Treatises and Technical Texts on Shipbuilding

NADL

03.00 Longitudinal and Transversal Control

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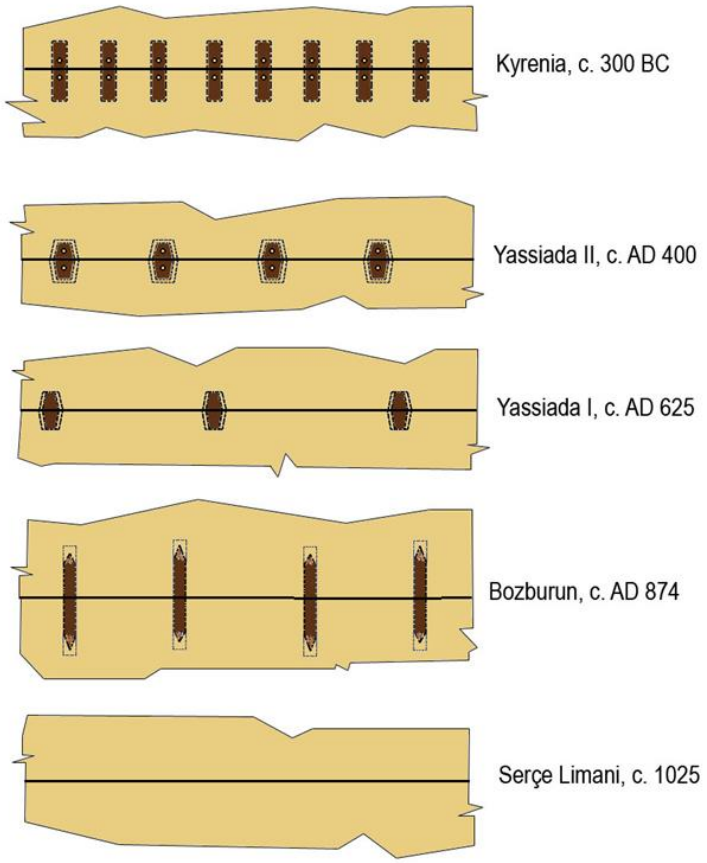
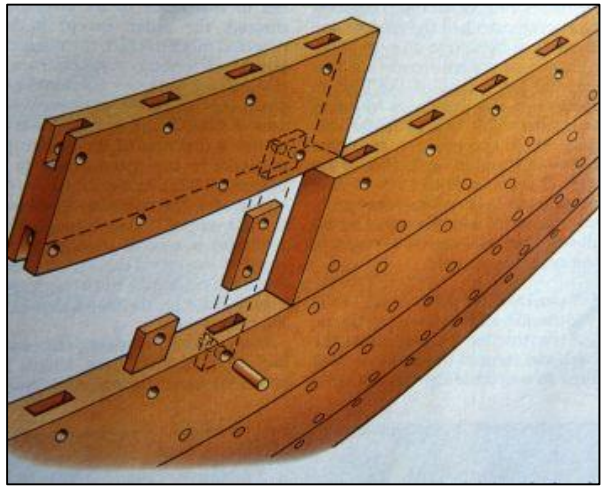
Last edited: June 2020

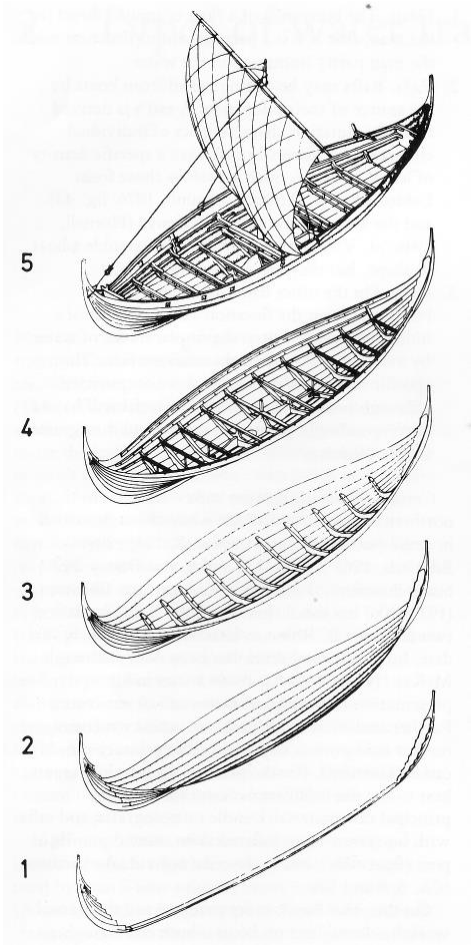
Longitudinal Control



Mortise and tenon construction was controlled longitudinally. There may have been transversal molds to control the hull shape, but the vessels were built longitudinally, by adding strakes over strakes.

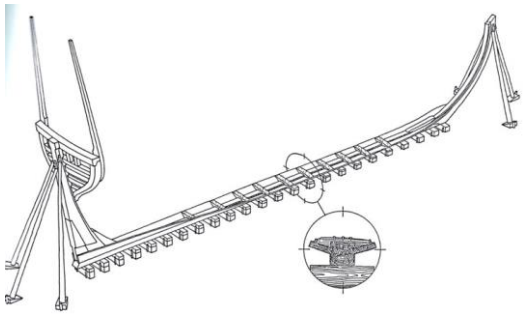


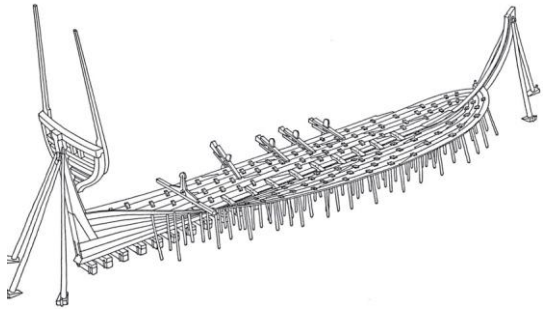
Longitudinal Control

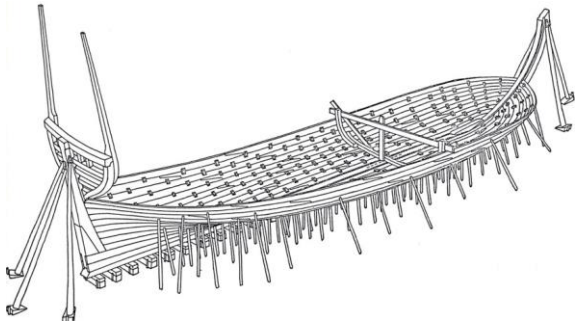


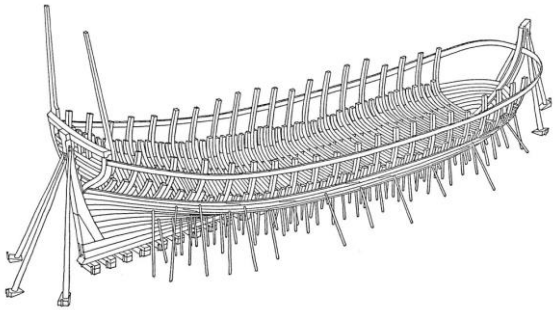
Shell-based vessels were conceived and built longitudinally.

