Dendrochronology and the ships of the European Expansion

ForSEAdiscovery
Filipe Castro
April 2014

Training regarding the tasks included in ESR7 and ESR8 (WP2)

Documentation on forestry

Documentation on shipbuilding

Defining an Iberian ship (morphological traits)

Make a list of shipwrecks with timber

Select sites for sampling

Sample

Synthesize the results

Assess best practices

Synthesize documentation of forestry

Synthesize documentation on shipbuilding

Publications

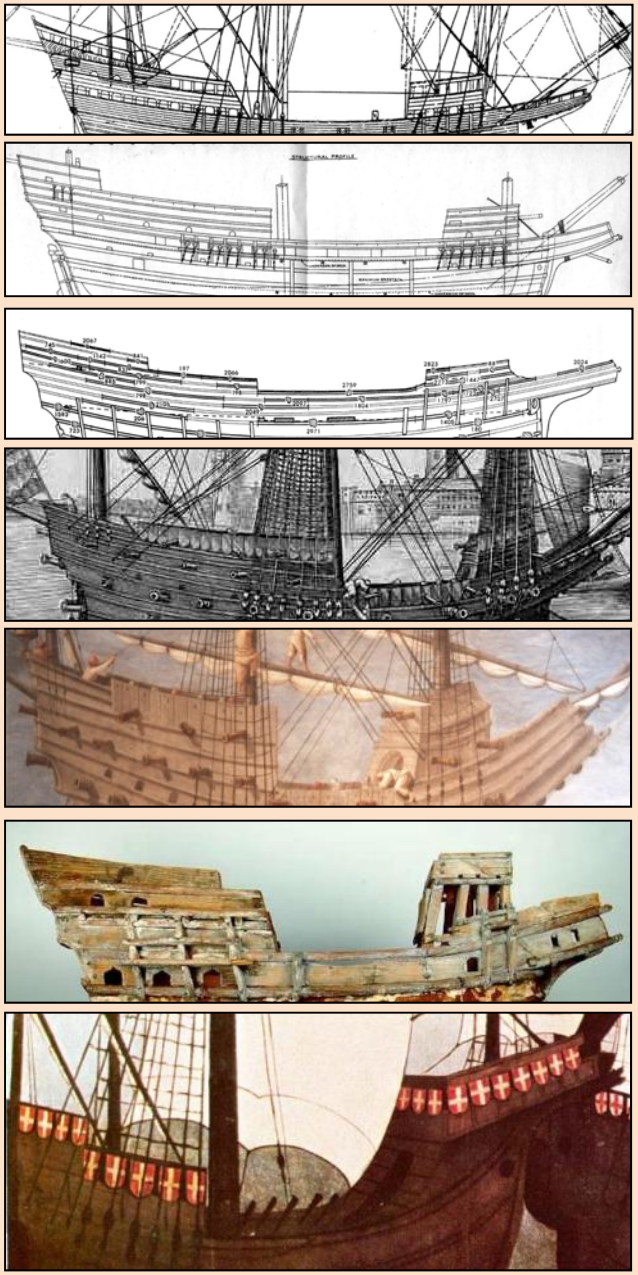
GIS database of Portuguese Shipwrecks

Protocols for dendro-sampling

Training regarding the tasks included in ESR7 and ESR8 (WP2)

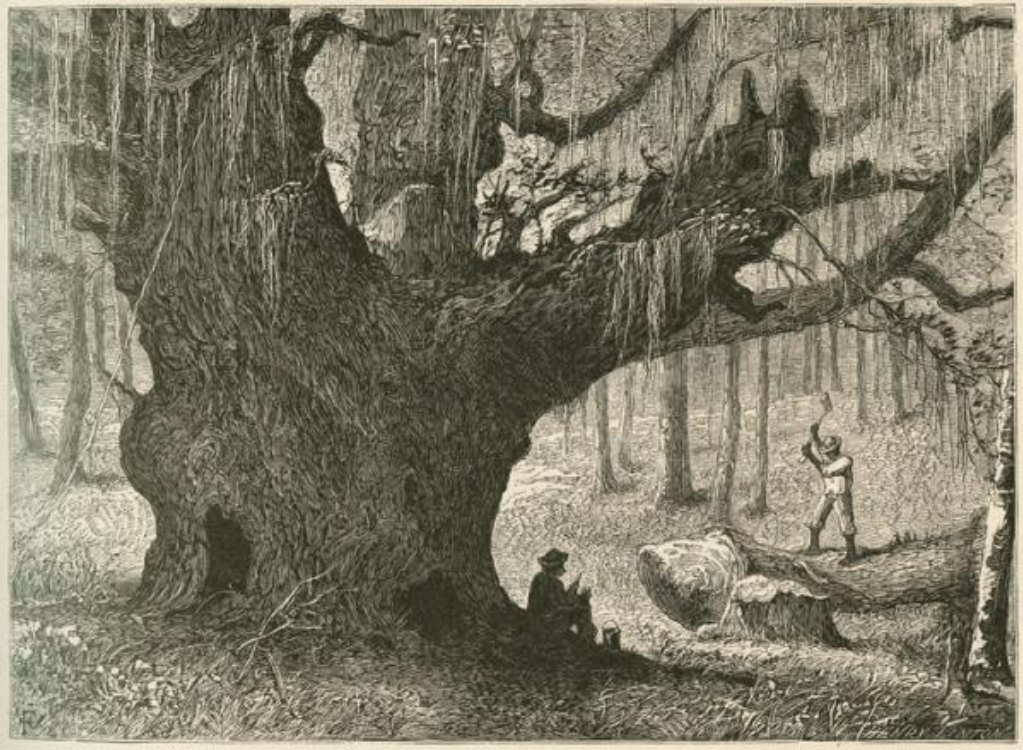
1	List of ship types				about	30	
2	List of dimensions	from treatises	from contracts	from shipwrecks	about	100	
3	List of ship parts	…and shapes			about	200	
4	Shipwreck database	scantlings vs.	overall dimensions vs.	provenience	about	400	
5	Image database				about	4000	
6	Architectural signatures				about	20	
7	Lines drawings library				about	100	NEED HELP
8	Graminhos/recipes				about	30	
9	Morphological matrixes				about	20	traits

Looks worse than it is…

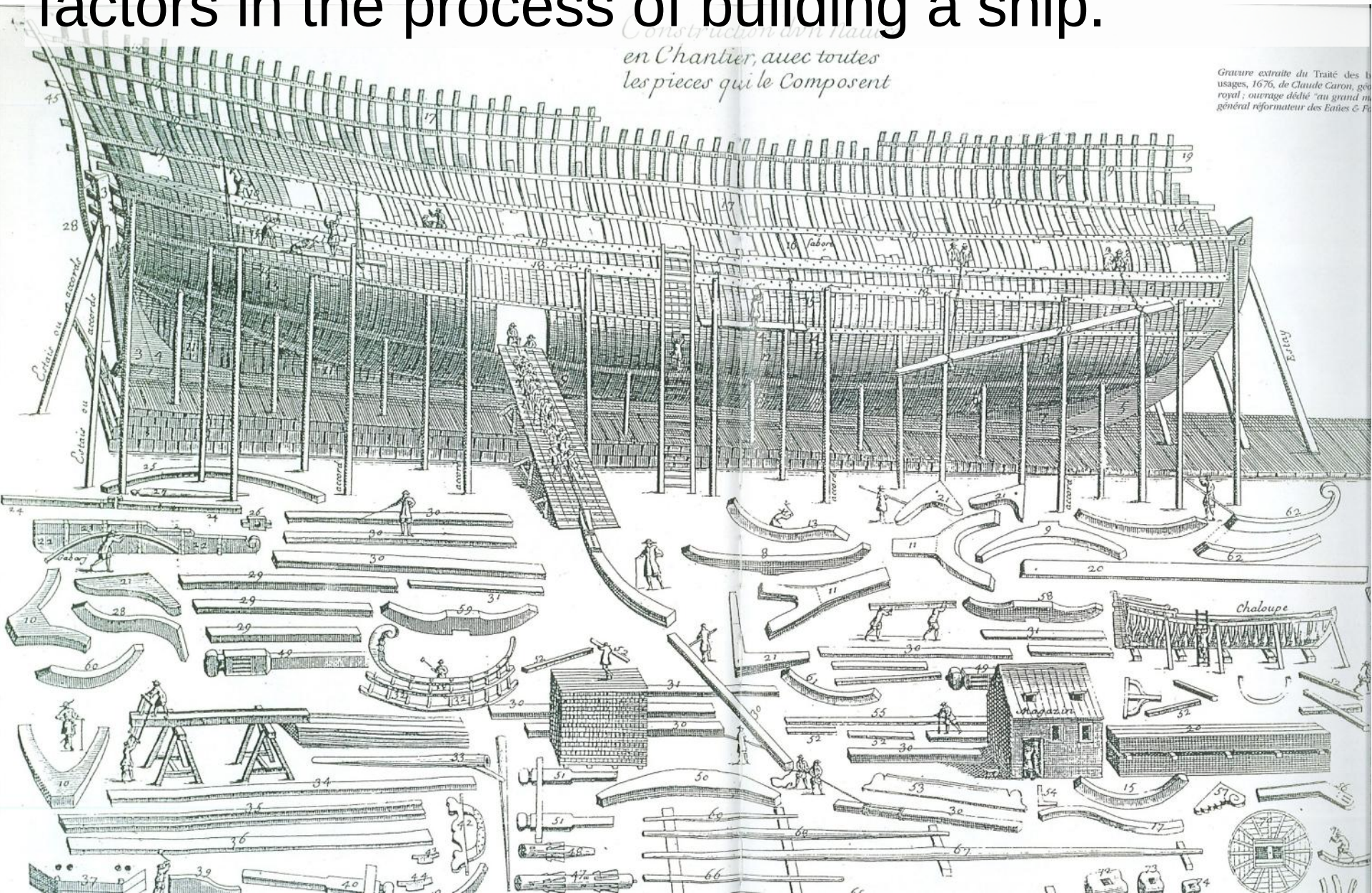


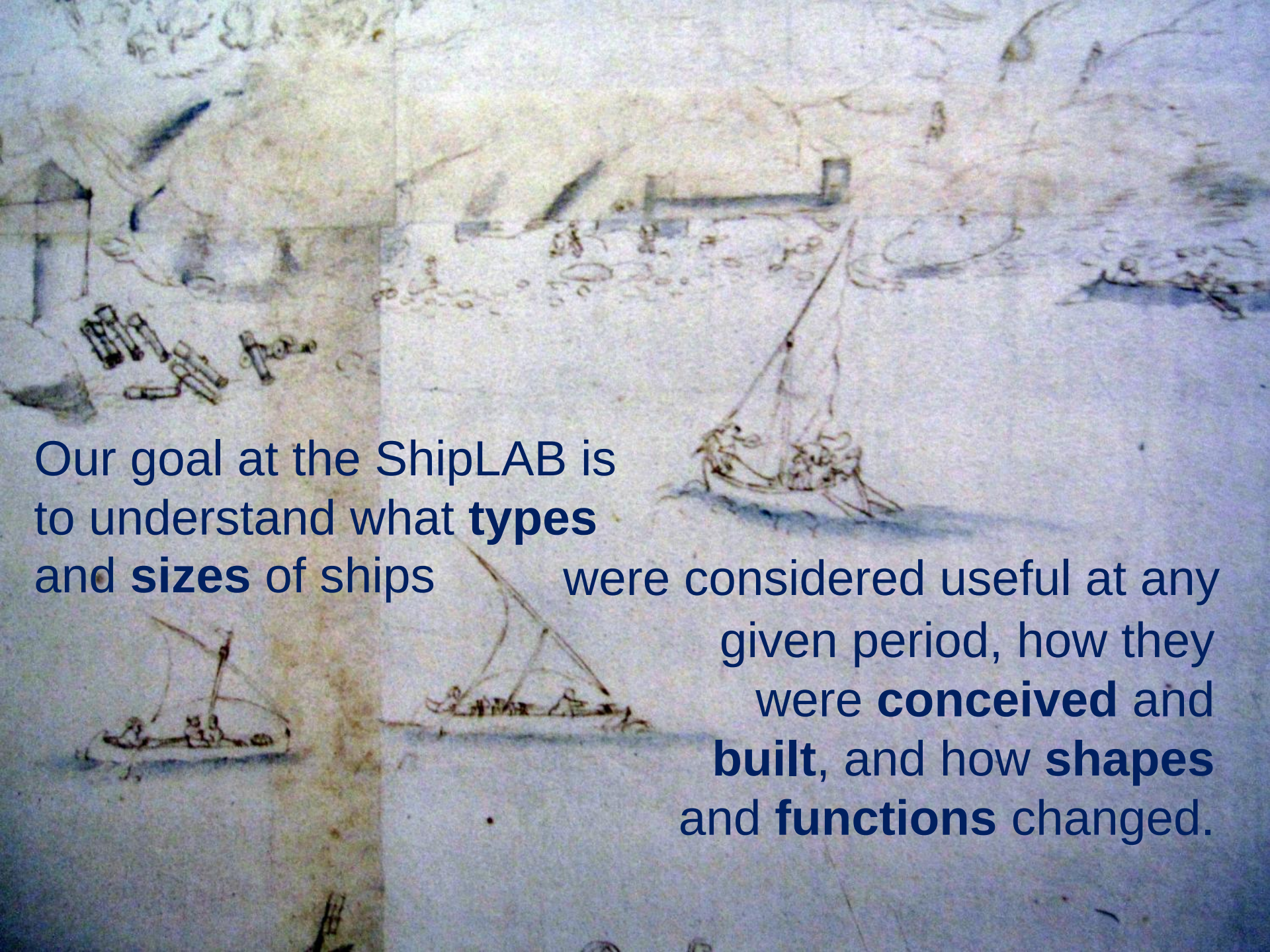
The ships that opened the world to Europe were complex and sophisticated machines, and their **conception**, **construction**, and **seakeeping** abilities are poorly understood.

Dendrochronology (and perhaps DNA studies) is a tremendously useful tool to study 16th century Iberian seafaring and get a better understanding of these ships, the way they were **conceived**, **build**, and **sailed**.



Timber availability was one of the most important factors in the process of building a ship.

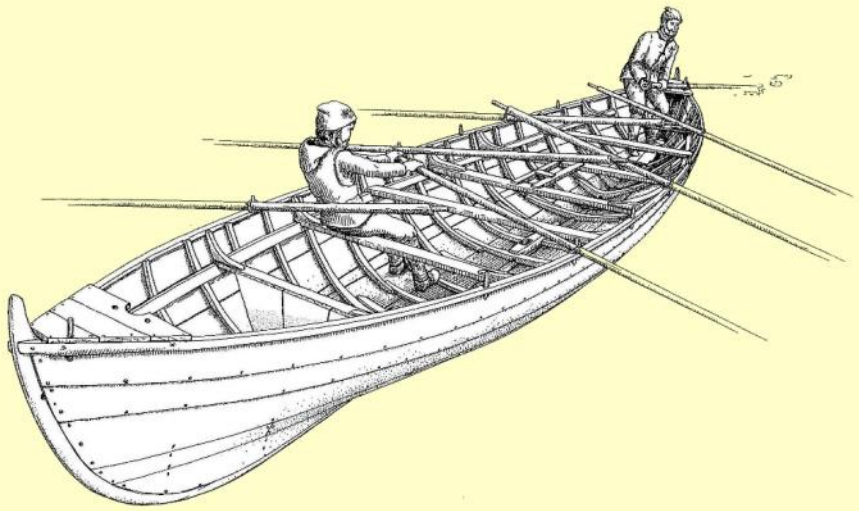


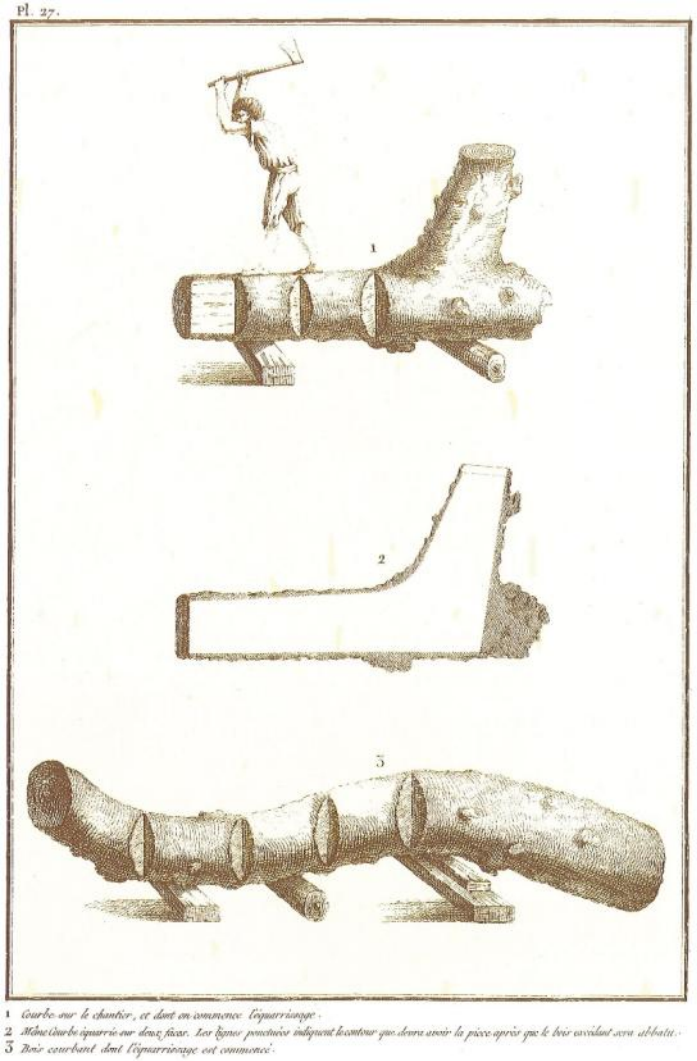


Our goal at the ShipLAB is to understand what **types** and **sizes** of ships were considered useful at any given period, how they were **conceived** and **built**, and how **shapes** and **functions** changed.

