

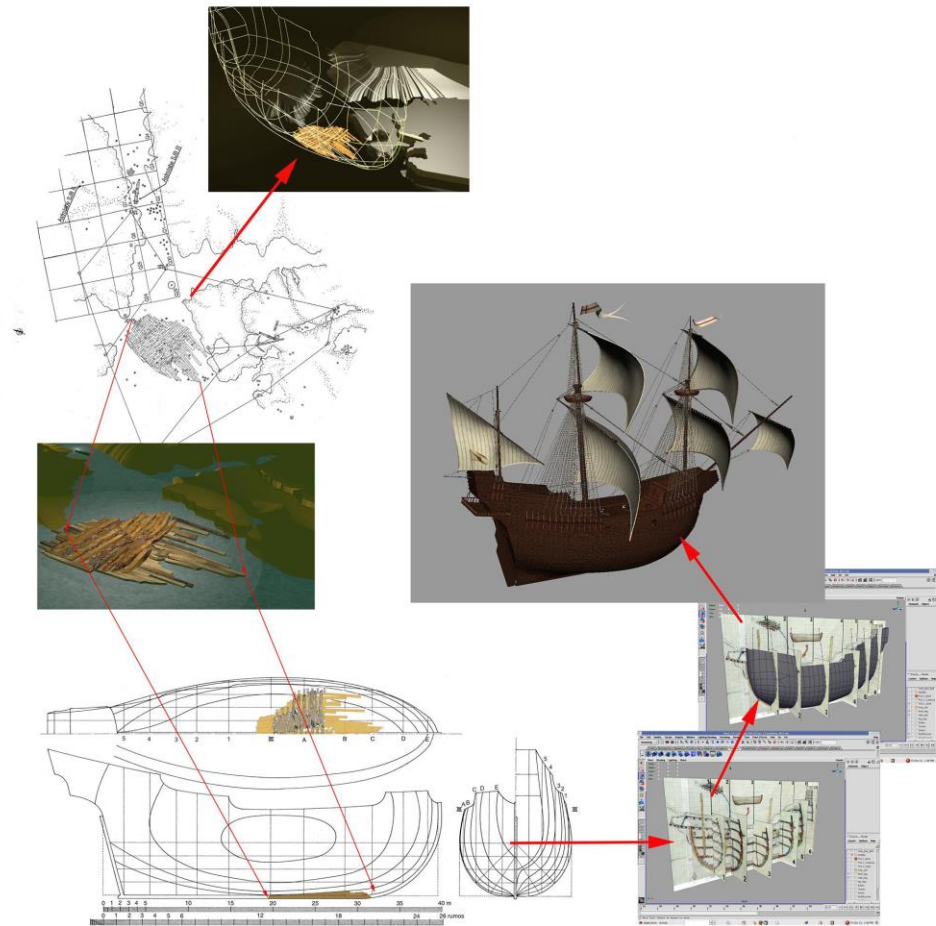
Research and Reconstruction of Wooden Ships



14.02 Research and Reconstruction

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Last edited: May 2021



3D Models

from shipwreck remains
or old technical tests

Research and Reconstruction



Archaeologists try to reconstruct extinct cultures from the material remains of past human behavior.

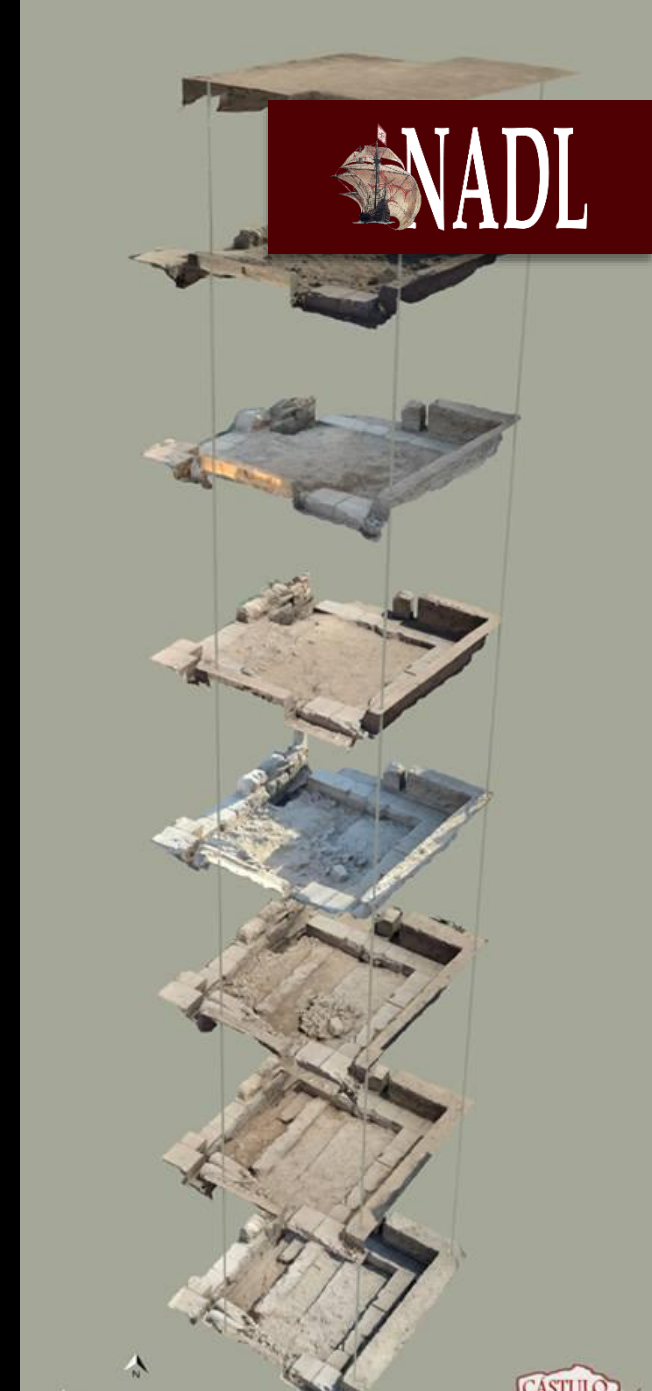
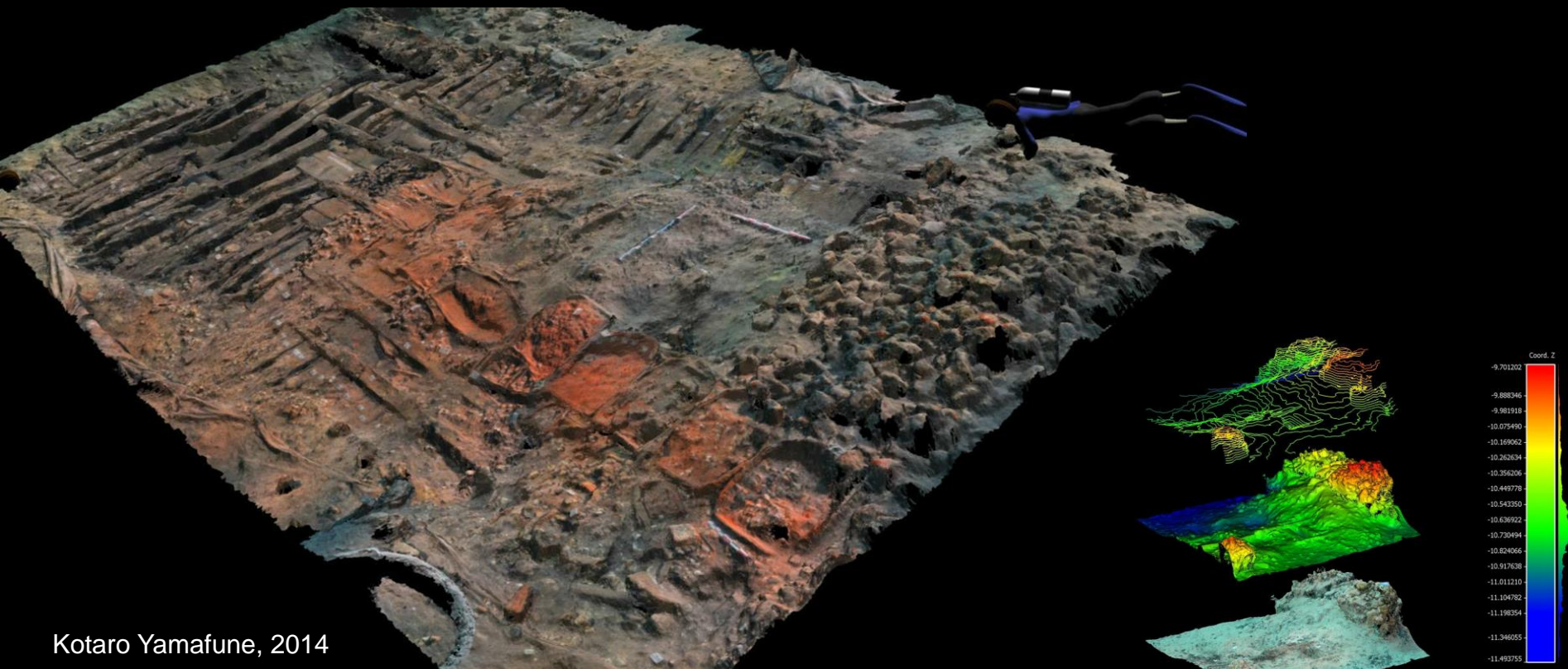
Research and Reconstruction