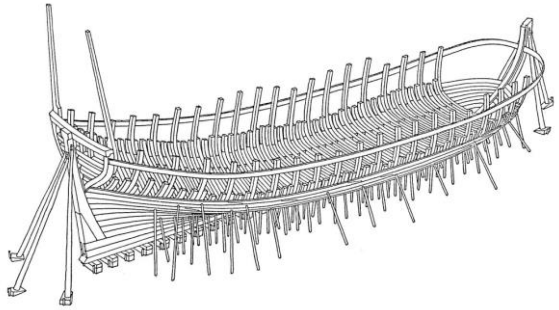
Longitudinal Control











Ab Hoving drawings of a bottom-based Dutch merchantman, conceived and built longitudinally.

Note the midship mould, placed on the widest section of the hull for control of the transversal shape.

Longitudinal Control

From the second half of the 14th century onwards, ships were built in Italy based on a small number of measurements:

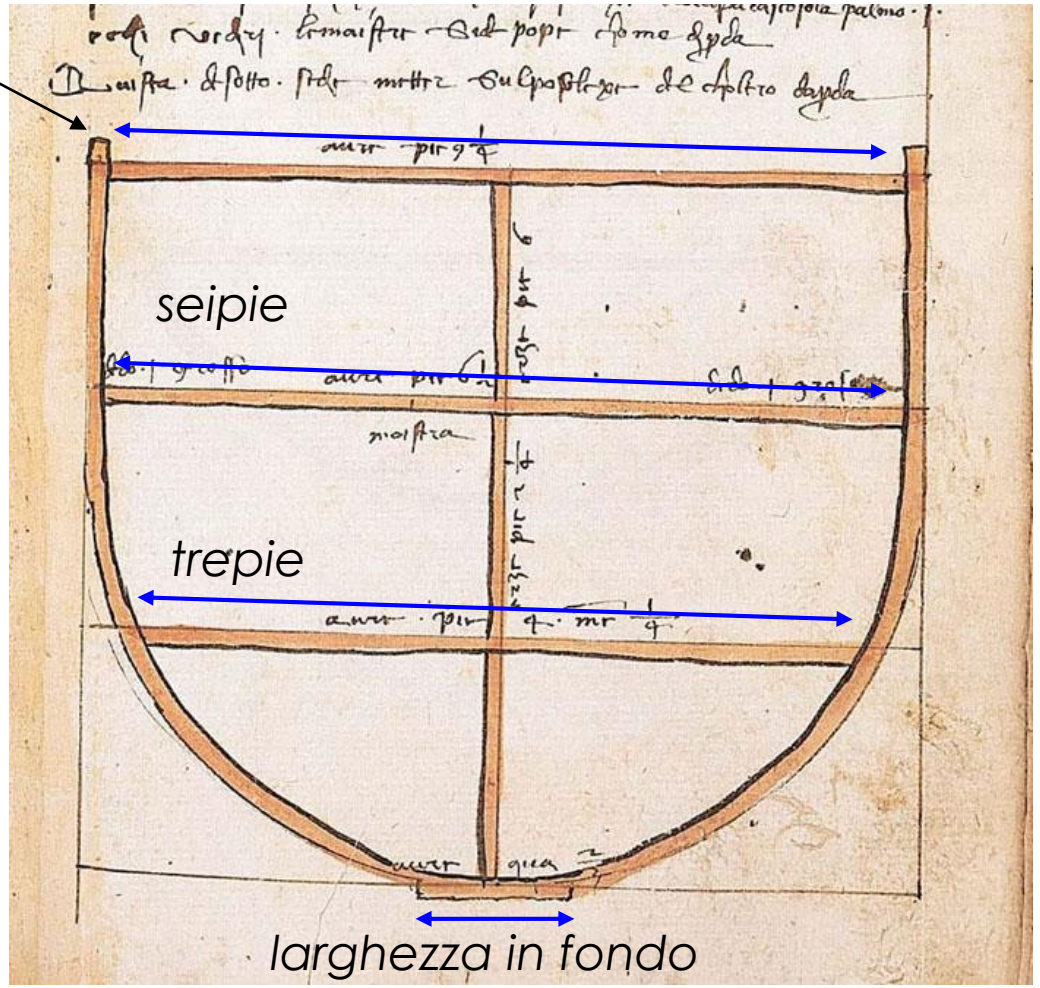
1. Length of keel and dimensions of the stem and sternpost,
2. Depth of hold (*puntale*),
3. Width of the bottom, measured between the bottom stringers (*larghezza in fondo*),
4. Width of the master frame measured 3 feet above the bottom (*trepie*), and
5. Width of the master frame measured 6 feet above the bottom (*seipie*),
6. Maximum beam (*larghezza in bocca*).

Andersen 1925; Bellabarba 1993, 1996; Bondioli pers. comm. 2008

Transversal Control: Midship Section

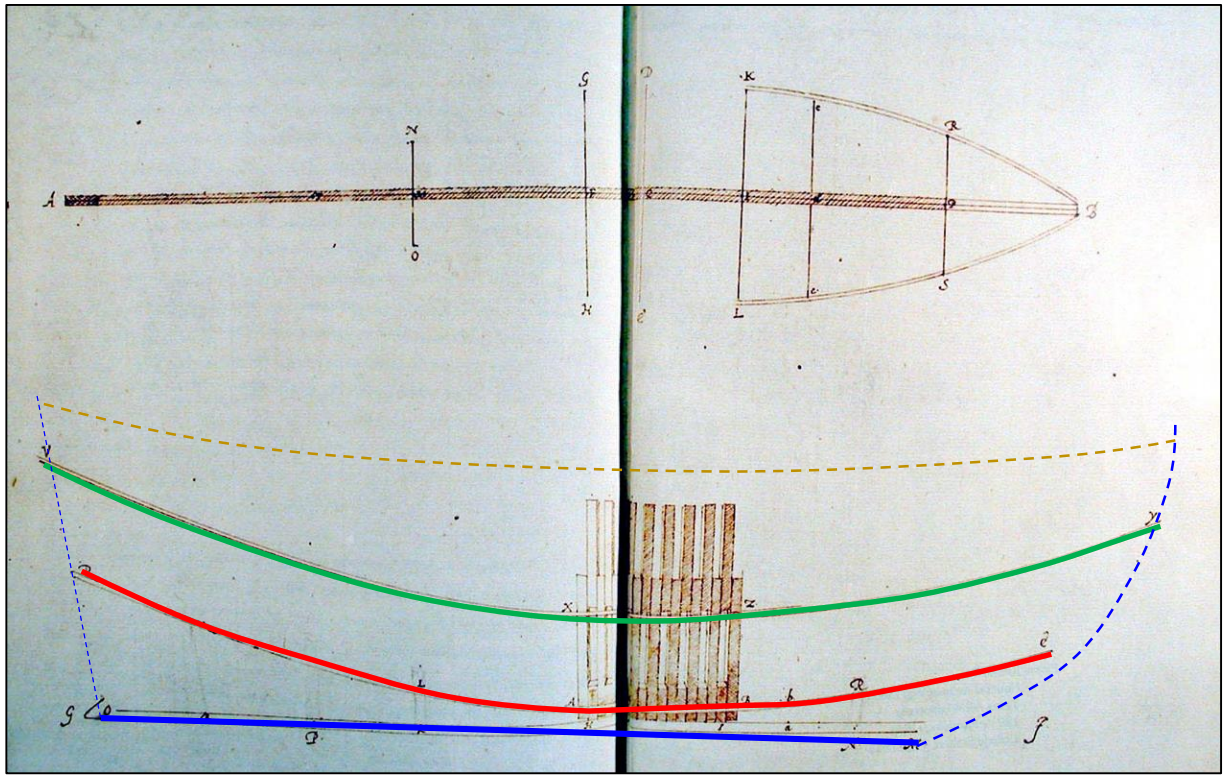
The shape of the midship section was defined with offsets and drawn with a batten.

