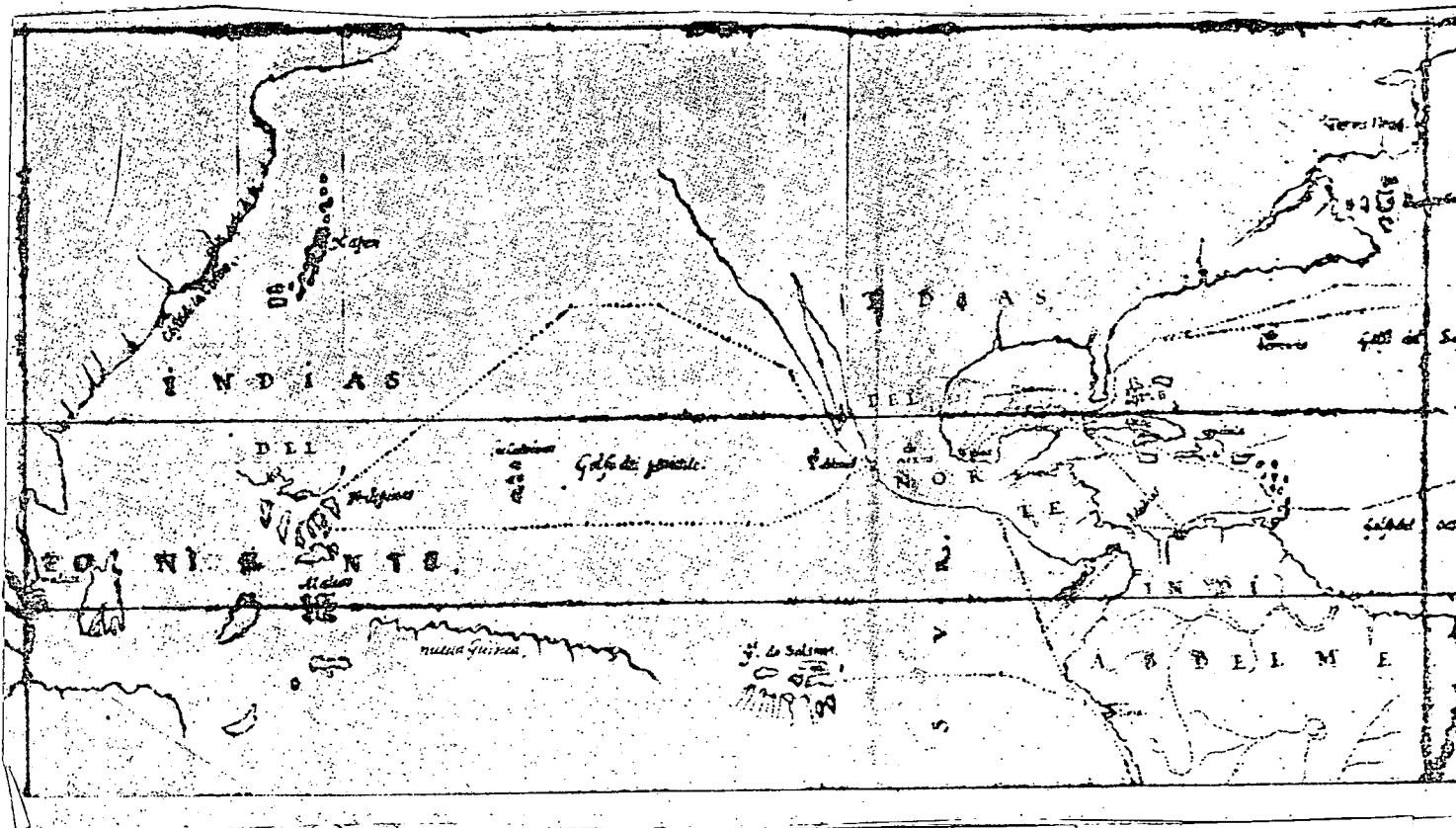


Fig. 57. Chart by Lopez de Velasco, c. 1575 from a M.S. 'Demarcacion y diuision de las Indias', now in the John Carter Brown Library Providence, Rhode Island. In the East, it draws the Raya or Demarkation line through the Malay Peninsula, placing the Mollucas in the Spanish sphere. On the right may be seen the Western equivalent as laid down in 1494. This map also shows the courses across the Atlantic and the Pacific Oceans, including Mendaña's route to the Solomom Islands in 1567-68. It was very similar to the chart which the San Phelipe would have carried in 1596.