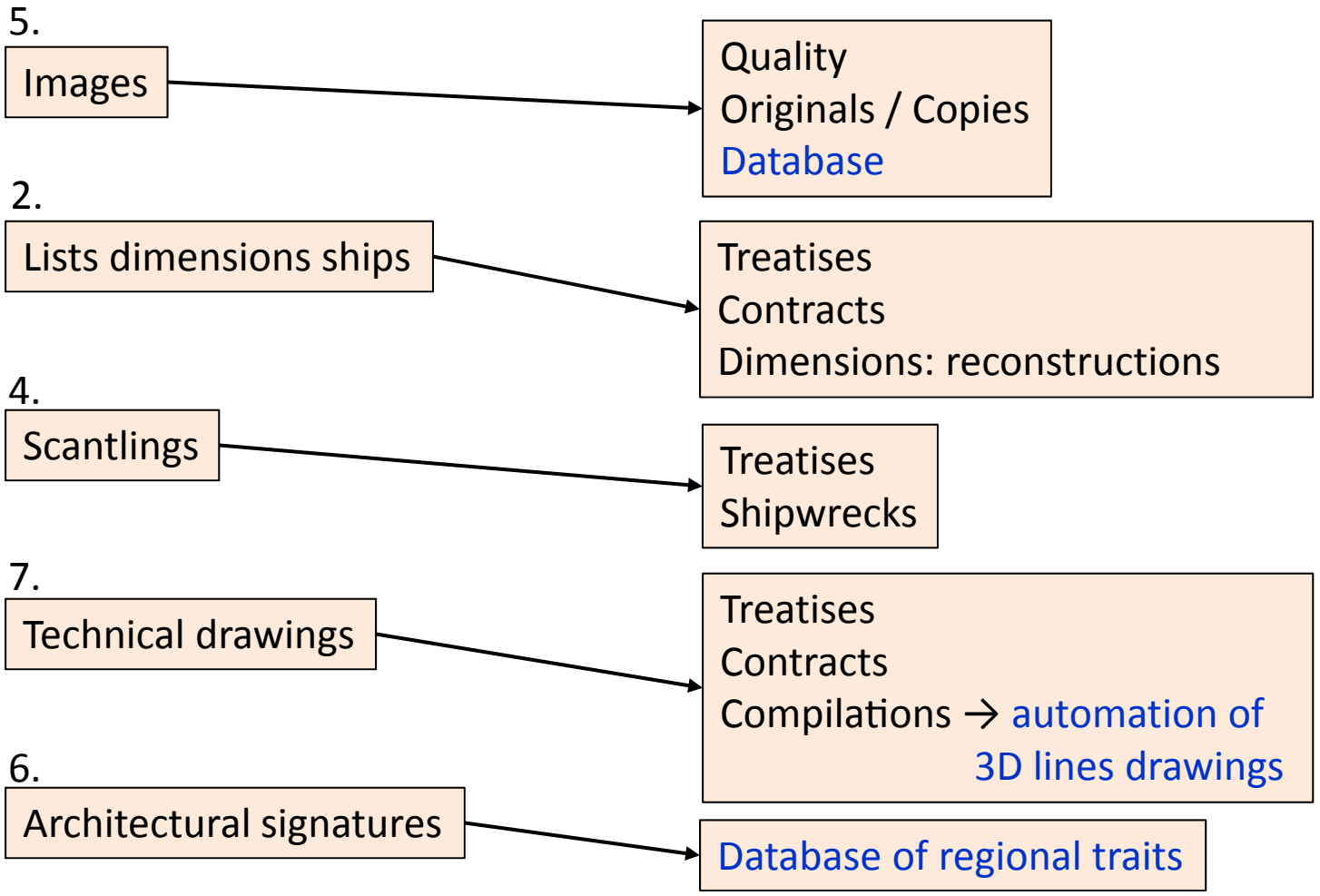
José Luis Casado Soto mentions a Spanish 1522 document that refers:

“cinco chalupas nuevas en astillero ‘de madera de roble e tingladas de borne’ de porte de 35 a 40 toneles, tres pinazas ‘calafatadizas e de banço de roble’ de porte hasta 40 toneles y otras ocho pinazas ‘tingladas de borne e madera de roble’ de entre 35 y 40 toneles”





The database to be implemented should include **timber sizes, ages**, the **falling dates**, the timber **species**, **conversion**, and **provenience** in the context of a database that includes the following input.


5.
Images
Quality
Originals / Copies
Database
2.
Lists dimensions ships
Treatises
Contracts
Dimensions: reconstructions
4.
Scantlings
Treatises
Shipwrecks
7.
Technical drawings
Treatises
Contracts
Compilations → automation of 3D lines drawings
6.
Architectural signatures
Database of regional traits

5.

Images

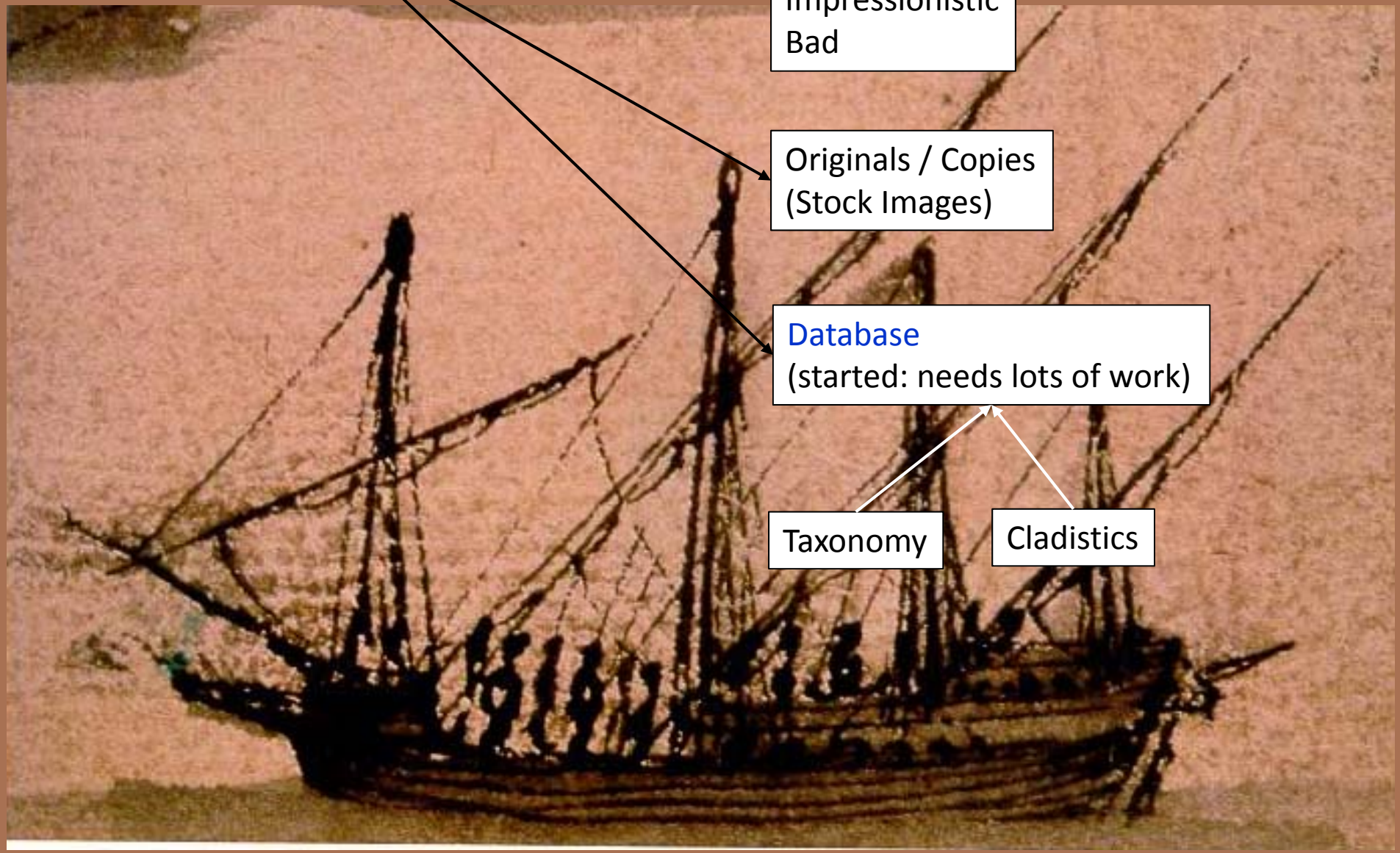
Quality:
Good
Impressionistic
Bad

Originals / Copies
(Stock Images)

Database
(started: needs lots of work)

Taxonomy

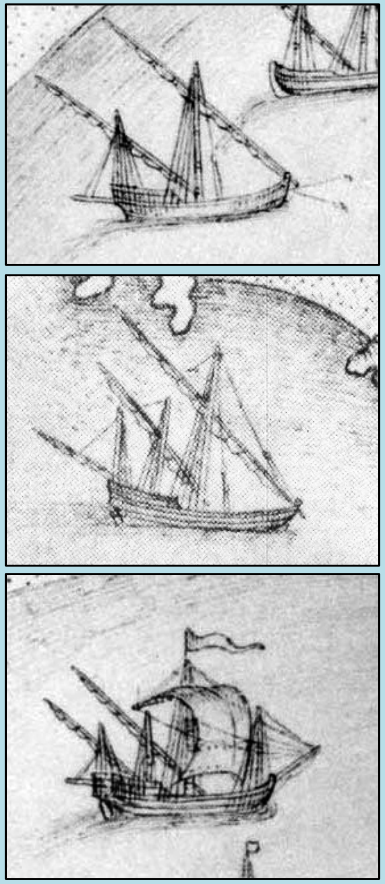
Cladistics



9.

Morphological matrixes

- Structure (carvel, lapstrake)
- Stem post (round, straight)
- Sternpost (round, straight)
- Stern panel (yes, no)
- Forecastle (0, 1, 2, 3 pavements)
- Stern castle (0, 1, 2, 3 pavements)
- Masts (1, 2, 3 or 4)
- Sails (1, 2, etc.)
- Rigging (square, lateen, etc.)



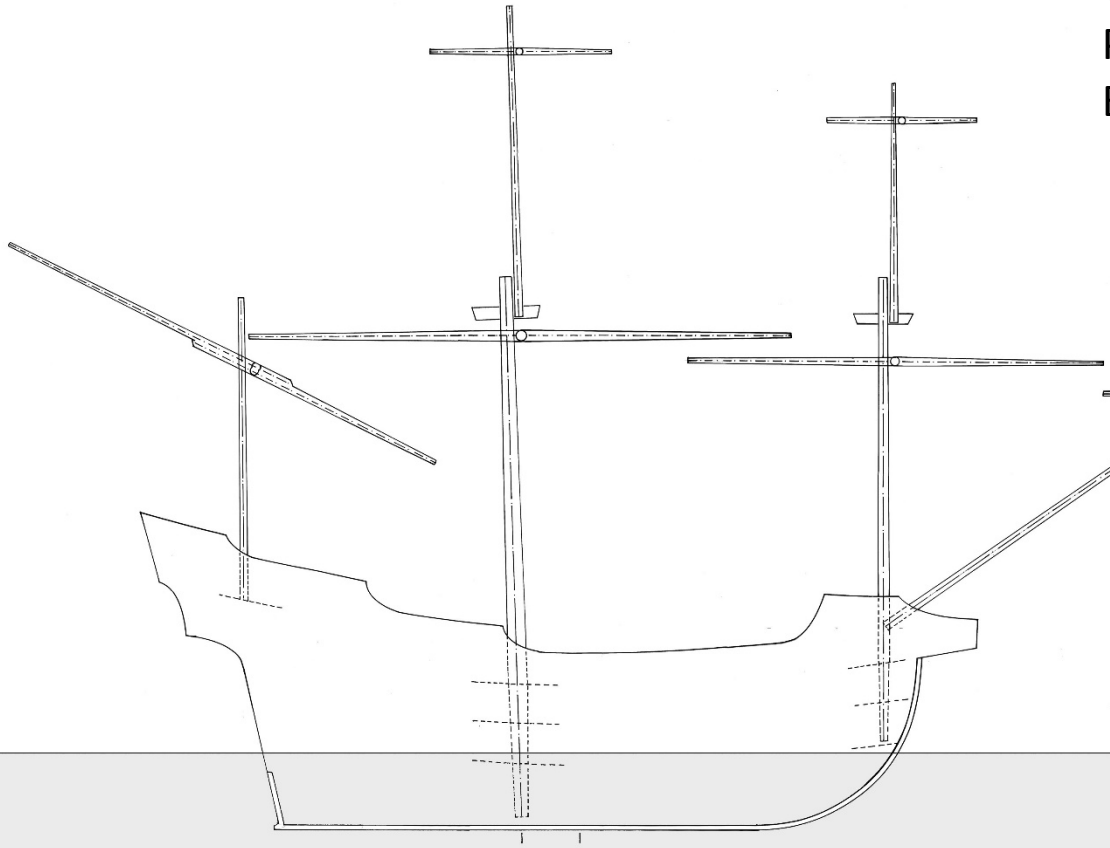
Duarte d'Armas, 1509. Excellent pictures, same hull, two, three, and four masts.

2.

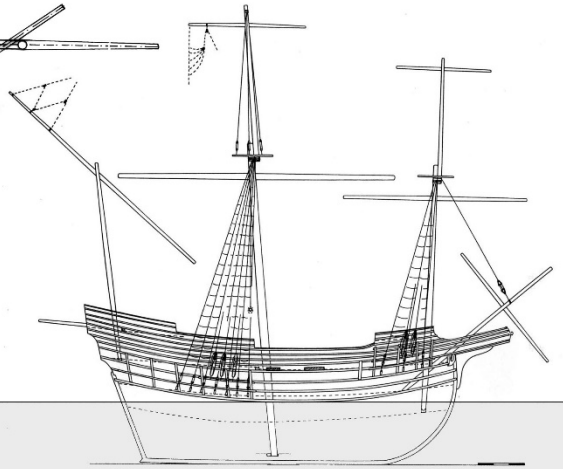
Lists dimensions ships

Size/Scantlings
Treatises
Contracts
Dimensions: reconstructions

Carla Rahn-Phillips list
Portuguese texts
English texts



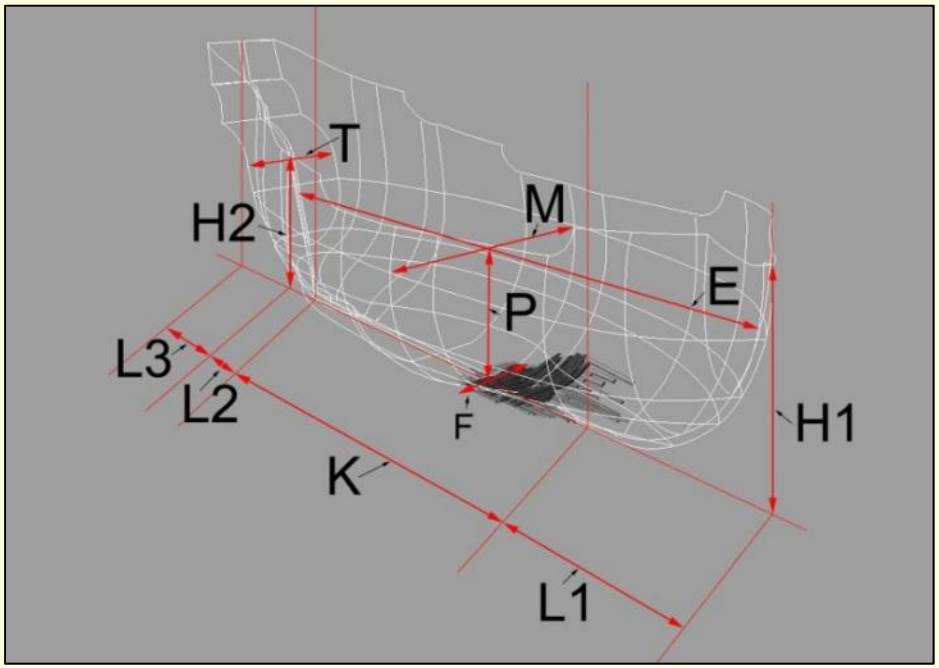
Nossa Senhora dos Mártires, 1606



San Juan, 1565

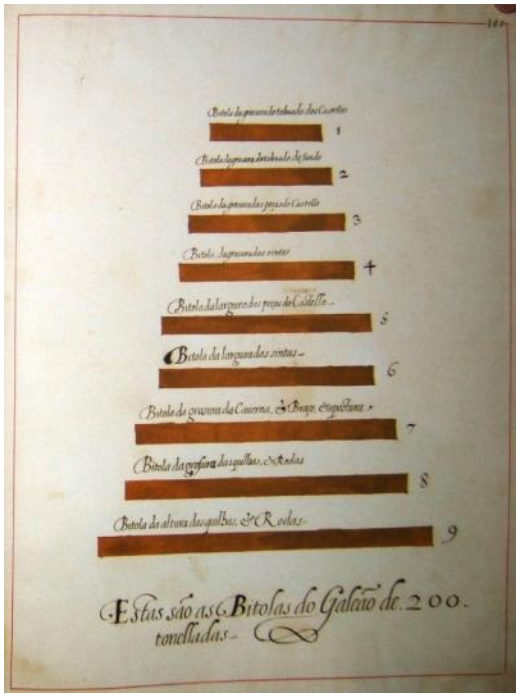
A ship in parameters

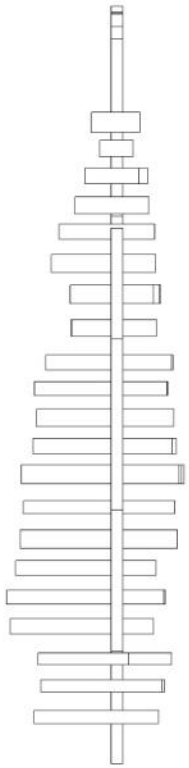
Designation
Date
Source
Country
Keel length (K)
Length overall (E)
Beam (M)
Depth in hold (P)
Flat (F)
Transom (T)
Runs: Height (Rh)
Runs: Length (Rl)
Entries: Height (Eh)
Entries: Length (El)

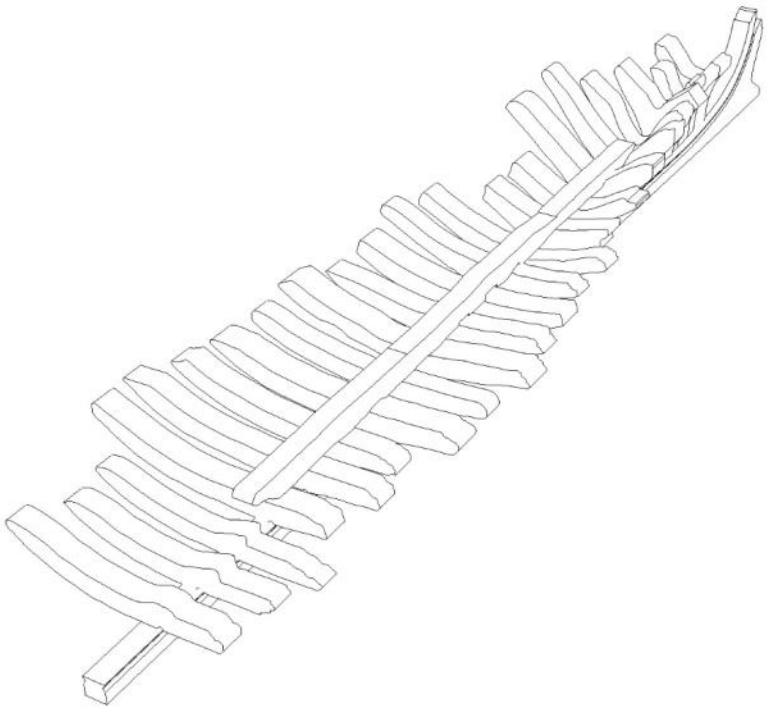


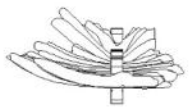
4.