Sometimes the shape was semi-circular, in which case it was drawn on the floor with a string and a pencil.



Transversal and Longitudinal Control

With or without a midship mold, the shape of a vessel was defined by three basic lines:



Lavanha's bottom stringer and main wale, c. 1600.

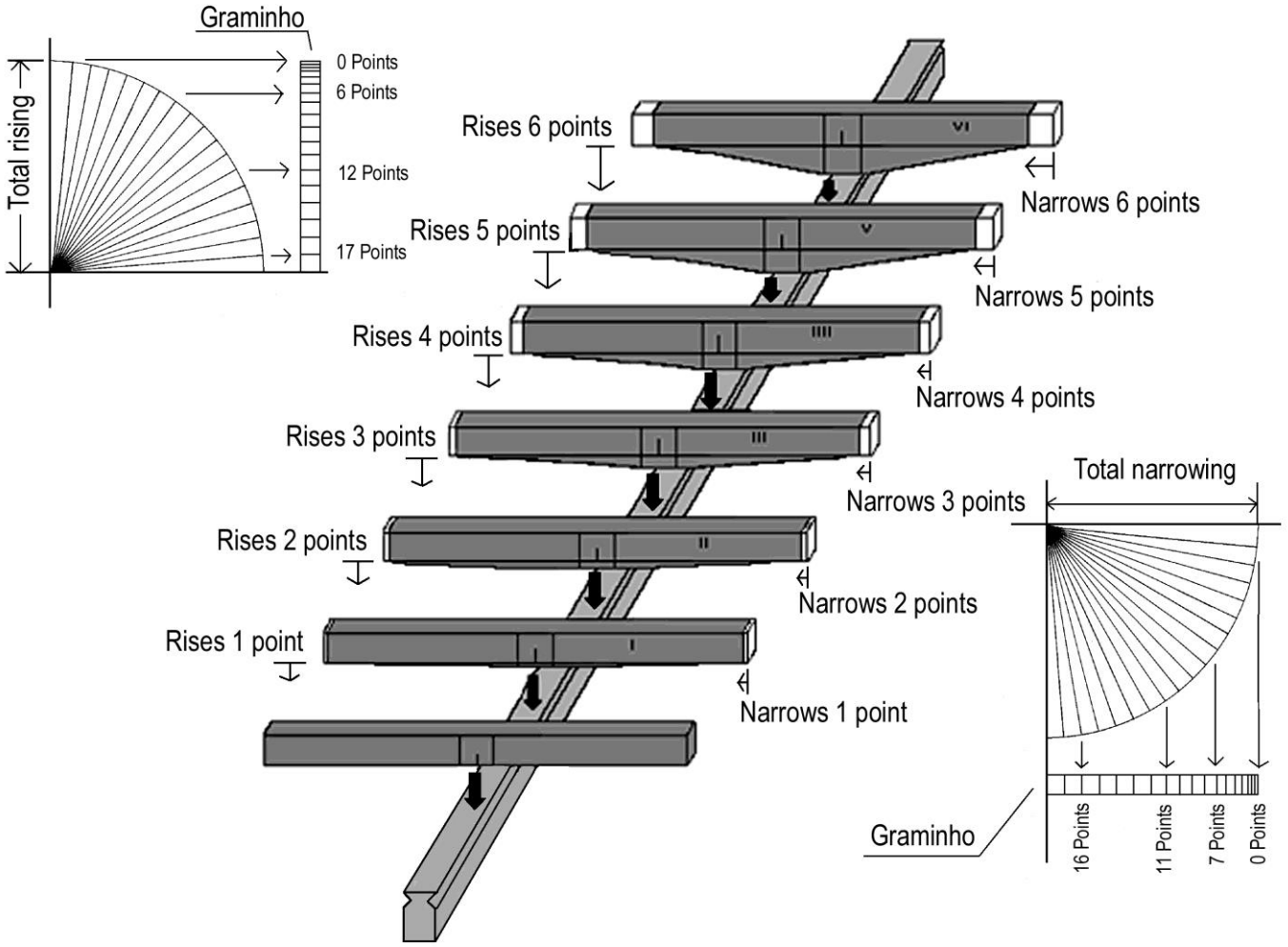
1. The keel and posts;
2. The bottom stringer, which Venetians called paraschossola;
3. Sometimes there is a main wale, between the bottom stringer and the sheer line;
4. The sheer line.

Transversal and Longitudinal Control

The shape of the bottom was obtained through the progressive narrowing and rising of the bottom of the midship frame. This operation was probably achieved by eye, or with the help of ribbands.

Mozambique, 2020. Boat being built on the beach. The shape is controlled transversely with two molds and a stern panel,and longitudinally by eye, with the help of ribbands (Photos: Mário Horta).