Fig. 56. A Japanese chart of the Pacific and Atlantic Oceans compiled about 1596. On the bottom left of this chart, (top left is mounted here), there is an inscription saying it is a copy of the San Phelipe's navigation chart. It is not a faithful copy as claimed, for North and South have been reversed here, and Japan has been moved to the centre, and the main Japanese coastal trade routes have been added. This is therefore likely to be a copy made from another copy of the San Phelipe's chart in Urato. Further points confirming this are the depiction of land to the North of Honshu labelled "ESO", and further South the name "Orankai". These two labels suggest an early 17th. Century date, for it was only in 1621 that Fr. Girolamo de Angelis wrote the first European report on Yezo (Hokkaido).

See Vol. I 'Japanese Interchange' p. 505 and Yoshitomo Okamoto, The Namban Art of Japan p. 139 Plate 76, and C. R. Boxer Some Second Thoughts on the Tragic History of the Sea, Hakluyt Society Annual Report for 1978 Fig. 4.

Fig. 58.



Compass rose from Koh-un Ikeda's Genna Kokaisho showing the European style division of the compass rose into 32 points. Reproduction from Nihon Kagaku Koten Zunsho, (Ed. Saigusa Hiroto), Vol. 12. p.87. Date of the original drawing is about 1620, tinted with water colours.

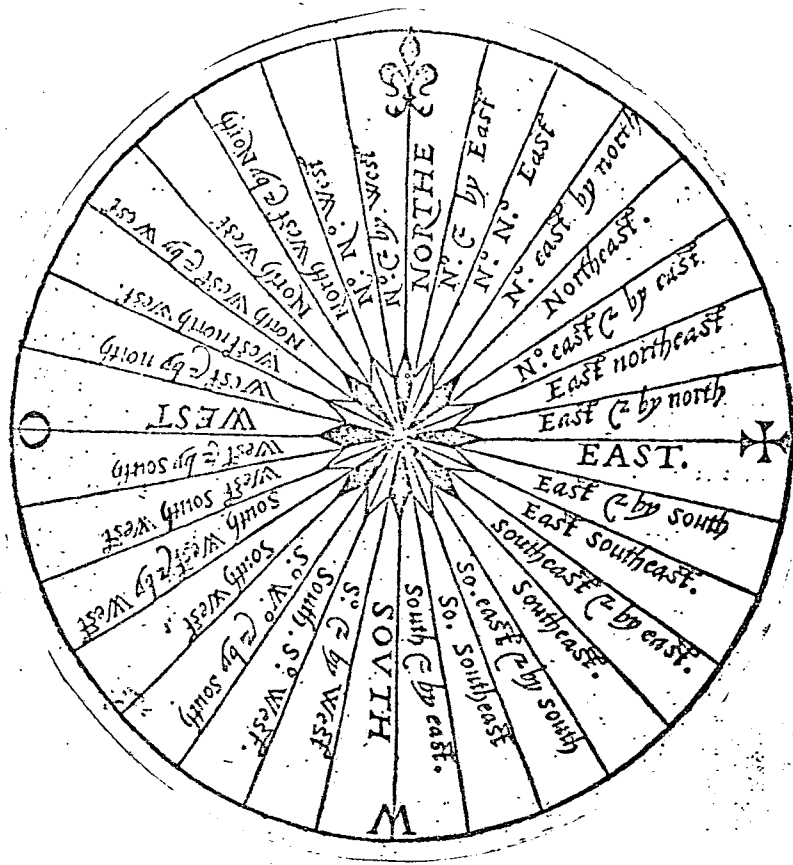


Fig. 59.

