

# Identification of wood used in the construction of the two *horeiae*-type vessels Toulon 1 and 2 (1<sup>st</sup> century AD, France)

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During the archaeological excavation of the ancient harbour of *Telo Martius* (Toulon, France) in 1985-1988, the remains of five Roman vessels were uncovered. Two of the five vessels, Toulon 1 and 2, were filled with stones and reused to build a jetty at the end of the 1<sup>st</sup> century AD. The others three vessels, abandoned in the 3<sup>rd</sup> century AD, correspond to larger sailing vessels.

The remains of Toulon 1 and 2 were recovered and conserved by impregnation with PEG and lyophilisation, and are now stored by the Regional Service for Archaeology in Aix-en-Provence (France). In 2010, the systematic study of the shipwreck collection began under the direction of G. Boetto within the framework of the final publication of the excavations.



Localisation of Toulon in Southern France

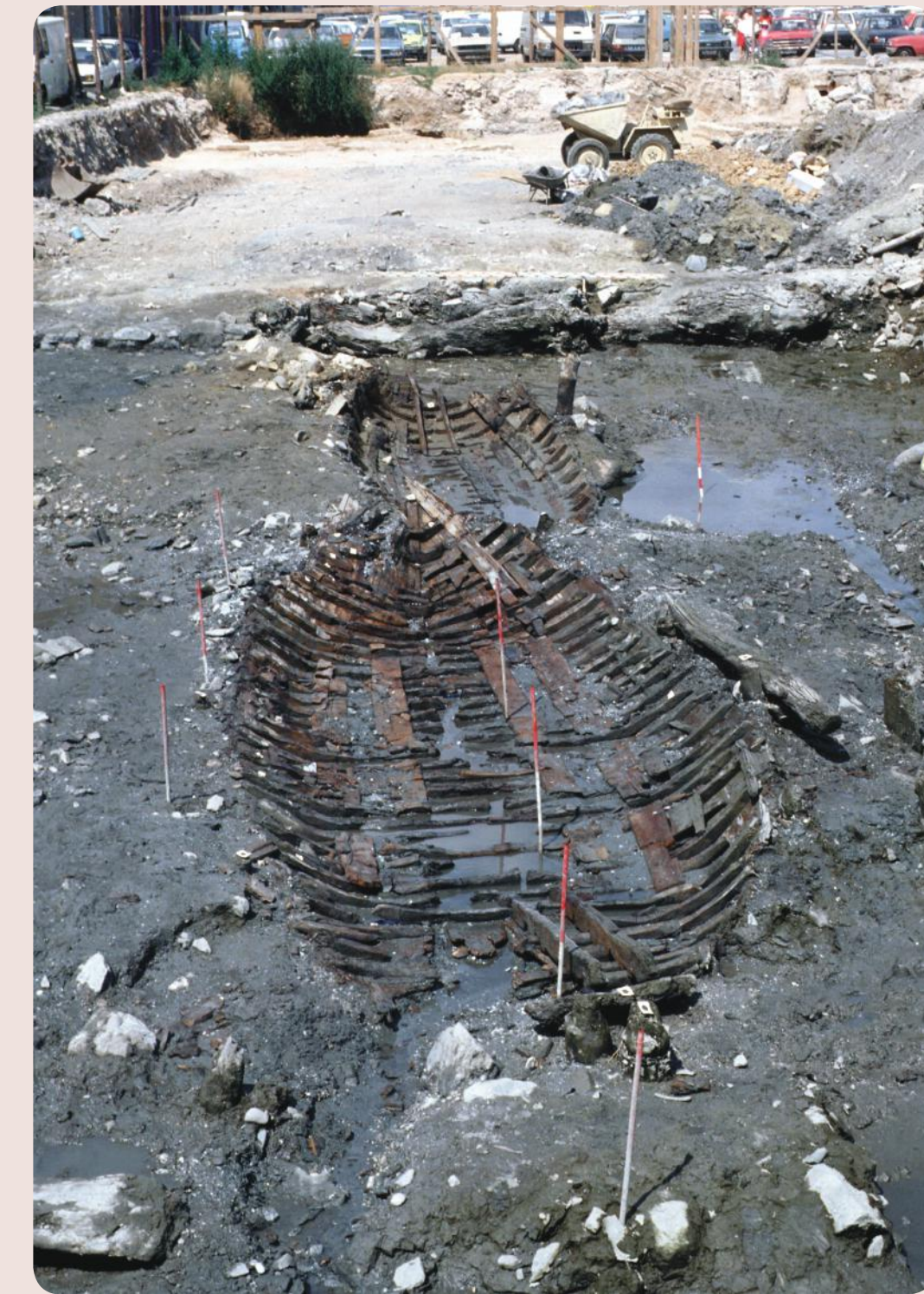
## Toulon 1 and 2: architecture and function