Transversal Control: Rising and Narrowing

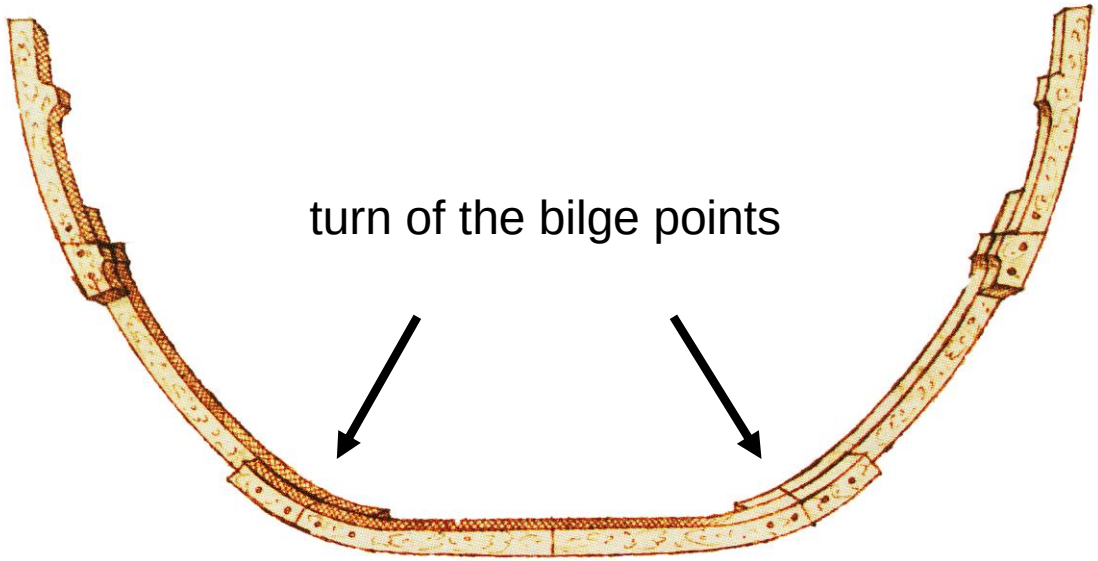


Sometime between the 13th and the 14th century, shipwrights started to apply scales to the midship molds in order to obtain a predictable rising and narrowing of the bottom.

Rising and Narrowing

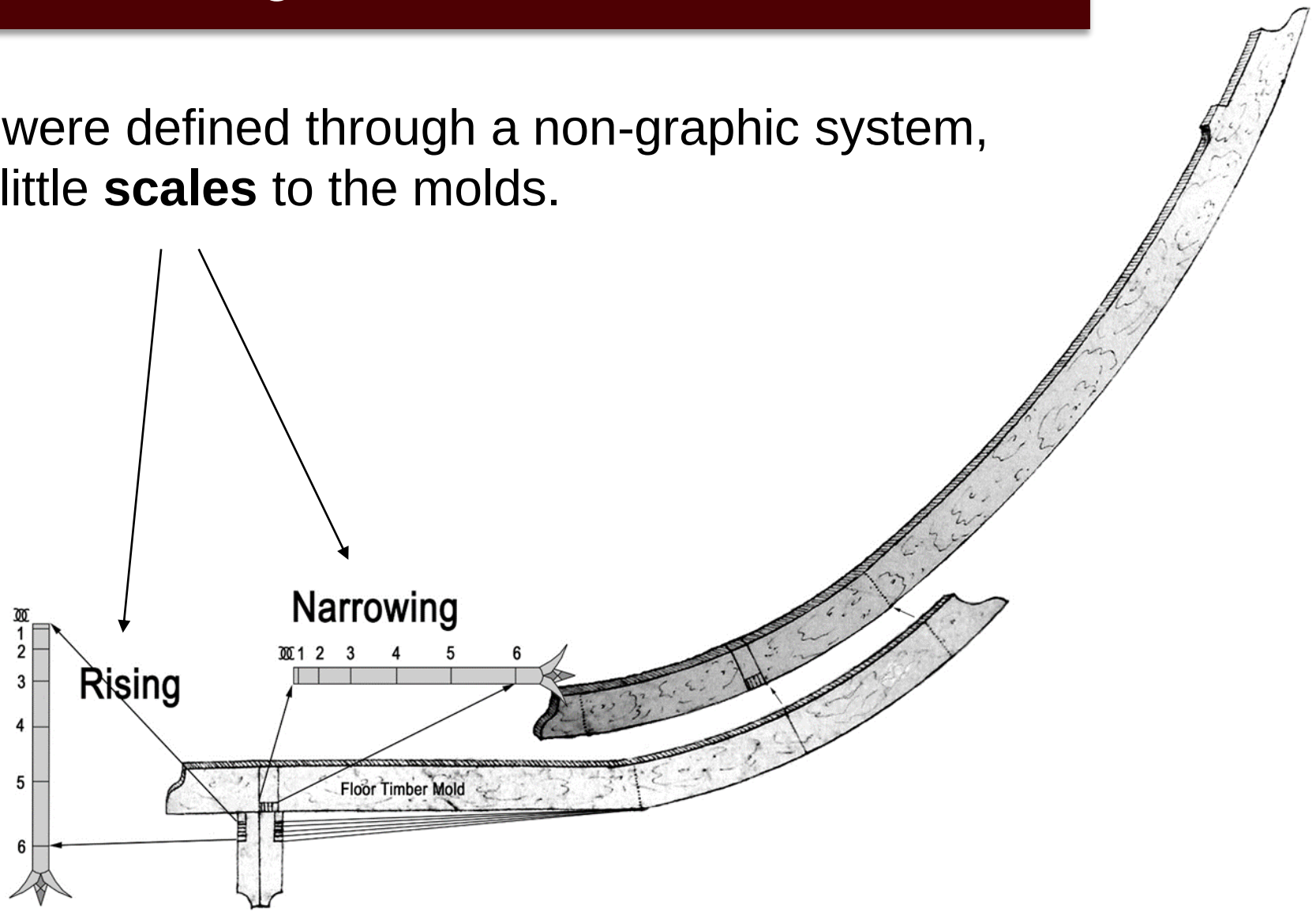
The first step was to define the turn of the bilge point, which is the point in a section where the narrowing and rising are applied; the point that divides the bottom and the sides of a section.

The timbers that compose a frame (floor and futtocks) are marked with a mold and sent to be cut. The rising and narrowing scales are applied to the mold to achieve progressively narrower and higher sections.



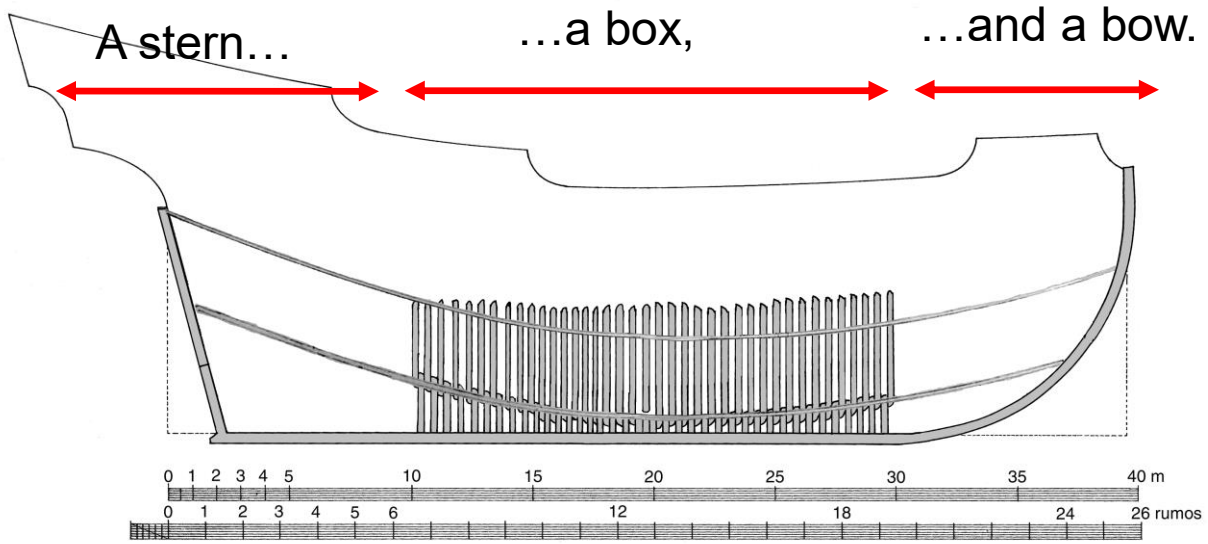
Rising and Narrowing

These lines were defined through a non-graphic system, by applying little **scales** to the molds.



