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Cover image: embankments at the Danube waterfront of Regensburg "Donaumarkt" made of re-used Roman material, probably Carolingian (S. Codreanu-Windauer, BLfD 2014).

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research

The boat mills of the Doubs, from the Middle Ages to the 20th century

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The boat mill was the technique best suited to the river Doubs which experienced frequent variations of flows and levels. The recent data from underwater archaeology enables us to trace the evolution of the mills from the 11th century to the beginning of the 20th century, the date of their disappearance.
Keywords: Doubs, boat mill, Middle Ages

Le moulin sur bateaux a été la technique la mieux adaptée à la rivière du Doubs qui connaît de fréquentes variations de débits et de niveaux. Les récentes données issues de l'archéologie subaquatique permettent d'en suivre l'évolution depuis le XIe siècle jusqu'au début du XXe siècle, date de leur disparition.
Mot-clés: *Doubs, moulin, Moyen Âge*

1. The boat mills of the Doubs: a long history

1.1. Adapting to the river regime

The Doubs, the main tributary of the Saône, drains a catchment area of 7,300 km^2, consisting mainly of a mountainous zone encompassing the southern Vosges and much of the Jura Mountains (fig. 1). It is a river with a precipitation regime of rain and snow, with a very irregular flow. The many floods occurring throughout the year (50% in winter, 13% in

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Fig. 1. Map of France showing the course of the River Doubs and its confluence with the River Saone (A. Dumont).

spring, 33% in autumn and 4% in summer) lead to considerable variation in flow and level. The Doubs has served as an abundant water resource for local people, which has been exploited for fishing, and for its hydraulic power, which drove many watermills. These mills were installed on boats, moored to the bank, thus allowing them to adapt to the constant fluctuation of the river's level.

Many archives, early 20th-century photographs, maps, and plans have been used to trace the history of these boat mills. Recently collected archaeological data can now be used to complement this historical information.

Fig. 2. The boat mill at Navilly, on the River Doubs, ca. 1900 (private collection).

The first mention of boat mills in archival texts dates from the 12th century, in Chalon-sur-Saône and Chazelle, for the River Saône, and from the 14th century, in Verdun-sur-le-Doubs and Sermesse, for the River Doubs (Farion 2004; Bailly 1979; Bonnamour, Jaccottey 2016). Under the Ancien Régime, the mills belonged to lords (e.g. the Duke of Burgundy, or the Lurieux family) who leased or rented them out. Such tenants did not run the mills themselves, but hired millers to do the work. After the Revolution, the mills were either run by their owners, or rented out to millers. In the middle of the 19th century, there was a boat mill in every town along the lower part of the River Doubs. Most of them ceased to function at the end of that century, but some continued until the beginning of the 20th century. The last two on the Doubs were in Navilly until 1915 (fig. 2), and in Pontoux until 1923, undoubtedly one of the last working boat mills on a French river.

1.2. Complex facilities requiring constant maintenance

The floating mills of the Doubs were formed by two boat hulls, between which was the vertical undershot wheel[1] driven by the river current (fig. 3).

[1] Undershot: water hits the wheel paddles at the bottom of the wheel.