Compass Rose from Richard Eden Arte of Navigation(1561 edition)
 Part II , opposite Fol. liv.

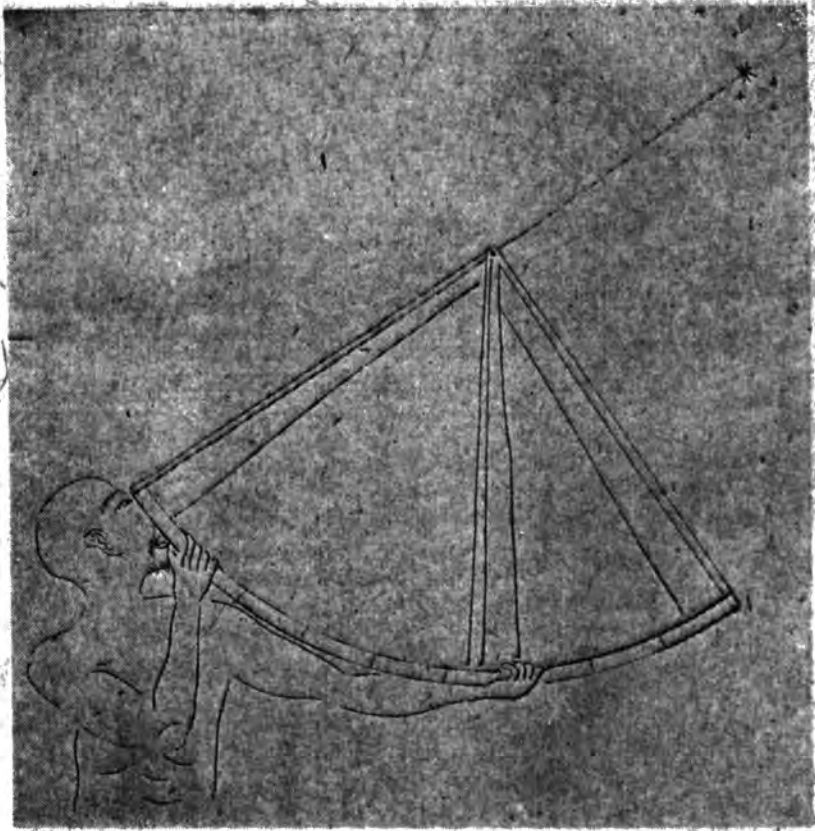


Fig. 60.