Transversal and Longitudinal Control

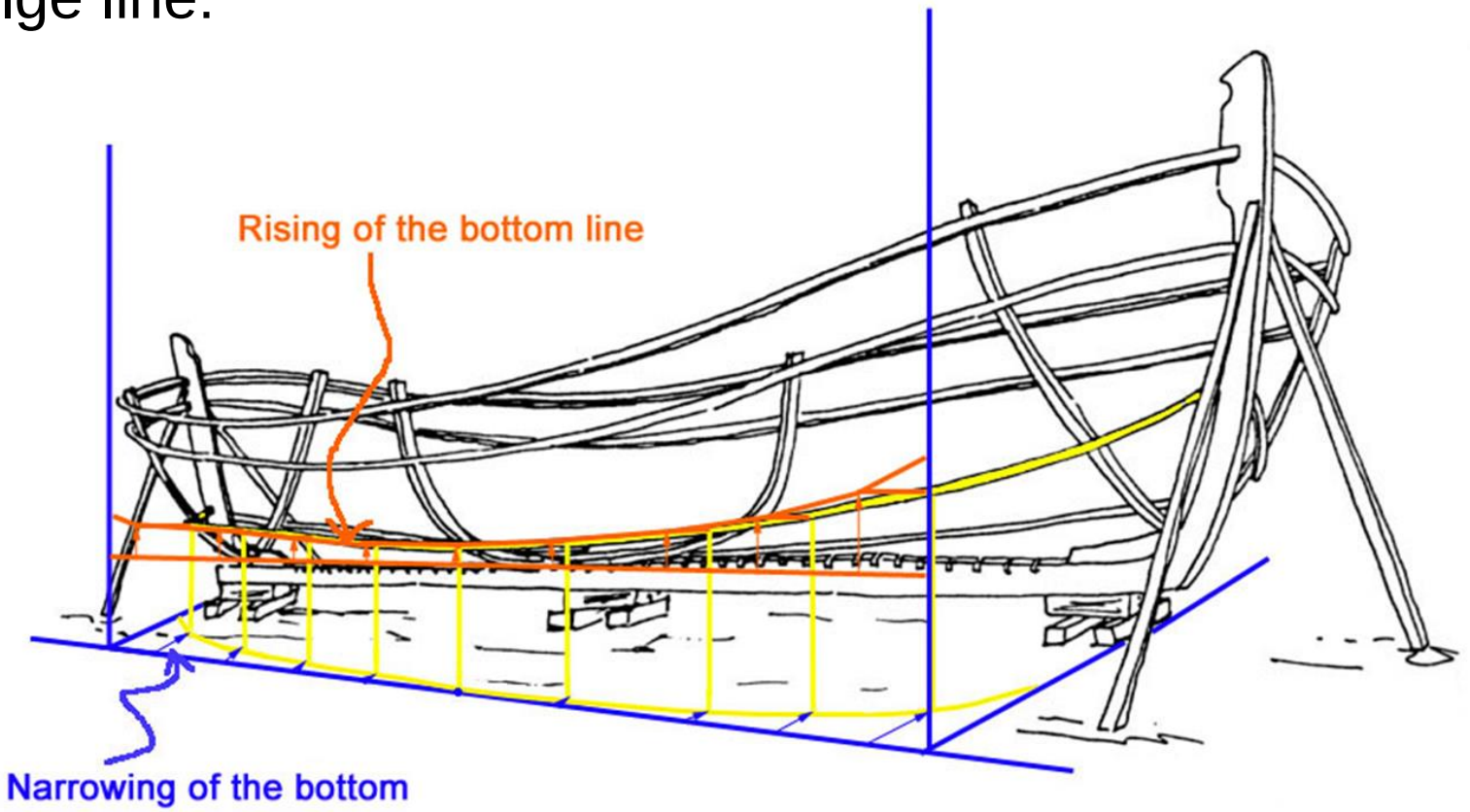
Vessels were thought of as a box with ends, and ends – the entries and runs - were the price seafarers had to pay to be able to steer, etc.



Two frames, fore and aft, defined the box: tail frames in English and *capo* or *chao di sesto* in venetian.

Rising and Narrowing

Normally the entries and runs were designed by eye, and the box was built through a non-graphic system, using horizontal and vertical projections of the turn of the bilge line:



Rising and Narrowing

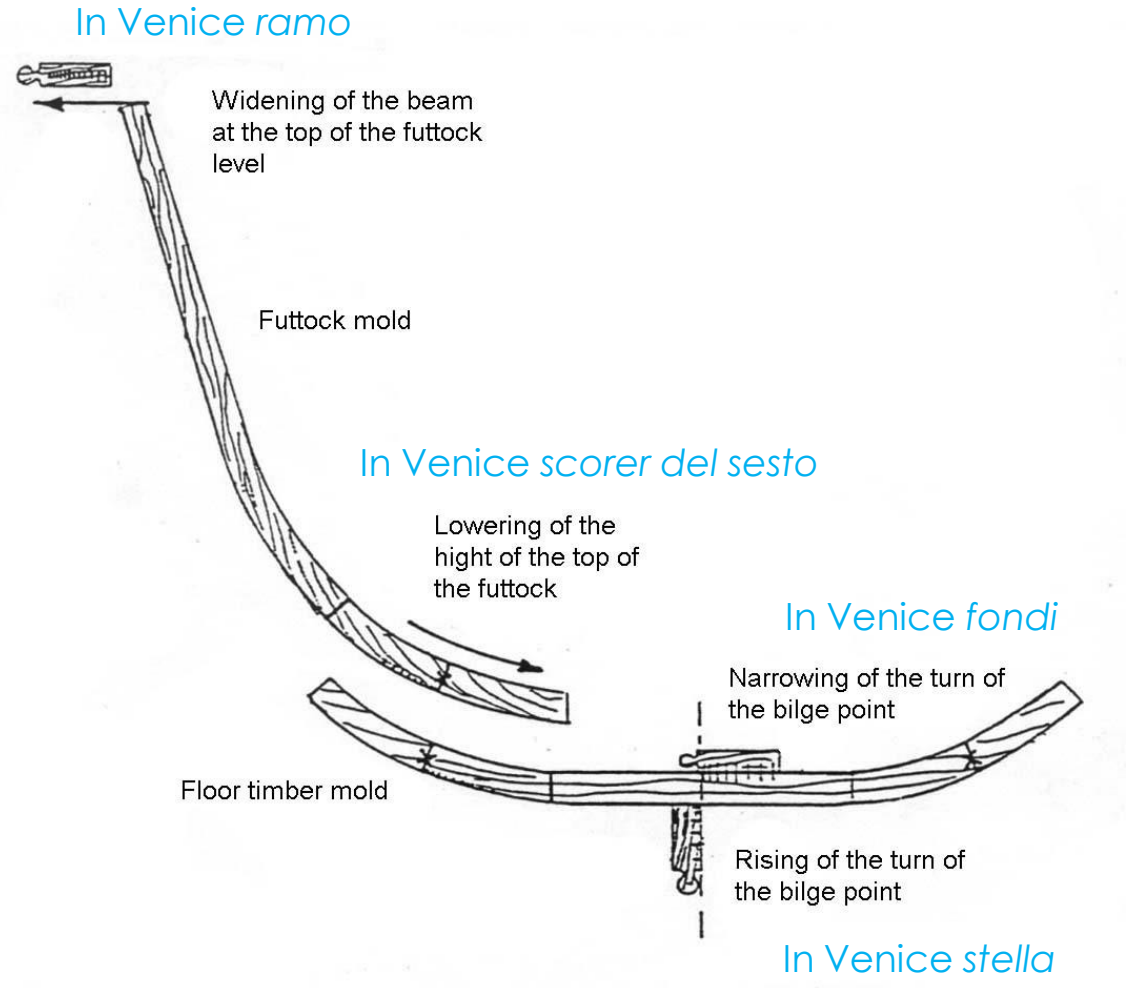
In Italy it was common to apply four different scales to the molds:

a) A rising scale;

b) A narrowing scale;

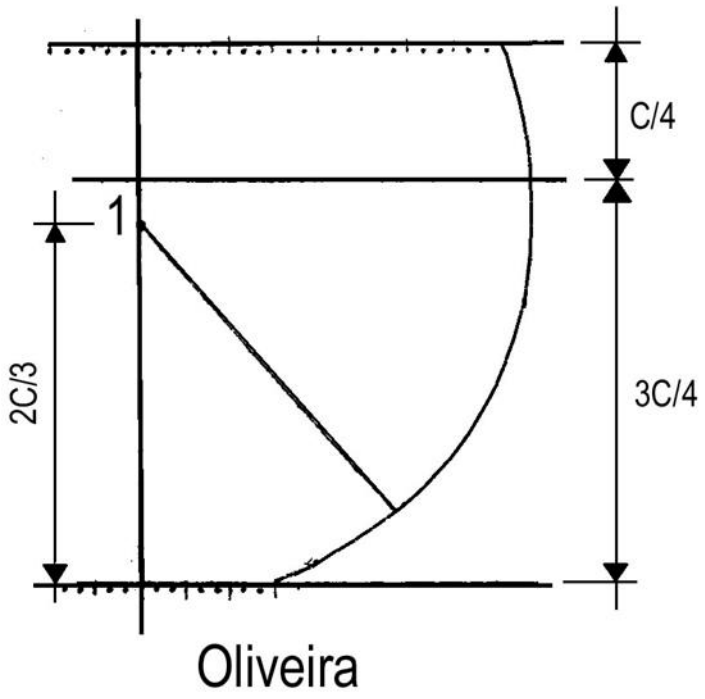
c) A widening scale, to get more deck space; and

d) A slight slide down of the mold, to reduce the sheer on the deck.

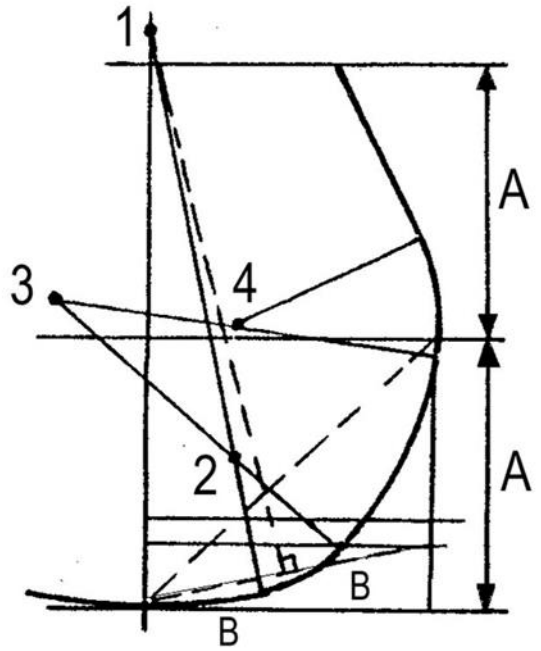


Rising and Narrowing

In the late 16th century some midship sections became more complex, but the scales applied to the arcs remained essentially unchanged.



