THE WRECK OF THE MID-17TH-CENTURY *ERQUY-LES-HÔPITAUX* (CÔTES D'ARMOR, FRANCE)

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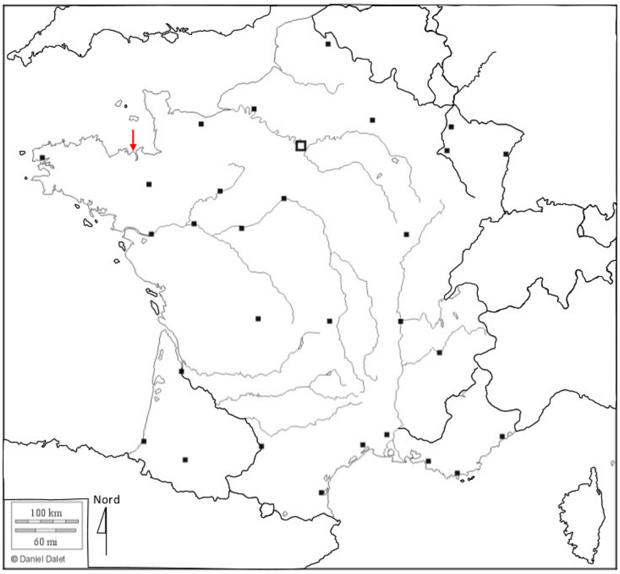

Fig. 1.1. Location of the wreck *Erquy-les-Hôpitaux*, Côtes d'Armor, France (all rights reserved) Source: Daniel Dalet

INTRODUCTION

The wreck at Erquy (Côtes d'Armor) was announced in 2002 by Yves Meslin and assessed in the same year by a team from Drassm (Département des Recherches Archéologiques Subaquatiques et Sous-Marines, ministère de la Culture) directed by Michel L'Hour and Elisabeth Veyrat. It is situated on the foreshore, alternately covered and uncovered by the rhythm of the tides (Fig. 1.1). In 2014 and 2015, the wreck was the subject of a programmed excavation carried out under the direction of Olivia Hulot and Marine Jaouen, archaeologists at DRASSM. The architectural study of the wreck was carried out by Eric Rieth (CNRS, LaMOP/Musée National de la Marine).

Besides, beyond the excavation, that operation is attached to a programme of multi-year studies directed by O. Hulot on the problems of excavation in the context of the foreshore which implies the definition of a strategy of terrain and the putting into effect of methods and techniques of excavation, as well as the recording of data (architectural statements in particular), adapted to such an «amphibious» environment (Fig. 1.2).

Fig. 1.2. General view of the site; the wreck is situated near the yellow tractor and the group of people
Source: Images Explorations — F. Osada

The cargo brought to light in the course of the assessment of the wreck was composed principally of a lading of lime in barrels and, perhaps as a complementary freight, a lading of slate.

The dendrochronological analysis of some 60 scantlings of wood has been carried out by Catherine Lavier (CNRS, Laboratoire d'archéologie moléculaire et structurale). The study of the oak staves of the barrels allowed two thirds of them to be dated to the 17th century, and to associate them geographically to the same ecological sectors of Burgundy. The analysis of the scantlings of the architectural remains, of elm, led to a dating of thirteen amongst them to the year 1627 (*post quem* date), in all probability very close to the felling date of the trees. In addition, these timbers present an ecological appearance corresponding more or less to that of the present «Pays de Loire».

The wreck was re-buried at the end of the 2015 campaign, using synthetic fabric, sandbags and sand.

1. WHY EXCAVATE THE *ERQUY* WRECK

The preliminary question that is posed is that of the scientific justification to excavate, with all the constraints and technical difficulties previously evoked, the wreck of a boat close to 9m long by about 3m breadth, whose construction is dated, in all probability, to the first third of the 17th century, and more precisely according to the results of the dendrochronological analysis, around 1627, close to the felling date of the trees. That interrogation returns, indeed, to a more general problem for the archaeology of wrecks of the modern era which, although clearly formulated in France during the 1980s[1] on the example of Anglo-Saxon research in particular, still seems to encounter sometimes certain difficulties in being accepted by our scientific community, despite the results obtained[2].

Why therefore excavate a wreck such as that at Erquy? The response hangs upon the weak knowledge of the history of naval architecture of this category of boat, which depends on a vernacular type of naval architecture. In the particular technical context of small private boatyards, it often appears difficult, for lack of sufficient sources, to describe, from the point of view of the history of techniques, the architecture of these boats of the modern era as one can do it summarily for that of the ships of Graeco-Roman antiquity, for which one can now define not only the principle and processes of construction, and their mutations over a long period of history, but equally, starting from the identification of «architectural signatures»[3] the evolution of the forms and structures of the hulls, or even the characteristics of different regional traditions.

Without going into detail, it is always important to recall briefly certain aspects in the body of that presentation, on the nature of the difficulties encountered in understanding through the written, graphic and iconographic sources of the modern era, the characteristics of the architecture of a boat such as that at Erquy. The first problem is connected to the mode of techno-economic production of the shipyards constructing these types of small vessels intended principally for coasting, short sea trades, and local fisheries. In this context of private and artisanal construction, the order for a boat was often given without relying on a plan or descriptive specification[4]. To take up the title of a book by the pre-historian André Leroi-Gourhan, vernacular naval architecture, to which the *Erquy* wreck belongs, relies above all, indeed, to a technical culture of «gesture and word», which leaves hardly any documentary traces for the historian of techniques

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[1] For one of the first articles in France, see RIETH, 1985: 7-11.

[2] For the results, see for example the issue of the review «Archéo-Théma», 2014, vol. 4, coordinated by E. Rieth and entirely dedicated to underwater archaeology of wrecks of the modern era in the Mediterranean. See also the volume of the Italian review «Archeologia Postmedievale», 2014, vol. 18, published under the direction of C. Beltrame and dedicated in its totality, as the subtitle «Archeologia dei relitti postmedievali» indicates, to the archaeology of post-mediaeval wrecks.

[3] That notion, defined at the outset, in relation to wrecks of the mediaeval and modern eras, is applicable to both ancient and contemporary wrecks (cf. RIETH, 1998: 177-188).

[4] The contracts for construction, when they exist, are reduced to the minimum, briefly mentioning the dimensions and financial conditions.

and archaeology to make use of, except the architectural vestiges themselves of the boat in question.

The second question concerns the technical sources, in the occurrence of treatises of naval architecture. It is necessary to await the 18th century for the appearance in these documents, be they manuscript or printed, of information of a technical order on the architecture of boats for coasting or coastal fisheries. As a general rule, it is principally the general characteristics of dimensions, proportions, forms of hull, or even rigging, that are mentioned. A revealing example of the nature of this data is provided by a manuscript entitled *Répertoire de construction*, dated 1752, by Pierre Morineau, the director of shipbuilding of the port and arsenal of Rochefort. This document describes, amongst other examples, a «Breton chaloupe, or chasse-marée […] serving for the transport for several purposes from the coast of Brittany to that of Aunis»[5]. These are principally the internal arrangements and proportions of that family of small sailing coasters, of lengths between 13 and 14.5m, whose hulls are in large part undecked for the smallest examples that are described. In addition, as a good royal constructor working in the arsenal and trained in a learned technical culture, where writing, calculation, geometry, drawing, thenceforth made part of professional training, Morineau drew up the transverse body plan, with diagonals (a usage not contemporary with the wreck), of the «Breton chaloupe» with a round stern. In summary, he provides no information on the actual structure of the vessel, that architectural «anatomy» according to the term of the historian A. Jal, excluding the characteristics of the longitudinal carpentry, the transverse carpentry, the planking, the methods of assembly of the different architectural elements… that in reality only the archaeological remains are susceptible to reveal, and which for the historian of techniques and archaeology constitute the fundamental data to define the principle and processes of construction.

The third problem that fully justifies the scientific choice to excavate a wreck such as that at Erquy is connected to the very great diversity and also complexity, in terms of known techniques, of vernacular naval architectures. In this respect, it seems necessary to briefly recall what the celebrated Swedish engineer-constructor Frederik Henrik af Chapman wrote in his treatise of naval architecture translated and published in French in 1781 under the control of Vial du Clairbois, an authority on the subject. Having identified two classes of ships «those which serve for coasting and short sea navigations […] and those which are employed in long-distance voyages and which are fit to navigate on the ocean», he follows by specifying his proposal:

[5] The manuscript treatise of MORINEAU, 2010: 212ff.

> *in examining the first class one sees vessels which different peoples use to serve for their transport in coasting or their commerce with their closest neighbours. But as the climates, the extent and the depths of the seas, the positions of countries in relation to the sea and between themselves, also their productions, are very different from one nation to another, the vessels cannot be of the same kind; they ought necessarily to be subject to these circumstances, as much in their proportion and form, as in the manner of their being rigged* […]. *If then one observes the vessels comprising the second class, one recognises that, constructed for the same end, they are, of whatever different nations, similar in their essential parts*[6].