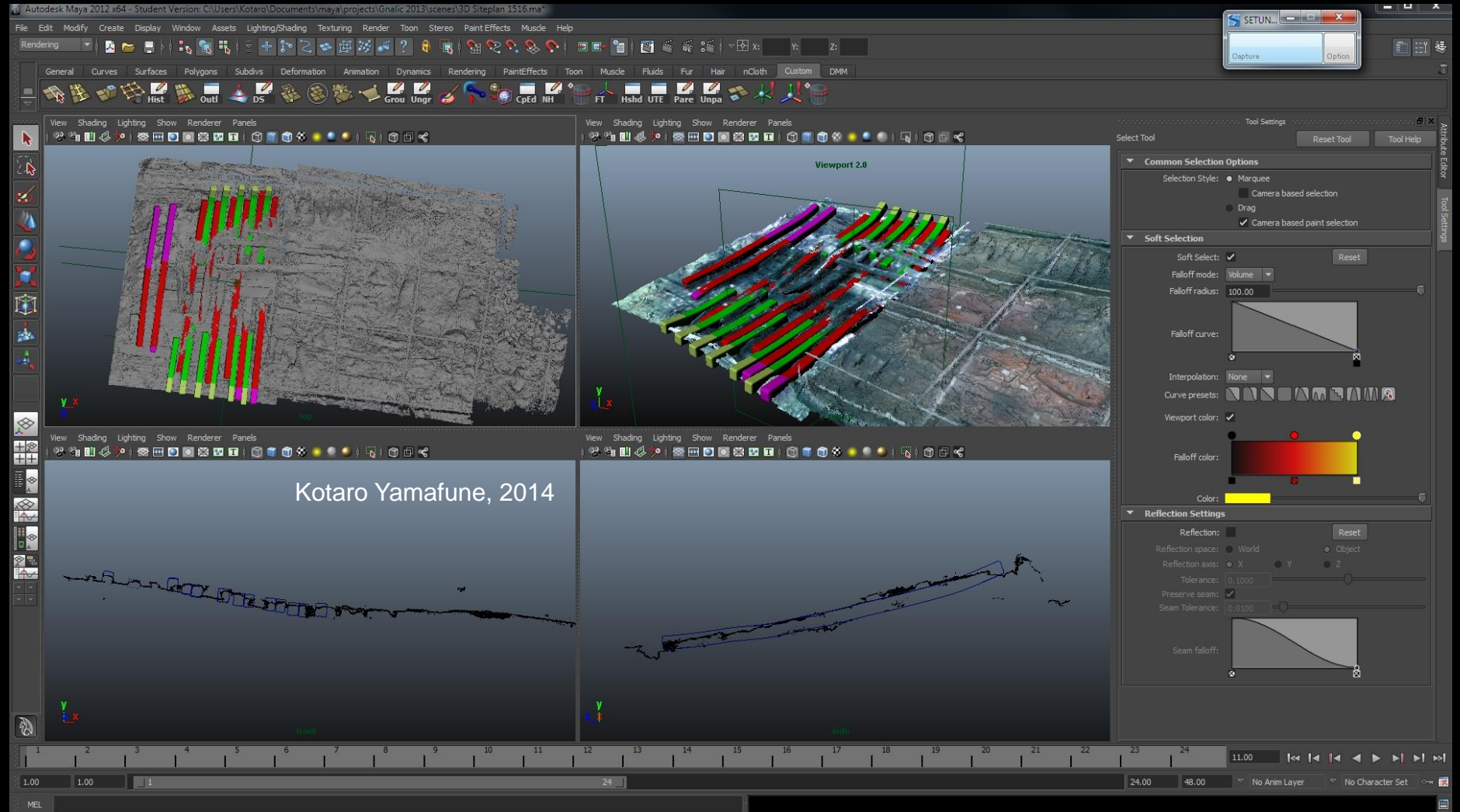
Nautical archaeologists try to reconstruct ships from their archaeological remains, or from technical manuscripts.

1. From shipwrecks

a. Get good data: photogrammetry, FARO Arm scanning, accurate drawings.



b. Sites must be recorded in three orthogonal plans



c. Timber Catalogue



A timber catalogue consists of a site plan and sections with all the timbers referenced, a list of the timbers referenced with the square where they were recorded, and a fiche with information on every timber.

Inventory

No.	Description	Size	1/10	3D	Photo	CHAM
01	Y-frame	212	-	Adolfo	Peter	-
02	Plank	81	Flavio	-	Chris	-
03	Floor timber	313	-	Adolfo	Peter	003
04	Plank	84	Peter	-	Peter	-
05	Plank	117	-	-	Peter	-
06	Plank	40	-	-	Peter	-
07	Plank	137	-	-	Peter	-
08	Plank	92	-	-	Peter	-
09	Plank	106	-	-	Peter	-
10	Plank fragment	66	-	-	Peter	-
11	Stringer fragment?	106	-	-	Peter	-
12	Fragment	26	-	-	Peter	-
13	Plank repair?	38	Peter	-	Peter	-
14	Frag. transv. timber?	40	-	-	Peter	-
15	Plank fragment	21.5	-	-	Peter	-
16	Fragment	50	-	-	Peter	-
17	Fragment	71	-	-	Peter	-
18	Fragment – ceiling?	24	-	-	Peter	-
19	Fragment	38	-	-	Peter	-
20	Fragment	41	-	-	Peter	-
21	Fragment	52	-	-	Peter	-
22	Fragment	19	-	-	Peter	-
23	Fragment	43	-	-	Peter	-
24	Plank fragment	77	-	-	Chris	-
25	Plank fragment	128	-	-	FC	-
26	Plank fragment	23	-	-	Peter	-

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Timber: Stern Post No. 073W

Figure 73.1 – Photomosaic of the timber (not to scale).

Length preserved: 290 cm
Section: sided 22/24 cm, molded 19 cm.
Conversion: It is a standing tree, with the roots on the bottom and the branches forming the arms.
Tool Marks: All surfaces eroded.
Coatings: Not apparent in this timber.
Fasteners: Planks fastened with iron nails (11 mm) and treenails (25 mm). Three iron bolts connect it to the stern knee, (30 mm, heads 55/60 mm, recesses 60/70 mm, 25 mm deep) 53 and 70 cm apart. The after face has three protrusions difficult to explain. They were probably not used to receive the gudgeons because the best preserved one has two diagonal nail holes in the corners (Fig. 073.2). Planks were connected to the after face of the sternpost with square nails (11 mm).
 On the starboard side there are four instances of two nails and what looks like carpenter marks (Fig. 073.3).
Bolts at: 26.5 cm, 80, 150 cm, counting from the base of the adjacent stern knee. The bottom 20 cm are missing.
Planks: On the starboard four plank hoods seem to fit the rabbet (059,060,056, gap 51 cm, 053). To port side three plank hoods fit the garboard (057, 054, 055).
Other timber associations: Nail holes on the after face of the sternpost suggest that there were timbers fastened to this face.
Recording: CHAM 001. Full FARO Arm drawing (Adolfo).

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Details:

Fig. 073.2 – Nail pattern and possible carpenter marks.

Fig. 073.3 – Protrusion on the after face of the sternpost and diagonal nails.

CHAM images (2014):

PB14-001 - Cadaste

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c. Timber Catalogue



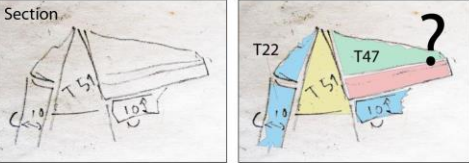
A timber catalogue consists of a sketch book and a final, clean and edited, catalogue.

T47
(A15)

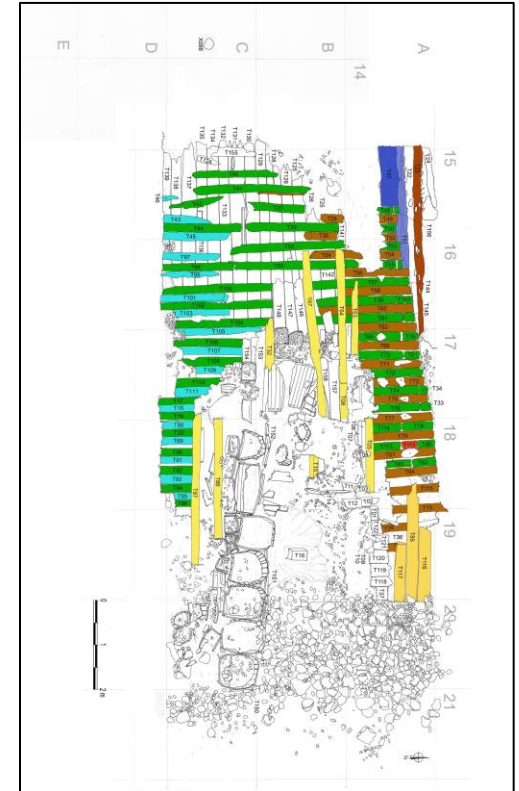
Longitudinal timber
Sided = 37-42 cm
Molded = abt. 8 cm
Length Preserved = 1.34 m exposed
Very eroded.



Section



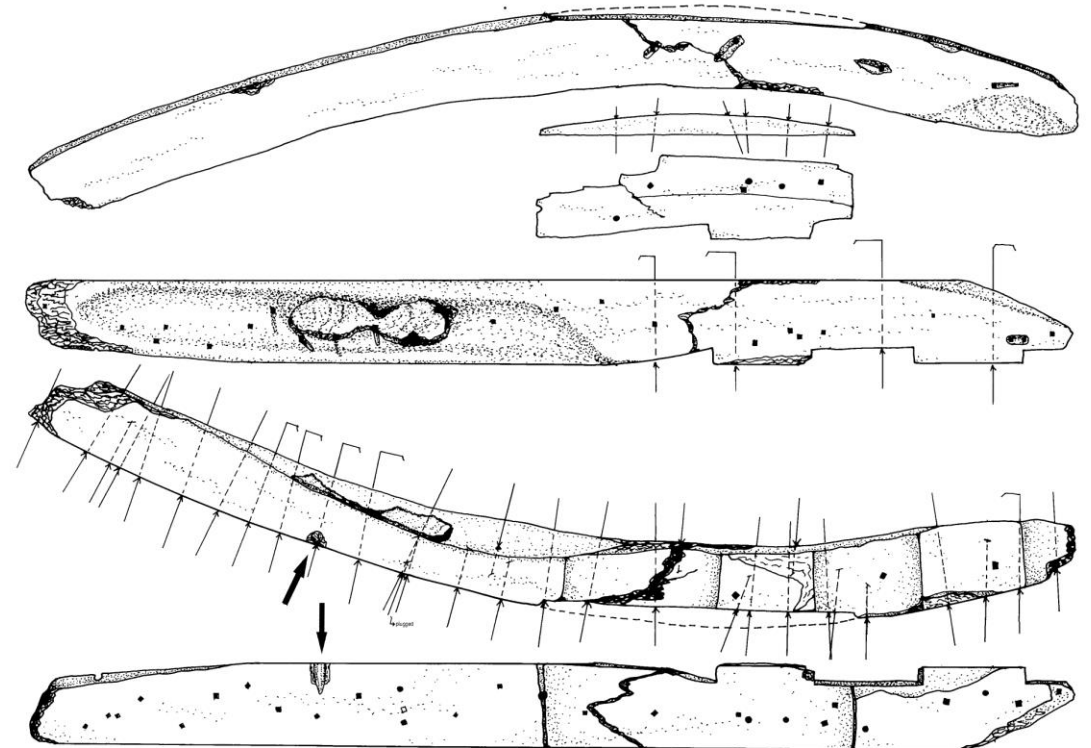
This timber is difficult to record because there are many concretions around it. When we have a laboratory where it can be taken, it should be brought up and recorded.