Toulon 1 and 2 measure, respectively, 8.3 m and 6.3 m in length, 3 m and 2.25 m in width, and 60 cm and 50 cm in depth. A keel, a transitional stern timber and a sternpost (conserved only in Toulon 2) constitute the axial carpentry. Forward, the structure is completed by the transom bows nailed to the keel.

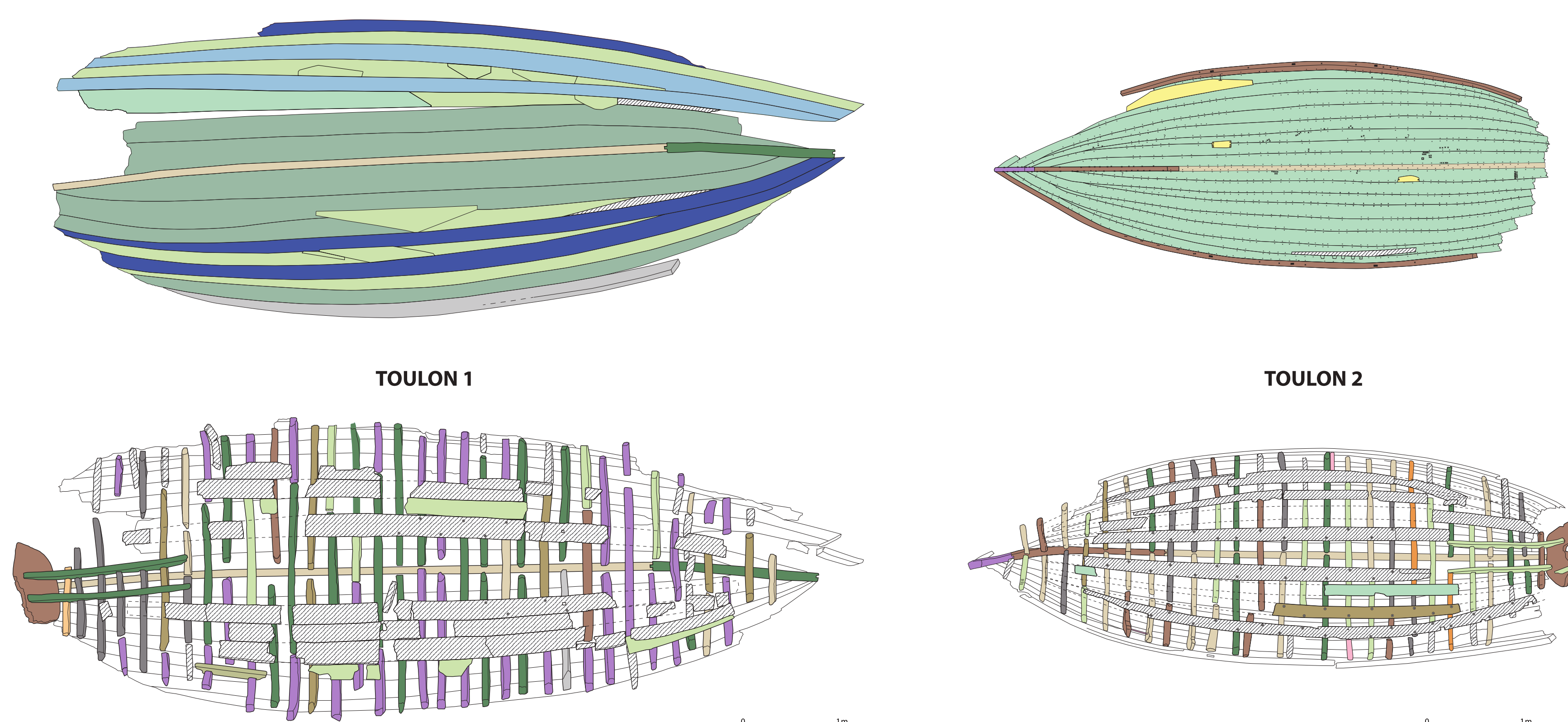
Each side counts nine strakes per side, the ninth strake being a wale. The planks are connected to each other and to the keel by closely-set mortise-and-tenon joints. A capping gunwale covers the wales and rectangular recesses to house the oarlocks perforate both these elements. Finally, a bulwark completes the stern (conserved only on the starboard side of Toulon 2).

