

## Some objections to the link between Gallo-Roman boats and the Roman foot (*pes monetalis*)

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In recent years, the writings of Maarten de Weerd on the subject of the Roman foot, *pes monetalis*, or PM, of 296 mm, and its use in the construction of Gallo-Roman boats, have become more numerous (de Weerd, 1988a; 1988b; 1990). His approach seems interesting as it could disclose one of the parameters revealing Roman influence on continental naval architecture. However, the methodological aspects should be subject to caution and on this basis his conclusions are debatable.

Our first reservation concerns the technique used to register the distances between the floor-frames. No objective basis for this is given. The author seems to choose unsystematically, the mid point, the leading, or the after, edge of the frames.

The second reservation concerns the attempt to specify a precise unit of 296 mm based on relatively few and mostly incomplete artefacts. Boats possessing both extremities are rare and their parts very often depend on the shape of the raw material. The differences between the finished product and the initially planned one can, in the case of frames, lead to small variations in their laying out. For this reason, de Weerd does not systematically use the same point of measurement of the frames. To reduce the consequences of such anomalies, an interesting check can be made by measuring the greatest length of the flat bottom then dividing this by the number of frame spaces. It is thus possible to obtain an average value (1: in Figs 1 and 2) probably close to the one used when the frames were distributed on the planking.

Finally, de Weerd does not use the major elements, such as the mast-step, the midship frames, or the beginning of the curved part of the extremities, to carry out the first subdivision of the boat.

This difficult problem cannot be solved if measurements are based on the framing only. A more effective approach would include the detailed analysis of marks left by carpenters on the middle axis. However, to date such marks are known only on the boats *Mainz-3* and *Mainz-9* which have not been exhaustively published (Höckmann, 1983: pl. 86/3).

The results here (Figs 1 and 2) have been obtained by measuring, in a consistent way, the spaces that separate the frames. The middle point is used if they form a single frame; if they are a pair, the contact point between the two frames is taken as a reference. Therefore, the exact point can be found precisely even when the frames have disappeared.

Generally, it has been noticed that the variation in the distance between the single or paired frames is at least 10 cm on a given boat, but more often 20 cm or more.

The diagram illustrating the single or paired frames on Gallo-Roman boats, and on those considered as such, shows a succession of measurements ranging from 45 to 110 cm (Fig. 1). The shorter distances relate to boats with single frames and the longer, to those with paired ones. Finally, the larger the boat, the smaller the spaces between the floor-frames become.

Thus, with paired frames, an interval of 1 m is found on boats measuring around 10 m (*Yverdon-2*); 0.8–0.9 m on barges of 20 m (*Bevaix*, *Yverdon-1*); 0.7 m on those reaching 30 m (*Zwammerdam-4*).

The distance between the frames does not, therefore, depend on a single unit of measurement (metre, decimetre, *pes monetalis*) but on the type of frame, on the size of the boat and on its loading capacity. If a Gallo-Roman boat, or one considered to be one, such as *Mainz-3*, may

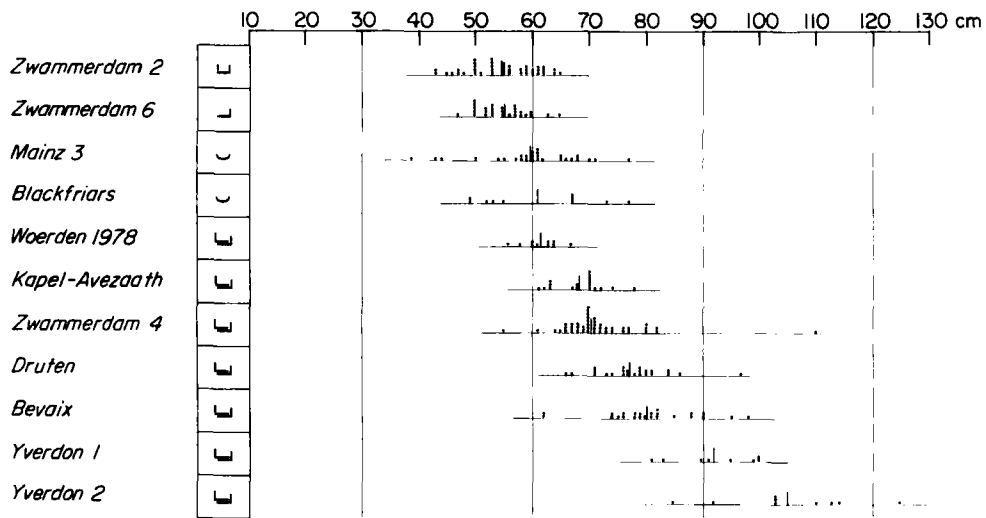


Figure 1. Histogram showing the distance between the frames of different boats discovered north of the Alps and dating from the 1st to the 4th century AD.