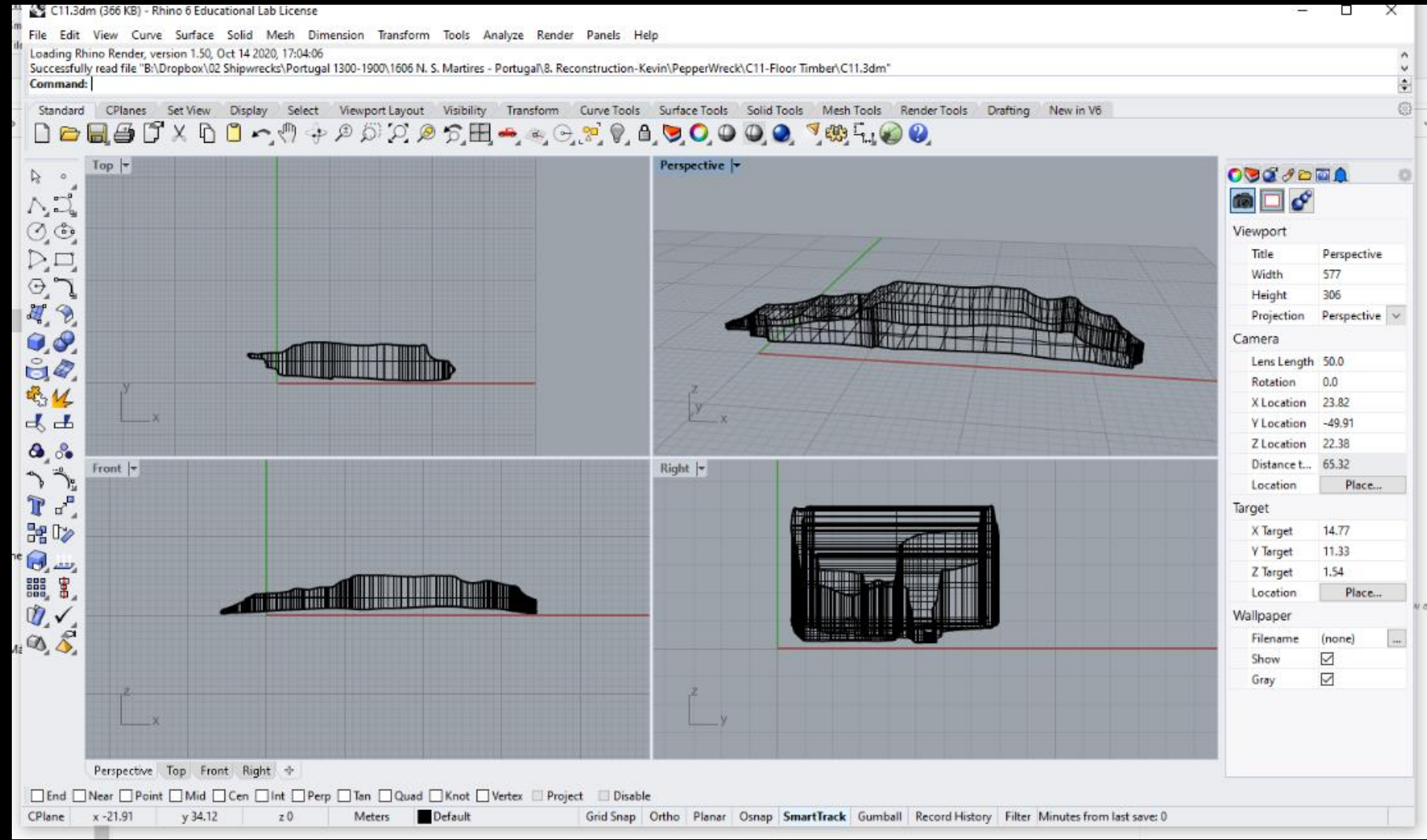
d. Careful drawings of the most important timbers

Typical recording includes:

1. Description;
2. Dimensions, such as length, sections, bevels;
3. Fasteners, with positions and direction;
4. Toolmarks;
5. Coatings, painting;
6. Waney edges.

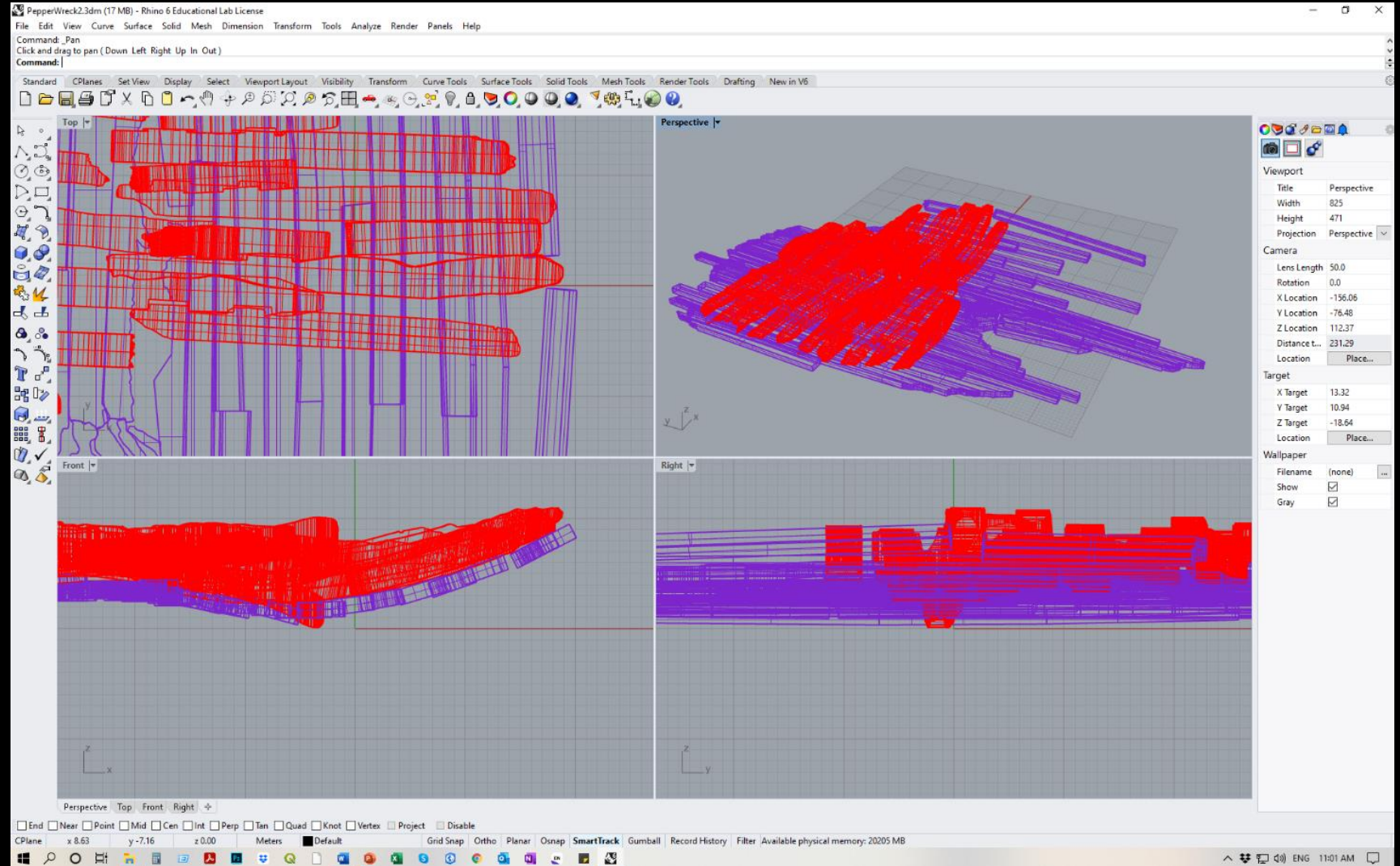


e. Developing partial 3D models



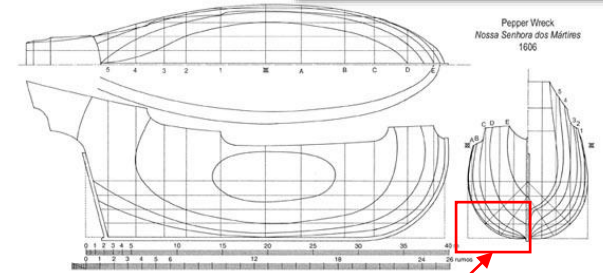
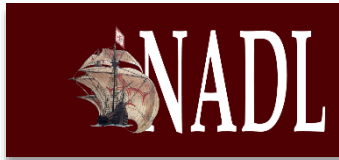
Kevin Gnadinger, 2008