The transversal carpentry is composed of floor-timbers with futtocks, alternating with half-frames or overlapping half-frames. All these elements are assembled to the planking by treenails and a few nails. The boats do not have a keelson or a mast step; a ceiling (stringers and mobile planks) completes the structure internally. Finally, both of the boats present some hull repairs.

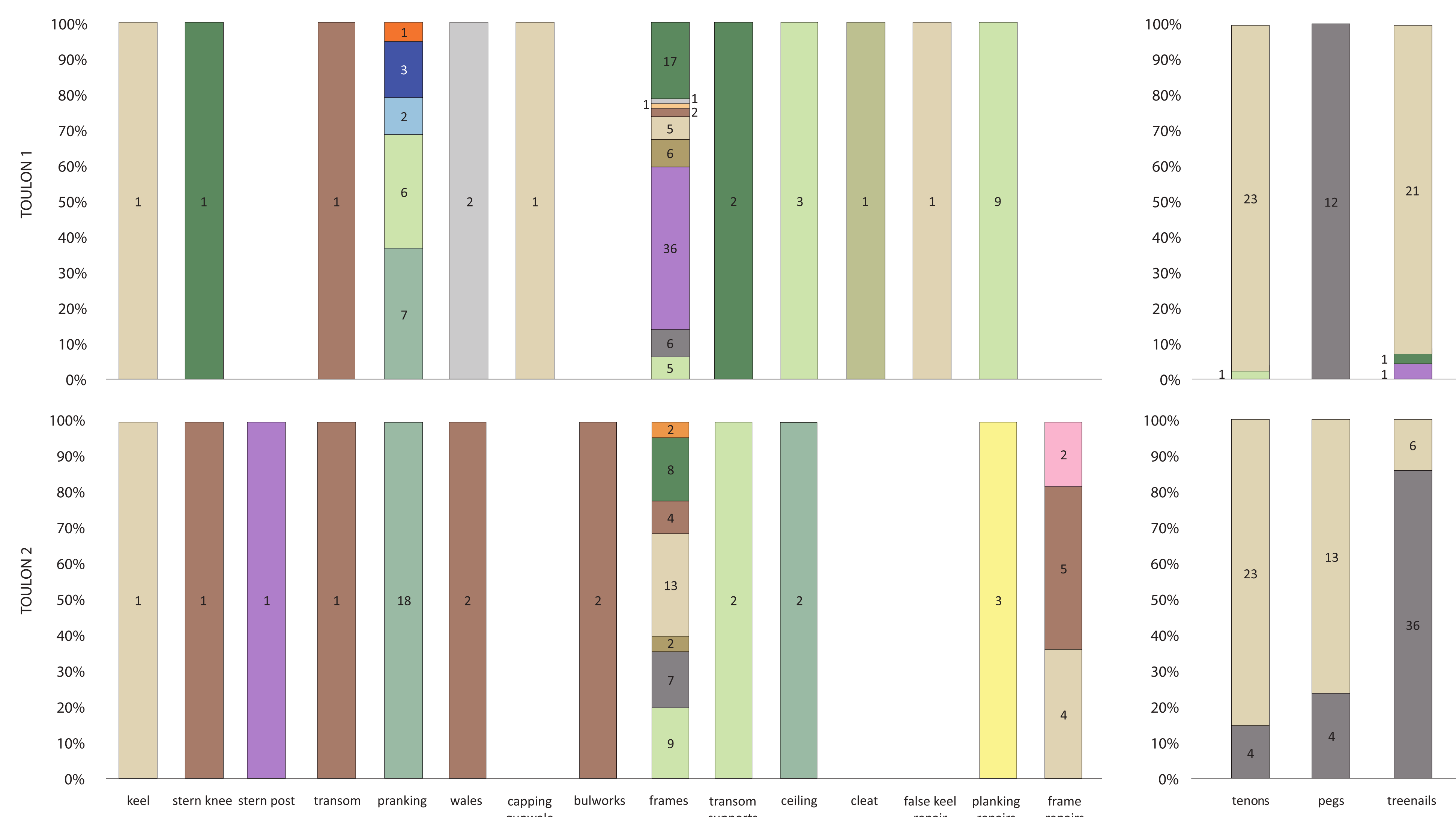
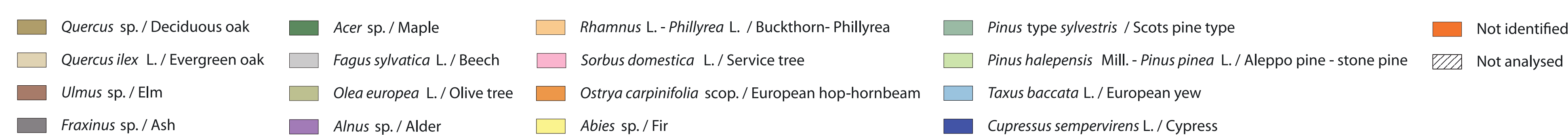
The characteristics of the hulls of Toulon 1 and 2 show that they were based on a shell structural concept and on a longitudinal strake oriented hull-shape. The building process was shell-first. These boats, characterised by a transom bow, belong to the *horeiae*-type vessels known from the Tunisian mosaic of Althiburus (2<sup>nd</sup> c. AD) and correspond to small boats used as harbour lighters or for fishing.