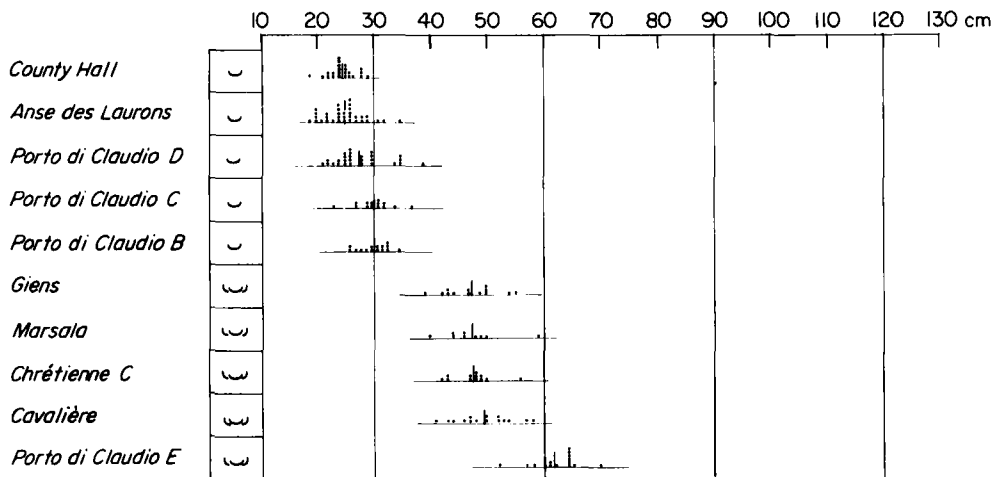


Figure 2. Histogram to show the frame-spacing over the keel of Roman boats and boats with planks assembled by means of mortises, tenons and pegs.

sometimes have values close to that of the *pes monetalis*, the histogram (Fig. 1) clearly shows that particular cases do not prove the rule; the sample studied is too small. If this basis for metrology is used, it could be assumed that the carpenters of the *Hjortspring* boat used the metre (Rosenberg, 1937: pl. 2)!

The analysis of Roman boats or those with planking assembled by mortises, tenons and pegs, is somewhat different. The examples pre-

sented here show a coherent picture with two sets of values (Fig. 2). Only measurements from the keel are taken into account, excluding the stem and the stern post. The first is found close to 25–30 cm with single floor-frames. The second generally consists of larger boats with single floor-frames separated by passive frames fastened only on the sides; the distance between the floor-frames is close to 45–50 and 60 cm.

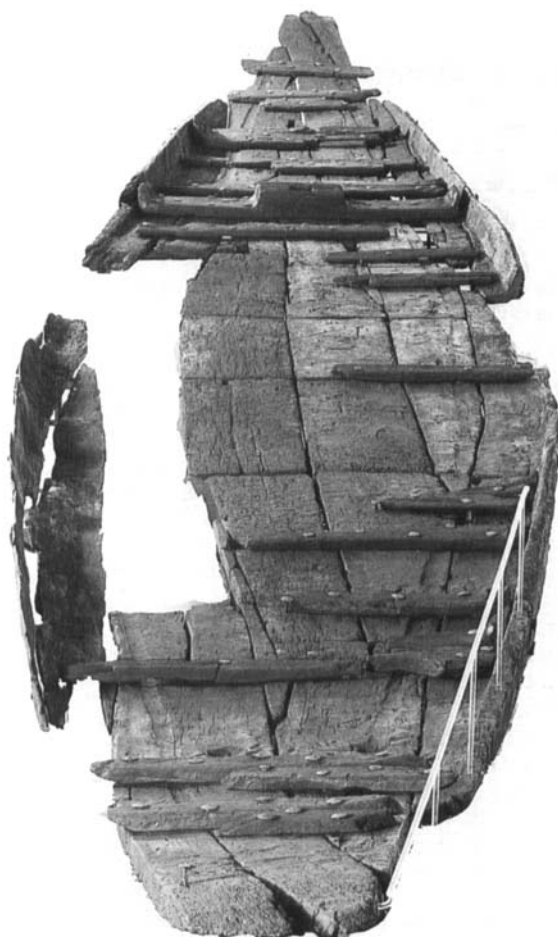


Figure 3. Facsimile of the barge of *Bevaix* which was built with oak trees felled in AD 182.

### The planking and its standardized shaping

M. de Weerd (1988a; 1988b) suggests that, on all of the *Zwammerdam* plank-boats, standardized lengths of planking based on the *pes monetalis* were used, with values equivalent to 25, 50 or 70 PM.