f. Developing a 3D model of the ship remains

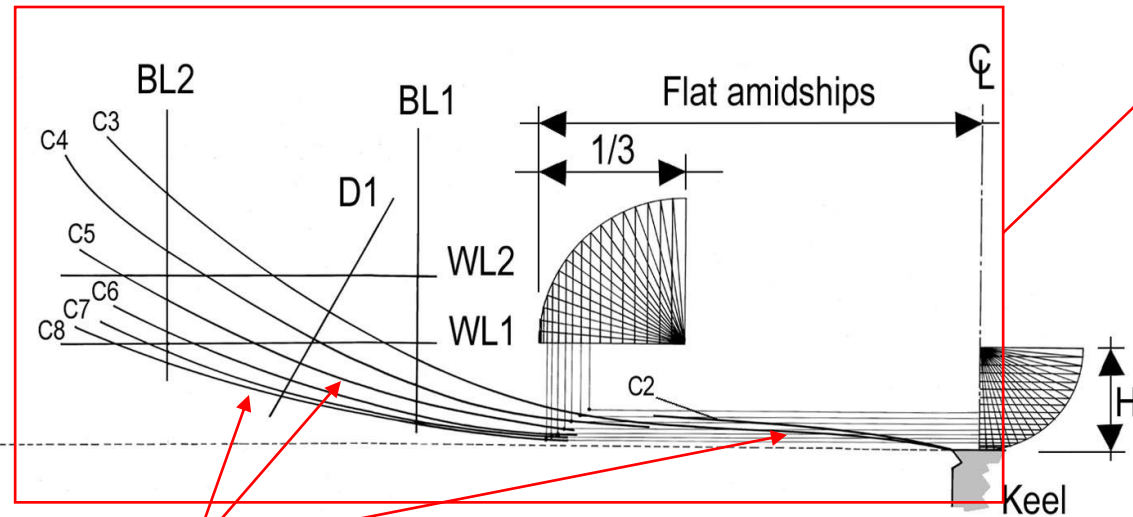
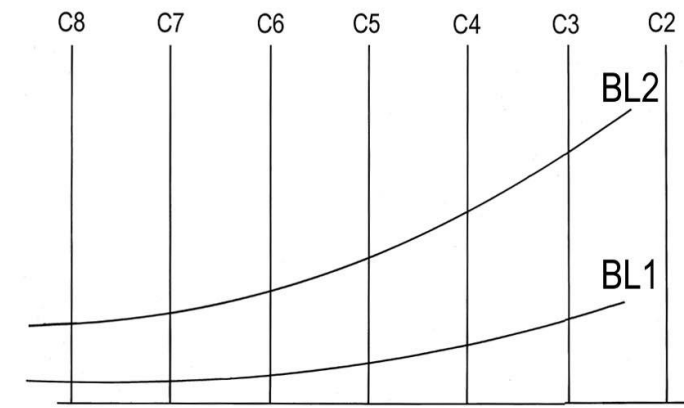
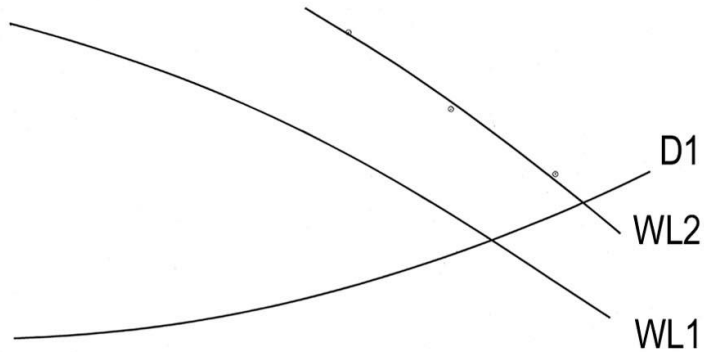


Kevin Gnadinger, 2008

g. Taking lines from the 3D model



- C - Frames (stations)
- WL - Waterlines
- BL - Buttock lines
- D - Diagonal
- H - Total rising (1 room-and-space)