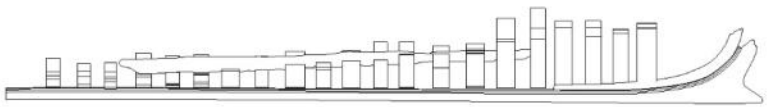
Scantlings → Treatises Shipwrecks







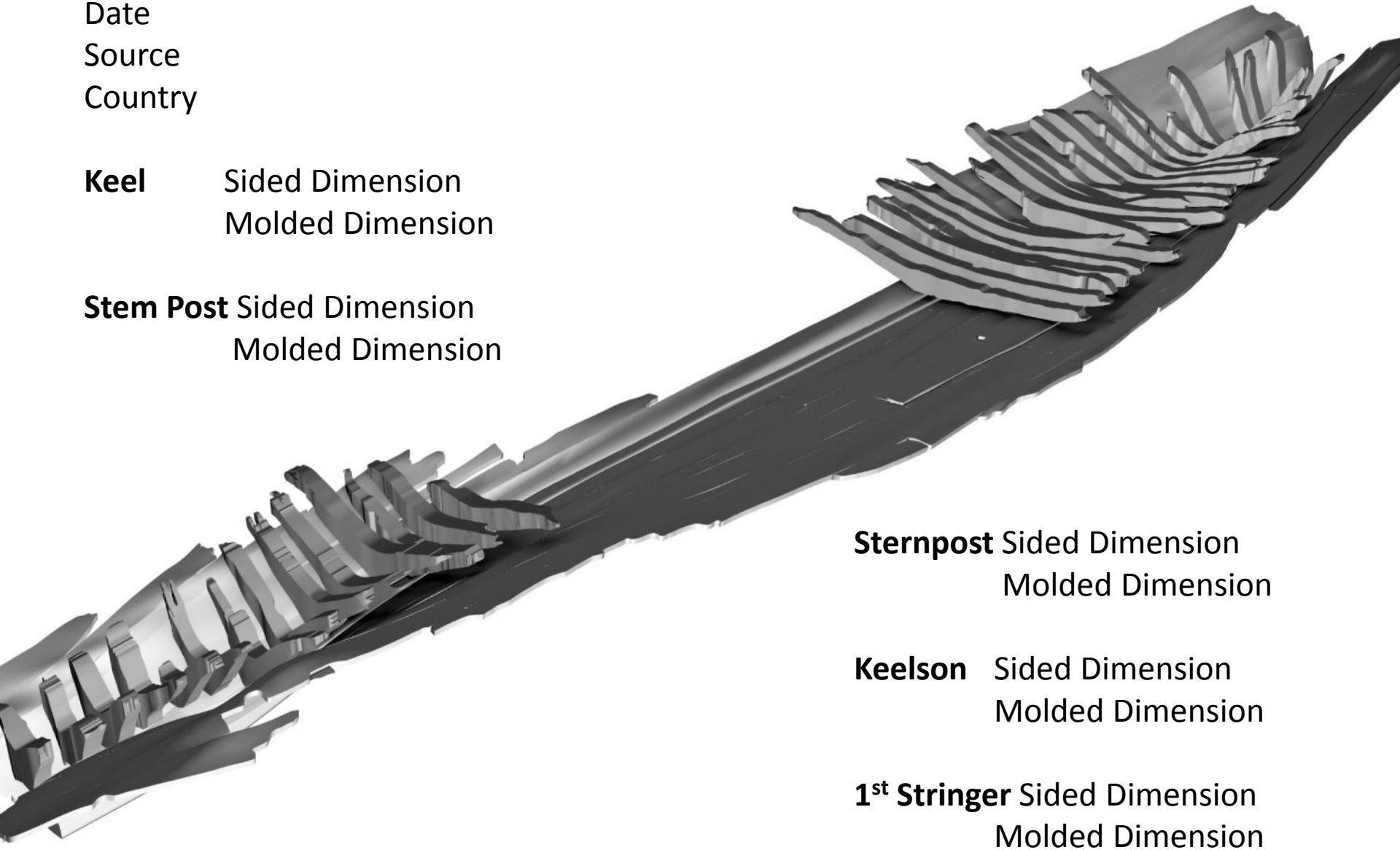




Designation
Date
Source
Country

Keel Sided Dimension
Molded Dimension

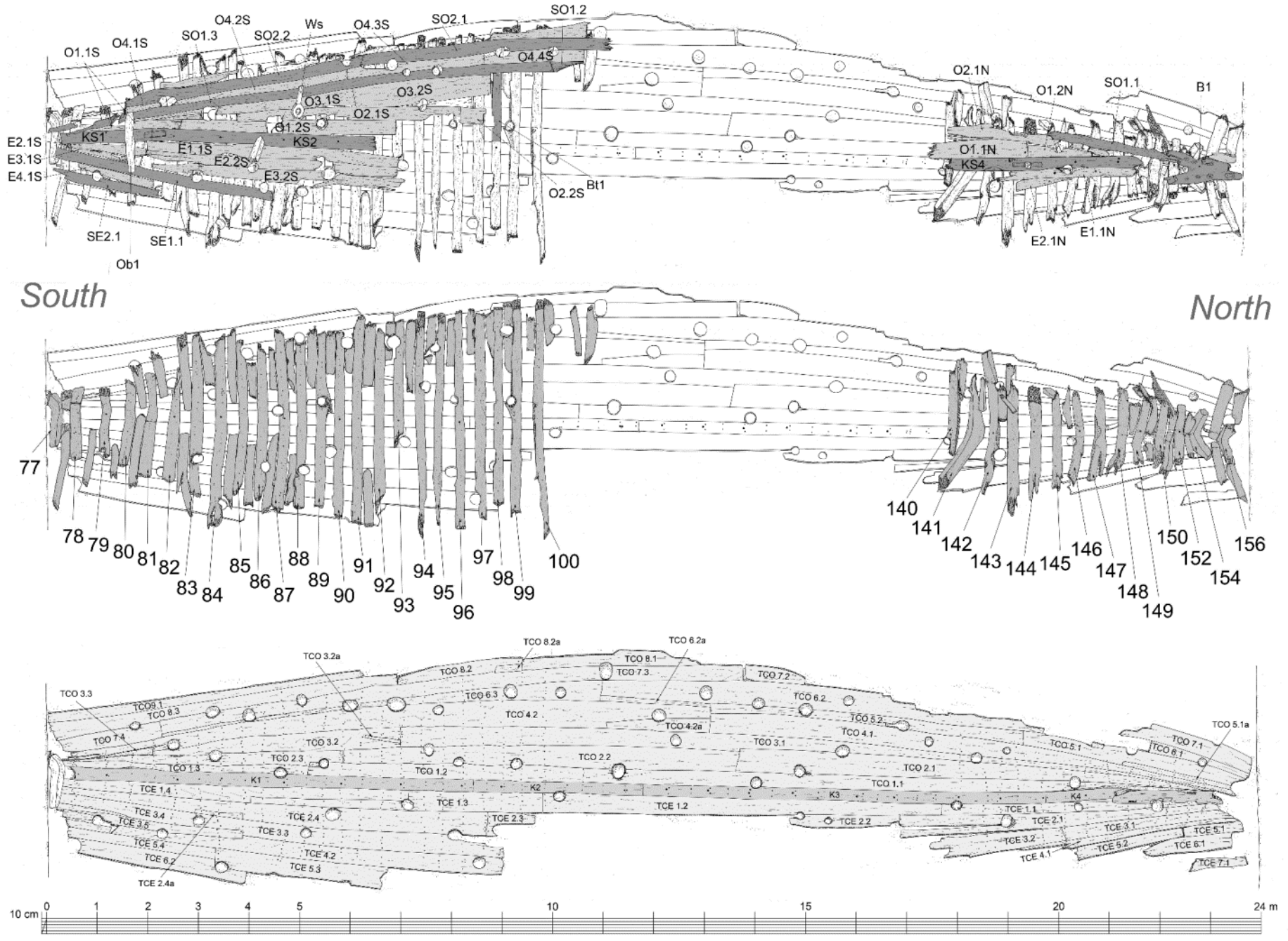
Stem Post Sided Dimension
Molded Dimension



Sternpost Sided Dimension
Molded Dimension

Keelson Sided Dimension
Molded Dimension

1st Stringer Sided Dimension
Molded Dimension


O1.1S
O4.1S
SO1.3
O4.2S
SO2.2
Ws
O4.3S
SO2.1
SO1.2
O4.4S
O3.1S
O3.2S
O2.1S
O1.2S
KS1
KS2
E1.1S
E2.2S
E3.2S
E2.1S
E3.1S
E4.1S
SE2.1
SE1.1
Ob1
O2.2S
Bt1
O2.1N
O1.2N
SO1.1
B1
O1.1N
KS4
E2.1N
E1.1N
South
North
77
78
79
80
81
82
83
84
85
86
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95
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142
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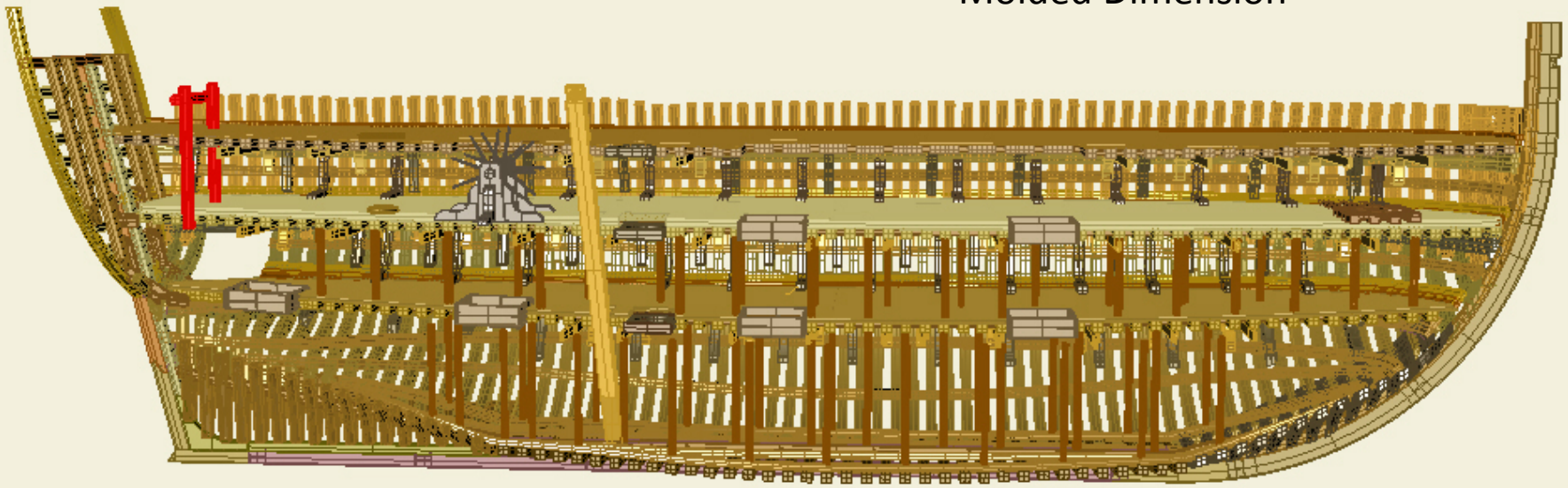
146
147
148
149
150
152
154
156
TCO 3.3
TCO 9.1
TCO 8.3
TCO 7.4
TCO 1.3
TCO 2.3
TCO 3.2a
TCO 8.2a
TCO 3.2
TCO 8.2
TCO 8.1
TCO 7.3
TCO 6.2a
TCO 6.3
TCO 4.2
TCO 4.2a
TCO 7.2
TCO 6.2
TCO 5.2
TCO 4.1
TCO 3.1
TCO 2.2
TCO 1.2
TCO 2.1
TCO 1.1
TCO 5.1
TCO 6.1
TCO 7.1
TCO 5.1a
K1
K2
K3
K4
TCE 1.4
TCE 3.4
TCE 3.5
TCE 5.4
TCE 6.2
TCE 2.4a
TCE 2.4
TCE 3.3
TCE 4.2
TCE 5.3
TCE 1.3
TCE 2.3
TCE 1.2
TCE 2.2
TCE 1.1
TCE 2.1
TCE 3.2
TCE 4.1
TCE 3.1
TCE 5.2
TCE 5.1
TCE 6.1
TCE 7.1
10 cm
0
1
2
3
4
5
10
15
20
24 m

Perspective

Floors Sided Dimension
Molded Dimension

1st Futtocks Sided Dimension
Molded Dimension



2nd Futtocks Sided Dimension
Molded Dimension

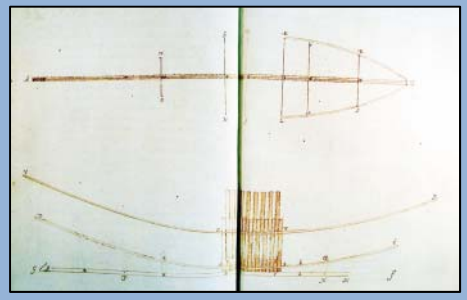
Planking Widths
Thickness

Ceiling Widths
Thickness

7.

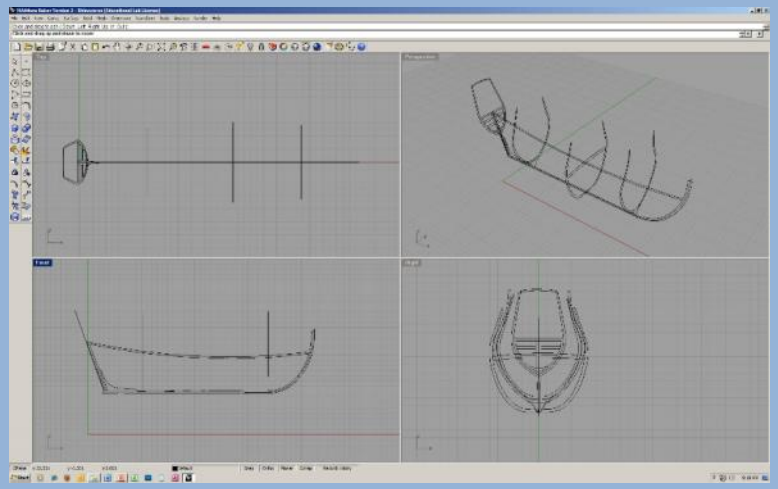
Technical drawings

- Treatises

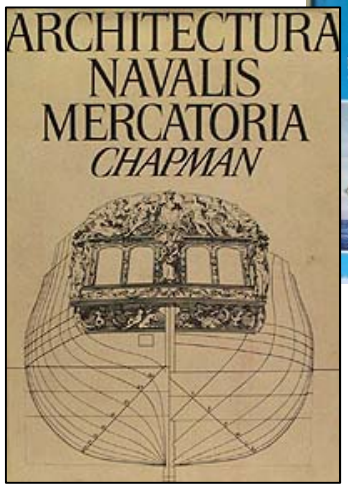


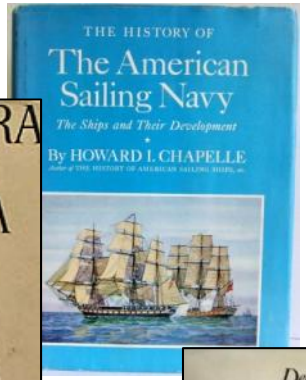
J. B. Lavanha c. 1600

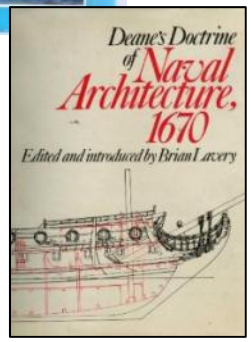
- Contracts
- Compilations → automation 3D lines drawings



Developing databases of ship shapes.

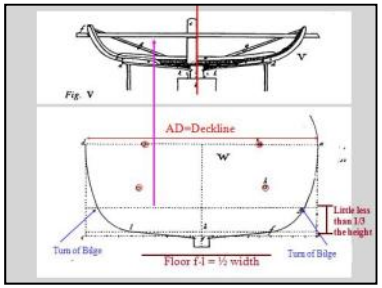




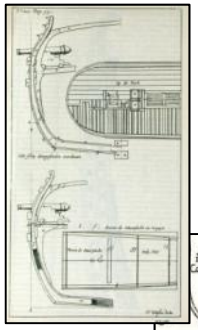


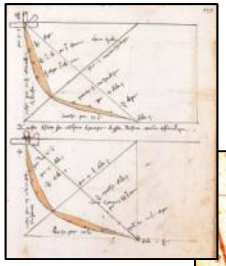
There are dozens of collections of lines drawings published.