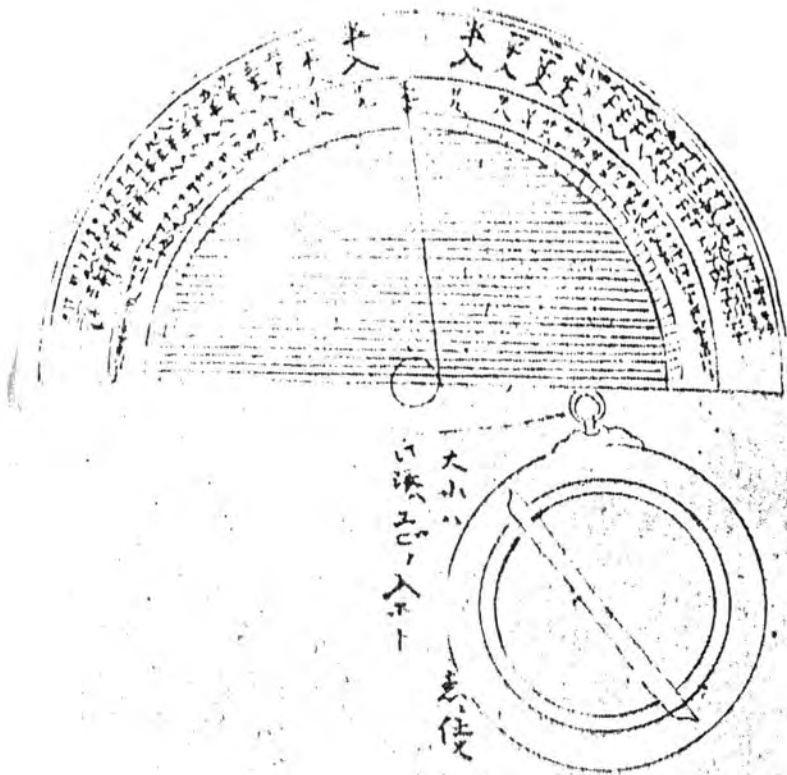


Fig.60. A very large portable quadrant as drawn by Koh-un Ikeda. Its Japanese user is shown observing the Pole Star. The drawing was published in Nagasaki in 1618 in the Genna Kokaisho. This photocopy is taken from an edition by Saigusa Hiroto in Nihon Koten Kagaku Zunsho, Vol 12, p.92.

Fig.61. Koh-un Ikeda's instructions for calibrating an astrolabe. This is significant in the light of his drawing of an uncalibrated astrolabe, (see Fig. 62). His method of calibration is unlike both Spanish and Portuguese practice, for though it is marked out symmetrically as joined by the horizontal lines shown, 1 is shown at 0' above the horizontal with graduations running towards 45'. This also makes sense in the Japanese context because the Japanese rarely sailed into higher latitudes as only the northernmost points of Hokkaido lie above 45° N., but all the Japanese trading interests at this time lay south of this. Such a division would not make comparable sense in Europe. Koh-un Ikeda's astrolabe was not useless above 45° N. because numbers begin at 1 and run to 9 starting again at 45' and running to 90'.

The conventions of calibration are thus more like Spanish than Portuguese practice. A Portuguese astrolabe has been recovered in Japanese waters from the wreck of the *Madre de Dios* lost in 1609. This astrolabe recovered in 1928 shows that though taken to Japan, the Japanese did not learn how to use astrolabes from the Portuguese who invariably used zenith distances in calibration.

Photocopy shown here as Fig. 61 is taken from Koh-un Ikeda, Genna Kokaisho, edited by Saigusa Hiroto in Nihon Koten Kagaku Zunsho, Vol 12, p. 91.



Fig. 62.

Fig.62. This mariner's astrolabe is depicted in the Genna Kokaisho, 1618., A mariner's astrolabe as depicted in the Genna Kokaisho, 1618. It is interesting because of its similarity to the Astrolabe shown opposite. Note the close resemblance of the pinion heads, alidades, the design of the top ring mounting, and the fact both astrolabes have no numbered calibrations. Koh-un Ikeda therefore was able to see an astrolabe almost certainly from the same place of origin as the one shown opposite which was found on Valencia Island, off south west Ireland. Yet another astrolabe, now very worn, but of the same thickness, and only $\frac{1}{2}$ " larger in diameter was recovered during 1968 - from the wreck of the Armada galleass Girona, which broke up near the Giants Causeway, Northern Ireland on 26th October 1588. This taken together with the references made by Koh-un Ikeda to Captain Gonsalves, the Spanish captain who taught him to navigate, suggests a Spanish provenance for all three astrolabes.

The finding of two uncalibrated astrolabes without the traditional stampings of the Cosmographer Major, suggests the growth of an unofficial trade in unfinished astrolabes for export, despite rules requiring the inspection and stamping of astrolabes by the Cosmographer Major in Seville.

Though an astrolabe was the type of instrument which could be used for many years after manufacture, Koh-un Ikeda's drawing of one so similar to ones in use thirty years before in Europe, is suggestive of a growing conservatism in some aspects of Spanish navigational practice.

The astrolabe shown as Fig. 62. is reproduced from an edition of the Genna Kokaisho, edited by Saigusa Hiroto in the Nihon Koten Kagaku Zunsho, Vol. 12. p. 93.