Toulon 1 and Toulon 2 during the excavation (courtesy Centre archéologique du Var, Toulon)



Distribution of the different wooden species on the keel and planking (top) and on the frame and ceiling (G. Boetto).



Charts representation of proportions of wooden species used in the structures and assemblages from Toulon 1 and Toulon 2 (G. Boetto).

## Wood identifications

A total of 411 samples of wood were analysed for Toulon 1 and 2. For Toulon 1, 126 samples were taken from ship structural elements (keel, planks, frames and ceiling), and 59 samples were taken from ship assembly elements (tenons, pegs and treenails). For Toulon 2, 140 samples were taken from ship structural elements, and 86 samples were taken from ship assembly elements.

Between Toulon 1 and 2, a total of 16 different tree species were identified in ship structural elements, including five coniferous and 11 broadleaf species. Toulon 1 sampling revealed the use of 13 tree species, while only 11 different species were identified on Toulon 2.

The keels and the transom bows were made, respectively, from evergreen oak and elm. For the stern transitional timbers two different species were used: maple for Toulon 1 and elm for Toulon 2. Alder was used for the sternpost of Toulon 2. Due to the importance of the axial carpentry, species with excellent mechanical qualities and very high durability were chosen. Maple, characterised by rather modest technical qualities, was probably chosen due to its hardness.

The planking of Toulon 1 was made from four different species of conifers: Scots pine type, Aleppo pine/stone pine, cypress and European yew. The wales were made of beech and the capping gunwale of evergreen oak. The Toulon 2 planking was more homogeneous, employing only two species: Scots pine type for the planks and elm for the wales and the bulwark.

The homogeneity of the planking and the use of coniferous softwood species characterised by high elasticity and flexibility are typical in the ancient Mediterranean shipbuilding and are related to the predominant role of the shell in the ship structure.