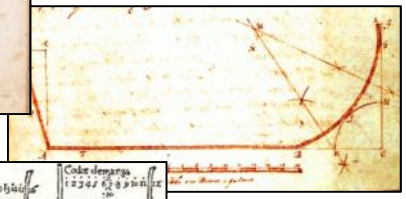
The work of François Edmont Paris (1806-1893).

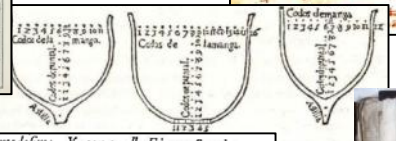


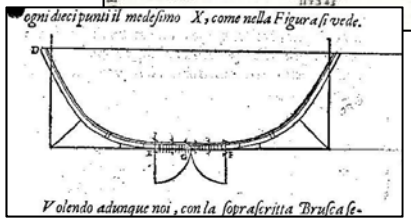
Shipbuilding Recipes.

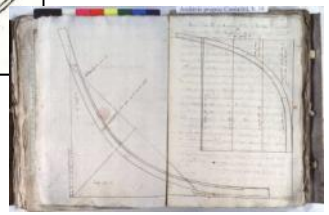










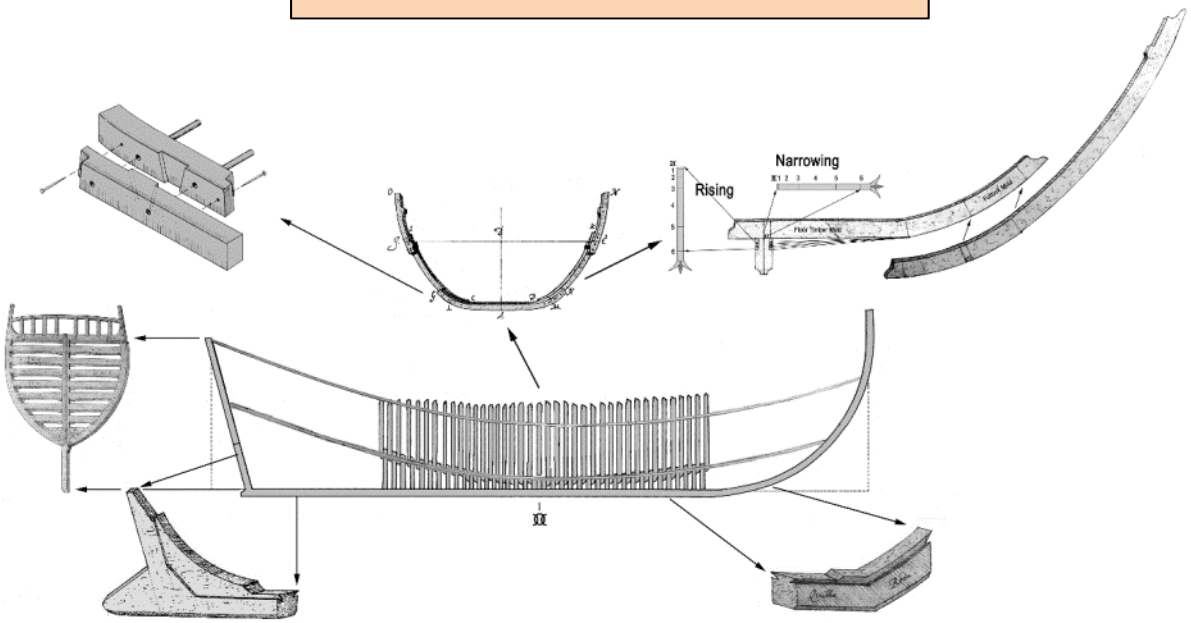


6.

Architectural signatures

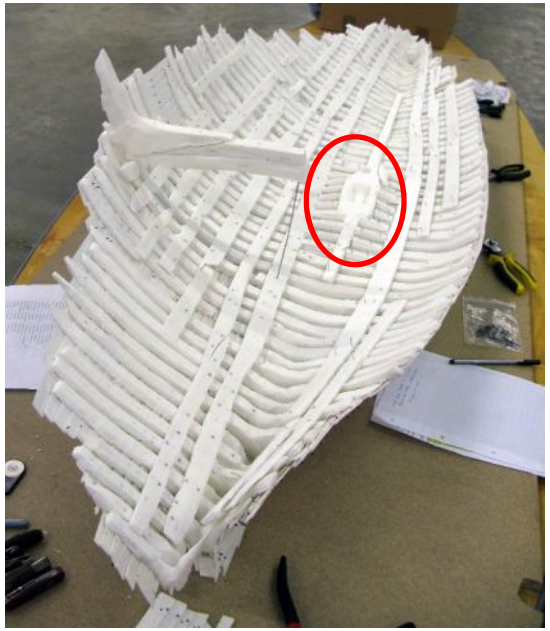
Database
(e.g. Tom Oertling list of traits)

Or:
- Carpenter marks
- Numbered frames
- No. of pre-designed frames
- Floor-futtock scarves
- Bow heel
- Stern heel



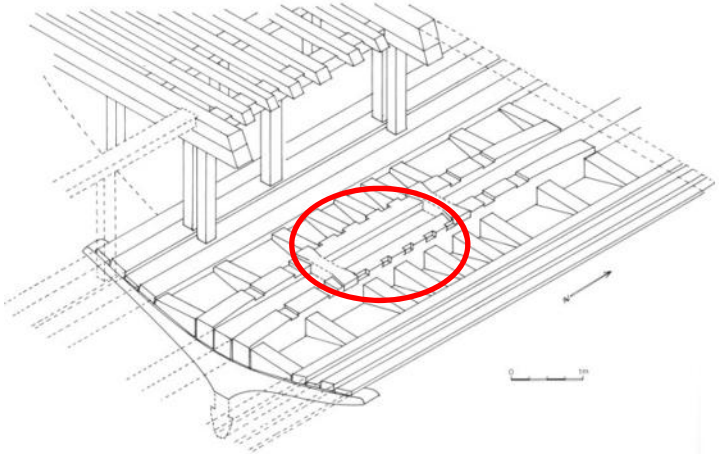
6.

Architectural signatures



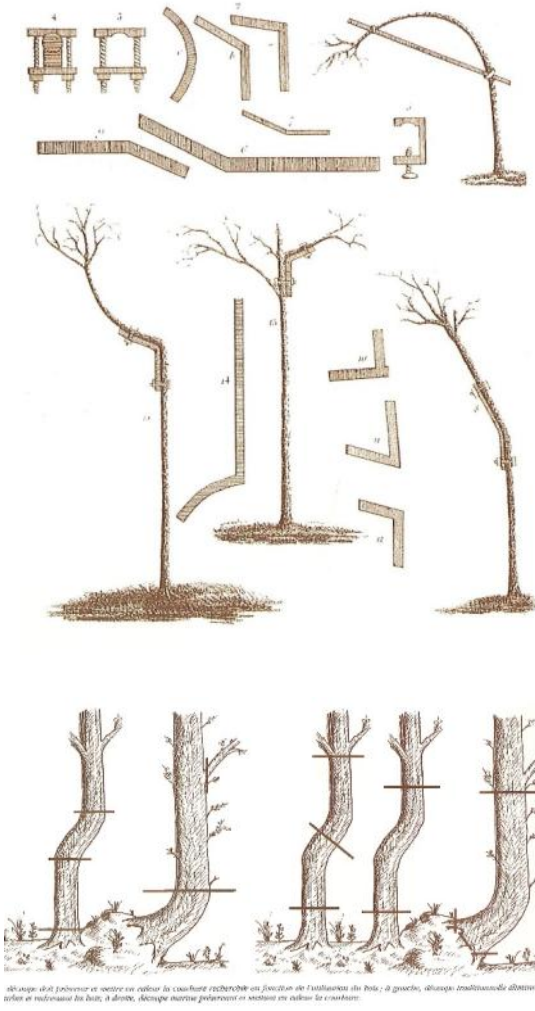
Atlantic:
Maststeps as an enlargement of the keelson
Hooks/Couces
Dovetail scarves

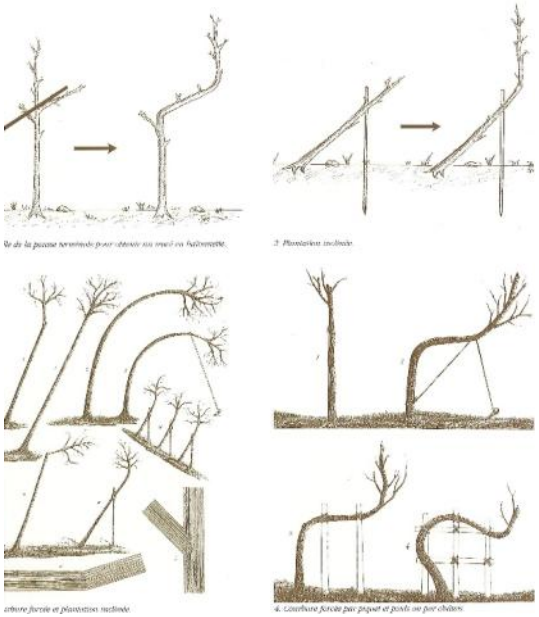
Mediterranean:
Maststeps between sister keelsons
Simple connections keel/posts
Hooked scarves

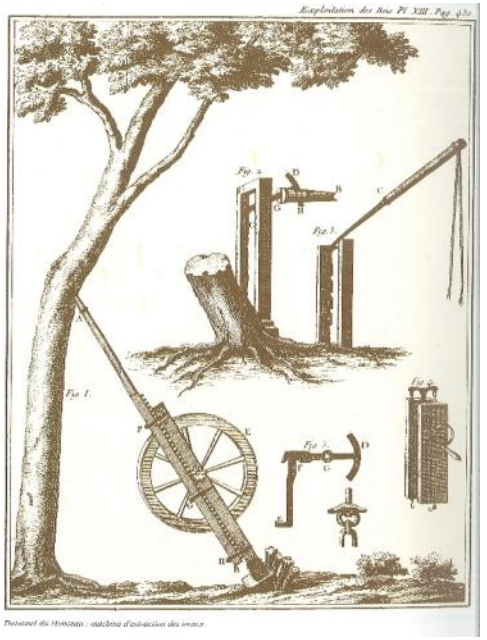


Dendrochronology

- Tree species
- Quality (over time)
- Tree typologies (forest degradation through constantly cutting the best trees?)
- Evidence of pruning/shaping?
- Tree size
- Tree age
- Falling date
- Conversion
- Provenience







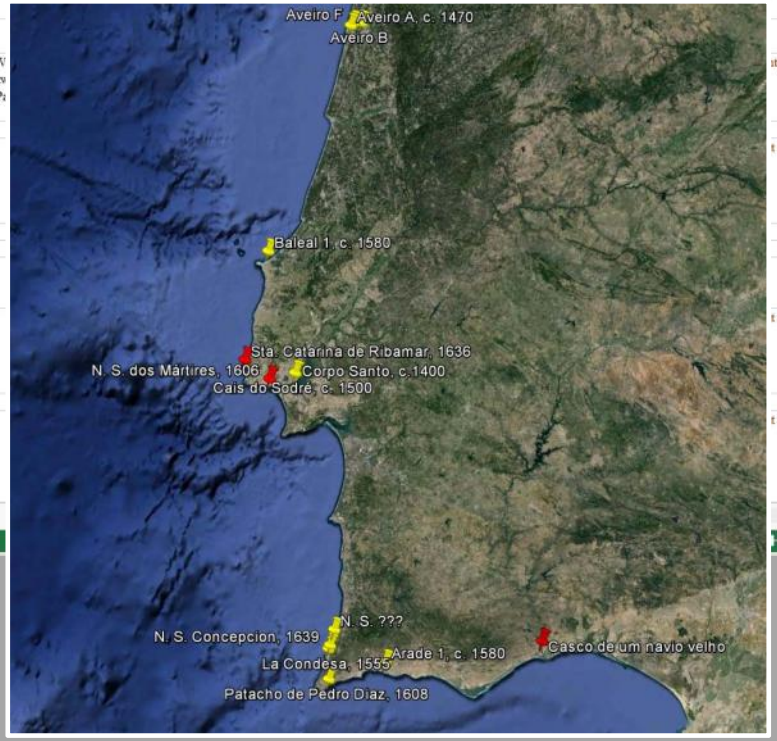
Post-Med Ships Feb 20-2014 - Excel

Castro, Filipe

	Shipwreck	Northing	Zone	Route	Nationality	Lost - Country	Lost - Place	Depth	Found	Status	Publications (see Biblio)	Timber remains	Ballast Pile	Type	Tonnage
				1										2 - General Dimensions	
223	*Witte Leeuw*			I. Route	Dutch	St. Helena					Not published				
224	*Batavia*			I. Route	Dutch	Australia	Morning Reef, W. Australia			Excavated by J. Green	Several articles and an excellent dissertation in print by W. van Duivenvoorde				
225	*Utrecht*					Brasil	Bahia								
226	*Vergulde Draeck*			I. Route	Dutch	Australia	Ledge Point								
227															
228															
229															
230															
231	Mediterranean														
232	Cavalière			Med.		France	Cavalaire sur mer	12m	1992	excavated 1994-5	One paper	extensive			
233	Hvar HV0536			Med.		Croatia					Not published				
234	Mortella 2			Med.		Corsica					One report				
235	Mortella 3			Med.		Corsica					One report				
236	Lake Garda			Med.	Venetian?	Italy	Lazise, Lake Garda	24-27m	1960	Surveyed by Capulli and Bondioli. 642 wood fragments	One book	extensive; but damaged by trawler	stone ballast	galley (fusta?)	
237	San Vito lo Capo			Med.		Italy	San Vito lo Capo, Sicily	3.5m	1988						
238	Villefranche *(Lomellina)*			Med.	Genoese	France	Villefranche	18	1979, April 6, by Alain V surveyed by DRASM t under the direction of P Grandjean.					itman	600 tons?
239	Casarossa			Med.		Italy									
240	Contarina 2			Med.		Italy	Contarina, Porto Viro, Rovigo	4.3 m	1898					t	
241	Lido 1			Med.		Italy									
242	Lido 2			Med.		Italy									
243	Yassiada 16th Century			Med.		Turkey	Yassi Ada		1967						
244	Calvi 1			Med.	Ragusan? The timber is abundant in the Adriatic.	France	Calvi, Corsica	7-9m	1979					t	
245	*Parissona grossa*			Med.		Italy									
	Gagliana grossa			Enroute from Venice to Istanbul?		Croatia	Gnalic rock	24-27m	early 1960s					t	