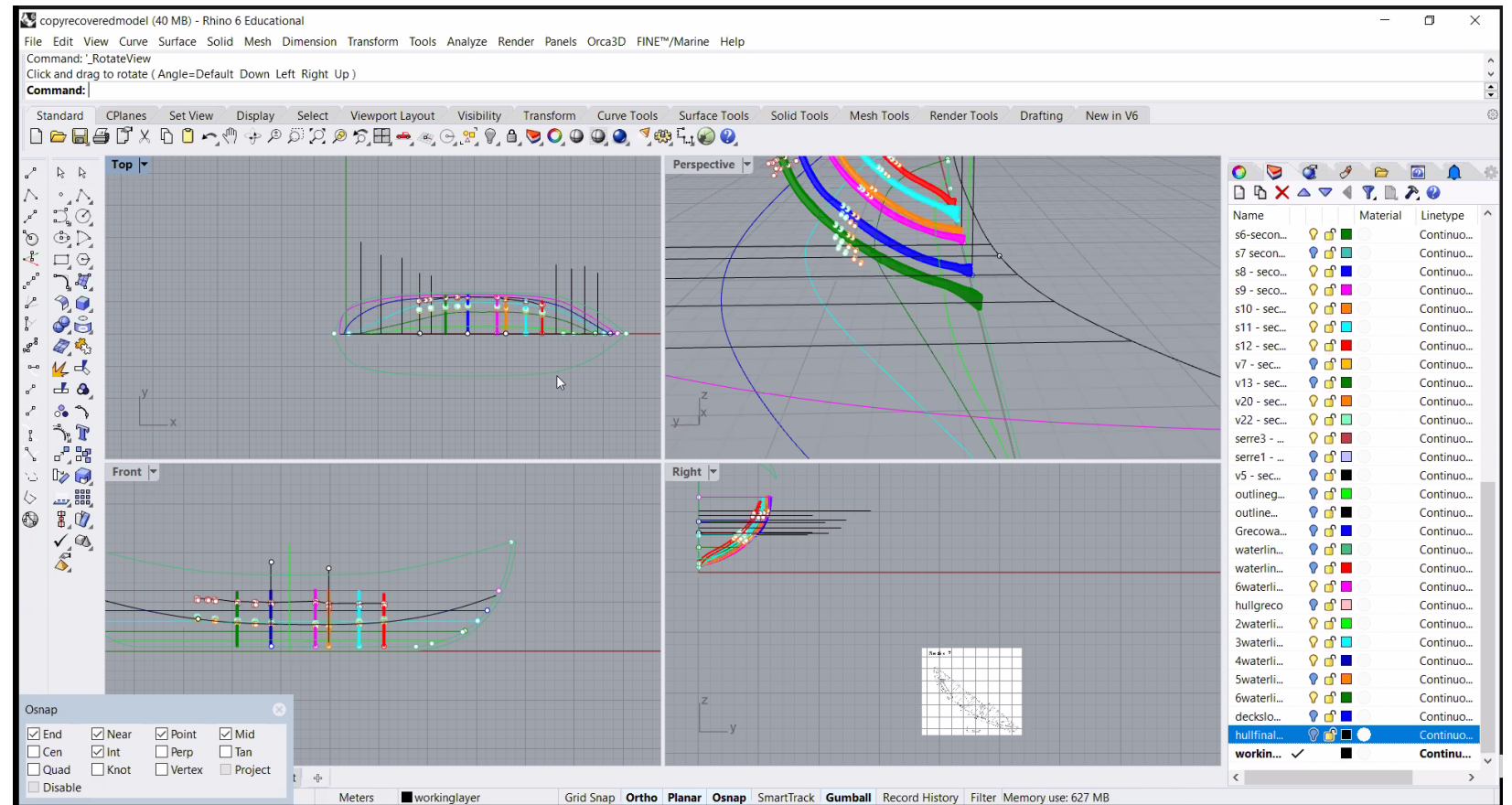


Lines represent the lower surface of the floor timbers and first futtocks

h. Faring lines

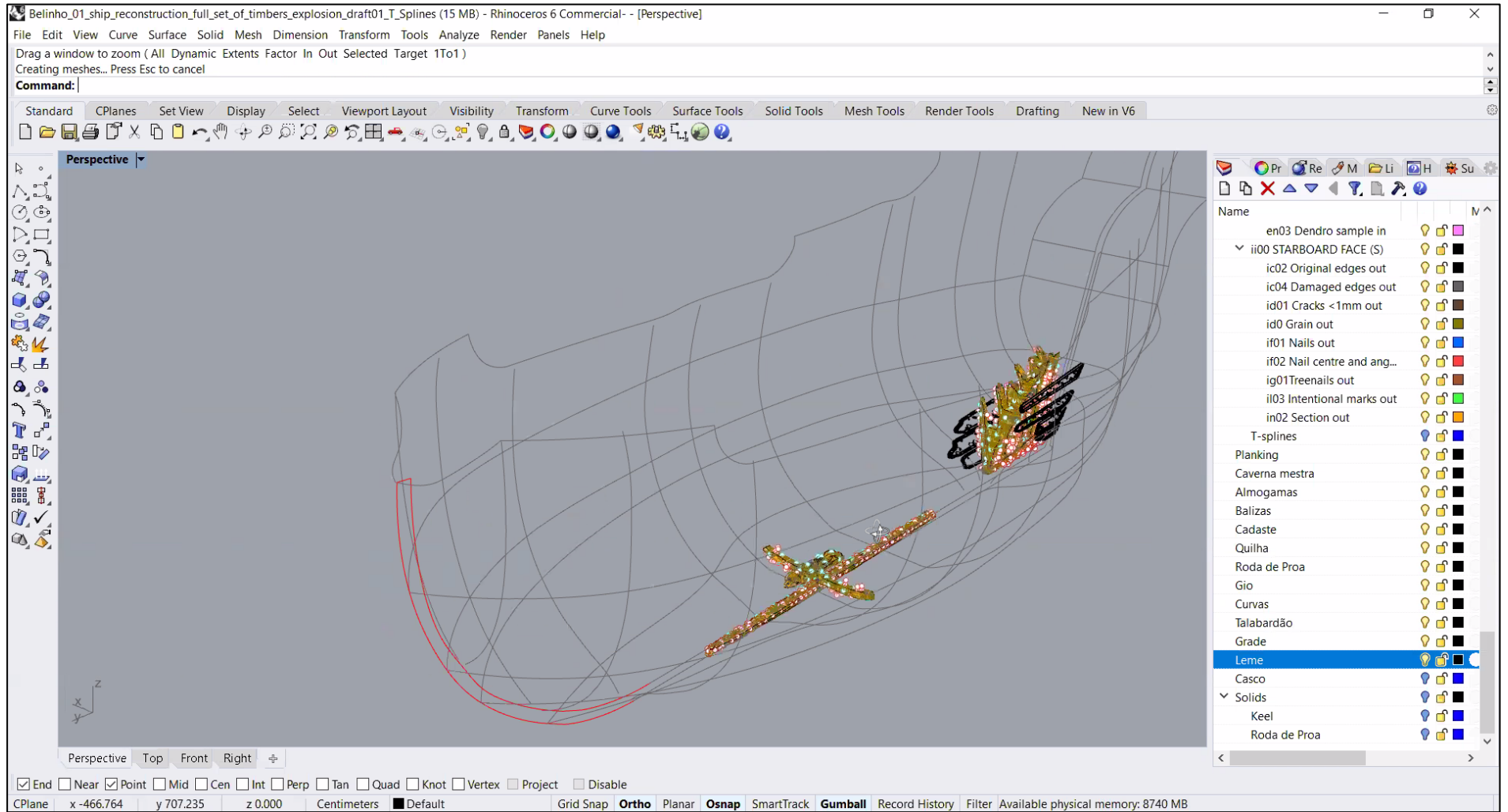


Lines from shipwrecks need to be faired. Ships' remains deform, we make mistakes when we record their curves, and ships were imperfect. Our reconstructions are always tentative, based on truncated data, and stand as educated guesses.