In a very explicit, innovatory and pertinent manner, Chapman, as a practitioner of naval architecture, underlines the great diversity of boats for coasting, serving for small navigations, of which that from Erquy is a perfect illustration, which contrasts with a certain uniformity in the ships fitted for the long cours «proper to navigate on the ocean». That architectural diversity amongst coasters is applied not only at the scale of countries, but also, reduced, at that of regions, even of localities, referring to the environmental particularities of local and regional nautical spaces, to those of their functional techno-economic context participating in the construction of this archaeological concept of «Traditional zones of transport geography in relation to ship types», defined by the Swedish archaeologist Christer Westerdahl[7], which is translated into terms of the species of timber, dimensions, proportions, hull forms, types of structure, methods of propulsion, the nature of their use, methods of working…

It is with regard to these perspectives briefly recalled that the scientific objectives of the excavation and study of the *Erquy* wreck have been determined.

2. THE ARCHITECTURAL REMAINS: DESCRIPTION

2.1. Conservation of the Remains

The wreck, preserved at the outset over close to 9m length and 3m breadth, has been wholly exposed in two campaigns (2014 and 2015). The remains, preserved over only 7.8 by 2.6m after degradations (by clandestine activities) occurring since the assessment of 2002, present a strong transverse and longitudinal dissymmetry at the level of their preservation (Fig. 1.3).

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[6] CHAPMAN, 1788: IX-X.

[7] WESTERDAHL, 1995: 213-230.

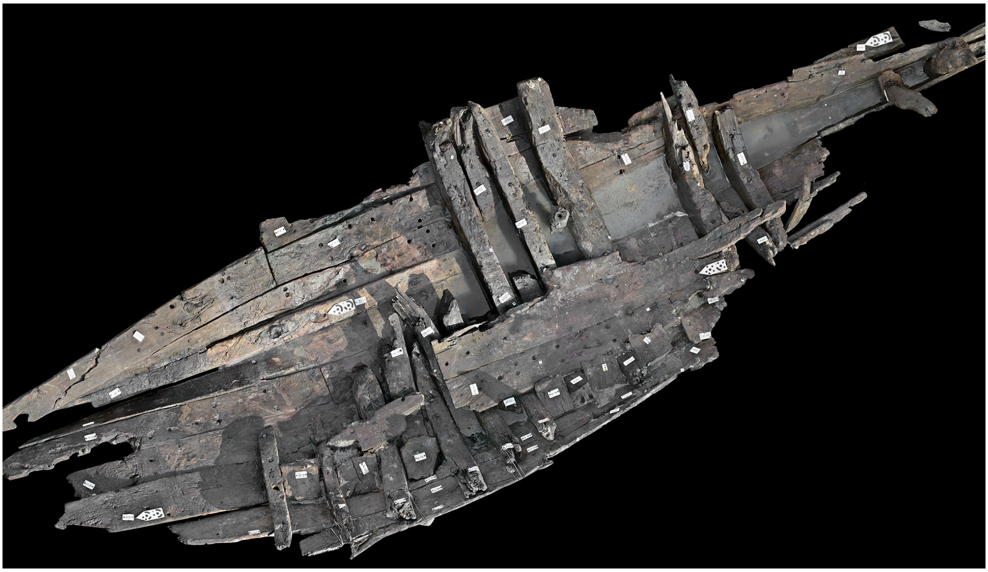

Fig. 1.3. Orthophotography of the wreck
Source: A. Guesdon

In a general way, the port half of the hull is better preserved in structure and form than the starboard half for the forward three quarters of the remains. The better preserved port side has six strakes preserved from the keel (VB13 to VB10), except in the last quarter aft where a single strake is preserved to port. On the starboard side, in large part broken except in its aft quarter where the hull has kept its form in elevation, only two strakes are preserved from the keel (VT15 and VT13) along the whole length and a third strake (VT20) is very partially preserved in the centre of the wreck. Of the frames, ten floor and crook timbers are preserved in total of which seven (VR57, VR58, VR59, VR61, VR62, VR63, IND82) are relatively good both in their form and structure. Three floor timbers are very partially preserved on their port ends (VR54, VR55, VR56). The greater part of the starboard futtocks have been destroyed. Only very short lengths of futtocks survive (MT51, MT52). In contrast, twelve futtocks are relatively well preserved to port (MB49-MB60). In the same way, no filling boards are preserved on the starboard side, while nine are present to port (AC10-18). No ceiling planks are preserved to starboard, while three ceiling planks remain connected to port, over variable lengths (Va11/Va22, Va12/Va32, Va23) (Fig. 1.4).

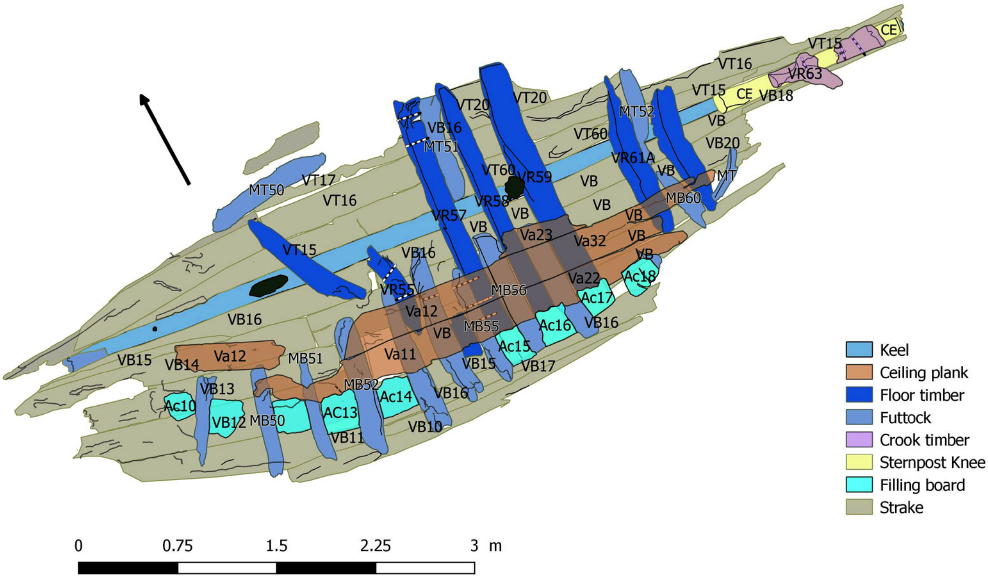

Fig. 1.4. Identification of the architectural elements
Source: Drassm

Forward, only the foot of the stem, or part of a foreknee is preserved, while no vestige of a sternpost remains at the stern.

2.2. The Longitudinal Carpentry

2.2.1. The Keel (Fig. 1.5)

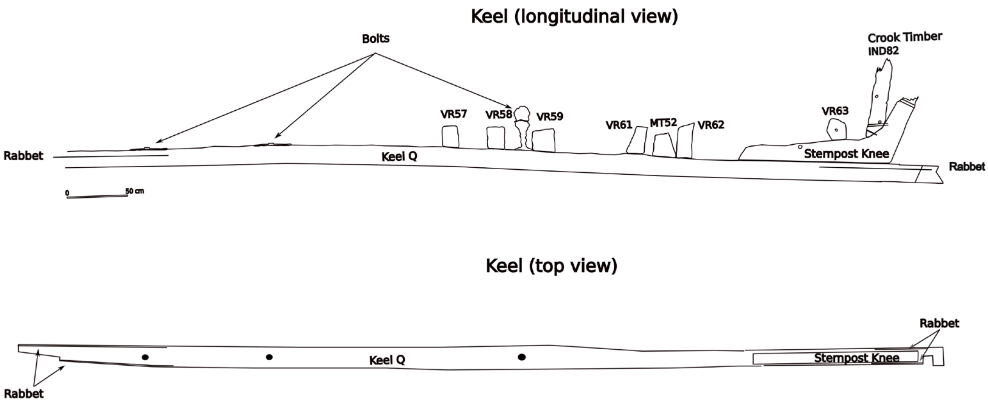

Fig. 1.5. The keel
Source: E. Rieth and E. Poletto

The keel, of beech[8], is wholly preserved in length. From the extremity of its scarf forward to the end of its skeg aft, its length is 7.1m. The longitudinal section taken off manually at the level of the back of the keel shows a regular curvature in the form of an arc whose offset height is between 7 and 8cm. This arc is confirmed in the longitudinal section created from the numeric photogrammetry of the wreck. The question arises as to the chronology of this curvature. In all likelihood, it is a deformation and a hogging of the extremities of the keel associated with the life of the boat, the most frequently attested case.

The average vertical height of the side of the keel is 11cm. At the scarf forward it is 14cm. At the skeg aft the height seems much reduced. It is 9.5cm. The breadth of the upper face, the only one that could be measured, evolved slightly along its length. It is 14cm at the fore extremity (not including the scarf), 16cm at the mortise for the sternpost, and 14cm at the skeg aft. Between the two extremities, its average breadth is 15cm.

The keel, starting from the extremity of the scarf forward, presents a particular shaping over a length of 1.4m. The arrises of the upper surface of the keel are in effect given a chamfer. At that level the breadth of the upper face of the keel is only 10cm, but below the hewn edges of the keel it is 14cm. The section of the keel then becomes rectangular over most of its length. It is possible that the chamfer forward may be intended for the garboard to be better fitted, which, logically, is set at this level as a function of the rapid and significant narrowing and rising of the entry and run of the hull.