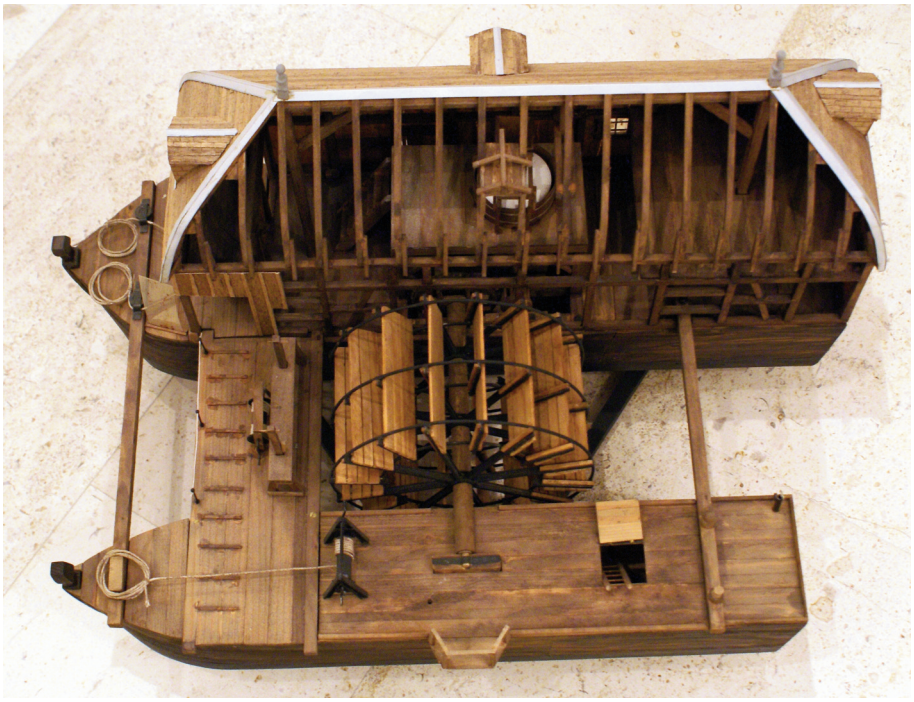


Fig. 3. Model by François Borgeot, on display at the Ecomusée de la Bresse Bourguignonne, Pierre-de-Bresse (photo by A. Dumont).

The smaller boat, the *forain*, served as a stabilizer, while the larger boat, the *corte*, supported a wooden building inside which the mill mechanism was located. A gangway connected the boat mill to the bank, along which the sacks of grain and flour could be carried on a man's back or in a wheelbarrow. Upstream of the boats, a dike was built to guarantee an adequate supply of water when the river level was low (fig. 4). It consisted of one or two rows of wooden stakes, which were reinforced by stones at their base. Between these stakes, wood was woven to form a wattle fence.

These dikes (*bouchier*, *bouchot*, *benne* or *banne*, in old French) required constant maintenance, and the owner had to have the necessary wood resources to repair or consolidate them. These dikes often are cited in the archives, as the source of many conflicts of use, because they formed obstacles hampering navigation, thus sometimes causing accidents or even shipwrecks. They also served as favourable fishing grounds, and so traps or nets were placed inside the dike to capture the fish.

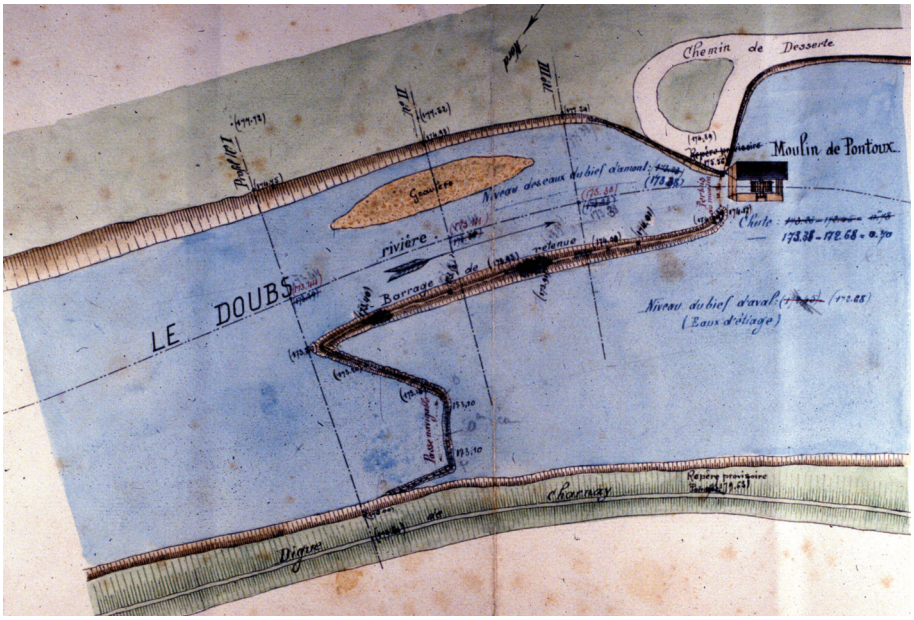


Fig. 4. Layout of the boat mill at Pontoux, on the River Doubs, dated 21st October 1910 (document in the Denon Museum, Chalon-sur-Saône).

The boats and the wheel were subjected to heavy stresses and had to be protected in the event of a high flood or when the river froze (Peyronel 1984). Sheltered zones were built along the banks to harbour them until conditions improved.