Fig.63. This mariner's astrolabe is now in the National Maritime Museum, and normally on show in the Navigation Gallery was found under a stone on Valencia Island, south west Ireland in 1845. The site of its discovery was near the Blasquet Island wrecks of Armada ships in 1588. It has been assumed that the astrolabe came from one of these ships, but in Full Fathom Five, Colin Martin has shown that some Armada pilots were already familiar with that normally safe haven, while the Carew MSS. suggest a continuing Spanish familiarity with that coast, culminating in the Kinsale venture of 1598.

Diameter 178mm.
Thickness 14-16mm.
Weight 2270gms.

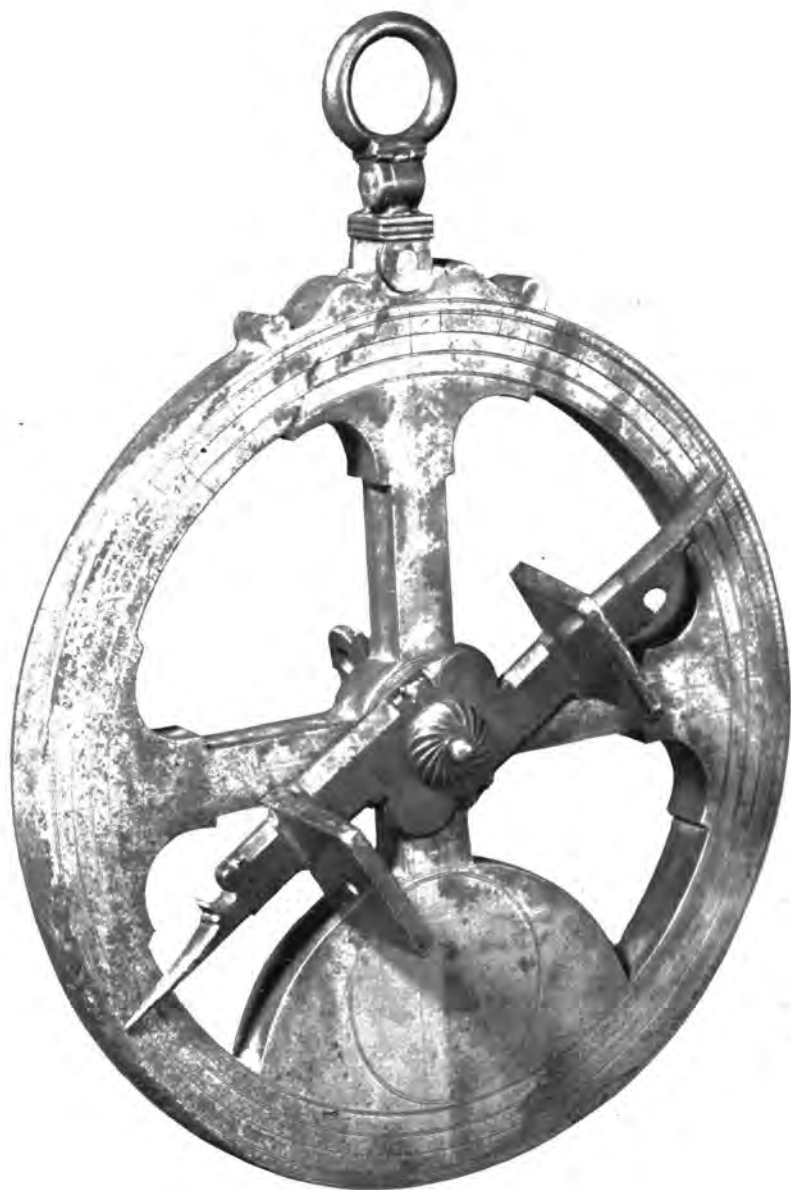


Fig. 63.