Besides this chamfer forward, a second important characteristic has been observed. It concerns the rabbet which is limited to the two ends of the keel. At the bow, the rabbet begins at the level of the scarf intended for the assembly of the stem and ought presumably to be prolonged in the cheek of the stem. At the stern it commences at 17cm from the skeg and is extended on one part of the mortise for the foot of the sternpost. Its length cannot be precisely determined. Its width is 4cm. The positioning of the rabbet towards the fore and aft extremities of the keel is without doubt connected with the necessity of ensuring a better support to the garboard and to reinforce its fastening at

[8] In respect of the beech keel, there are two principle points to be made. In the first place, beech is considered today as a timber poorly adapted to shipbuilding, notably for the pieces which in tidal zones are susceptible to being as often dry, when the boat is beached at low tide, as in the water. If that characteristic of the beech of inferior durability and of a tendency to split and attack by worms can be applied to the case of the planking of the upper part of the live-works, it seems that it ought to be to a great extent discounted for the keel, the garboards, which even at low tide, rest in an essentially humid context in the mud or sand, and thus not submitted to that alternation of humidity and dryness. In the second place, the use of beech may sometimes appear to be considered as an «architectural signature» of Basque shipyards from the end of the Middle Ages to the beginning of the modern era. In reality it can stated as a fact in regard to the historic documentation, that shipyards in other territories than the Basque in the Atlantic-Channel arc have chosen to make their keels in beech. This is the case, notably, in the Normandy shipyards (Haute Normandie) in the second half of the 16th century, as the thesis by Anne Gérardot of the École des Chartes has perfectly demonstrated, based on the specifications for construction and repair of the ships fitted out for the Newfoundland fishery, and for commerce, which are preserved in the notarial archives of Rouen and Honfleur. One of the reasons for such a choice is very probably connected to the existence, in proximity to the shipyards of that part of Normandy, of forests of beech. The length and straightness of the trunks of the beech make them, in all probability, the preferred timber for making keels.

a place where the hull is closed up, as it approaches the sternpost particularly, requiring a significant twisting of the planking with, as a consequence, strong mechanical restraints.

The forward extremity of the keel is provided with a plain vertical scarf 26cm long intended for assembly with the foot of the stem. The oblique scarf of classic morphology has a breadth of 7.5cm at its rear end and 4.5cm at its front end. Its height is 14cm.

The aft extremity of the keel is given a mortise open on its port side into which the foot of the sternpost is assembled (Fig. 1.6). This building of the tenon of the sternpost into an open mortise appears to be uncommon with regard to the usage of a closed mortise which is itself attested in Western and Northern Europe from the end of the Middle Ages. The mortise has a breadth of 9cm, a length of 12cm, and a depth of 9.5cm corresponding to the height of the keel at that point. These dimensions evidently correspond as well to those of the tenon of the foot of the sternpost. The aft face of the mortise is fashioned obliquely. The inclination in relation to the upper horizontal face of the keel is of the order of 70 degrees, a value which, as we will examine later, corresponds to that of the aft face of the sternpost knee and therefore of the sternpost. That of the forward face has not been observed. Besides the open mortise, the aft extremity of the keel possesses two other characteristics. The first is a discontinuity of 0.5cm between the height of the keel (9cm) at the level of the notch and that of the keel forward of the notch (9.5cm). The second is a skeg of angular profile, of 7.5cm length.

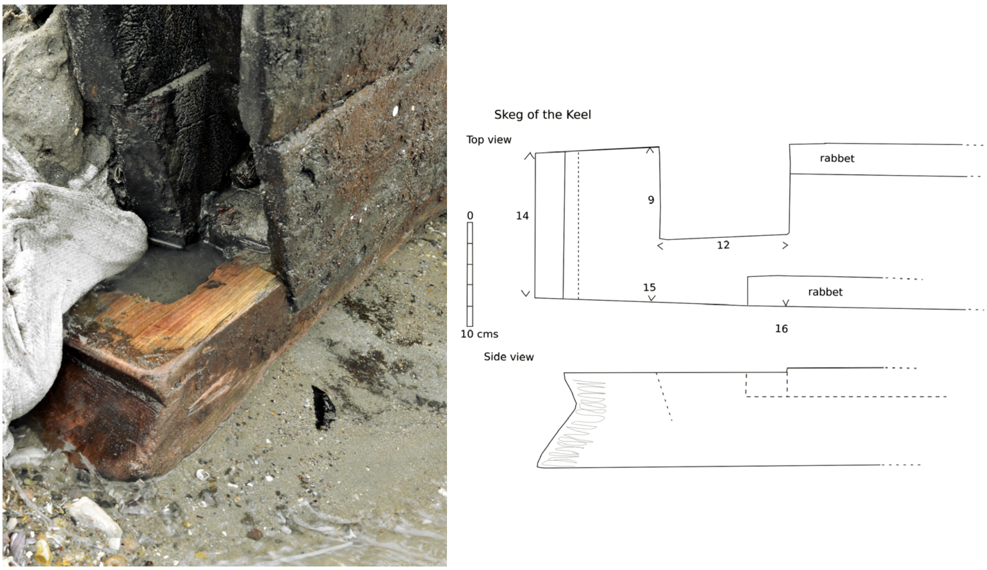

Fig. 1.6. The open mortise in the aft extremity of the keel
Source: Images Explorations — F. Osada; E. Rieth/S. Bertoliatti

One last characteristic of the keel, very important from the point of view of the general knowledge of the interior carpentry of the hull, has been registered. Along the whole length of the upper face of the keel, just three traces of assembly by an iron pin have been observed (Fig. 1.7). The first, corresponding to a pin of 3cm diameter, is situated at 70cm from the forward extremity of the keel, some 1/10 of the length of the keel. The second, corresponding to a pin of 4cm section, is placed at 1.66m from the forward extremity of the keel, or around 1/4.3 aft. Finally, the third is placed at 3.8m from the forward extremity of the keel, or around 1/1.9 aft. Unlike the other two this pin of 3cm section is preserved intact in height under the form of an iron concretion. Its height is 37.5cm. This pin is located in the space separating the floor timbers VR48 and VR59. An important characteristic to recall: these three pins are the only traces of the assembly observed, and carefully checked on various occasions, on the upper face of the keel. They are essentially intended to fix a keelson — not preserved — to the keel. That signifies that the floor timbers, with the exception of the rising floor timber VR61 fixed to the keel by two carvel nails, are «floating», that is to say without any assemblage, in relation to the keel. We will return during the study of the framing to the floating character of the floor timbers.

Fig. 1.7. Three traces of assembly by iron pins/bolts in the keel
Source: Images Explorations — F. Osada

2.2.2. The Stem, or the Foreknee

The only piece of the longitudinal carpentry actually identified as oak, the stem is preserved over a total length of 40cm, although during the assessment carried out in 2002, the stem, without doubt having a certain curvature and with a marked appearance of rake[9], appeared relatively well preserved in elevation. There is no doubt, then, on its identification. This is not the case for the piece observed in 2014 at the forward extremity of the keel, whose form, position and state of preservation (degradation uniquely on its forward extremity, notably) could correspond either to the beginning of the stem, or to the after part of the foreknee, to be assembled in the vertical plain scarf cut in the keel, and being fixed by means of a nail driven transversely from the exterior vertical face of the piece. In the case of the hypothesis of a foreknee, the foot of the stem, not preserved, would in turn come to be assembled by a scarf to this presumed foreknee and to the keel. In addition, the placing of a treenail has been identified on the right upper face of this extremity (stem or foreknee), which otherwise presents numerous traces of a pitch--based coating. The blind hole for this treenail ought in all likelihood to correspond to a point for assembly of a piece of internal reinforcement, perhaps an apron.

2.2.3. The Sternpost Knee

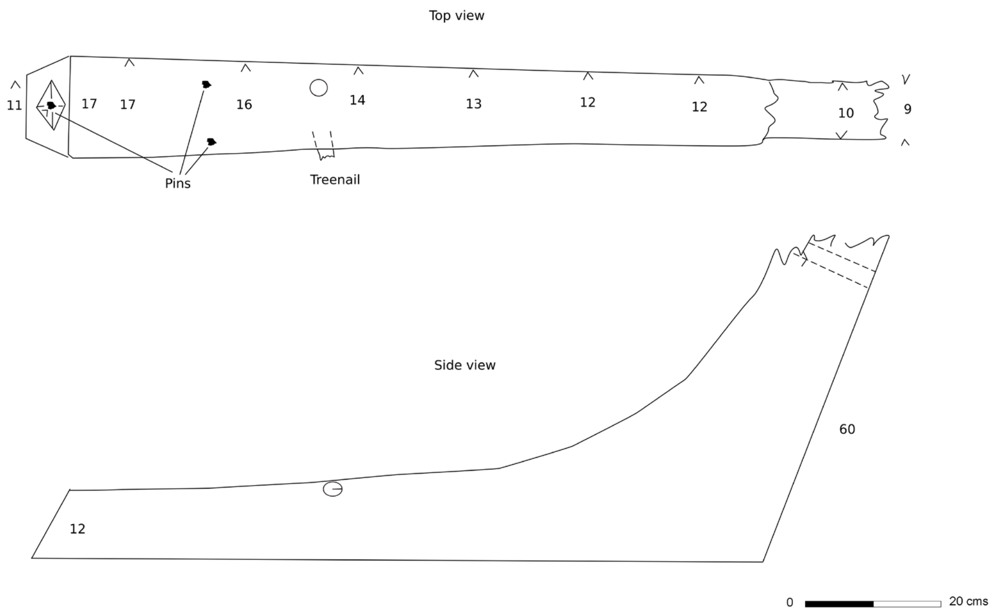

Fig. 1.8. The sternpost knee
Source: S. Bertoliatti

[9] A slight forward rotation of the stem accentuating the effect of the rake is not to discount it totally.