1.3. A boat mill as early as the 11th century in Sermesse

Since 2008, a programme of systematic underwater survey of the River Doubs upstream of its confluence has sought to identify any remaining submerged heritage (Dumont 2015). This survey confirmed that dredging during the 20th century had not completely destroyed the archaeological remains preserved at the bottom of the river. In the section surveyed, half the channel, between the right bank and the middle of the river, had been dredged, while the other half remains more or less intact. Vestiges of ancient structures are visible at a depth of between 3 and 5 m. Among them are the piers of a Roman bridge at Pontoux, as well as numerous remains of dikes from fisheries and mills. The wooden stakes in these vestiges have been dated by radiocarbon analysis[2] and

[2] The number of tree rings was insufficient for dendrochronology.

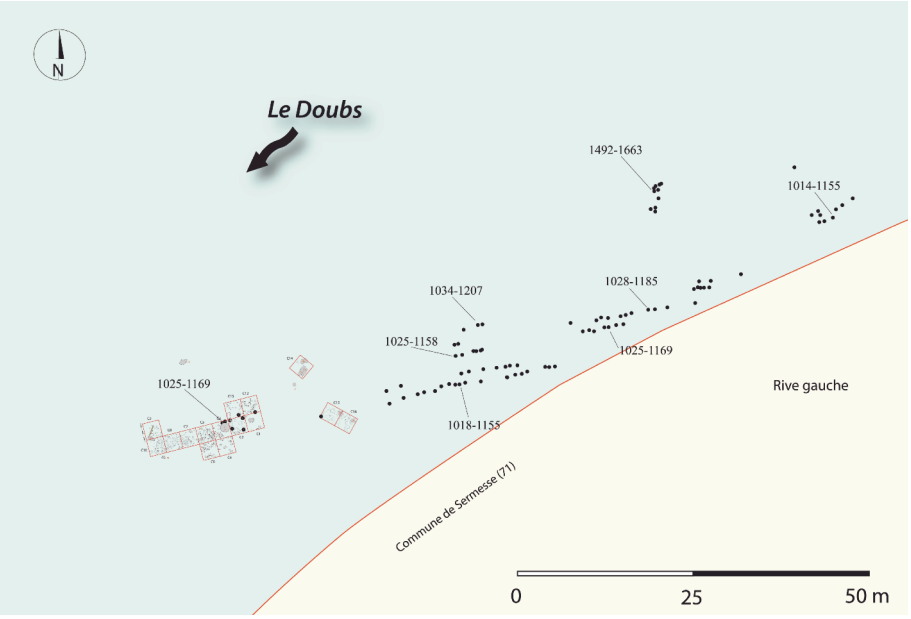


Fig. 5. Site map of the remains of a boat mill mooring area that operated from the 11th to the 12th century, and during the modern period, 15th to 17th century. The ^{14}C radiocarbon dating was done at the Poznan Laboratory. The date range is given with a probability of 95.4% (A. Dumont, P. Moyat).

so, for the first time, it is possible to highlight the location of a boat mill dating from the 11th to the 12th century.

The site consists of 84 wooden stakes, which form a slightly oblique alignment starting from the bank and going towards the channel, with occasional interruptions. At the downstream end of this structure, several millstone fragments suggest a dike designed to channel water to a floating mill.

A series of ^{14}C analyses dated several stakes from this new site: seven stakes fall within the calibrated date range, from the beginning of the 11th century to the end of the 12th century (fig. 5). One stake, standing next to an unbroken millstone lying on the sediment, has been dated to the interval AD 1025-1169 (fig. 6). The site must have been subjected to strong erosion, destroying the lighter elements (pottery and wood), and leaving only millstones and upright wooden stakes in place.

At the end of the excavation, eleven millstones or millstone fragments were removed from the water to be studied in more detail (fig. 7). However, one quadrangular stone, pierced through the centre, was not raised because of its weight.