An ensemble of Rodrigues five panoramic of the coast of Samadanga (present day Flores Island in the Molucca's), in front of which he has shown Ilha de Nuca Raja, (modern Paloe, or Raja Island). The village, top left, lies just of the Compeço Da nuca Raja. corresponds to present day Mausambi.

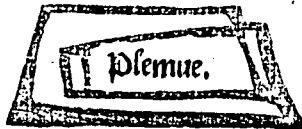
To the right of this illustration there is shown a modern chart of the same coast. From this it is apparent that Rodrigues was making a rutter, and not producing these coastal profiles to a constant scale. He has also devoted considerable attention to the plant and trees, for these were the 'Spice Islands'. These were the very parts of the Suma Oriental rarely, if ever seen outside the Armazéns in Lisbon before. Armando Cortesão prepared an edition for the Hakluyt Society in 1944-5. This illustration is copied from Plate 10 of that edition of The Suma Oriental of Tomé Pires, an account of the East from the Red Sea to Japan written in Malacca and India in 1512-1515, and the Book of Francisco Rodrigues, rutter of a voyage in the Red Sea, nautical Rules, almanack and maps, written and drawn in the East before 1515. Translated from a Portuguese MS in the Bibliothèque de la Chambres des Deputies, Paris. Hakluyt Society, 2nd Series CXXXIX and XC. Cambridge, 1944.

De la mer

Entre ceste poincte de boult & gaudester ya deux lieux. Et entre les deux ya vng banc qui est le trauers des deux poictes. Et au dedâs du bâc ya vng rade. Et si tu veulx aller pouster dedans range la poincte de boult. car lantree y est pres. Et la poincte de boult est bien saynne dehors. Mais dedans ya vne pierre. Donne toy garde d'elle quant seras dedâs la poincte de gaudester.

De gaudester au four ya sept. lieues & gisent nord nordest & sud syroest.

Plemue

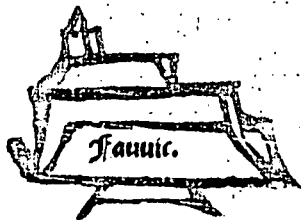


La pchaine poincte que voyras auant de boult cest la poincte de plemue. Si tu veulx entrer en plemue va tout droit le cap sus.

Si tu veulx aller a la chenale platine qui est deuers lest va ps du poinctaux de babort car destrebort est trop soubme.

Si tu veulx aller a la chenale doctembre donne rny au cap de liste deuers lest et puis va auant soubz la maison au chenaleier usque aye la chenale ouuerte.

Et quant auras la chenale ouuerte va sus par le meilleu. Et quant le poinctaux qui demeure destrebort sera ariere du trauers va auât saint patrot et iras pres du fasser qui demeure destrebort.



La pierre de plemue est a trois lieues de terre:

Dii.

North European rutters of the same date as Rodrigues rutter were much cruder in their execution, as this page taken from Le Grant Routier by Pierre Garcie, 1521 edition Shows. It describes the features of the sea bed between Plymouth (top woodcut) and Fowey, (bottom woodcut). This is reproduced from D.W. Waters, Rutters of the Sea, p. 32.

The first English rutter to include woodcuts of the coastline was Robert Norman's Safegard of Saylers, or great Rutter, Containing the Courses, Depthes, Sounding(s) Floudes, and Ebbes, With the markes for the entrings of sundrie Harboroughs both of England, Fraunce, Spaine, Ireland, Flaunders and the Soundes of Denmarke, with other necessarie Rates of common Navigation: Translated out of Dutch into English by Robert Norman, Hydrographer. John Windet, and William Iudso. for Richard Ballard, London, 1584.

Fig. 65.