The sternpost knee CE, of unidentified material, preserved over its full length and partially in height, was in position, in connection with the keel and the port and starboard planking. Its length on the lower face of its horizontal arm is 1.3m, its height at its forward end is 12cm, and 60cm on its vertical arm, the breadth of its upper face reduced progressively from 17cm at its front end to 12cm at its rear end. The breadth of its vertical face, regularly fashioned and in contact at its end originally with the sternpost, is 10cm in its upper part and 9cm at its base. This strong piece cut from a natural knee appears, paradoxically, weakly assembled to the keel. At its front end, one square iron carvel nail driven through a pilot hole ensures its initial assembly. At its upper face, two iron concretions have been observed at 26cm from the front end of the horizontal arm of the knee. It seems likely that these two spikes were intended to assemble the foot of a crook timber rather than to fix the sternpost knee to the keel. At 44.5cm from the front end, a treenail of 3cm section, whose position seems to be displaced towards the starboard arris of the knee, seems to correspond to a second point for assembly of the knee to the keel. It is however necessary to emphasise that in that part of the wreck it was very difficult to fully drain the water accumulated between the sides. From this fact, and despite the controls, another point of assembly could have escaped our observations. Two other treenails have been identified. The first is situated at 44.5cm from the forward end of the horizontal arm of the sternpost knee in its port lateral vertical face. This treenail of 3cm diameter fixes the port garboard to the knee. The second blind treenail is located in the aft face of the knee, at 48cm from its base. This treenail of 3cm diameter made the initial fixing of the sternpost to its knee.

2.2.4. The Sternpost

A first «phantom piece»: although totally destroyed, without doubt recently by clandestine activities as was also the case for the stem, several characteristics of the sternpost can be reconstructed such as its section, its rake and the position of the rabbet. The breadth of the end of the keel at the position of the open mortise into which the tenon fitted allows us to reconstruct that of the sternpost: 16cm at its front face and 15cm at the aft face. We note that the tenon, instead of being centred as customarily, was offset in the port half of the sternpost, the other half of the foot of the sternpost being supported to starboard on the upper face of the keel. The breadth of the vertical face can be determined as a function of the position on the keel of the aft face of the sternpost knee on the one hand, and on the other from the apparent breadth (around 12.5cm) of the starboard face of the sternpost deduced from the photos taken during the assessment of 2002. In terms of this data the breadth can be estimated as around 21cm. One other characteristic of the sternpost can be specified: a rabbet of length 8.5cm (photographed in 2002) was cut in the vertical face of the sternpost.

2.2.5. The Keelson

A second «phantom piece»: the keelson[10]. A bolt, that situated between the floor timbers VR58 and VR59, is preserved intact to its head (Fig. 1.9.). Its height is 37.5cm. Taking account of the height of the two floor timbers (17 and 19cm), the height of the keelson can be reconstructed in all likelihood as around 18cm/18.5cm above the floor timbers. No data allows its breadth to be reconstructed. As a hypothesis, a breadth close to that of its height seems reasonable. The length of the keelson is more difficult to determine. Its minimum length in terms of the three points of attachment could comprise between 3.8 and 4m. As to its maximum length it seems hardly possible to evaluate it, from the too great number of unknowns. Two characteristics however are certain. On the one hand, the reconstructed section of the keelson appears clearly to be stronger than that of the keel and consequently makes the keelson into a major piece of reinforcement of the primary longitudinal carpentry of the hull, even if the number of bolts in the assembly and their intervals appear a little too reduced in relation to the reconstructed length of the keelson. It is besides possible that that presumed keelson, in a principal or secondary role, served as a mast step. If the relationship of proportions between the sections of the keelson and that of the keel corresponds to traditional practices[11], the weakness of their assembly seems unusual, and in any case reduces the structural function of the keelson. On the other hand, the three bolts are located, for one amongst them for sure and for the others in all probability[12], in the space separating two floor timbers. Although it hardly conforms to the theoretical usages that wish the bolts to pass systematically through a full thickness over their whole length at the risk of weakening their solidity, the *Erquy* wreck shows, after other wrecks, that important deviations can exist between the theoretical precepts of the treatises and the practical reality of the shipyards.

[10] In 2014, one displaced piece (Ca) situated in the fore part of the wreck had been identified as perhaps corresponding to a part of the keelson. This fragment is of elm and the seven associated treenails are oak. It would seem that that identification ought to be considered with great reserve. No trace of assembly by means of treenails has been identified on the back of the keel. The question remains for the floor timbers of the fore part of the wreck, of which none is preserved.
[11] Cf. for example the keelson /mast-step of the boat of Lanvéoc (model in the Musée National de Marine, Inv. N.º 3 CP 5. This model had been made from data from 1830, published by PÂRIS, 1882: vol. 1, 38. As we will examine it later, this sailing cargo vessel represents a preferential model for comparison with the *Erquy* wreck.
[12] Because of the absence of preservation of the floor timbers.

Fig. 1.9. The best preserved iron pin/bolt between the floor timbers VR58 and VR59
Source: Images Explorations — F. Osada

2.3. The Transverse Carpentry

2.3.1. The Frames (Fig. 1.10)

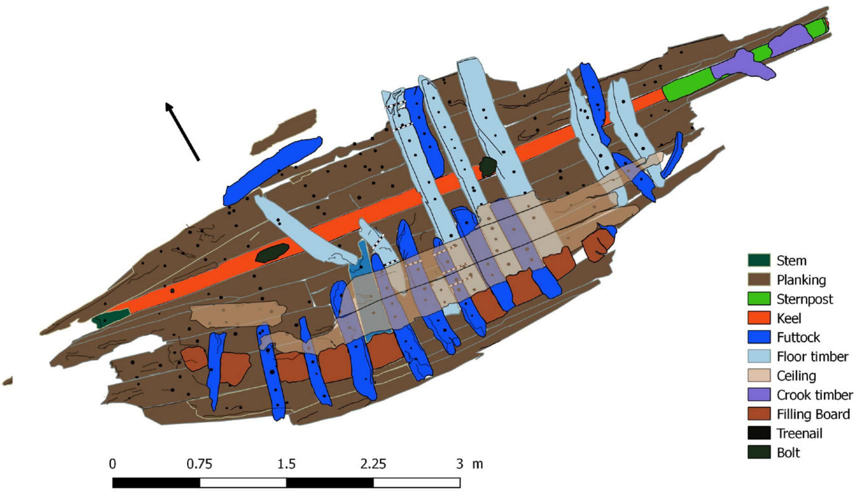

Fig. 1.10. Planimetric view of the architectural remains
Source: Drassm

In total, these are ten floor timbers and crook timbers, which are preserved, of which seven (VR57, VR58, VR59, VR61, VR62, VR63, IND82) are relatively good, both in their form and their structure. The last frames forward have completely disappeared. To port, three floor timbers are very partially preserved, and displaced, too, at their port arms (VR54, VR55, VR56), the only ones preserved. The greater part of the starboard futtocks have been destroyed. Only very partial lengths of futtocks exist, MT51 and MT52. To port, in contrast, twelve futtocks are relatively well preserved (MB49, MB50, MB51, MB52, MB53, MB54, MB55, MB56, MB57, MB58, MB59, MB60) of which two MB50 and to a lesser extent MB49, were displaced. Despite this partial state of preservation of the frames, numerous important observations for the knowledge of the transverse carpentry have been made.

On the scheme of the general disposition of the transverse carpentry, four principal characteristics have been brought to light. Firstly, the two first futtocks to port, MB49 and MB50, and even perhaps the third MB51, seem to present a certain inclination in relation to the other futtocks, which are disposed following an axis perpendicular to the keel. Secondly, all the preserved futtocks are systematically overlapped without connection, against the front vertical face of the floor timbers in regard to the stem. Now, the disposition considered as traditional, even canonic, according to theoretical precepts of carvel shipbuilding on the transverse principle, «frame-first», is the inverse of that of the *Erquy* wreck. According to that traditional disposition, the floor timbers of the wreck ought to be situated in direct regard to the master section, which constitutes a transverse axis of symmetry. Forward of that, the futtocks ought to be crossed on the front face of the floor timbers. Aft of the master section the futtocks ought to be fixed on the rear face of the floor timbers with respect to the stem. Thirdly, the lower end of the futtocks are worked obliquely, making the general organisation appear to rest on criteria other than that considered as traditional. It can be said, indeed, that the lower extremities of the port futtocks MB52, MB53, MB54, MB55 are cut obliquely and that the tapered lower extremities are oriented toward the stem.