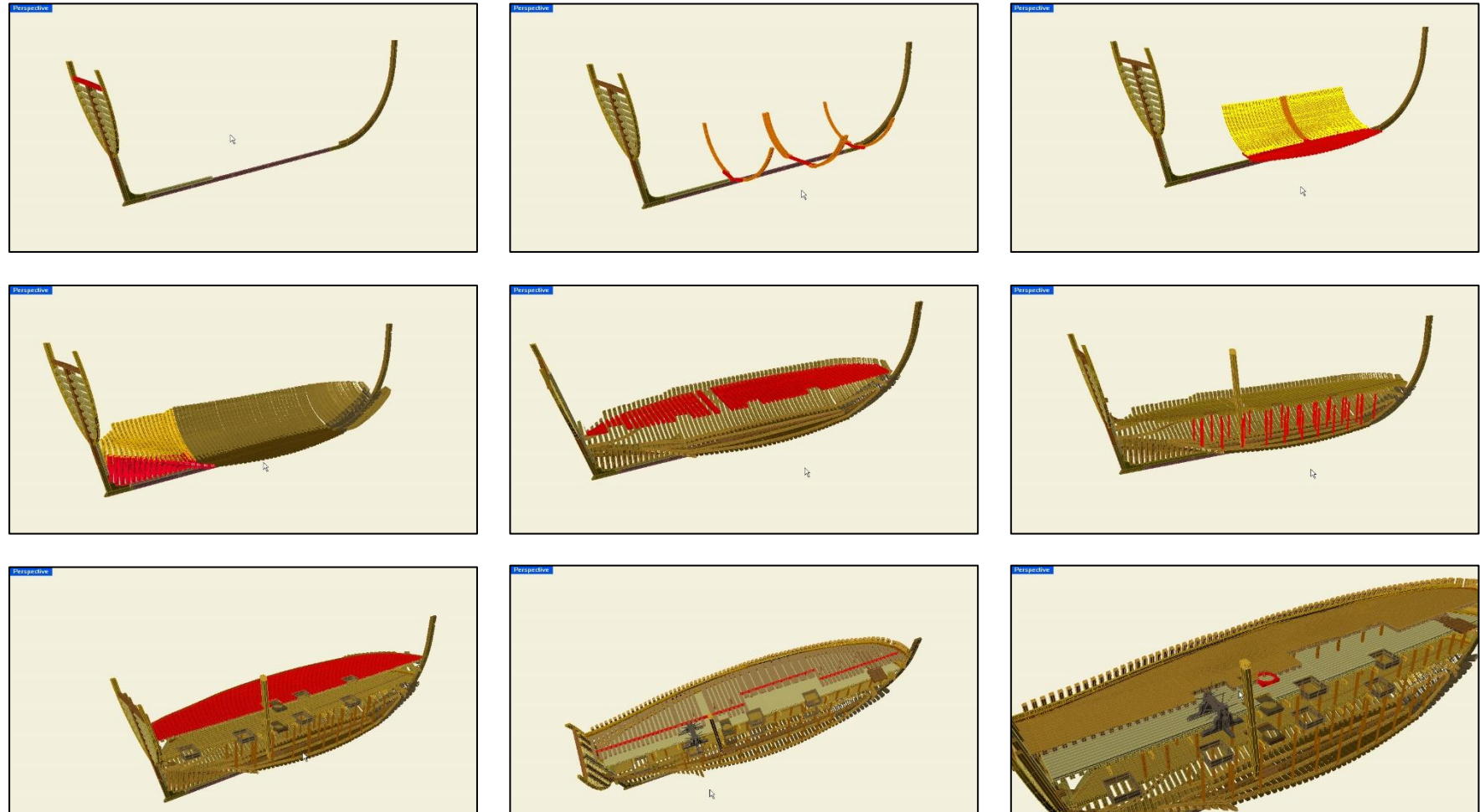
Beatrice Fabretti, 2021

i. Developing a set of lines



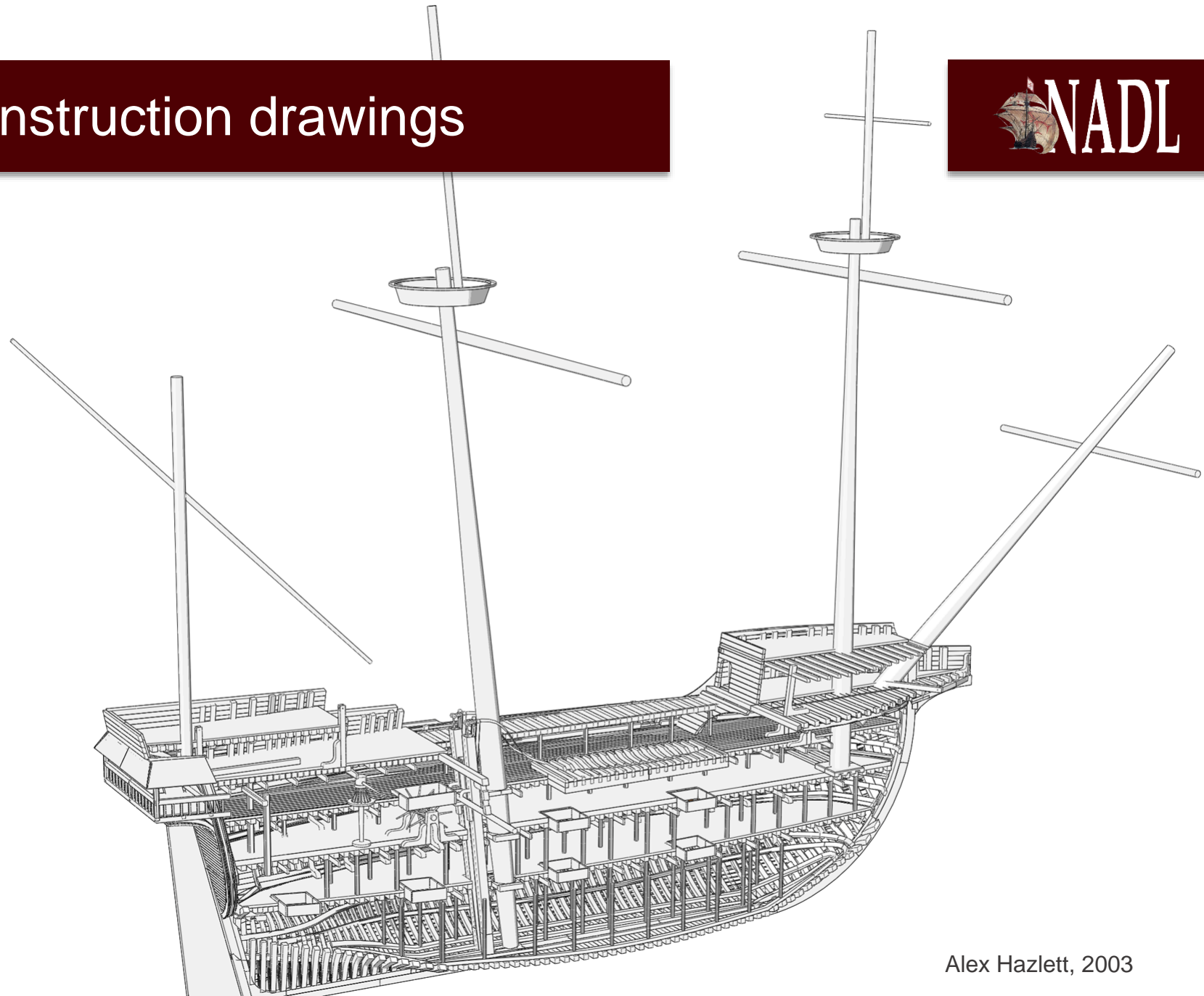
Miguel Martins, 2016

j. Developing a set of construction drawings



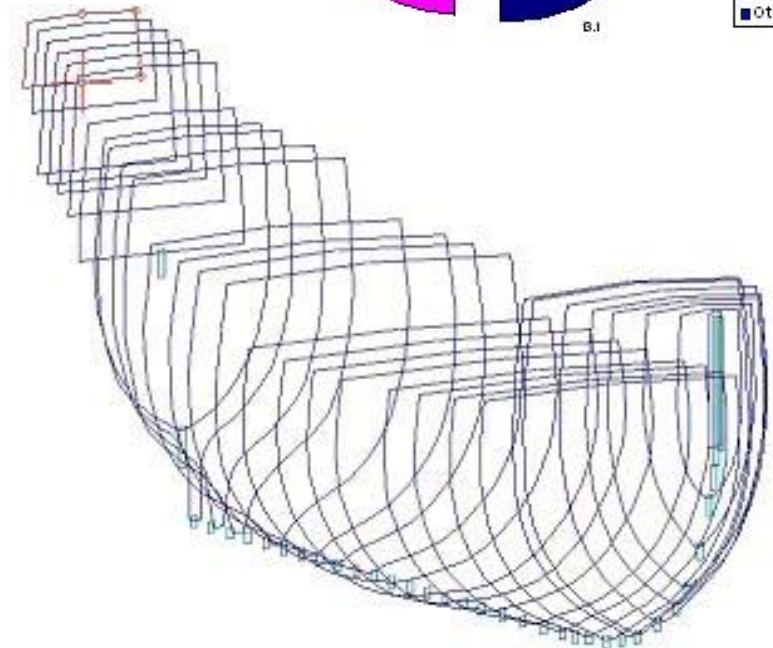
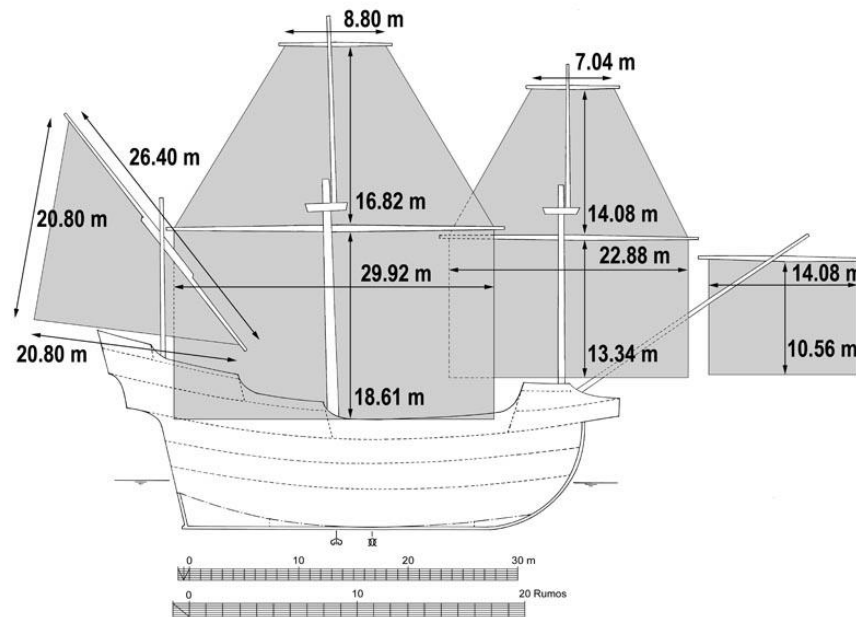
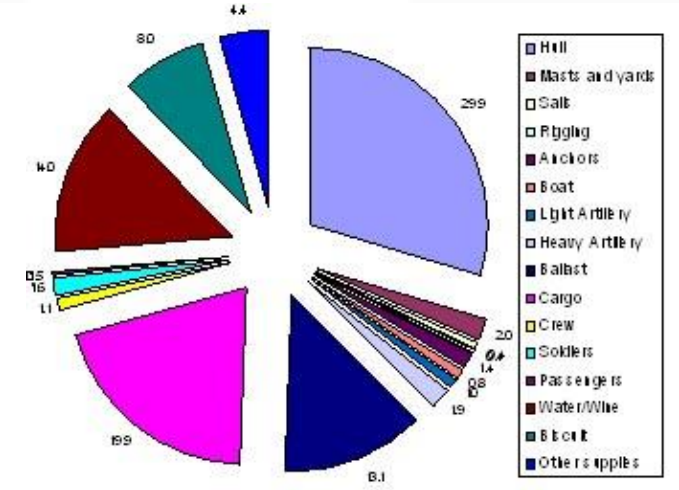
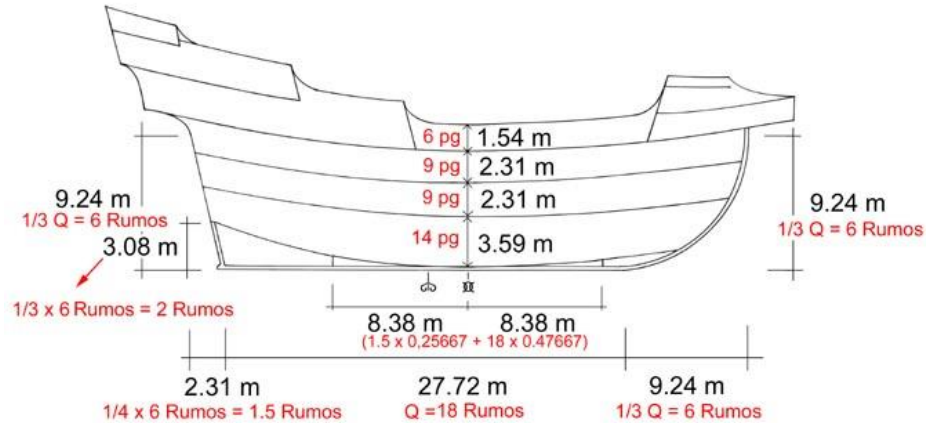
Alex Hazlett, 2003

j. Developing a set of construction drawings



Alex Hazlett, 2003

k. Evaluating the plausibility of our reconstruction



2. From technical texts

Manoel Fernandez



Written sometime in the late 16th or early 17th centuries, these “regimentos” (rules for the construction of a ship) were copied into a beautiful manuscript dated 1616 and signed by a guy named Manoel Fernandez, possibly a shipwright, and possibly made to offer to king Felipe III of Spain, when he visited Portugal, in 1619. The dedication was taken from the manuscript, possibly after the Portuguese independence, in 1640.

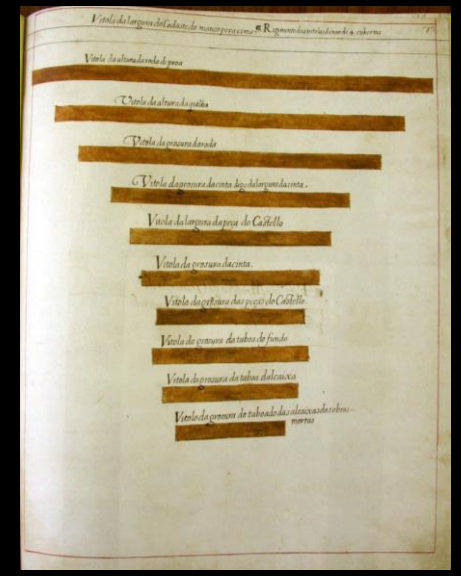
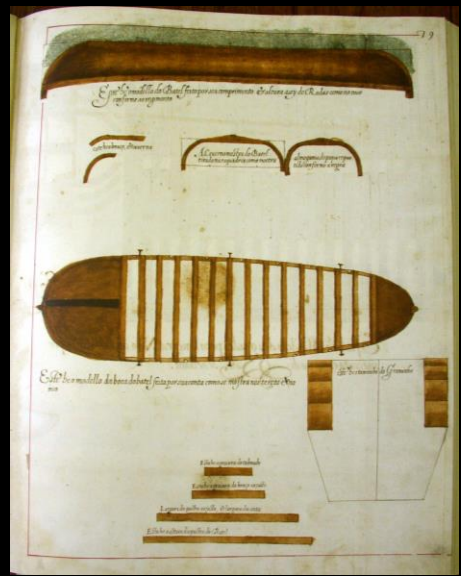
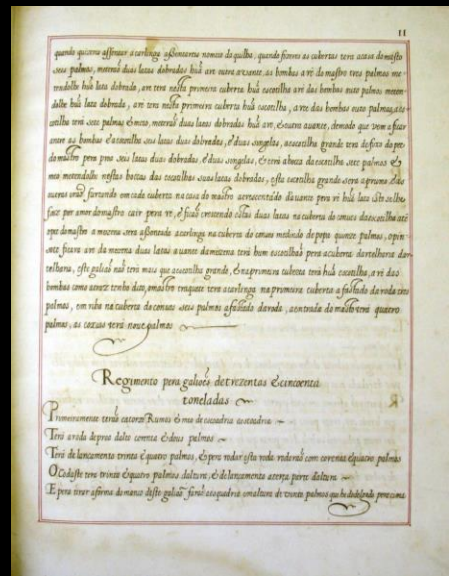
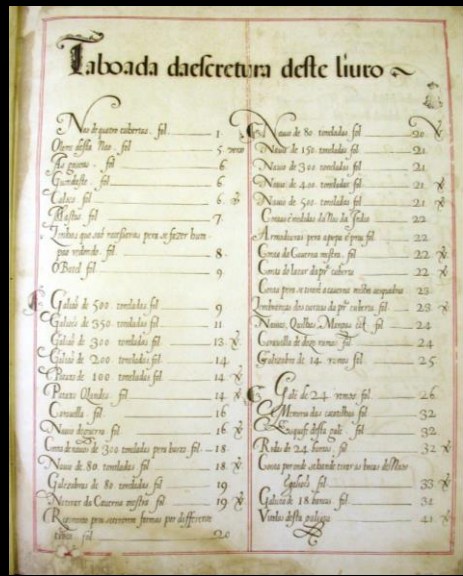
Research and Reconstruction