Iberian | North Atlantic & Baltic | Mediterranean

READY

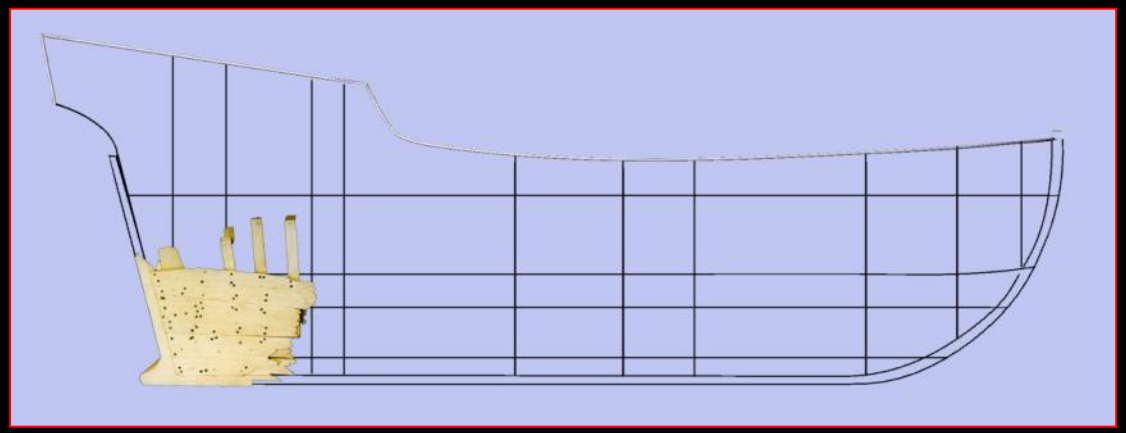


shipwreck database

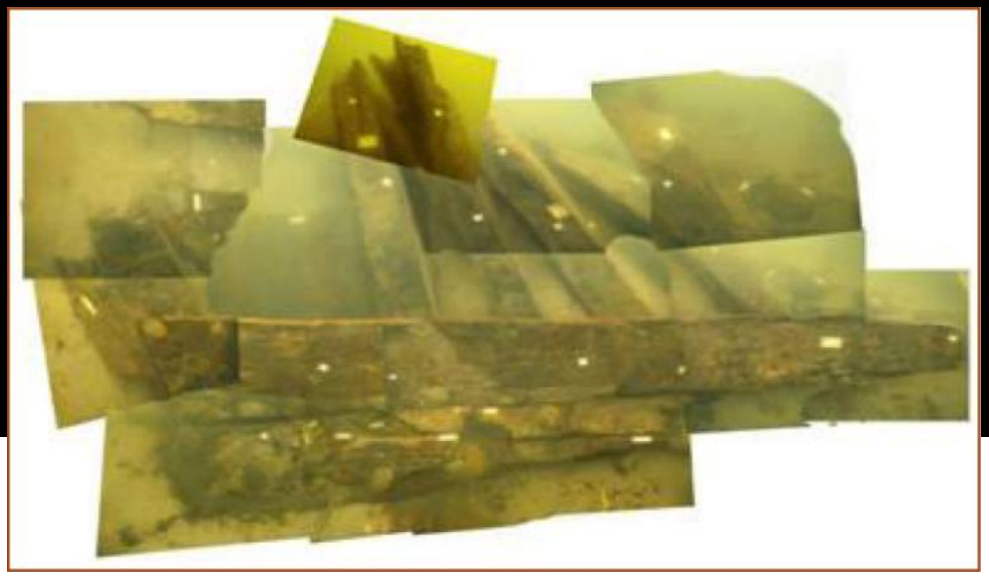
c. 200 shipwrecks

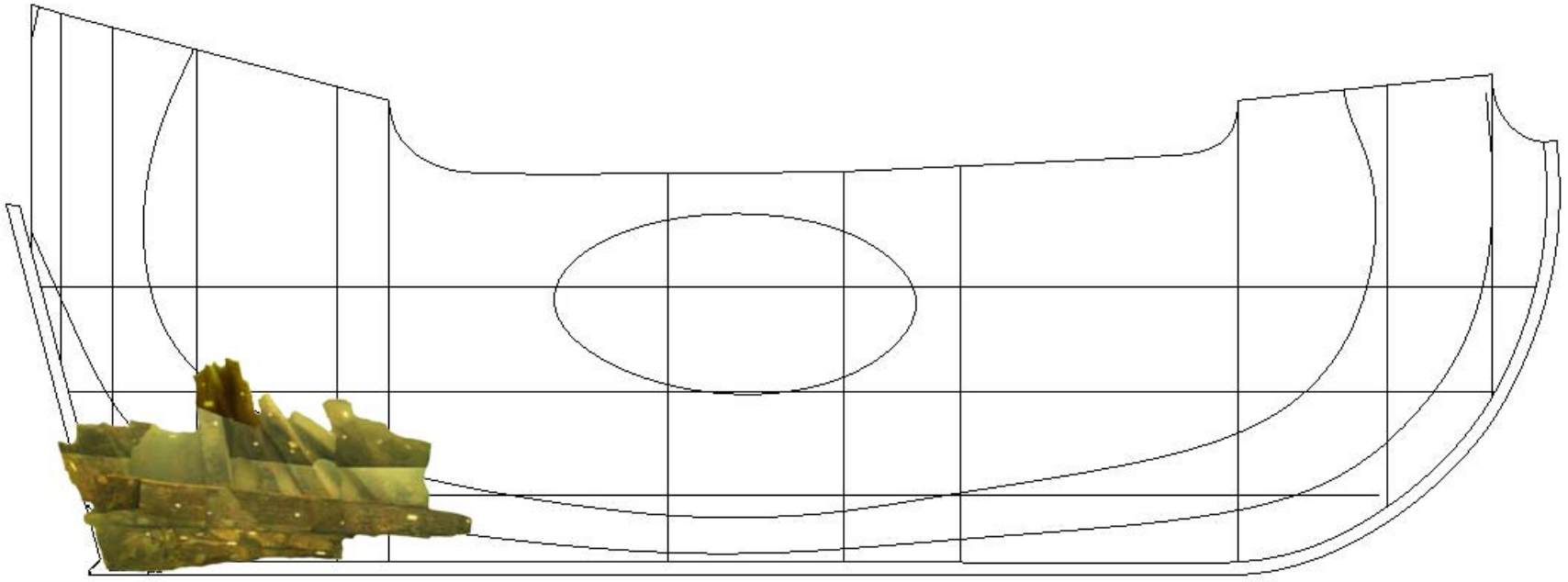
1. Corpo Santo, c. 1400

Keel	11	13
Sternpost	11	13
Stern heel	11	15
Y-frames	12	16
Room-and-space	32	-
Planking	20	4.3

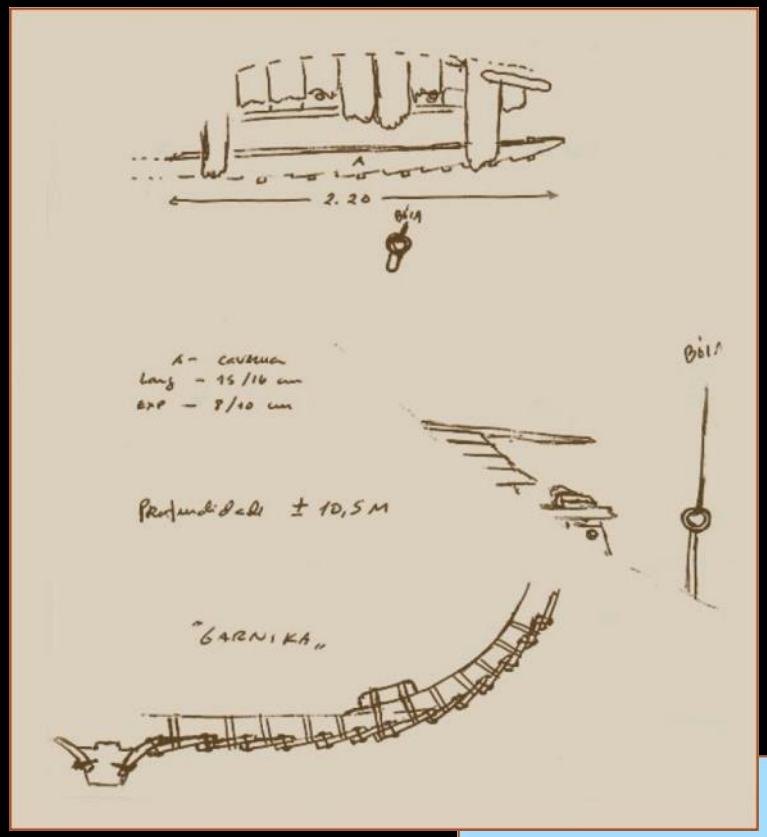


2. Aveiro F, c. 1400

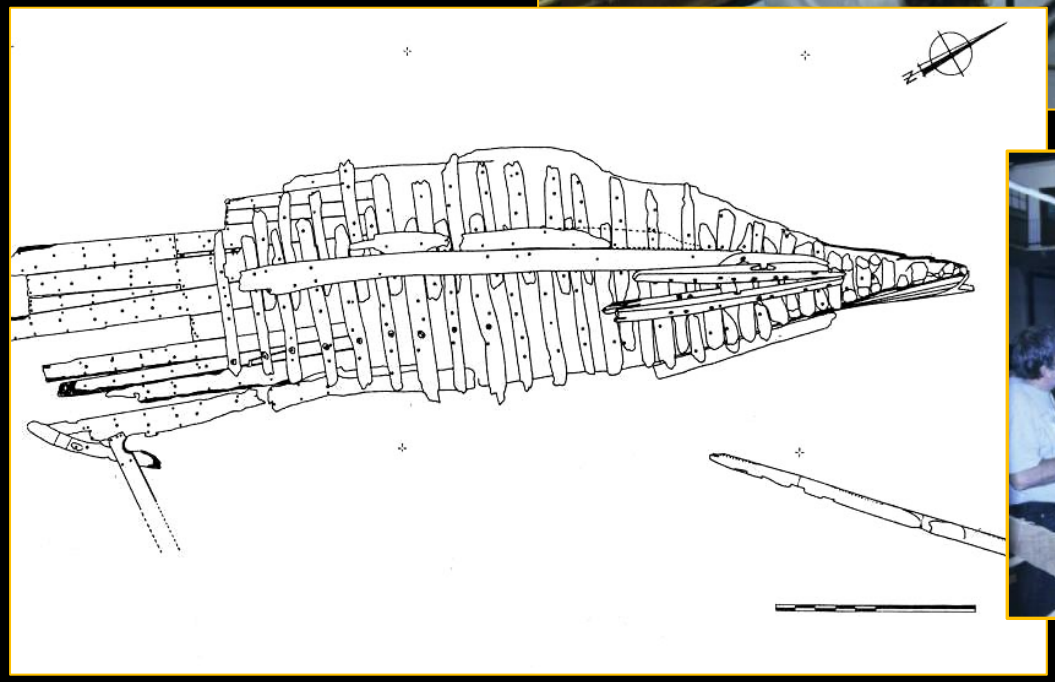




3. Aveiro G, c. 1410



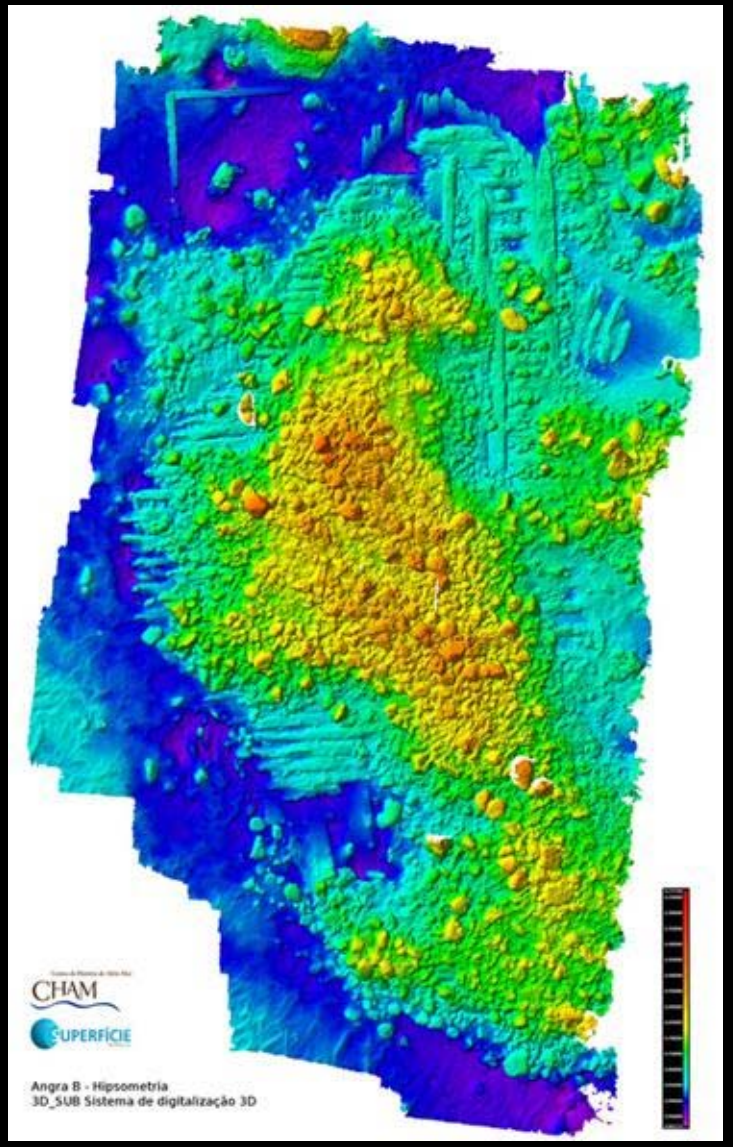
4. Aveiro A, c. 1450



5. Cais do Sodré, c. 1500

Keel	25	27
Keelson	27	26
Floor timbers	18-22	18-22
futtocks	18-20	18-20
Room-and-space	46	-
Planking	20	7-8

6. Aveiro B, c. 1500

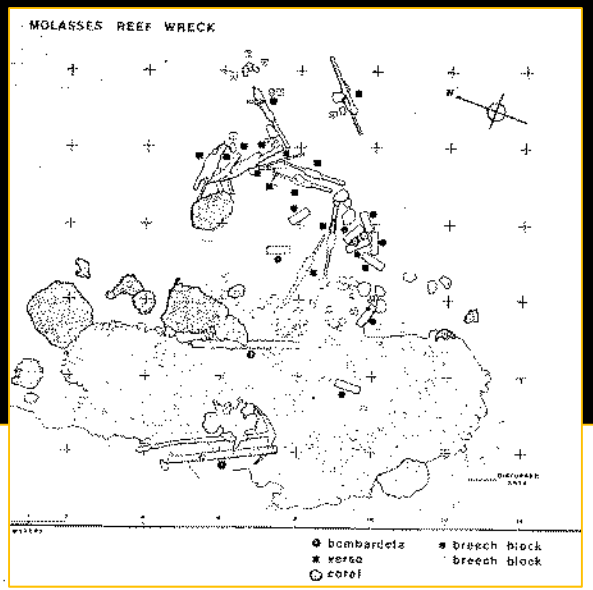


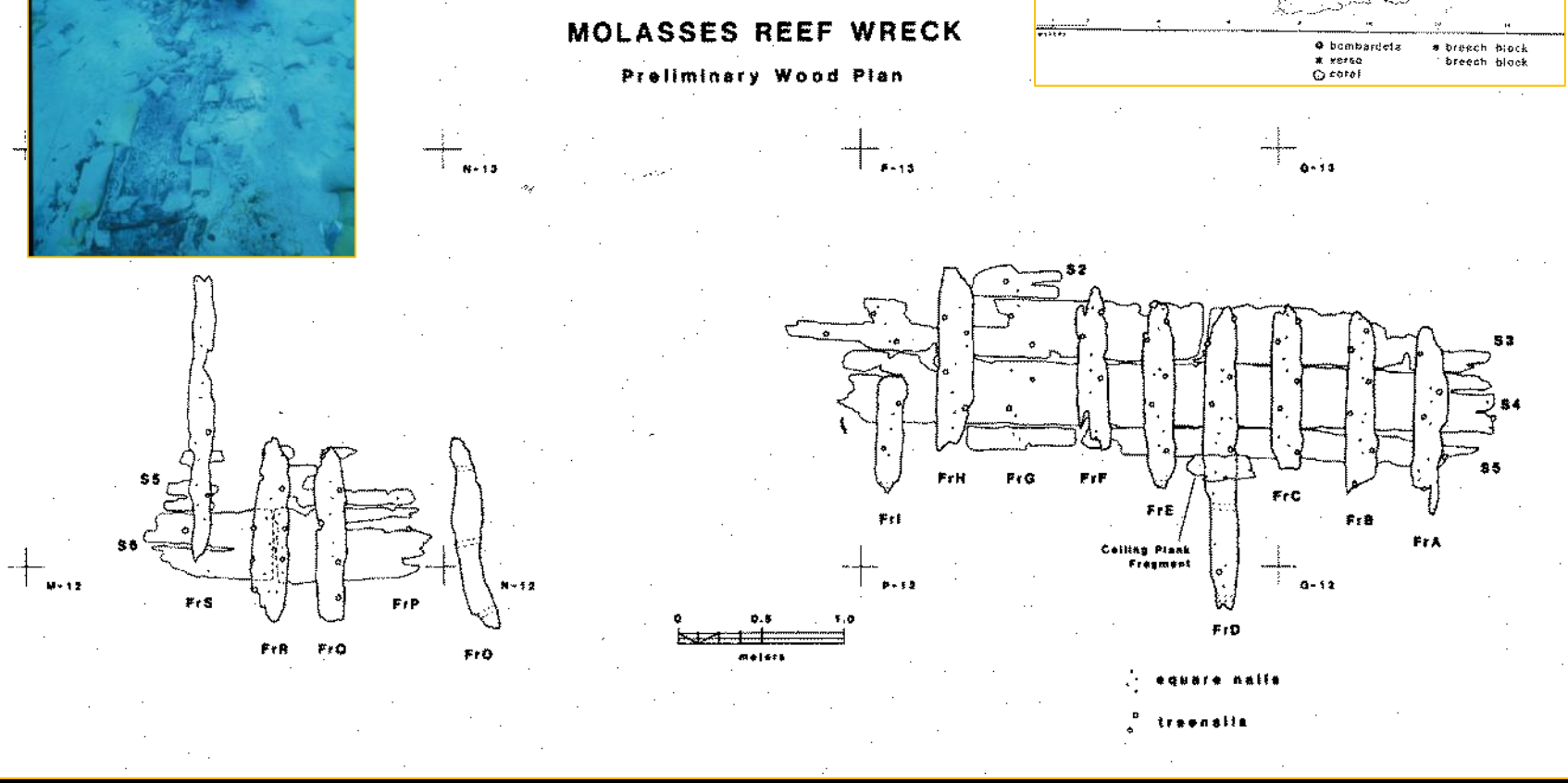
7. Aveiro C, c. 1500

8. Aveiro E, c. 1500

9. Molasses Reef, c. 1510

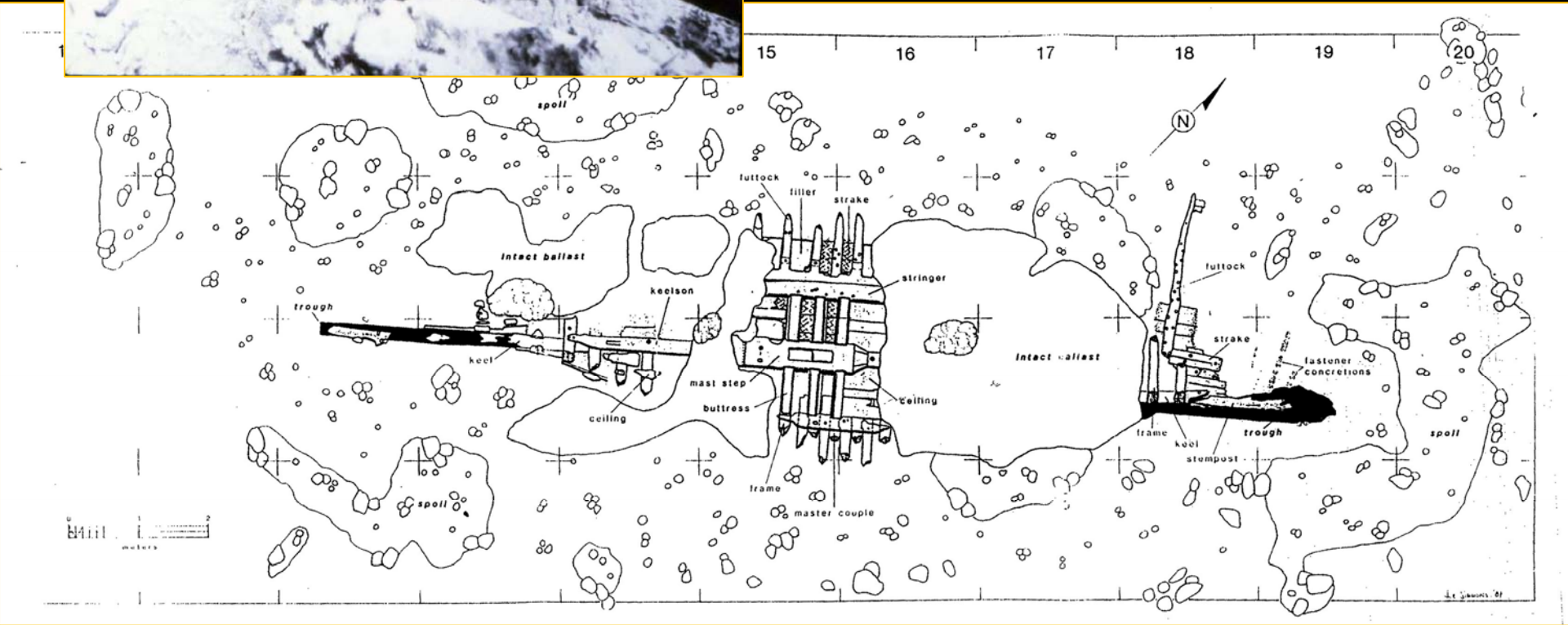
Keel	unknown	unknown
Floors	16	16-17
Futtocks	16	16-17
Room-and-space	32.5	-
Planking	30	4.5
Ceiling	14	2