On the contrary, the frames were highly heterogeneous, with nine species used in Toulon 1 and seven in Toulon 2. This heterogeneity and the apparently chaotic disposition of the different species could be connected to some difficulties in supplying the shipyard. It is noted, however, that hardwood species were preferred for the frames, as is often attested in ancient shipbuilding.

The ceilings shows, unsurprisingly, the use of the same resinous species (Aleppo pine/stone pine and Scots pine type) employed in the planking. The transom bow supports were made of maple on Toulon 1 and Aleppo pine/stone pine on Toulon 2. A hardwood tree (olive) was also employed for the cleat found on the starboard side of Toulon 1.

The repairs of the planking were made from Aleppo pine/stone pine on Toulon 1 and fir on Toulon 2, a choice that probably reflects a deliberate and simultaneous selection in the search for strength, flexibility and elasticity. The keel of Toulon 1 was also repaired with an insert made of evergreen oak, and the repairs of the Toulon 2 frames show the use of elm, evergreen oak and service tree.

Finally, the assembly elements were made from five hardwood species and one conifer, including two predominant hardwoods (evergreen oak and ash) and three others species (Aleppo pine/stone pine, maple and alder).

## Conclusion

Most of the trees used in the construction of Toulon 1 and 2 were likely available along the coast or in the nearby riparian forests situated not far from the harbour. Other trees, such as fir, Scots pine type, beech, maple, European yew, were available in more remote areas.

Nevertheless, given the actual distribution of tree species in the mountainous and hilly areas situated in a range of 20-40 km to the north and north-west of Toulon (for example on the north slopes of the Sainte Baume or in the Esterel mountains), it is highly probable that the wood used to construct Toulon 1 and 2 was locally grown and ultimately transported to a coastal shipyard. Also the European hop-hornbeam, although rarely present in the western Mediterranean, is today attested in the eastern part of the Esterel mountains and so, in Antiquity, it could have been easily used to supply the local shipyards.

Given the ease of transporting all these woods to a shipyard situated near the ancient port of Toulon, and taking into account the function of these small boats, the use of local wood originating from the surrounding areas of *Telo Martius* seems quite probable.

In conclusion, the results obtained from the analysis of the wood used in the construction of Toulon 1 and 2 confirm the assumption of a local origin of these ships, scientifically proving the theory previously hypothesized from analysis of their construction characteristics coupled with consideration of their function as harbour lighters or for fishing.

\*The inability to differentiate the anatomy of wood from Scots pine (*Pinus sylvestris* L.) to that of black pine (*Pinus nigra* Arnold) and hooked pine (*Pinus uncinata* Ramond) led us to group the taxa under the name of "Scots pine type". Similarly, difficulties in distinguishing the Aleppo pine (*Pinus halepensis* Mill.) wood from that of the stone pine (*Pinus pinea* L.) led us to use of the denominations «Aleppo pine/stone pine».

## Selected bibliography

Boetto, G., 2009, New archaeological evidences of the *Horeia*-type vessels: the Roman Napoli C shipwreck from Naples (Italy) and the boats of Toulon (France) compared, in R. Bockius (ed.), *Between the seas. Transfer and Exchange in Nautical Technology, Proceedings of the 11<sup>th</sup> International Symposium on Boat and Ship Archaeology (ISBSA 11)*, Mainz 2006, Mainz, p. 289-296 (RGZM. Tagungen Bd. 3).

Brun, J.-P., 1999, *Le Var*, Paris (Carte Archéologique de la Gaule, 83/2).

Ferreira Dominguez, A., 2014, *Etude xylologique des barques de type « horeia » Toulon 1 et Toulon 2*, Master Thesis, Aix-Marseille University, Aix-en-Provence.

Guibal, F., Pomey, P., 1998a, Dendrochronologie et dendromorphologie, in G. Volpe (ed.), *Archeologia Subacquea, VIII Ciclo di lezioni sulla ricerca applicata in archeologia, Certosa di Pontignano 1996*, Florence, 1998, p. 425-446.