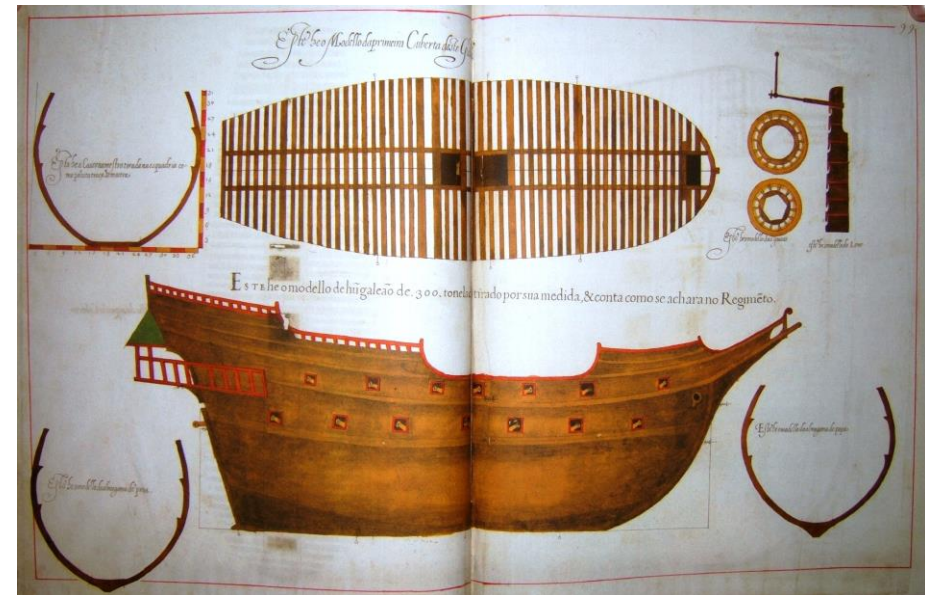
The manuscript has two parts: one with text and one with drawings, but not all texts have drawings and not all drawings have texts.

Another copy of the original from which this manuscript was made shows that there are mistakes in the text.

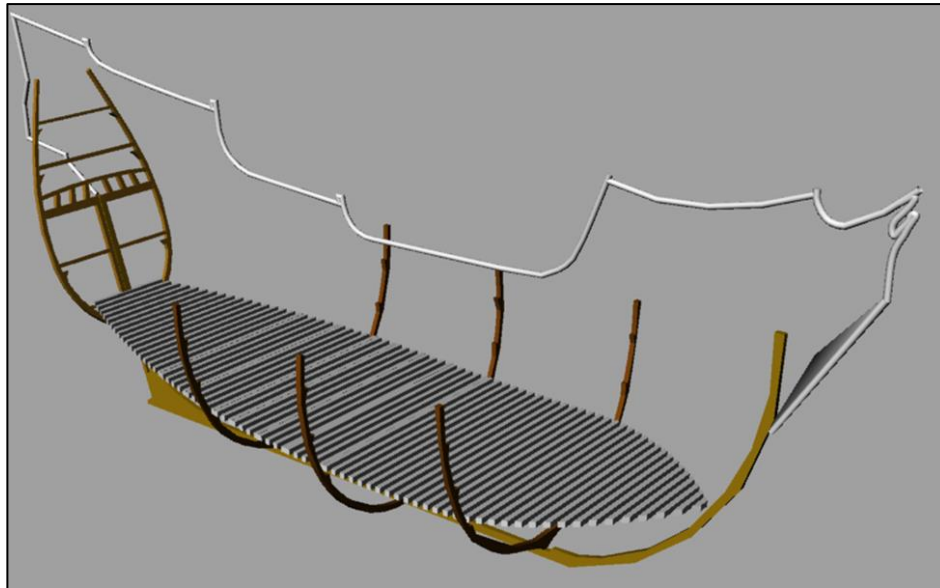
Some of the drawings are represented with different vertical and horizontal scales.



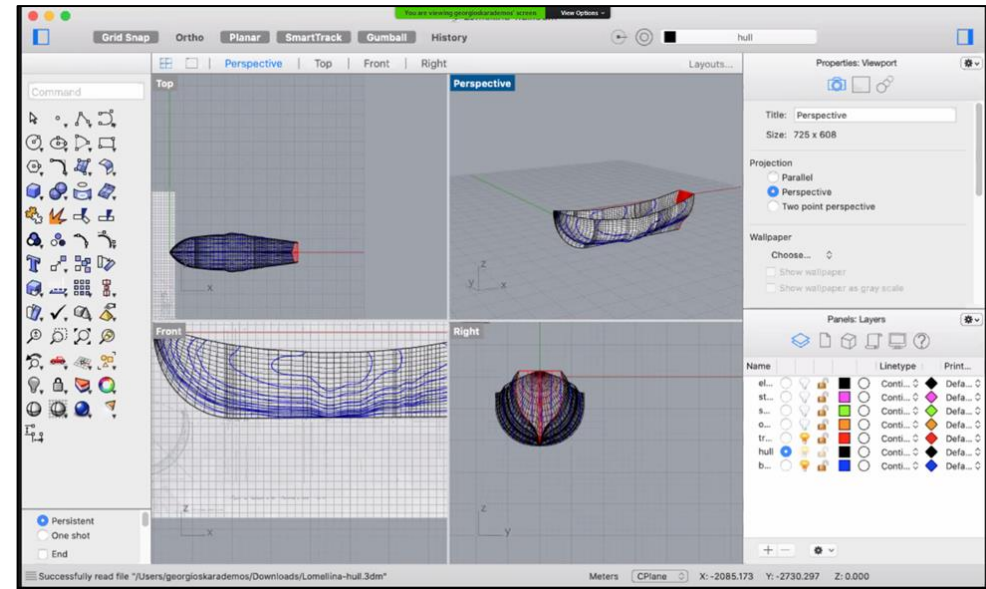
Reconstructions from these drawings require a lot of guess work. You have the profile of the ship, several frames, the shape and composition of the timbers of the decks, scantling lists, and in some cases details of particular timbers.



We are compiling the texts and drawings for a number of ships, and you can try to reconstruct them. It is an iterative process, so please be creative and don't be afraid of making mistakes.