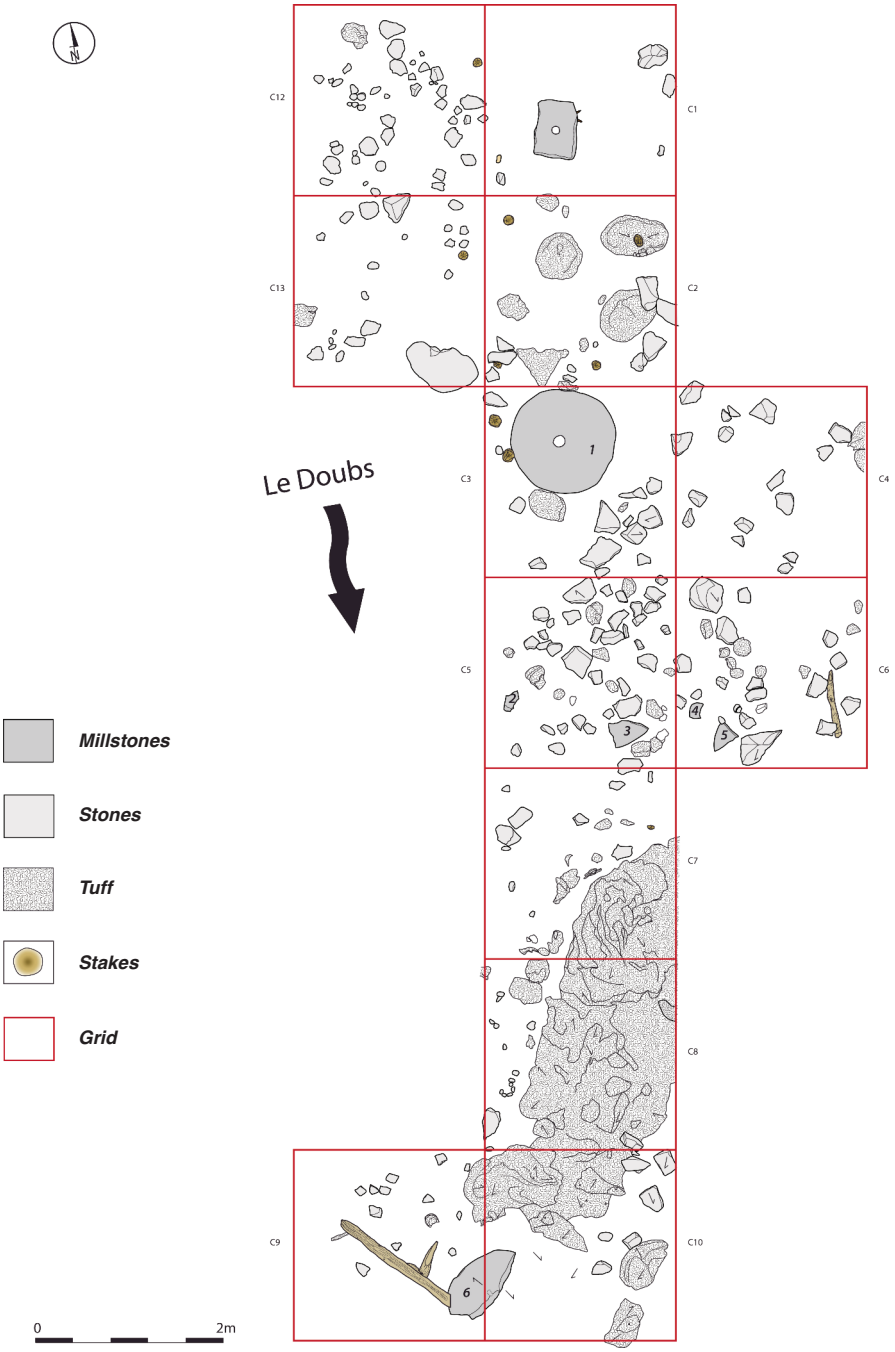


Fig. 6. The zone where the cluster of medieval millstones was found (A. Dumont, P. Moyat).