Conversely, the obliquely worked lower extremities of the port futtocks MB56, MB57, MB59 and MB60 and those of the starboard futtocks MT51 and MB52 have their tapered extremities oriented towards the sternpost (Fig. 1.11). If one takes into account that orientation of the lower extremities of the futtocks as a criterion for the organisation of the frames, the master section could be situated at the frames VR57/MB55, confirming the transition with the frames of the after part of the hull, for which the direction of the bevel of the lower extremity of the futtocks is reversed. We add that that frame VR57/MB55 is situated at around 35 cm forward of the middle of the length of the keel, a position completely compatible with that of the master section. Lastly it will be seen that this frame, presumed to be the master section, possesses besides another very important characteristic.

Fig. 1.11. Obliquely worked lower extremities of the futtocks; the direction of the bevel is reversed Source: Images Explorations — F. Osada

The fourth and final characteristic: no trace of any treenail has been observed on the interior face of the side between the upper extremities of the futtocks. That absence of any indication of the assembly tends to indicate that no second level of futtocks existed, and that the extremities of the futtocks directly associated with the floor timbers were extended to the full height of the hull. In that configuration, each frame was thus composed of one floor timber and two futtocks, one to starboard and one to port.

We examined previously the question of the dimensions of the frames and their spaces. These are relatively irregular. The average breadth on the upper face of the floor timbers is 14.3cm, with a minimum of 13cm (VR57) and a maximum (VR59) of 18cm. The average breadth of the upper faces of the futtocks is 13cm for a minimum of 9cm (MB51) and a maximum of 18.5cm (MB52). At the level of the filling boards, the average moulded thickness on the vertical faces of the futtocks is 15cm. These scantlings of the frames, other than that of the very heavy floor timber VR59 to which we will return, appear relatively significant in relation to the length of the keel bearing on the ground (7.1m) which represents one of the basic references for the dimensional definition of a boat. The measure of the spaces between the floor timbers is less meaningful because of the dispersion of the measures.

The impression that is drawn is that of a relatively dense disposition of frames. To evaluate that density, a coefficient for comparison is that provided by the ratio between the sided breadth of the floor timbers and the distance between centres of the floor timbers. The smaller the coefficient, the less the density of framing is. In the case of the *Erquy* wreck, the coefficient is round 0.45 (the maximum possible is 0.5: the room equals the space) corresponding to dense framing. In summary, in the case of the «*Lanvéoc* boat», still called the «gabare of Brest roads», for which data was taken in 1830, shows a small sailing transport vessel able to serve as a model for comparison with the *Erquy boat*[13], the coefficient is of the order 0.17, corresponding to a low density of framing. Now it is interesting to note that the *Lanvéoc* boat, of a size comparable to that of *Erquy*, and of which the scantlings of the frames are slightly more reduced than that of *Erquy* (12.2cm sided breadth of the floor timbers), is qualified by Admiral Pâris as «a kind of boa […] heavily constructed, in heavy pieces, spaced out and poorly fitted… It was reputed for its security, but not for its speed […]». With regard to this commentary on this «heaviness of construction» of the *Lanvéoc* boat, it would seem that the *Erquy* boat ought to relate to a still heavier form of construction, which will be evaluated from hydrostatic calculations made within the body of the researches to come on the reconstruction of the forms of the hull. Concerning the other characterisics of the *Lanvéoc* boat emphasised by Pâris, frames spaced out and poorly fitted, they do not apply, in summary, to the *Erquy* wreck.

We are considering at present the question of the relationships between the floor timbers and the futtocks on the one hand, and between the floor timbers and the keel on the other. With the exception of two frames, the floor timbers VR56 and VR57 and the futtocks MB55 and MB54 the others are characterised by a simple overlap, with sometimes a separation of some centimetres, between the floor timbers and futtocks (Fig. 1.12). The floor timber VR57 is itself overlapped with the MB55. At the level of the port futtock, three treenails of 3cm average section driven horizontally from the front vertical face of the futtock, connecting it to the floor timber. A nail, driven from that same face and situated at the lower end of the futtock, probably served to ensure a temporary connection before boring and treenailing. At the starboard floor timber VR57, whose end is eroded, two treenails and a nail having the same connecting function are preserved. An overlap and a similar connection between the floor timber and futtock are found at floor timber VR 56 very partially preserved, and its futtock MB54. A nail at the end of the futtock and two treenails disposed at 42 cm centres ensuring the connection. These two frames are the only ones to have the floor timbers and futtocks connected. All the other frames have futtocks floating in relation to the floor timbers. It is evident that that these very particular characteristics of the frames of the *Erquy* boat have consequences, which

[13] PÂRIS, 1882: vol. 1, 38.

we will consider in the third part of the study, at the dual perspective of the principle of construction and of the method of construction.

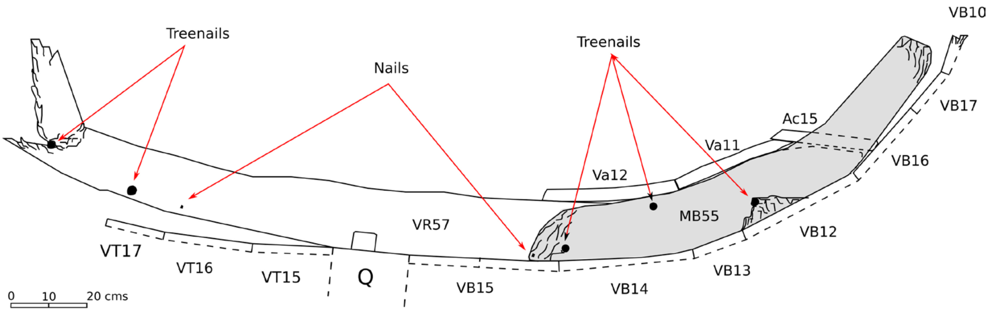

Fig. 1.12. The master frame VR57 (floor timber)/VR55 (futtock)
Source: A. Poletto

Another particular and also very important characteristic of the frames of the *Erquy* boat is the absence of any connection of the floor timbers and the longitudinal carpentry, with the exception of two frames at the after end of the hull. The first is the rising floor timber VR61 fixed to the keel by two nails driven from two tetrahedric countersinks cut in the front vertical face, and the second is the crook timber IND82 (Fig. 1.13), the last crook aft, connected to the sternpost knee CE by a nail driven from a similar countersink cut in the front vertical face. For all the other floor timbers, preserved or not, no trace of connection to the keel has been identified. The near totality of the frames and, notably, those of the central body of the hull, all «floating» in relation to the longitudinal carpentry and principally the keel, determines the conceptual and structural scheme. As in the case of the futtocks, floating in relation to the floor timbers, that floating characteristic of most of the floor timbers raises questions at the level of the principle of construction which will be commented on in the third part.

Fig. 1.13. The tetrahedral pilot hole in the front end of the sternpost knee
Source: Images Explorations — F. Osada

Two final aspects are to be considered. The first bears upon some characteristics specifically of the five frames sampled and studied in a detailed fashion (VR57, VR59, VR61, VR63 and IND82), and the second on the timber species.

Floor timber VR57, the presumed master section, of 13cm sided breadth and 17cm moulded depth, is preserved for a length of 2.35m, with 1.49m fully preserved on the port side. On the underside of the timber, corresponding to the centre of the keel, a rectangular limber is cut, 6cm broad by 5cm high. The same is found in the other floor timbers located on the keel. In advance of the study of the reconstruction of the form of the presumed master section VR57/MB55, and more globally of the reconstruction of the forms, one can emphasise that that floor timber, visually rising less than all the others preserved, would however seem to possess a certain rising. In a total length of the «line of the flat»[14] estimated as 1.88m, the properly flat central part of the floor timber would be of the order 28cm or maybe close to 15% of the measure of the line of the flat. As to the rising at the extremity of the line of the flat itself, it would be around 12cm or maybe 6.5% of the line of the flat. That presumed master floor timber, given a certain rising, is extended by a futtock with a large radius of curvature at its relatively soft bilge. The two floor timbers VR59 and VR61 situated aft of the presumed master section possess, logically for hull forms, an absence of flat of floor and a more and more marked rising of their arms. We note that these two frames present, besides, a peculiarity: a slight inclination towards the stern of the whole of the floor timber. The floating crook timber VR63, given a semi-circular limber, is placed on the curve of the sternpost knee; its squared foot is cut to accentuate its inclination towards the stern. The crook timber IND82, the last frame aft, rests on the sternpost knee to which it is fixed by a nail. Its foot, strongly squared, reinforces the effect of its inclination towards the stern. We note that this crook timber does not possess a limber and that it is connected at the beginning of the rising arm of the sternpost knee by a treenail driven horizontally. One last characteristic common to the two crook timbers is their summary fashioning into a piece of rather irregular form which gives the impression of a sort of filling up aft, in a massive fashion, than of frames.

Another important aspect to examine concerns the nature of the materials of the frames. In this respect, it is useful to emphasise the suppport of dendrometric analysis to the general study of the architecture of the *Erquy* wreck (Fig. 1.14).

[14] We recall that the «ligne du plat» is a horizontal line of the geometric construction of the form of the floor timber, passing through the upper face of the keel.