Oliveira



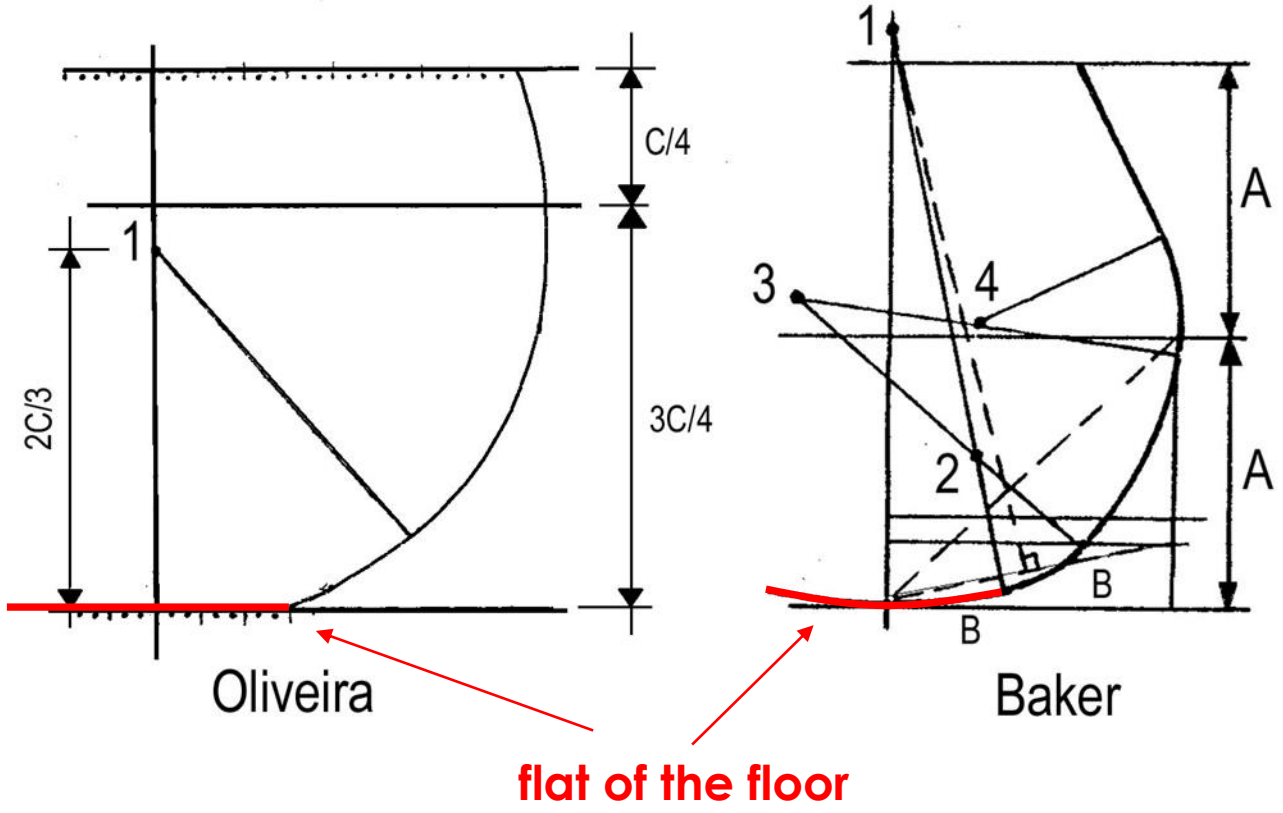
Baker

Greek (Mediterranean) mold

Rising and Narrowing

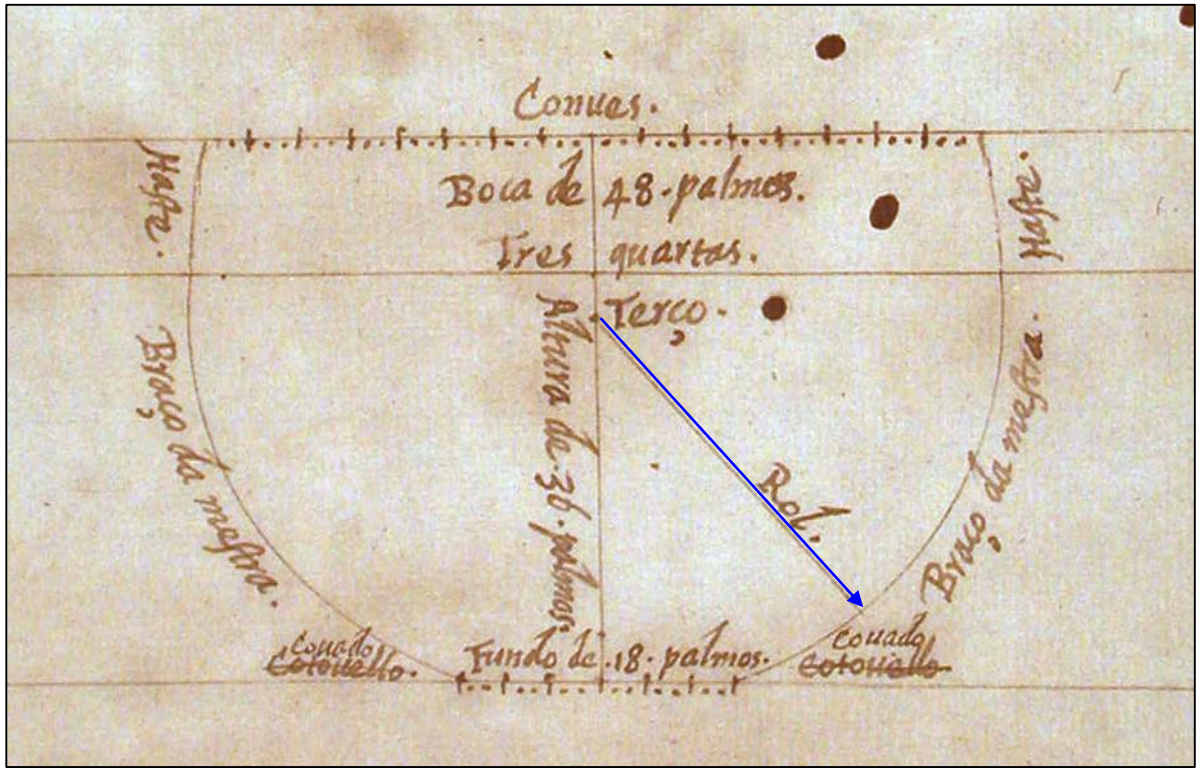
In the Mediterranean the bottom of the midship section may have been an arc.

In this case, the arc changed in order to rise and narrow the flat of the floor.



Rising and Narrowing

For flat floors the process of rising and narrowing is simple and explained some of the texts, such as that of Fernando Oliveira, dated to 1580:



1. Tracing the futtock circular arc with a line and a pencil.

Rising and Narrowing

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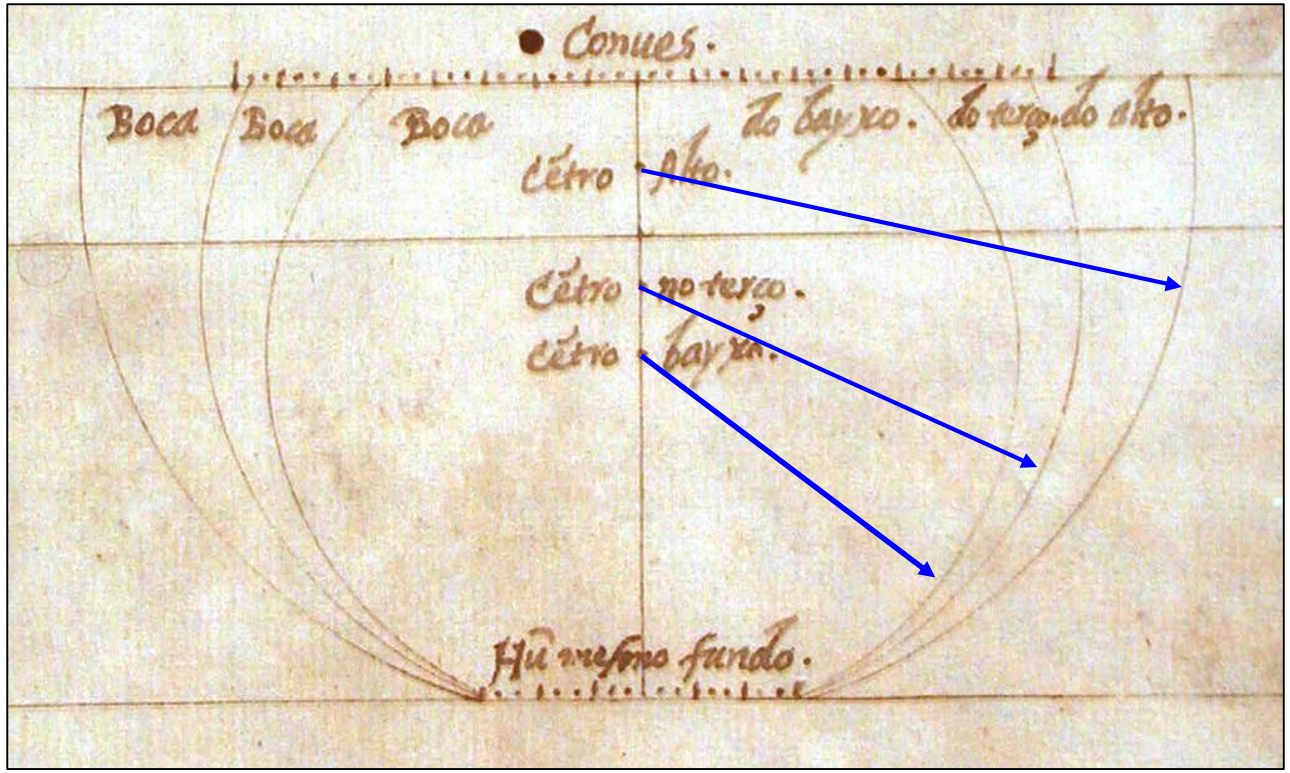