10. Highborn Cay, c. 1520

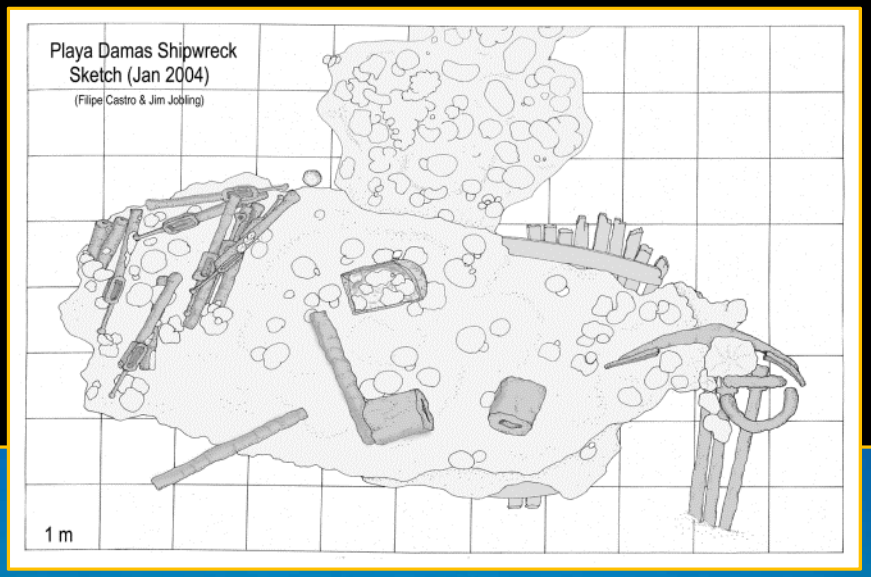
Keel	15-16.5	21
Keelson	16-21	17
Maststep	40	25
Mortise	15-17 x 65	13.5-15.5
Buttresses	11.8-13.5	16-21.9
Floors	16.5	17.5
Futtocks	16.5	17.5
Room-and-space	40	-
Planking	8-25	6
Ceiling	12-31	3
Foot wale	?	?
Main mast ∅	35 min.	-

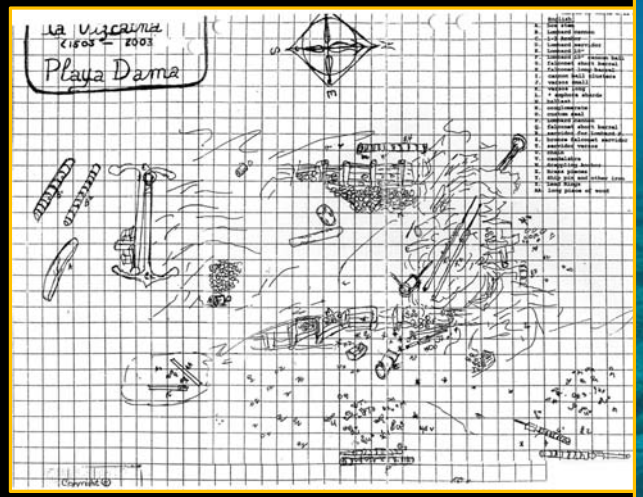


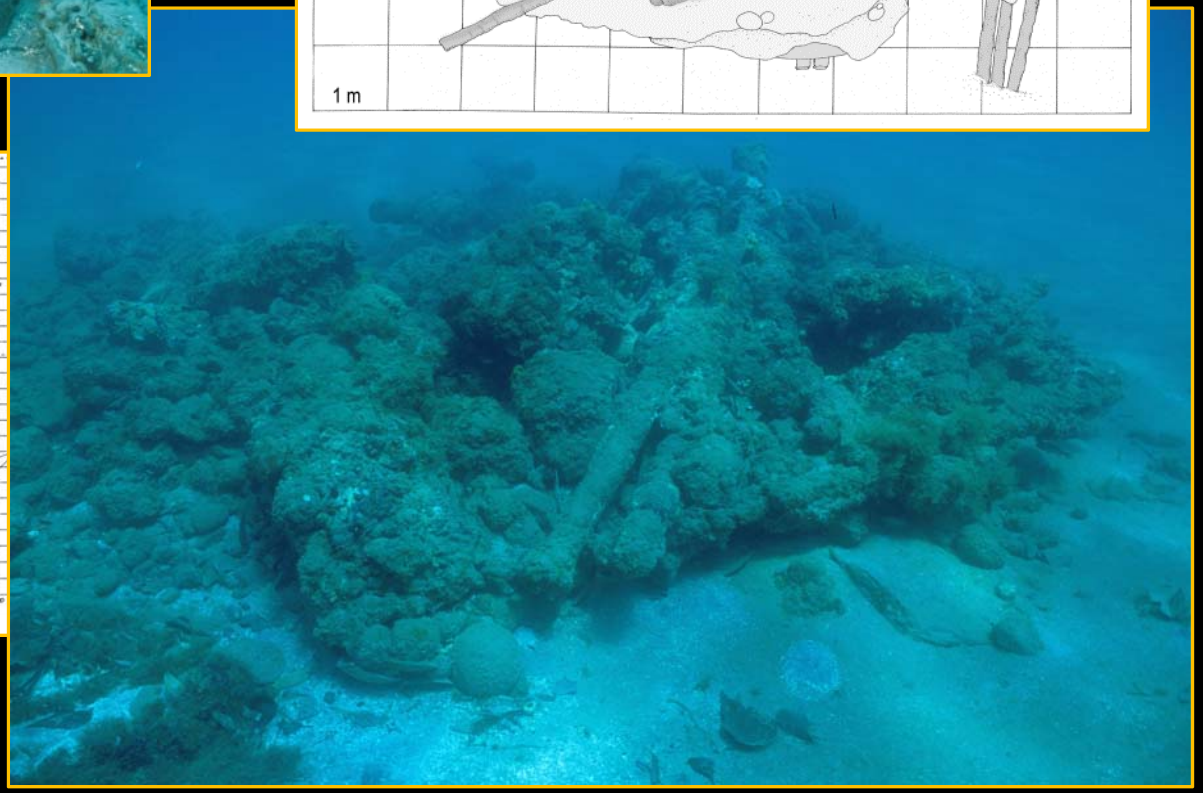
11. *Bom Jesus*, c. 1533

Futtocks	16-23	18
Room-and-space	47	-
Planking	17-26	9
Ceiling	?	2
Clamp	20	35

12. Playa Damas Shipwreck, c. 1530







13. Studland Bay, c. 1525

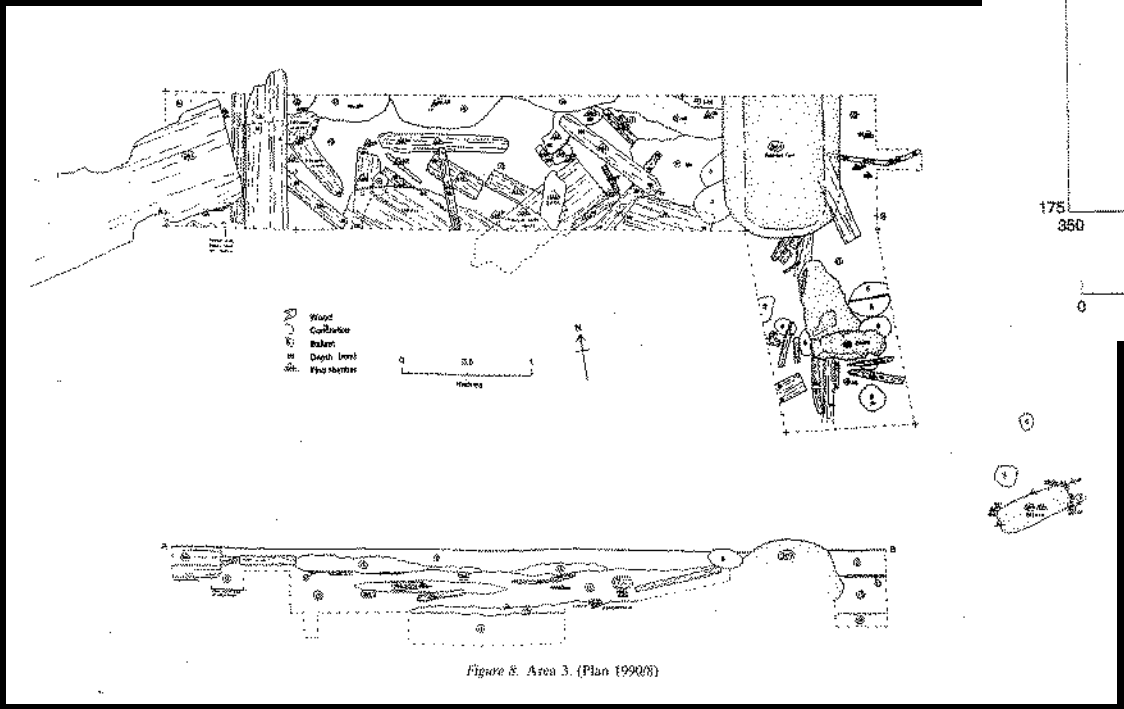
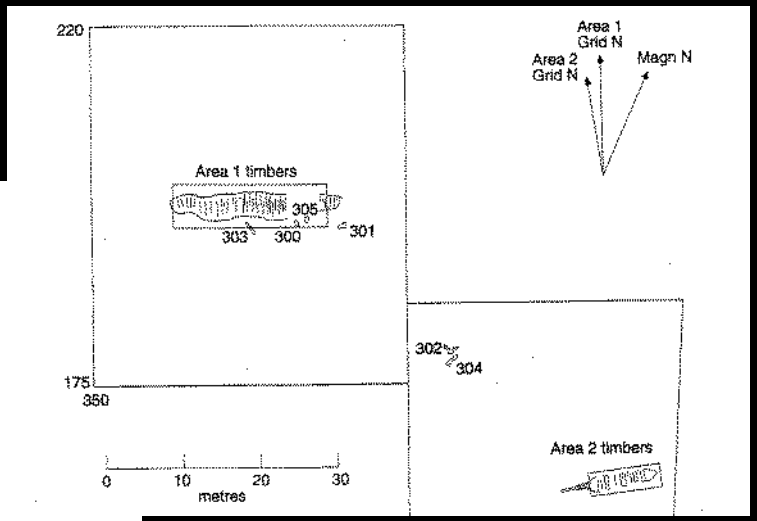


Figure 8. Area 3. (Plan 1990/8)



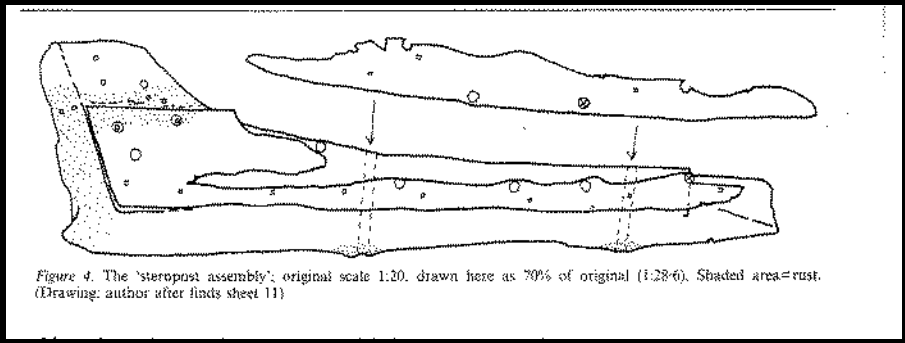
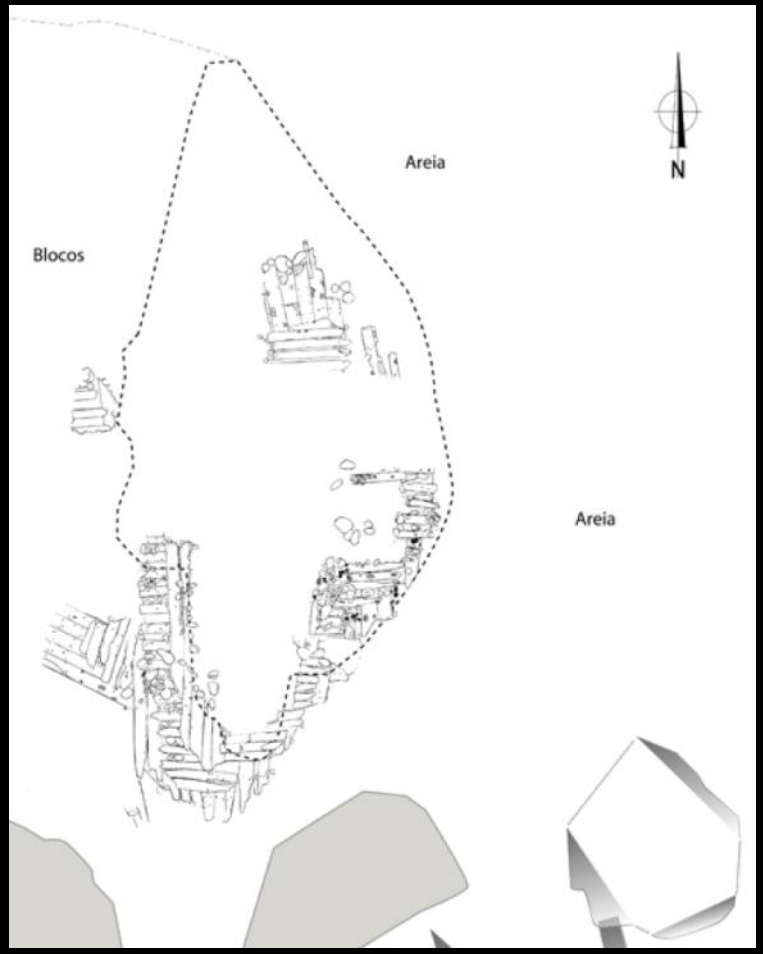


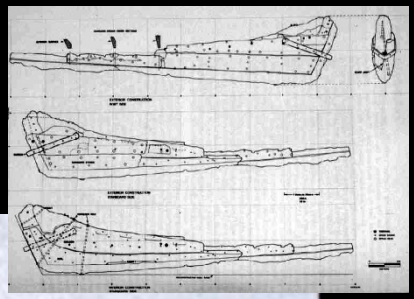
Figure 4. The 'sternpost assembly'; original scale 1:20, drawn here as 70% of original (1:28·6). Shaded area = rust. (Drawing: author after finds sheet 11)

14. Angra B, 1500-1600

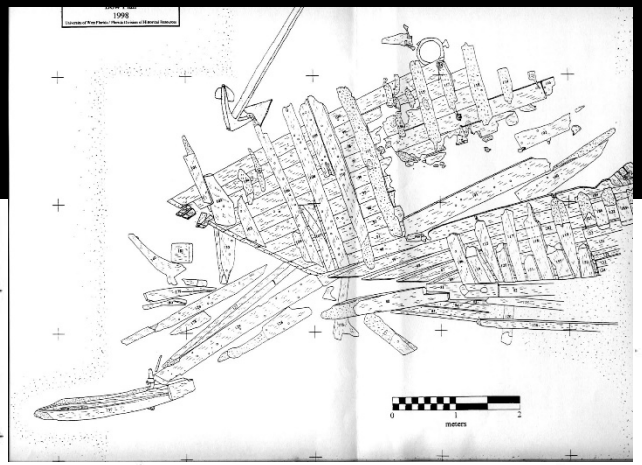


15. *San Esteban*, 1554

Keel	31	27
Floors	21-25	unknown
Futtocks	unknown	unknown
Room-and-space	42-44	-
Planking	19	10
Ceiling	unknown	unknown