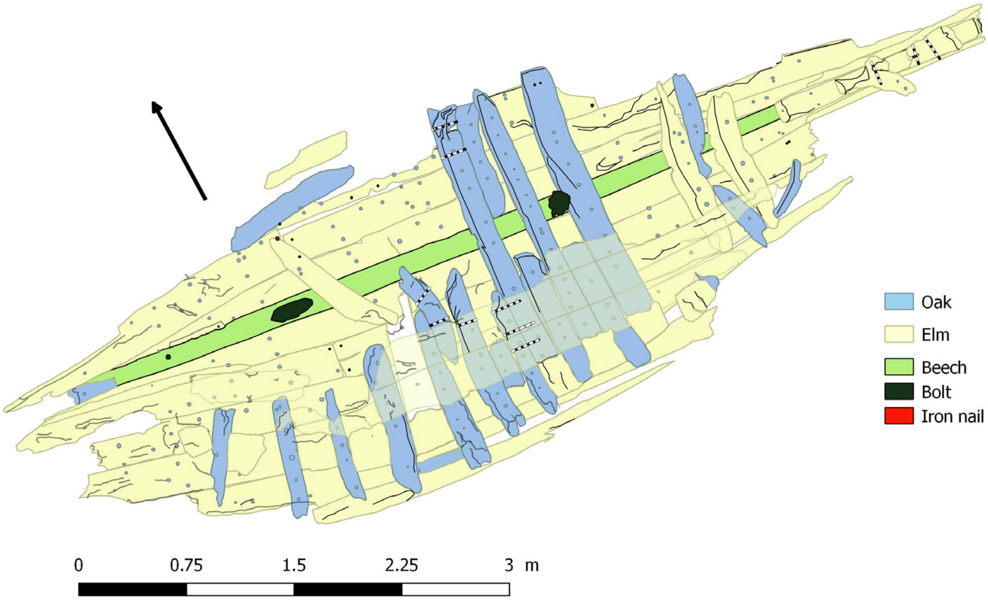

Fig. 1.14. Planimetric view of the various wood species in relation with the architectural remains
Source: Drassm

With the exception of one starboard futtock (MT51) which is in elm, all the other futtocks are of oak. That elm futtock is associated with the floor timber VR58 and the port futtock MB56, which are both of oak. It is difficult to find an explanation for these differences. Was it a question of a repair? Was it a question of an original choice, but then the question is posed of the reasons for using one futtock in elm and one in oak? Was it a question in the end of a constraint connected to the problem of supplying the shipyard? No data allows us to opt for one or the other of the hypotheses.

The floor timbers and the crook timbers have been cut in two materials: oak and elm. The five floor timbers of the central part belonging to the body of the hull (VR55, VR56, VR57, VR58, VR59) are all in oak. The rising floor timbers and the crook timbers (VR60, VR61, VR62, VR63 and IND82) are in elm. It therefore seems that a regular division exists between the two collections of frames timbers. The choice of oak for the floor timbers of the central part of the hull could be connected, perhaps, to certain of its mechanical characteristics, notably its strength in flexure and in compression, two categories of mechanical constraints that are the most frequent to occur on the floor timbers and, in particular, on those of the central part of the hull on grounding.

One last remark concerns the floor timber VR59, the last in oak, whose breadth on the upper face of 18cm is particularly large and, logically, could correspond to a choice to reinforce the transverse carpentry at this point of the hull. One of the hypotheses will be to associate this presumed need for transverse reinforcement of the hull to the placing of a mast and to its constraints on the framing. The studies to come on the reconstruction of the hull and of the rigging of the *Erquy* boat ought to permit more precision on that hypothesis.

2.3.2. The Filling Boards (Fig. 1.15)

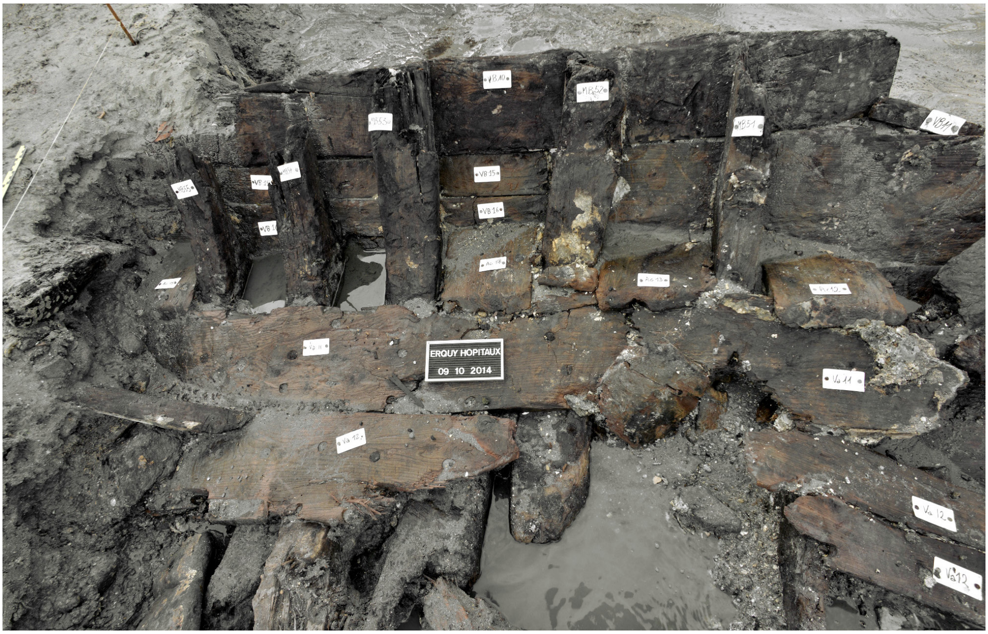

Fig. 1.15. The filling boards (left to right) AC15, C14, AC13, AC12
Source: Images Explorations — F. Osada

In total, nine filling boards (AC10-AC18) of which six are in elm (AC12-AC17)[15] are preserved on the port side. These pieces are simply built in forcibly in the space between futtocks at the upper edge of the floor timbers Va11, Va22 and Va59 which form the ceiling pieces called filling boards. Their length comprises between 24 and 30cm for a breadth of 26cm and a thickness varying between 3.5 and 5cm. Generous as the frames are, these filling boards contribute to the cohesion and reinforcement of the transverse carpentry of the boat[16], assuring a function of protection of the bottom by preventing objects from falling into the space and slipping into the bottom of the hull, risking obstruction of the flow of water to the pump. We add that the full ceiling of the bottom of the hull and the closure of the frame spaces by the filling boards facilitate the loading of loose cargo.

[15] The material of the three other filling boards is not known.
[16] Driven by force into the space, it is a question of compression on the frames. VT13.

2.4. The Side Planking

Along the port side, the best preserved, six strakes are preserved from the keel (VB13-VB10), except in the last quarter aft where only one strake is preserved to port. Along the starboard side, in large part eroded except in the stern quarter where the hull has kept its form in elevation, two strakes only are preserved from the keel (VT15 and VT13)[17] for the whole length of the hull, and a third strake (VT20)[18] is very partially preserved in the centre of the wreck.

These side strakes, arranged in carvel, the broadest of some thirty centimetres, are all in elm with the exception of one piece of plank in oak (VB17A). This piece of planking of reduced length and breadth, situated between futtocks MB52 and MB53, could perhaps correspond to a repair of strake VB11 to the extent where the piece of strake VB17, prolonging the piece VB17A, is in elm like the rest of the strake, and more generally, like the whole of the side planking. The almost general choice of elm for the planking merits some remarks. It is a timber considered as of great quality for shipbuilding[19], and more particularly for long pieces, provided that it is not subjected to alternating periods of humidity and dryness. From a mechanical point of view it is defined as a timber of great longevity, hard, elastic, of excellent strength in flexure and tension, difficult to split and therefore rather difficult to saw[20]. It is a timber that is notably attested in vernacular shipbuilding of northern France for fishing boats that dry out on the beach like, for example, the flobart and the Berck boat, two types of regional boat from the Pas-de--Calais, whose clinker planking is submitted to the abrasive effects of the sand at low tide.

The average thickness of the planks is from 3 to 3.5cm. Numerous traces of pitch have been observed on the planks, as well as vestiges of caulking at the level of the joints between the carvel planks of the bottom towards the fore and aft extremities of the wreck.

Two principal characteristics of this planking are to be emphasised. Firstly, excepting a few cases of iron nails, without regular spacing or correspondence with scarfs, and whose function remains indeterminate, the connections of the planking to the frames are made with oak treenails of 2.5 to 3cm average section. Secondly, the scarfs between the planks are of two types: plain scarf over a frame and overlapping scarf, in a frame space. A representative example of a simple scarf is that existing to port between planks of the garboard strake VB14 at the position of the missing floor timber VR53 which covered it originally. In the case of this scarf, each plank end is fixed to the frame with two carvel nails. A representative example of an overlapping scarf is that of the plank

[17] The next strake above the garboard, VT13, is composed of two planks separated by a simple scarf: VT13 to forward of the axis of the missing floor timber VR53 and VT16 aft of that axis.
[18] The strake VT20 is named VT17 forward of the floor timber VR57.
[19] «[elm] […] this is a timber of first choice for the [boat-]builder, as much for its strength as for the longevity that it assures in the boat» (STEWARD, 1971: 25). In terrestrial construction, this is a timber that is preferred for the making of beams in carpentry.
[20] BALLU, 2000: 59.