2. Tracing different futtock circular arcs, by moving the center of the arc along the central line.

Rising and Narrowing

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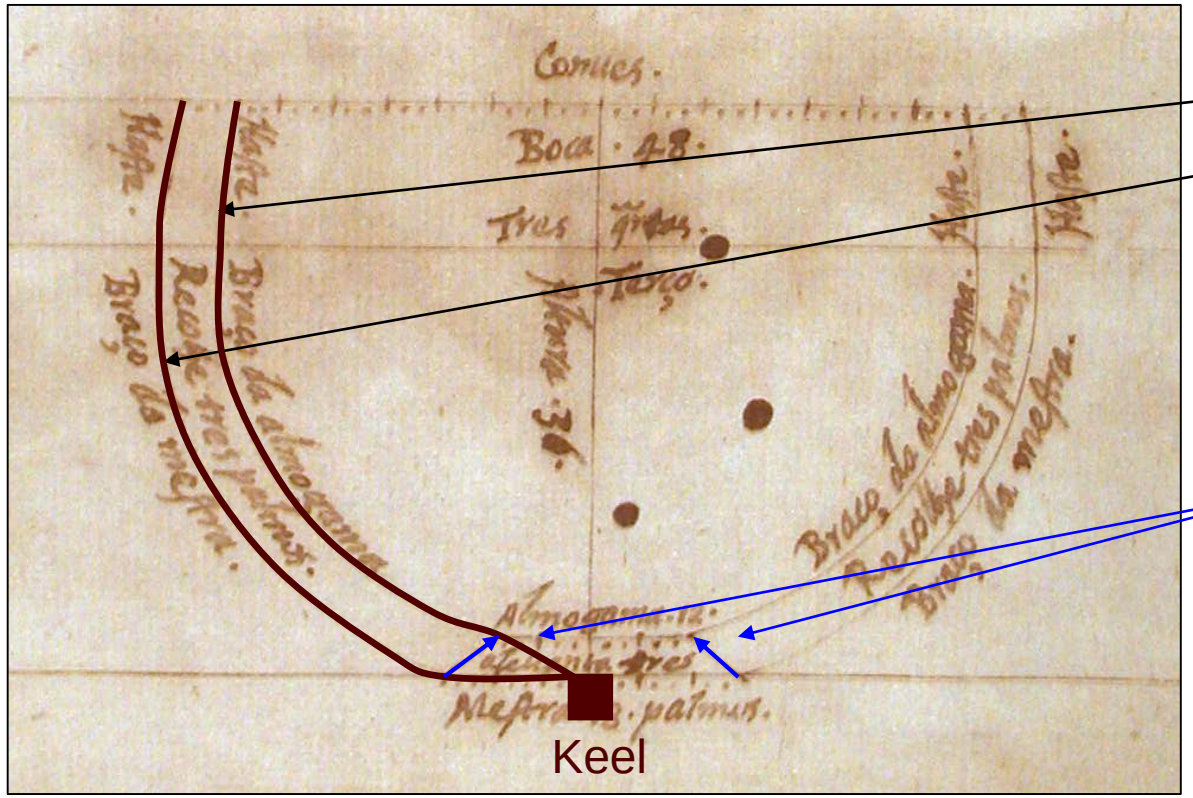
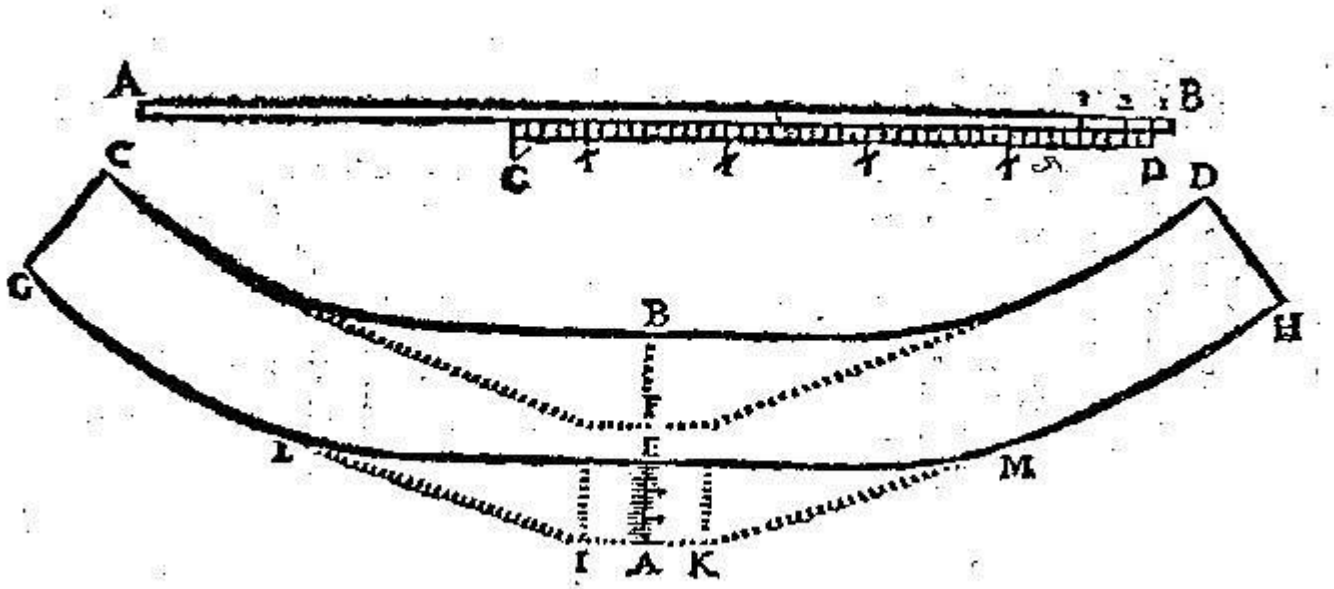


3. Tracing the narrowing and rising lines, which determine the shape of the tail frame.

Rising and Narrowing

Bartolomeo Crescenzio, around 1607, represents this process in a clear way, applying only a rising scale:



Rising and Narrowing

The so-called Greek molds will be explained in a later class. The next PowerPoint is a case study: the *saveiros* from Bahia de Todos os Santos, Brazil.

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