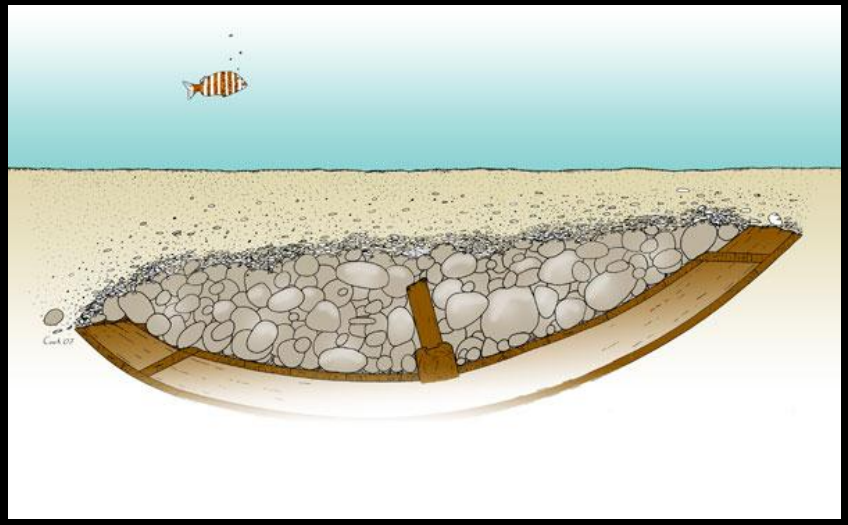


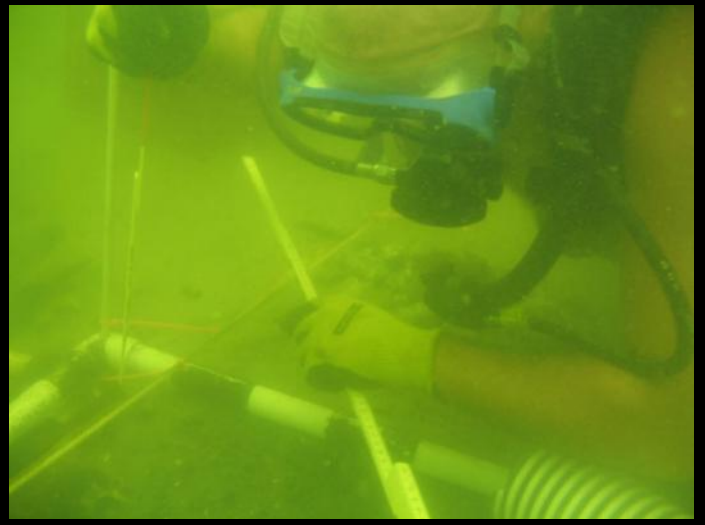
16. Emanuel Point / Pensacola 1, 1559



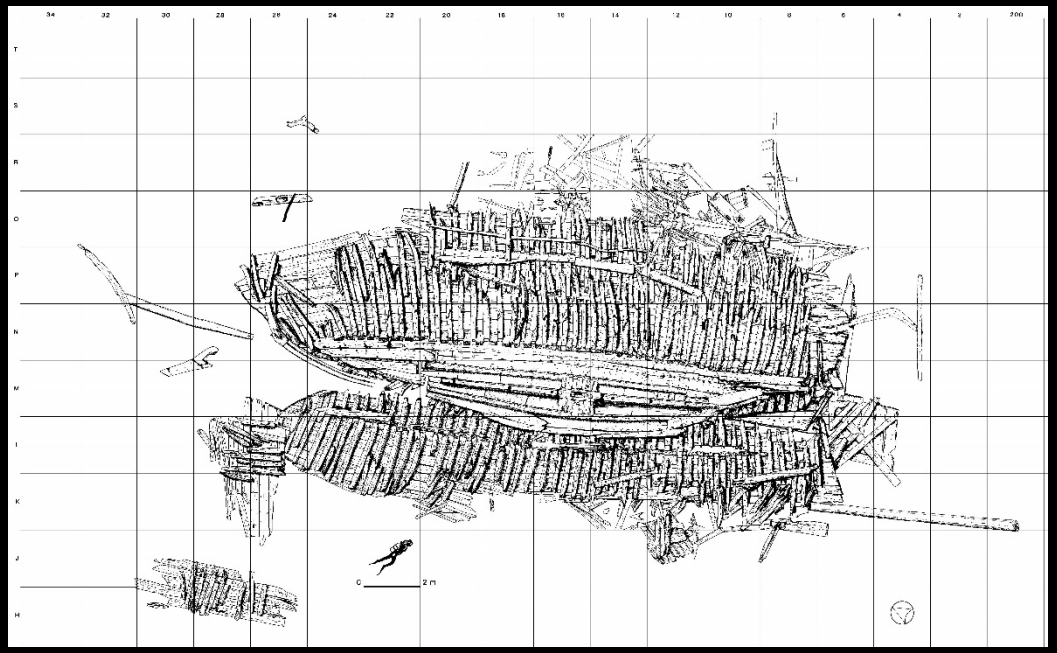
Keel	28-31-22-20	29
Stem post	31-28	30-28
Sternpost	25	35
Keelson	22-35-22	29
Maststep	47	39
Floors	18-20	18
Futtocks	18-20	19
Room-and-space	36-38	-
Planking	14-33	7.5
Ceiling	31-34	5-7

17. Pensacola 2, 1559

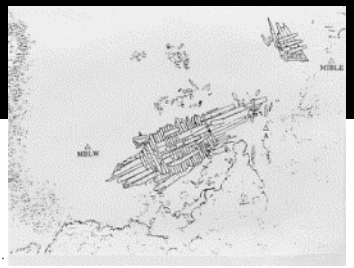


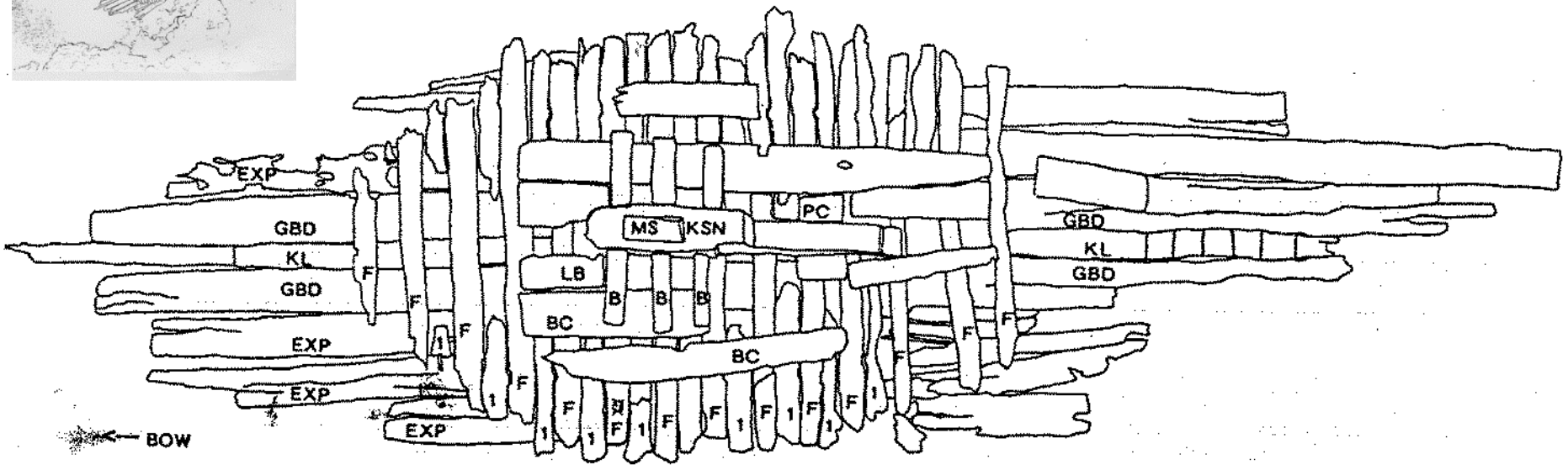


18. *San Juan*, 1565

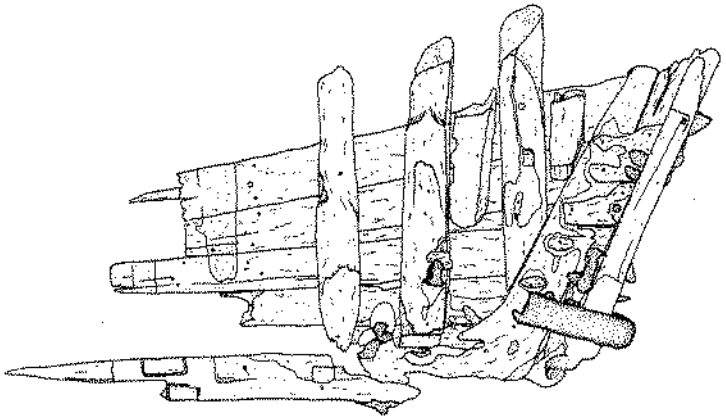


19. Western Ledge Reef Wreck, c. 1584

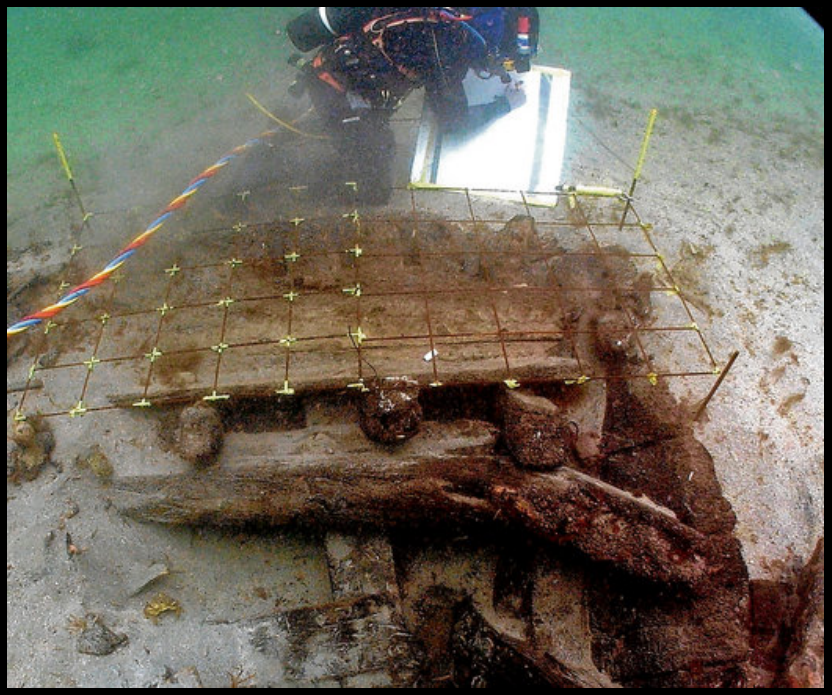




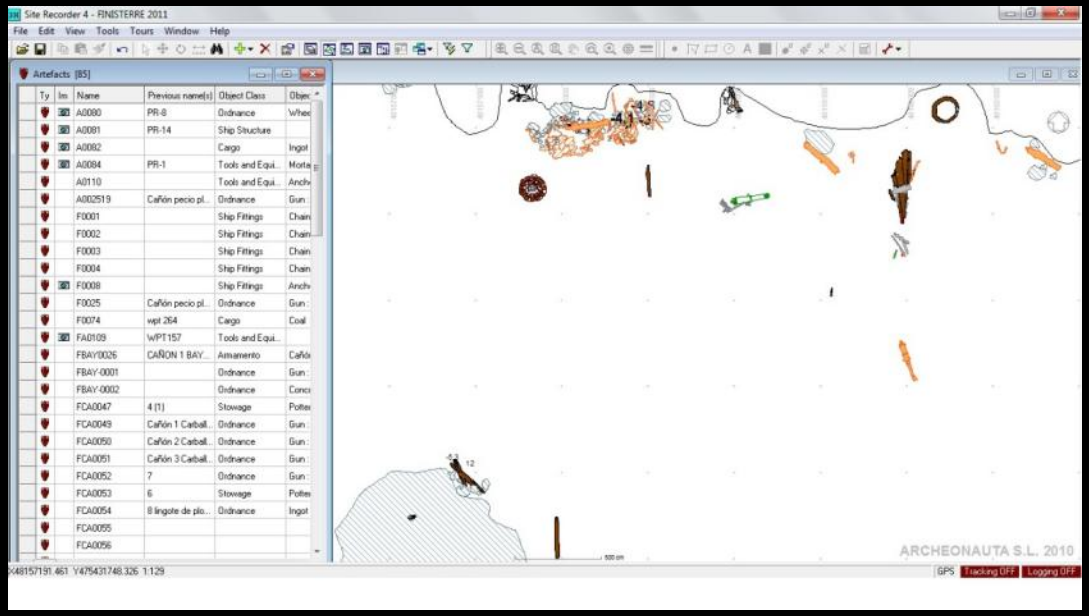
Keel	?	?
Keelson	20	17
Maststep	32	?
Sternpost	20	?
Floors	?	?
Futtocks	?	?
Room-and-space	?	-
Planking	26-37	3.5-4
Ceiling	?	3