VT20, of breadth 36cm. This scarf is situated in the space between floor timbers VR59 and VR60. The scarf is 38cm long on the angle; the height of its overlaps is between 10.5 and 11 cm. A treenail and two carvel nails fixed the plank VT20 west to the floor timber VR59 and a nail connected it to VR60.

Several particular characteristics of this planking are to be considered. The first, and the most significant for the scheme of the structure of the hull, concerns the relatively short length of certain planks of the bottom near the fore and aft extremities. It is very particularly the case for the two garboards VB14 and VB13, whose oblique ends are initially fixed by nailing into the rabbet of the stem. The starboard garboard VT13 of 30cm breadth at its after extremity with a preserved length of 2.37m. The port garboard VB14, slightly narrower (25cm at its after end), measures 2.54m in length (a preserved dimension close to its original). It seems likely that these two planks from the ends of the hull had a more or less analogous length. In these conditions, it would seem possible to interpret these similarities between the two garboards as the result of a technical choice which could be related to a simplification or to the facility of carrying out the work on these strakes connected with the significant narrowing and rising of the bottom of the hull at this point, implying a bending and a twisting of the planks.

We add that the after scarfs of the two garboards VB14 and VT13 are only slightly overlapped on the axis of the floor timber VR53.

At the stern, the closure of the bottom of the hull on the sternpost knee in modifying the perimeter of the side has led to the addition of a pointed steeler in the prolongation of the garboard VT13. This trapezoidal plank measures 1.33m total length, 44.5cm breadth at the aft end corresponding to its position in the rabbet of the sternpost, and 16.5cm at its forward end. This plank is fixed to the sternpost knee by two treenails of 2.8cm average section and without doubt, like the garboard, it was connected to the stem by two nails.

The two other particularities of the planking, of a secondary nature, bear firstly on the realisation of a patch carefully cut into a pentagon which is built into the thickness of the butt end of the starboard garboard VT13. This chock of 7cm breadth at the edge of the garboard and 10.5cm height, probably located at a knot which has been cut out, is fixed by a nail. Taking account of the slope of the edge, it is likely that it has been placed after the interior face of the planking. The second detail concerns a repair of the lower edge of the starboard garboard. 42cm long, by 4cm wide, it begins at 87cm from the fore extremity of the keel scarf. That fitting is fixed to the keel by two nails.

2.5. The Ceiling

A ceiling is very partially preserved in the port half of the wreck only. In total three ceiling strakes are preserved in place either high or low: Va11/Va22/Va59, Va12/Va32 and Va23. All these ceiling strakes are in elm. Their average thickness is 4cm, relatively heavy for the length of the boat. Their average breadth is 29cm. These ceiling strakes are fixed to the floor timbers and futtocks by means of treenails in oak with a section of between 2.5 and 3cm. In the structural scheme these strakes assure a reinforcing function at two levels.

The first is that of the transverse carpentry. The strakes are in effect placed at the position of the overlap of floor timbers and futtocks, and contribute from this fact, in all logic, to the reinforcement of that part of the transverse carpentry, of which it is necessary to recall its floating character, and therefore the relative structural weakness, which affects the majority of the floor timbers in relation to the keel on the one hand, and on the other to the overlap (without connection) of most of the floor timbers and futtocks. The second aspect is that of the longitudinal reinforcement of the hull, and also of its rigidity, associating the internal ceiling and the external planking. This structural role of the ceiling is emphasised, it should be recalled, in numerous marine treatises and dictionaries. It is thus that Bonnefoux and Paris, in the article «vaigrer», specify in their dictionary that «To ceil a ship is to apply planks, to add to the connection, to the solidity of its structure»[21]. In this respect, it is certain that the direct connection between the planking, the frames and the ceiling by treenails passing through the three thicknesses of timber would amplify that function. In the absence of a systematic dismantling of the wreck, it is however impossible to have a global vision of such connections. That has only been closely observed at the level of just two treenails.

We add that it is not impossible that a removable limber strake[22] was originally placed in the bottom of the hull between the lower ceiling strake Va23 and the keelson. Taking account of its mobility, this strake could have been destroyed.

3. THE ARCHITECTURAL REMAINS: ANALYSIS AND INTERPRETATION

Following a methodological distinction regarded as classic, it is important to envisage the analysis and interpretation of the *Erquy* wreck under two principal aspects: that of the principle of conception on the one hand, and that of the method, or processes of construction, on the other[23]. Concerning the first aspect, a supplementary methodological distinction is to be made between that which relates to the conception of the form of the hull and that which concerns the structure.

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[21] BONNEFOUX & PARIS, 1847: 636.

[22] That removable ceiling plank allows the cleaning of the bottom of the hull in order to avoid the limbers being blocked by objects or sediments.

[23] POMEY *et al.*, 2005: 29ff.

3.1. The Principle of Conception

The forms of the hull: the study of the reconstruction of the lines of the forms (Fig. 1.16), the definition of the hydrostatic characteristics of the boat (Fig. 1.17), and that of the rigging (Fig. 1.18), will begin in close collaboration with Sammy Bertoliatti (a professional ship carpenter) and Pierre Poveda (CNRS).

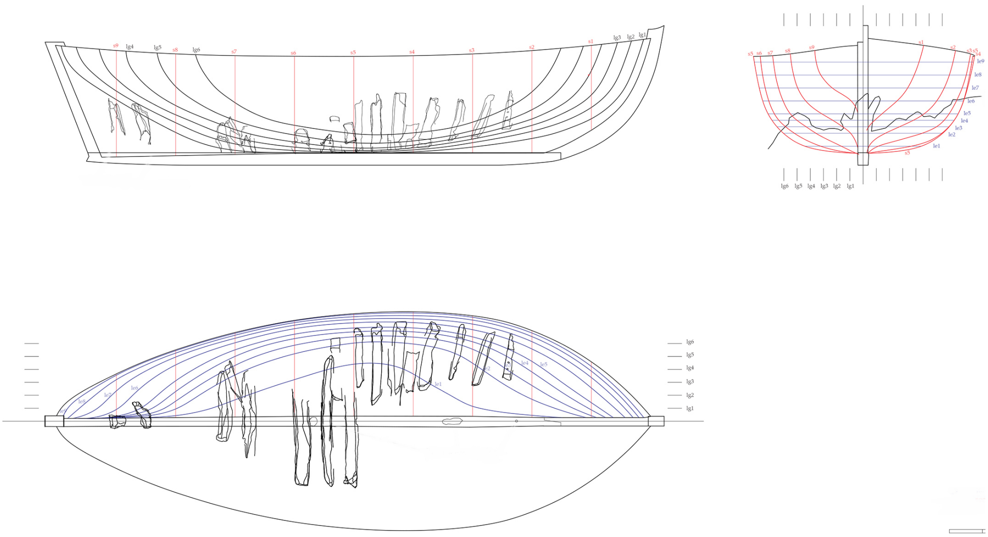

Fig. 1.16. Reconstruction of the lines
Source: S. Bertoliatti

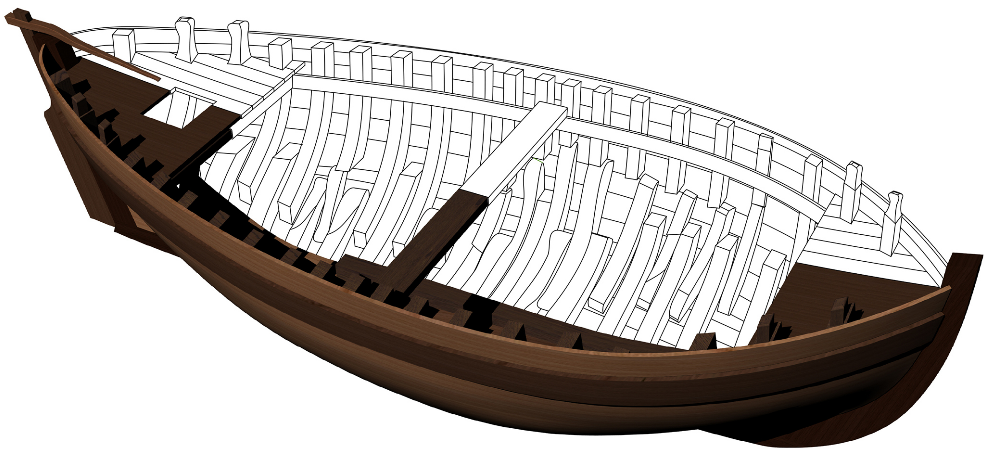

Fig. 1.17. 3D reconstruction of the architectural structure
Source: P. Poveda, AMU, CCJ, CNRS

Fig. 1.18. 3D reconstruction of the coaster *Erquy-les-Hôpitaux*
Source: P. Poveda, AMU, CCJ, CNRS

It appears that two frames, the presumed master-section VR57/MB55 and the frame VR56/MB54, the first frame situated in front of it, which are the only ones preserved in which the futtocks are connected laterally to the floor timbers by treenails and a nail, could have occupied a preferential position in the structural scheme (we will come back to that shortly) and on that of the conception of the forms. Besides, all the other preserved frames are not only «floating» in relation to the keel, but the futtocks also float in relation to the floor timbers. That absence of connection and of transverse cohesion of the frames would seem to suggest that it could be interpreted as an archaeological indicator of the secondary function of these «floating» frames, as much in the structural scheme as in the scheme for the conception of the forms. In this hypothesis, ribbands and/or some strakes of the bottom running from stem to stern, supported in the central part of the hull by the only two predetermined and pre-established frames on the keel

(VR57/MB55 and VR56/MB54), could have contributed to the definition of the forms of the hull, following, consequently, a general perspective of the forms of the hull of longitudinal character. From this, it is clear that in regard to the traditional archaeological classification of the principles of conception, the notion of transverse principle «frame first», such as seems to have been envisaged as normal for a carvel planked boat from the first half of the 17th century, does not seem applicable. The notion closest to that defining the principle of conception of the *Erquy* boat would seem to be that of «proto (or pre-) frame first» to a transverse perspective of the forms of centre of the hull alone, an important part of the conception of the forms (especially towards the ends) still rested on the ribbands (and/or some strakes), according therefore to a longitudinal perspective.