Alex Hazlett, 2003

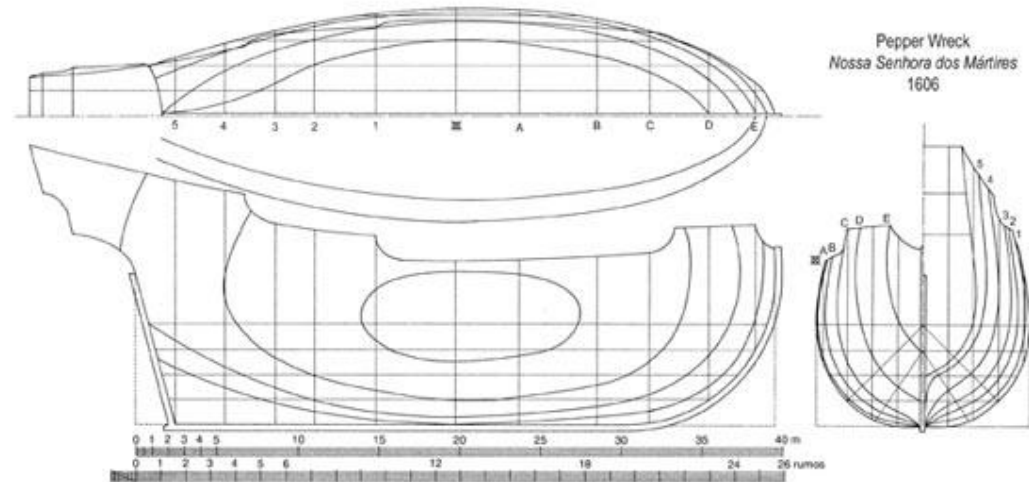


Beatrice Fabretti, 2021

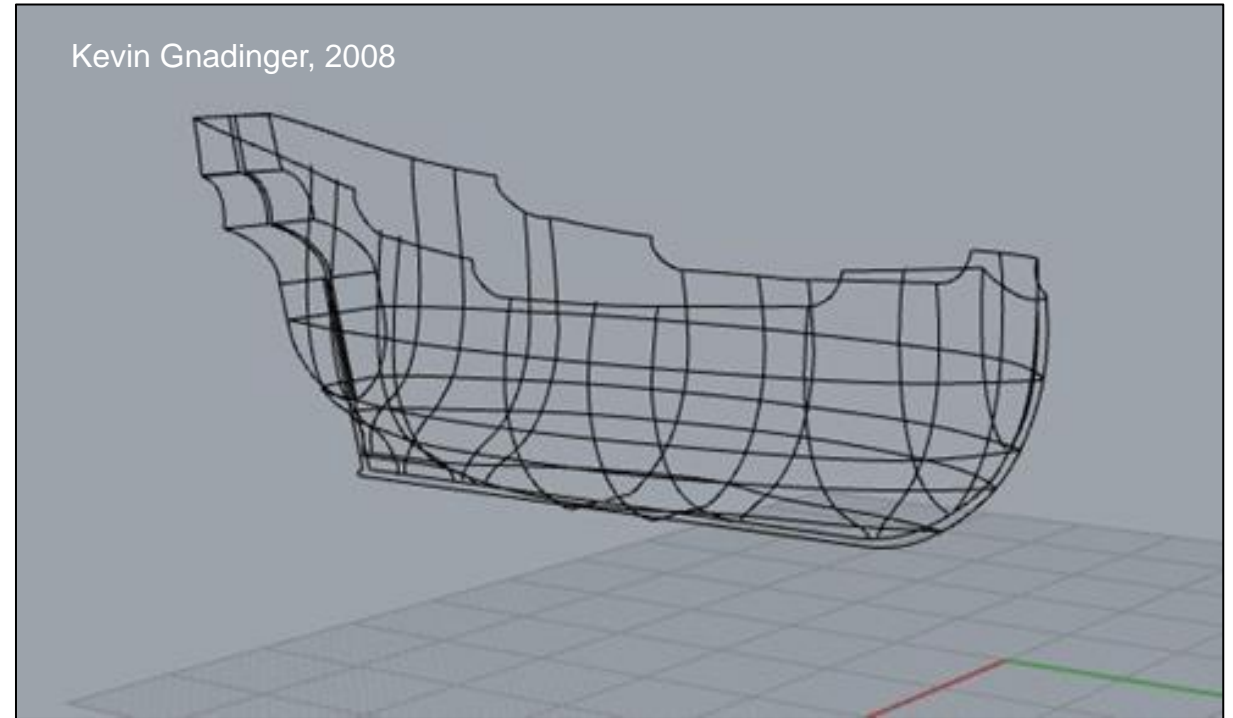
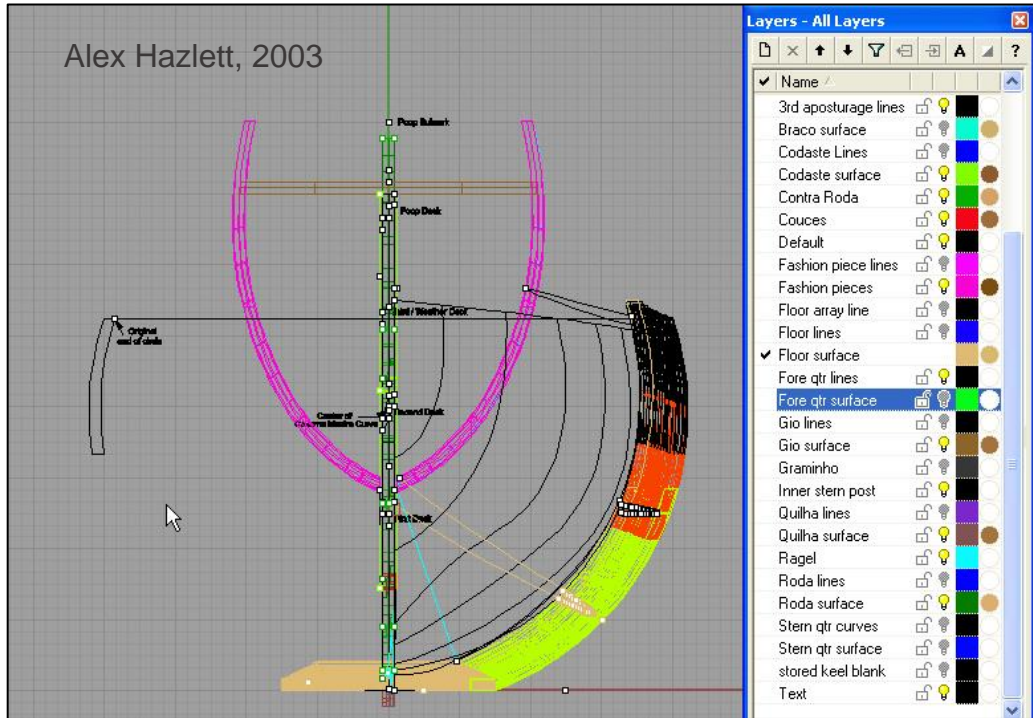
3. A Library of Hull Lines

We are compiling sets of lines drawings that can be used to make a first evaluation of a ship's size and shape.

We are collecting two types of hull lines: from technical documents and coeval ship models, and from tentative reconstructions of well-preserved shipwrecks.

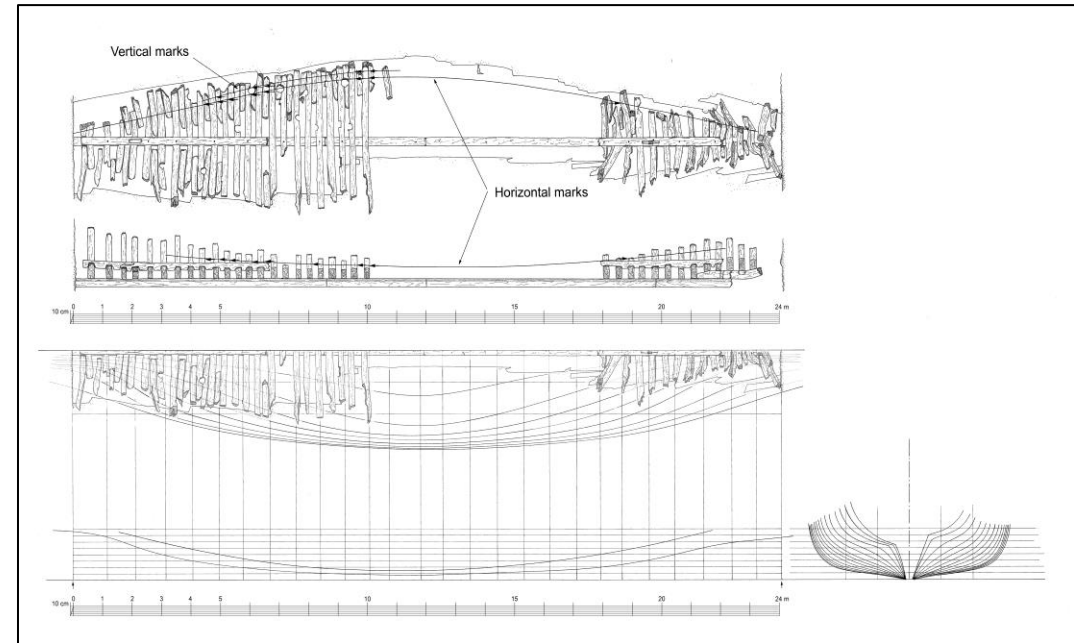
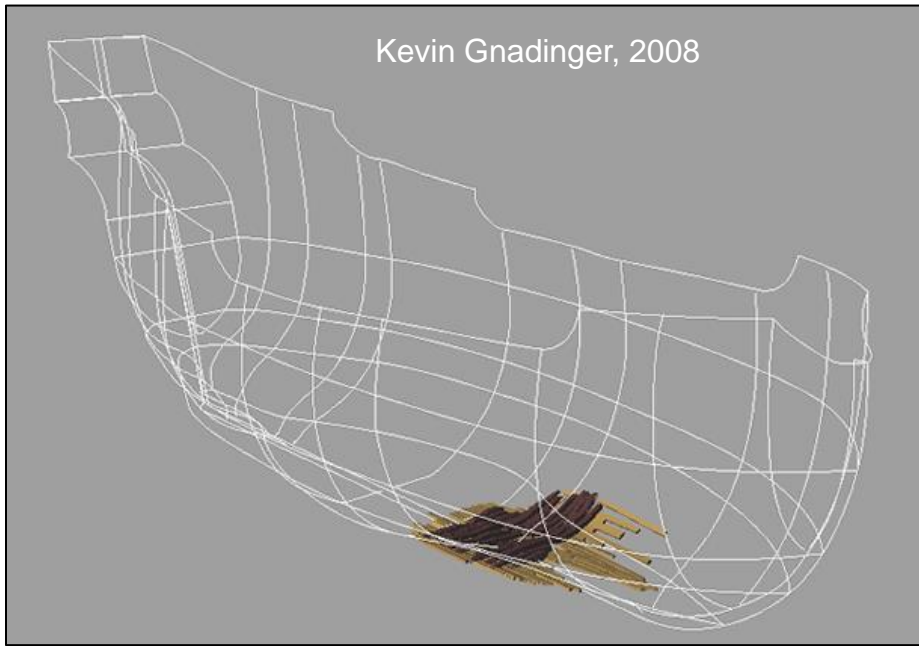


3. A Library of Hull Lines



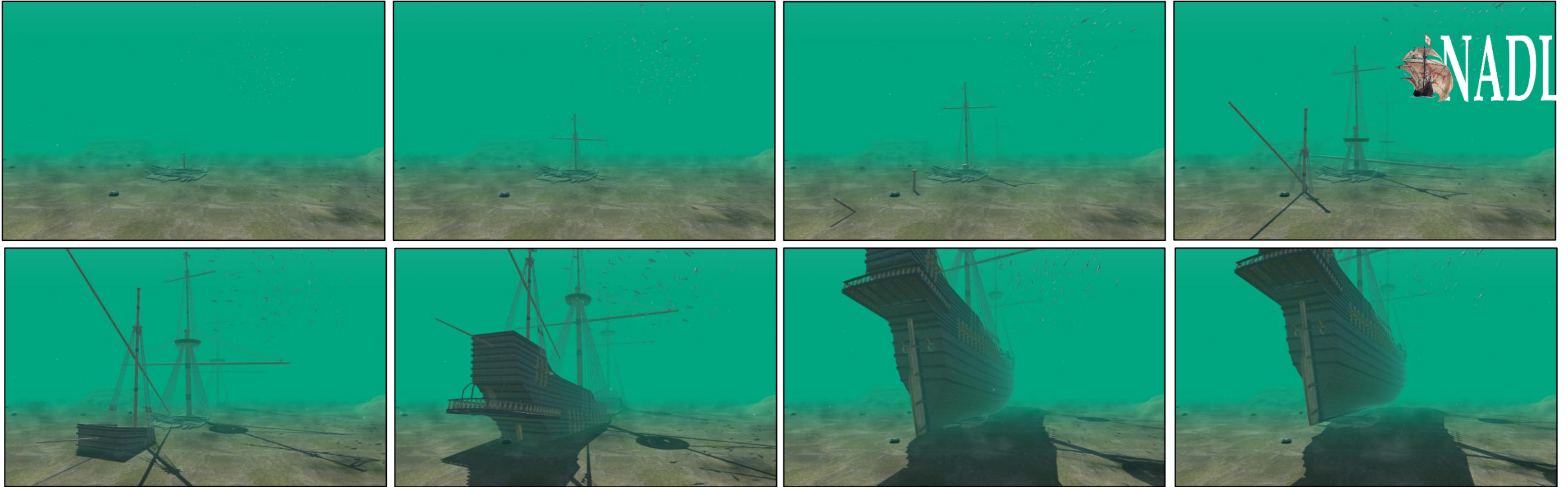
From the 2D drawings we are developing a library of 3D lines drawings' models. One day, we would like to automate this process.

3. A Library of Hull Lines



From the 3D lines drawings' models, we can try to hypothesize the range of sizes and shapes that might represent the ship we are trying to understand and reconstruct.

Research and Reconstruction



Josh Hooton, Jacob Stafford, Cody Leuschner, Thomas Sell, 2017

Thank you!