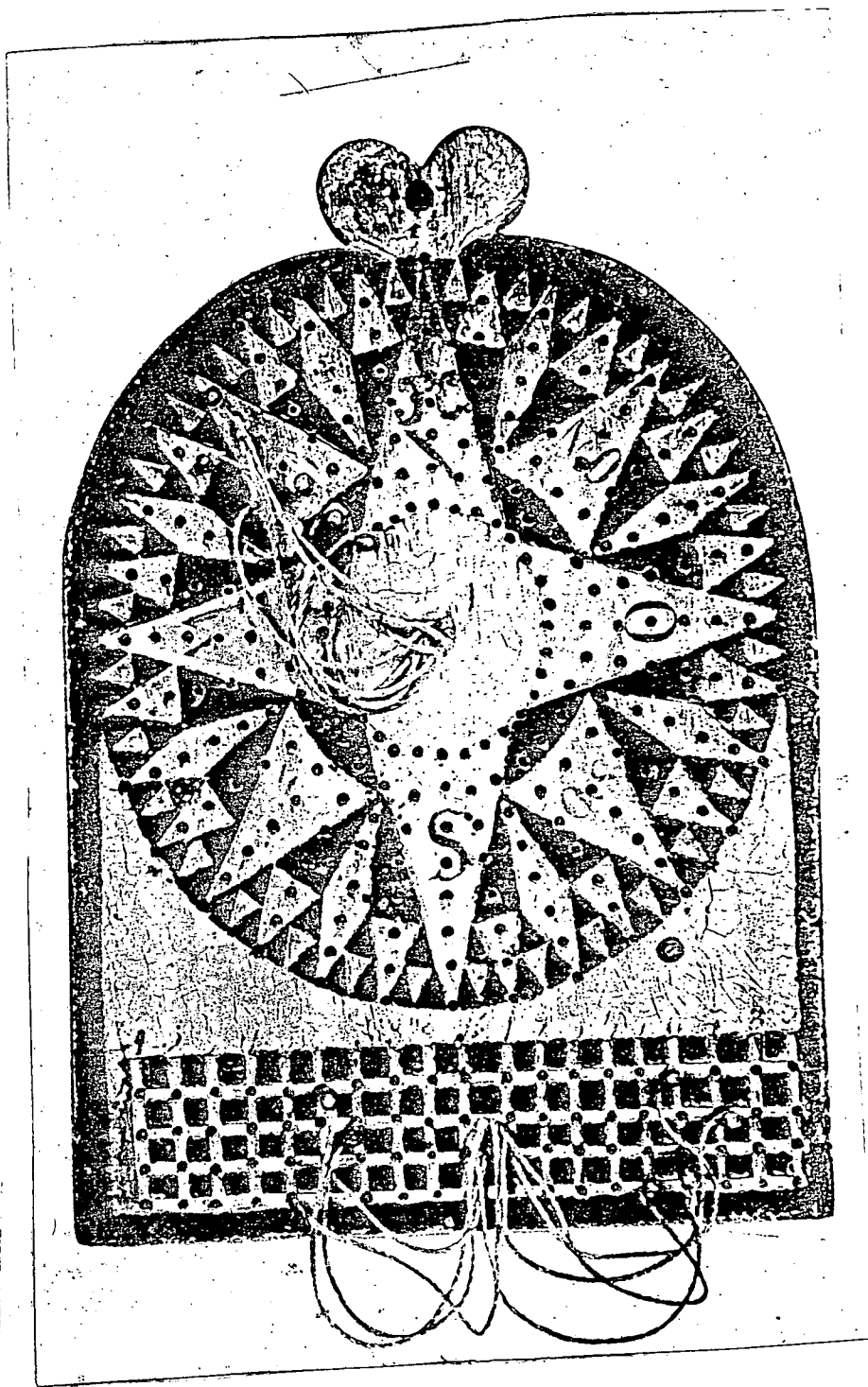


Fig.66.

This traverse-board was found in the Isle of Barra in 1844, but probably dates from the sixteenth century. It was used by the helmsmen to mark up which course he had steered. For each half hour run upon one course a peg was added on the appropriate wind rhumb of this board. Multiple entries in any circle of holes indicated a change of course. This traverse board is now in the National Maritime Museum.