One last remark is to be made with regard to this presumed «proto (or pre-) frame first» principle of conception of the forms of the *Erquy* boat. At the end of the 18th century, the Spanish author G. Juan described a method of conception of forms, based on the predetermination of the master frame alone, and the use of a system of ribbands of which «a certain amplitude or opening […] [is to be given] […] in the points […] where the two balance frames ought to be placed»[24], somewhat similar to that reconstructed for the *Erquy* wreck, to the extent that G. Juan mentions the position of two balance frames, for which no indication of such usage has been identified in the wreck. According to Juan, that method, which is qualified as particular to the «ancient shipbuilders […] who did not know the art of drawing the plans», being always practised by the builders, notably, he emphasised, «those who build boats and other small vessels», the category to which the *Erquy* wreck belongs.

3.2. The Structure of the Hull

These are the frames which, at the heart of the architectural structure, seem at a first analysis to constitute the basis of the whole of the hull. The frames, from their relatively heavy scantlings or a boat of a little over 7m length of keel bearing on the ground, and their disposition with a rhythm of a little more space than room, seem to correspond, in effect, to a technical choice of heavy construction. Always, this heaviness[25] of transverse carpentry stands in some «passive» way to the extent where the frames in themselves do not form a coherent architectural whole because of their dual «floating» character. The first comes back to the absence of connections between the floor timbers and futtocks with the exception of the two frames VR57/MB55 (the presumed master frame) and VR56/MB54, considered as predetermined. In these circumstances, it does not seem that the notion of the principle of «frame first» transverse conception can be applied to define the transverse carpentry of the *Erquy* wreck. In reality, the frames only possess an effective «active» transverse structural function, principally from their «heaviness», and

[24] JUAN, 1783: 15-17.
[25] According to a reading of naval architecture in treatises of the modern era.

by their assembly to the side planking and to the ceiling, largely by means of the keelson, that is to say by the architectural elements belonging to the longitudinal structure of the hull. Besides, neither does the notion of the principle of longitudinal conception «shell first» seem to take account of the architecture of the *Erquy* wreck. No term or expression of contemporary vocabulary for naval architecture or of the terminology of nautical archaeology seems to permit a definition of the principle of conception and the method of construction of the *Erquy* boat. The whole interest and significance of this wreck lies in that.

3.3. The Method of Construction

As a function of the archaeological data and its analysis from the point of view of the principle of conception, it is possible, as a research hypothesis, to propose a first provisional reconstruction for the principal sequences of construction.

- Placing of the primary axial carpentry: keel, stem, sternpost, sternpost knee;
- Assembly on the ground of the futtocks MB55 and MB54 (and their starboard pairs) to the floor timbers VR57 (the presumed master) and VR56;
- Putting these two predetermined frames in place on the keel and temporary lateral and longitudinal support by means of shores and stays; these two frames are comparable to fixed moulds;
- Either ribbands may be placed between stem and sternpost, which are supported on the outside faces of the two central pre-erected frames, or the bottom strakes placed up to the level of the bilge, supported, as in the hypothesis of ribbands, on the two predetermined frames;
- The rising floor timber VR61 and the crook timber IND82 at the sternpost knee may be introduced, perhaps, and connected to the keel with nails;
- Placing of the «floating» floor timbers fore and aft, whose contour is defined either by the ribbands, or by the strakes of the bottom, and connection of these to the bottom planking;
- The keelson is put in place and bolted to the keel through three frame spaces;
- The bottom planking is placed and connected, up to the bilge;
- Introduction of the floating futtocks and their connection to the bottom planking;
- Proceed with raising the side planking, perhaps with the concurrent placing of the ceiling and of connection through certain ceiling strakes to the planking;
- Introduction of the filling boards by force.

The absence of preservation of architectural remains renders the reconstruction of the sequences of the chain of constructional operations completely hypothetical. We will therefore terminate the reconstruction there.

PROVISIONAL CONCLUSION

At the end of this first phase of the study of the architecture of the *Erquy* wreck, several aspects are to be emphasised. It can be stated first of all that the *Erquy* wreck, from the first half of the 17th century, possesses a series of particular architectural characteristics with respect to those technical sources coming notably from treatises of naval architecture[26], put in evidence, and lead us to consider as representative of the whole of architectural practices of the modern era.

The particular principal architectural characteristics are as follows:

Architectural Element	Particular Characteristics
Keel	Partial rabbet
	Open mortise for the tenon of the sternpost
	No trace of connection of the floor timbers to the keel
	3 bolts for connection of the keelson
Keelson	Bolting through the frame spaces at 3 points
Frames	Position of all the futtocks on the front vertical faces of the floor timbers
	No connection of the floor timbers to the keel except the rising floor timber VR61
	No connection of the futtocks to the floor timbers except the presumed master section (VR57/MB55) and the first frame forward of that (VR56/MB54)
	Central floor timbers in oak
	Other floor timbers and crook timbers in elm

These particular characteristics, and especially the frames floating in relation to the keel, do not permit us to attach the architectural principle of the *Erquy* boat to the customary characteristics proper to the principle of «frame first», as that is classically defined in terms of analysis and of archaeological interpretation. The central question that is posed from that is that of the meaning to give to these particularities which appear, indeed, well outside the architectural norms defined by the historical sources, principally manuscript, of the era. Is it a question of isolated characteristics, specific to one shipyard, even to one constructor, or, on the contrary, is it a question of characteristics of a more general extent, and assimilable to the «architectural signatures» capable of expressing construction practices of a regional character? The *Erquy* wreck remaining for the moment as an archaeological one-off, no response can be proposed to that

[26] These sources are, it is true, later than the dating of the *Erquy* wreck. In France, the first work published and considered as a treatise of naval architecture is that of DASSIÉ, 1677. It is a purely theoretical work which addresses itself not to practitioners of shipbuilding, but to future naval officers (cf. RIETH, 1997: 15-27).

question. Now, is it necessary to emphasise that the scientific gamble was of importance in the scheme of the history of naval architecture to the extent where the *Erquy* wreck represents an architectural type, that of a boat destined for a regional coastal navigation, or, to a more limited scale of navigation, representative of a fleet of hundreds of units of comparable dimensions, constituting the fabric of the economic base of maritime transport of the modern era. It suffices to consult a commission as for example, that organised by Colbert in 1664, setting out a quantitative table of the vessels by port, for account to be taken of the numeric importance of the role of these coasters in the maritime economy of France in the «Ancien Régime».

With regard to boats of moderate tonnage, the archives attest that it was not exceptional that partially decked sailing vessels of a dozen tons to undertake navigations to destinations, very far distant from their home ports or harbours. The *Erquy* wreck can be included in this category. The dendrochronological analysis has made it appear, indeed, that the elms that served for the construction of the *Erquy* boat could have come from a forestry area corresponding to the present Pays de Loire. In the hypothesis, coherent in the case of a boat of reduced size, revealing a vernacular architecture, from a situation of relative proximity between the place of supply and the site of the shipyard, the *Erquy* boat could thus very well have been constructed in the Pays de Loire, somewhere between the departments of Loire-Atlantique and the Vendée.

In terms of that presentation, it can be stated therefore that in relation to the absence of the written and graphic sources, only archaeology is capable of reconstructing, in a certain more or less complete fashion, the architecture of these coasters in their more technical aspects. The *Erquy* wreck is a perfect illustration of the role of archaeology in extending knowledge of the history of naval architecture of the modern era on the one hand, and of its importance in the re-reading of a technical history too often considered as too well known and definitive to make appeal to the archaeological sources on the other. Of the other wrecks from the Atlantic arc, in other geo-historical contexts than that of the *Erquy* wreck, belonging more to that archaeological category of one-off, have led to a re-reading of history, considered as received, from the naval architecture or at least to a renewal of its interrogation. This is the case, for example, of the *Port Berteau II* wreck, dated from the beginning of the 7th century, situated in the river Charente. That wreck of a fluvio-maritime coaster, from its carvel construction of «frame-first» type, posed the question of its place in the chronology of the history of «carvel» naval architecture in the Atlantic arc.

The field of archaeological research will favour numerous future beneficial discoveries.

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