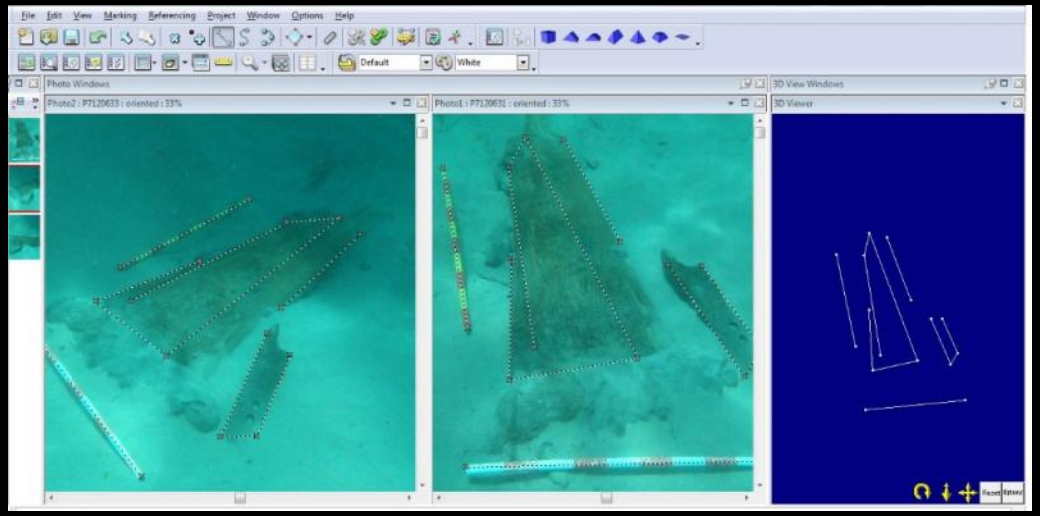


20. Ruthland, 1588

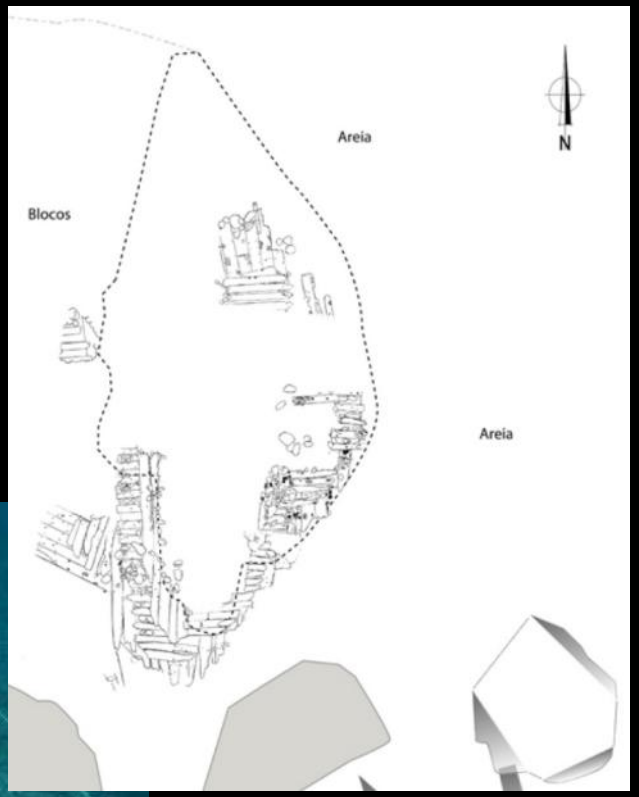


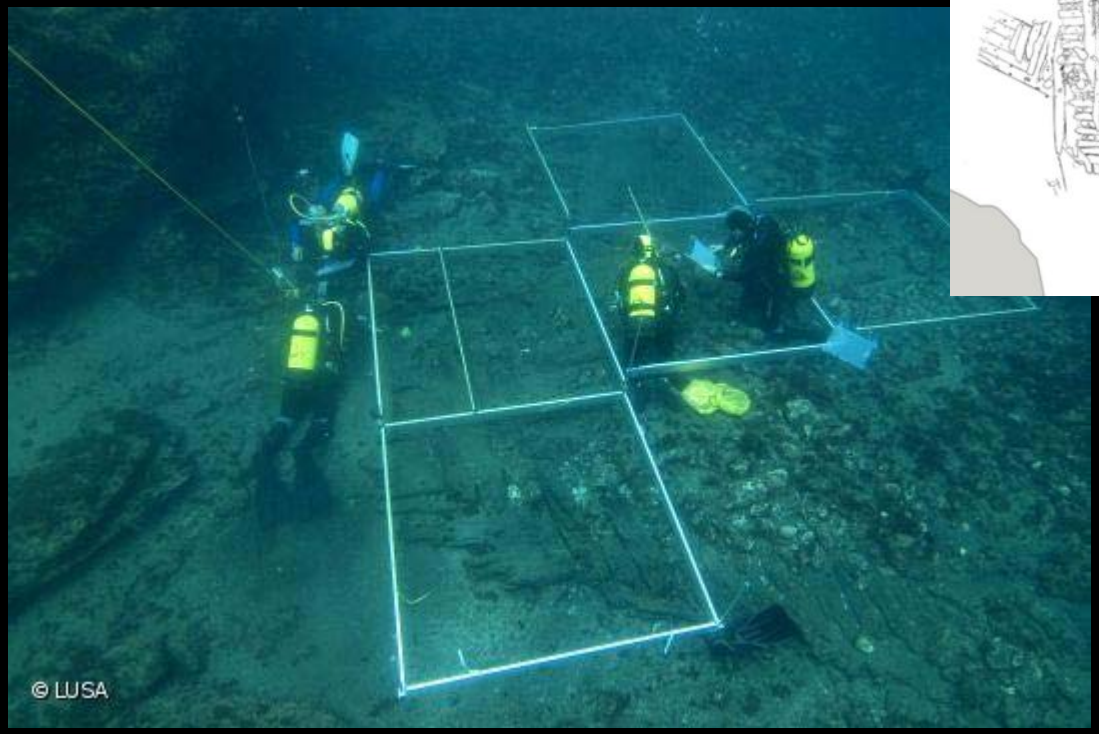
21. Punta Restelos, 1596





22. Angra B, c. 1600





23. Angra B1, c. 1600

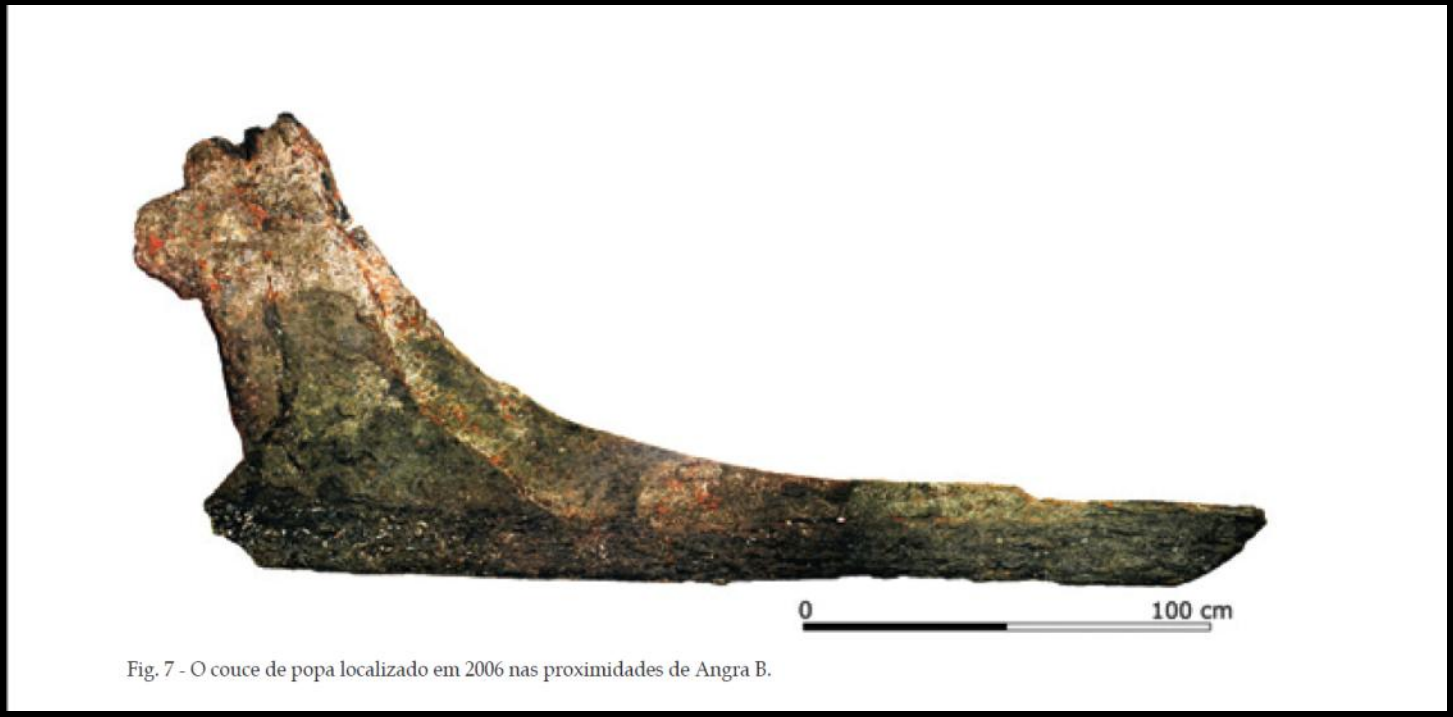
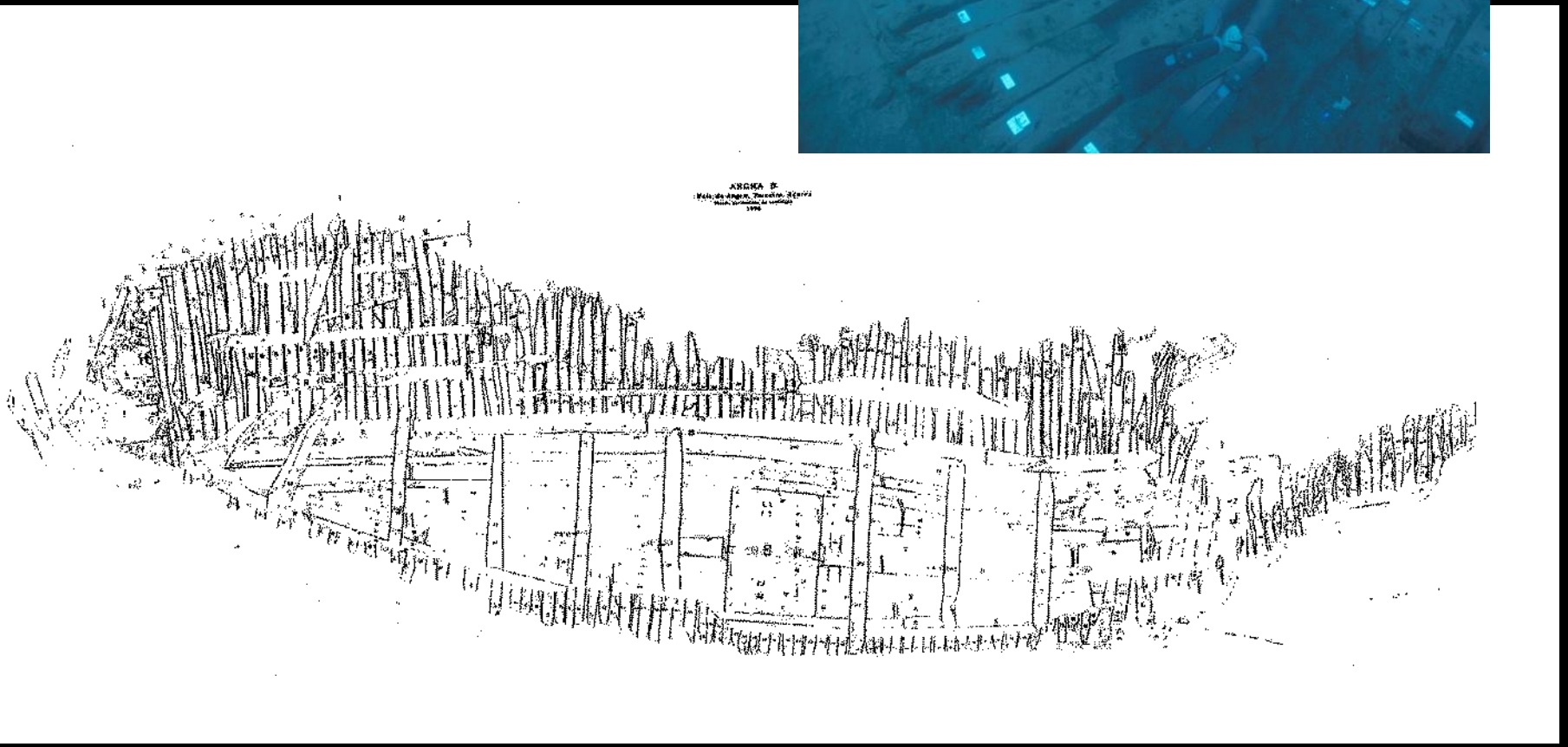


Fig. 7 - O couce de popa localizado em 2006 nas proximidades de Angra B.

24. Angra D, c. 1600



25. Angra E, c. 1600

26. Angra F, c. 1600

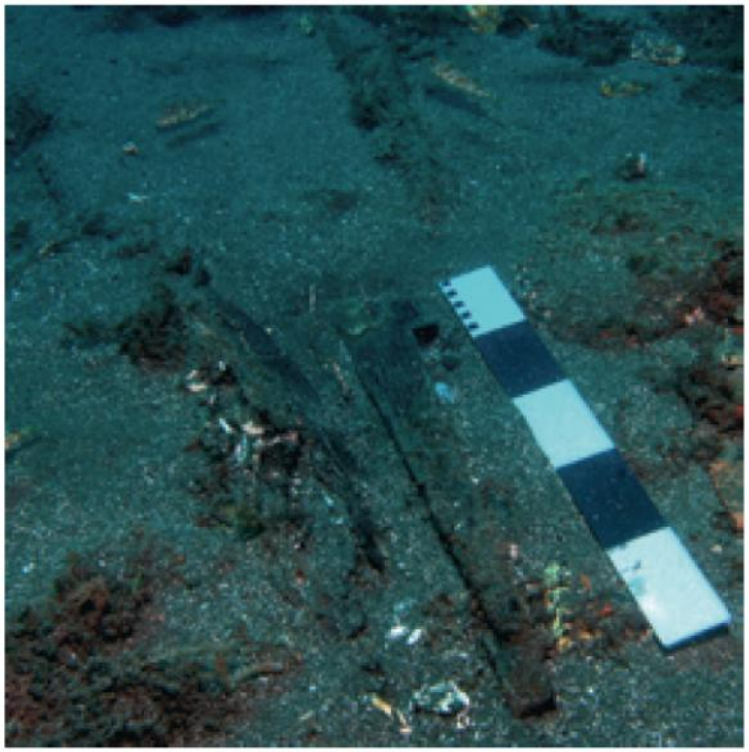


Fig. 9 - A quilha exposta em 2008: na foto é visível a escarva e o alefriz para encaixe da tábua de resbordo.

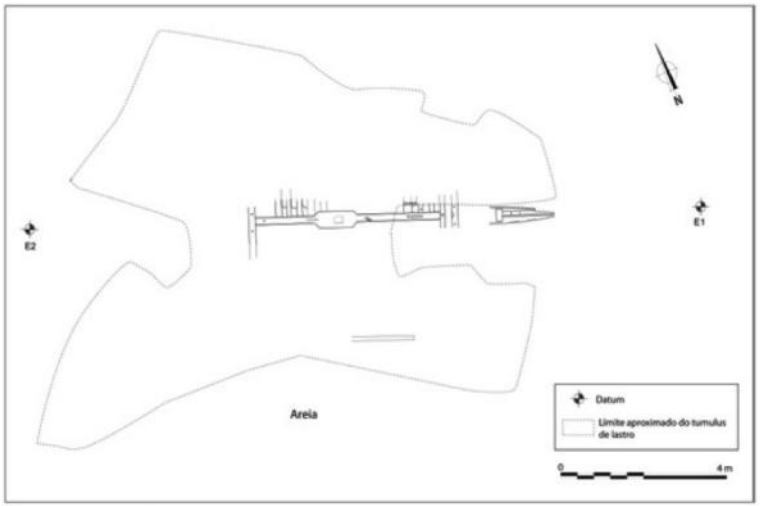


Fig. 8 - Esboço preliminar de Angra F.

27. Angra G, c. 1600

28. Angra I, c. 1600

29. Angra J, c. 1600

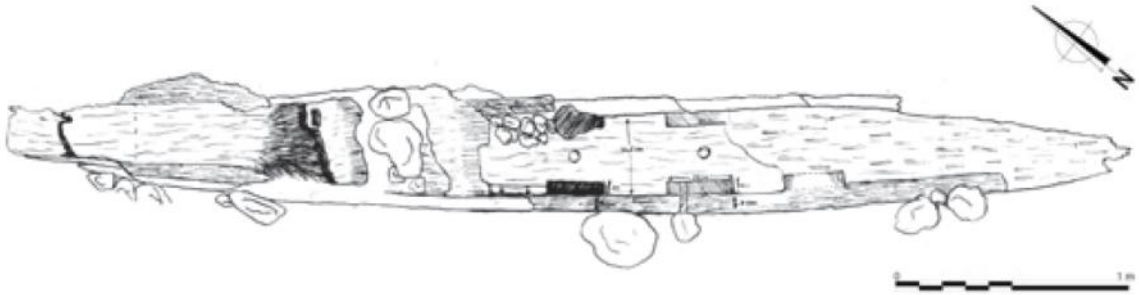
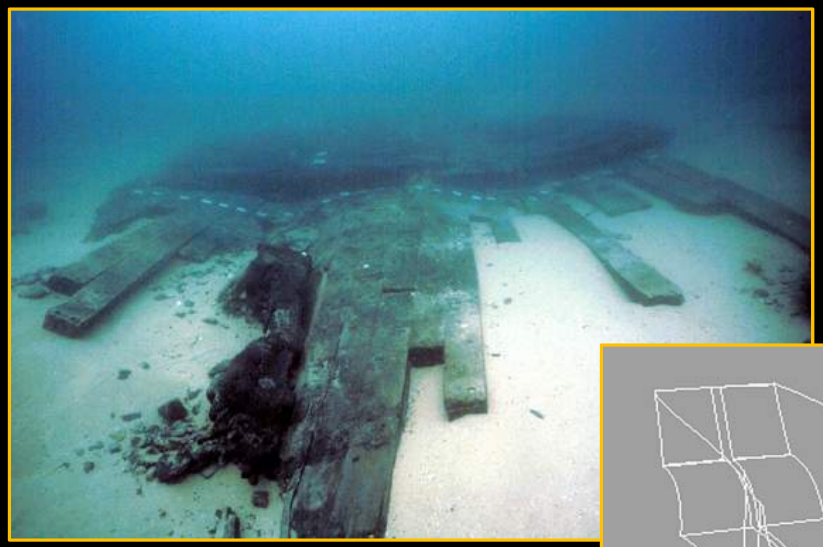
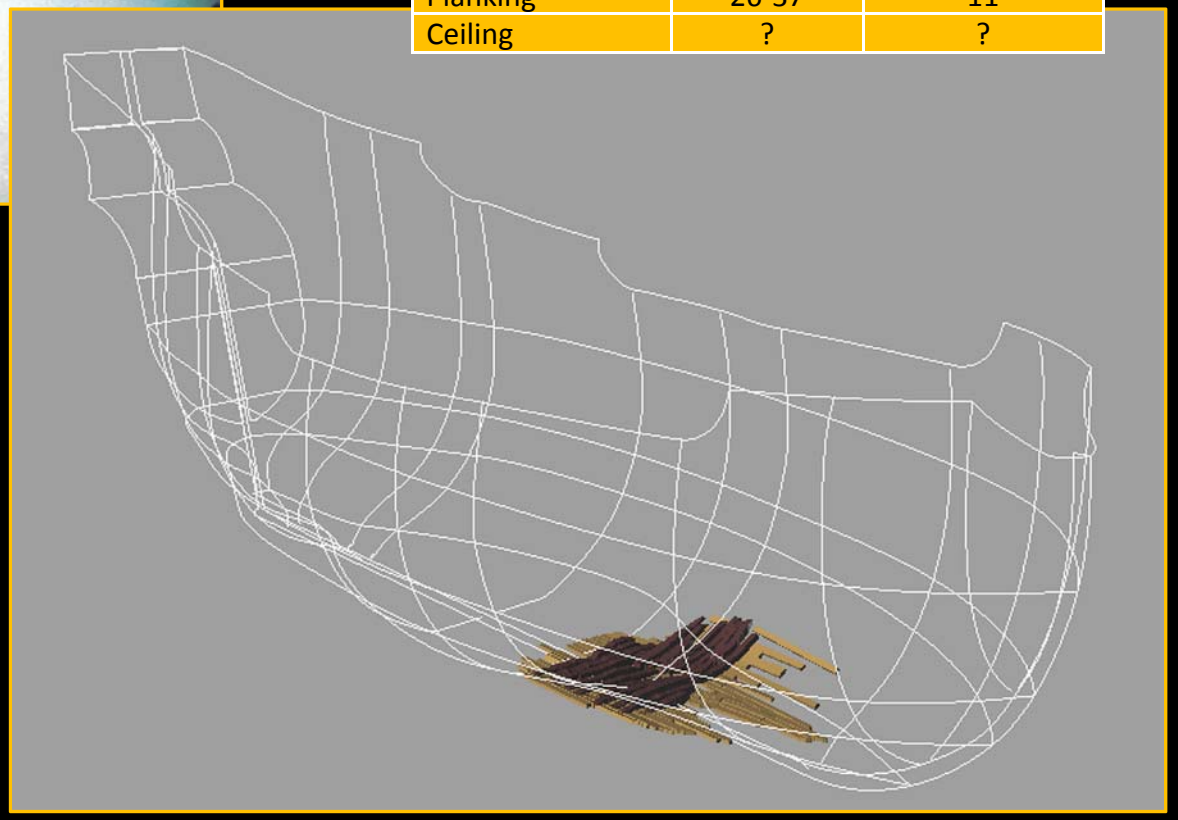


Fig. 11 - Esboço preliminar da estrutura do navio Angra J.

30. *N. S. Mártires*, 1606

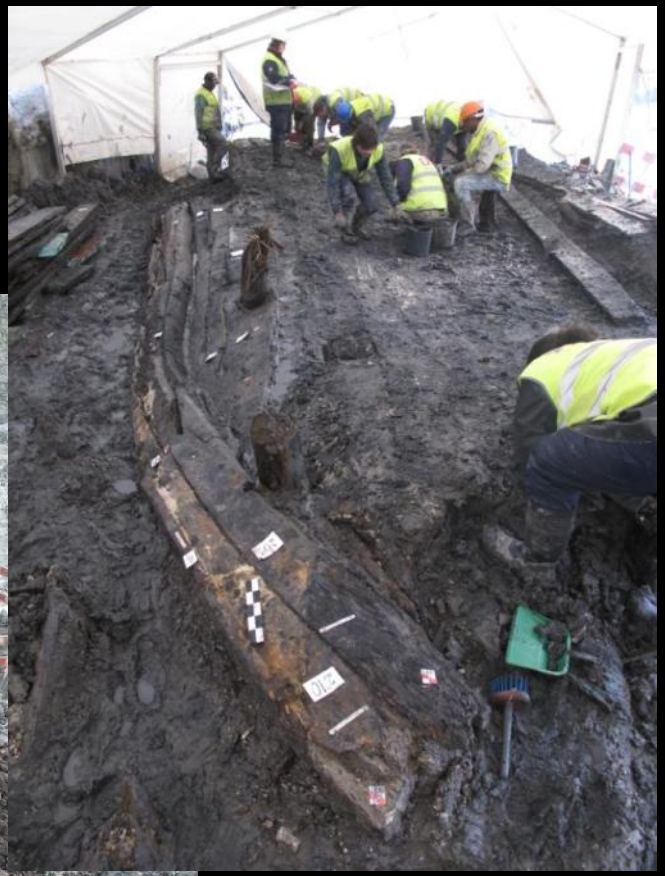


Keel	25	45?
Keelson	?	?
Maststep	?	?
Sternpost	?	?
Floors	25	25
Futtocks	22	22
Room-and-space	47	-
Planking	26-37	11
Ceiling	?	?



31. Boa Vista 1, c. 1600

32. Boa Vista 2, c. 1600



33. Largo do Município Timbers, c. 1600

34. Praça D. Luis, c. 1600

In conclusion

There is no question that any understanding of XV-XVII century Iberian ships and their potential advantages over the ships of other competing nations in the race for the Atlantic require an in-depth study.

This study should be based on all the data we can gather (written, iconographical and archaeological sources) pertaining to:

1) Taxonomy (which types were good for the Atlantic?)
2) Conception and design;
3) Construction (size/scantlings and scarves/fasteners);
4) Materials (timber, iron, canvas, rope);
5) Needs (the historical input);
6) Tastes (the cultural input).

I propose

That we collect all the bibliography, iconography, and archaeological reports available in one server, which should be accessed by all, and develop:

1	List of ship types				about	30	
2	List of dimensions	from treatises	from contracts	from shipwrecks	about	100	
3	List of ship parts	…and shapes			about	200	
4	Shipwreck database	scantlings vs.	overall dimensions vs.	provenience	about	400	
5	Image database				about	4000	
6	Architectural signatures				about	20	
7	Lines drawings library				about	100	NEED HELP
8	Graminhos/recipes				about	30	
9	Morphological matrixes				about	20	traits

Thank you!