Of the barges of *Zwammerdam*, only No. 2 and No. 6 have been fully published and therefore permit a critical approach. It is unfortunate that No. 4 has not been published as its dimensions and well-preserved state make it particularly relevant for analysis.

The arrangement of the planking of the bottom of *Zwammerdam*-2 and -6 shows an interest-

ing concept. The planking has been designed and staggered in such a way as to avoid having all the weak points on a single line. The gaps between the planks of the same strake are consistently unwedged. The zig-zag shaping therefore does not weaken the bottom part. It can be noted (Fig. 5) that there is no break between planks 2122C and 2122B of *Zwammerdam*-2; they are a single piece of wood (de Weerd, 1988b; Fig. 51). This can be observed on that boat now conserved and being re-assembled in the *Prins Hendrik* Maritime Museum in Rotterdam (ibid. Fig. 51). Plank 6122 (19.5 or 20 m long; ibid. Fig. 127) of *Zwammerdam*-6 is, on the other hand,

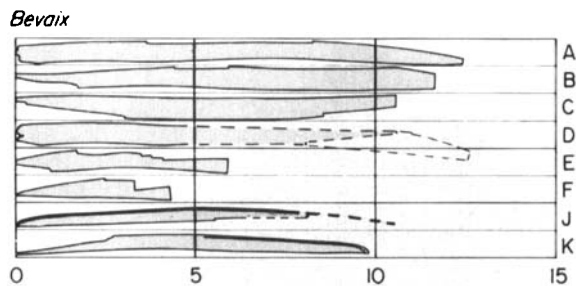


Figure 4. An unusually complete Gallo-Roman vessel: planking of the boat of *Bevaix*.

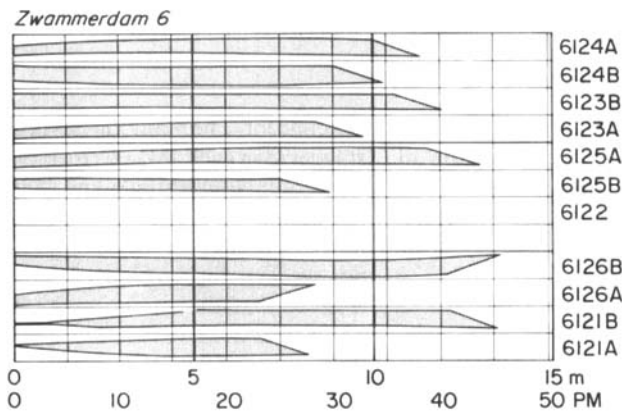
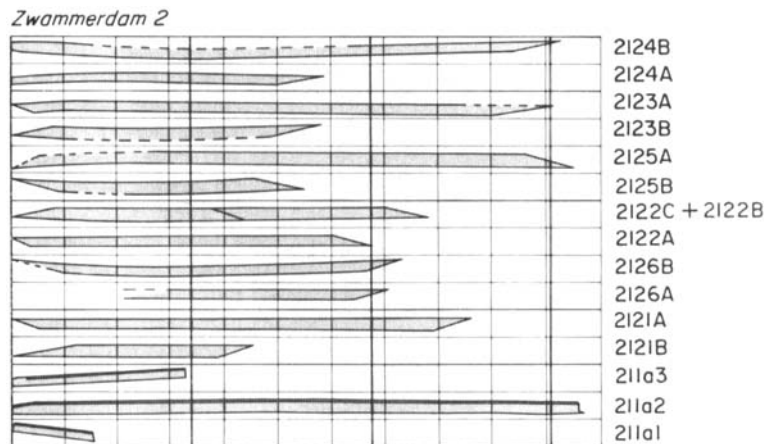


Figure 5. Planking of the *Zwammerdam* boats 2 and 6 (after de Weerd, 1988b: Figs 51 and 81). The part of the planking that forms one or the other extremity is always placed on the left; the letter B corresponds to the stem and A to the stern.

probably made up of two different pieces. It is even more difficult to try and identify the Roman foot from the length of the planking than from the distribution of the floor-frames (Figs 4 and 5). The number of measurements are poor and the shape of the planks must basically adapt to the general structure of the bottom. The plan of the planking of *Zwammerdam-6*, which is one of the simplest, clearly shows that it is subjective to identify standard lengths of 25, 30, 40 or 50 PM.

### Conclusion

None of the proposed arguments enable us to identify the use of the *pes monetalis* on Gallo-Roman boats, or those considered as such. The distance between the floor-frames merely indicates the close link found between the intervals of the frames, the type of framing and the size of boat.

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