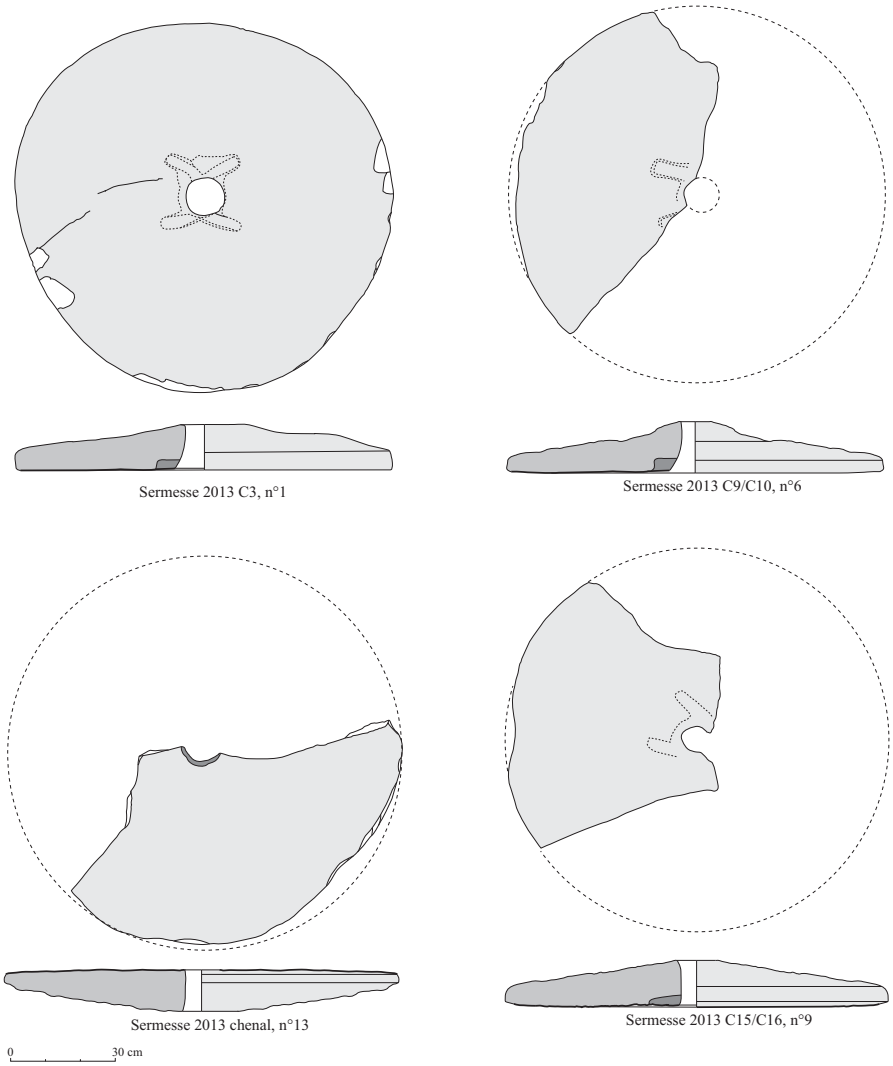


Fig. 7. Drawings of millstones from the medieval site of Sermesse (L. Jaccottey).

The seven millstones located in the axis of the dike were carved from the feldspathic sandstone of La Serre Horst, which was exploited very early on because of its suitability for grinding purposes. This massif, which is the only granite and sandstone outcrop in the predominantly limestone Jura massif, lies 50 km north-east of Sermesse. The River Doubs flows less than 10 km south of this outcrop, thus making it very probable that the millstones were transported by boat.

Mill excavations remain relatively rare in France, but fortunately there is a geographically and chronologically close comparison nearby. It is the Thervay mill, dependent on the Cistercian abbey of Acey in the Jura, excavated in 2007/2008. For the same chronological phase as the discoveries from the Doubs, the millstones discovered at Thervay range between 92 and 104 cm in diameter (Rollier 2011). On a broader scale, diameters between 101 and 110 cm are mainly known at sites dating from the 10th to the 12th century (Belmont *et al.* 2016). The Sermesse millstones fit perfectly into this chronology.

All the stakes found upstream of the Sermesse millstones are very eroded, with only the point remaining. Together with the millstones, they provide the last remaining evidence of the probable installation of a boat mill between the 11th and 12th centuries, a mill of which no other trace remains. It did not necessarily sink at this location; it is probable that, after having worked for some time at this point of the river, it was moved. During its period of use, old millstones and chippings, as well as the weights used to immobilise the boats supporting the mill, were probably abandoned in the River Doubs.

Until now, through archival documents, it was known that this type of installation had been used in this area since at least the 14th century. The new archaeological data now make it possible to attest to the establishment of the first boat mills on the Doubs from the 11th or 12th century, with a supply of millstones from La Serre Horst.

Four other fragments, lying in the channel at a greater distance from the left bank, are made out of a different type of stone, *meulière*, known as French burr or buhrstone, which was widely exploited in the Paris Basin for the production of millstones, and imported into the east of France from the beginning of modern times. These fragments were found in the channel in the zone where the only stake dated from this period (1492-1663) is located. Again, they may well have been transported by boat. Two of these fragments have been reassembled and belong to a bed-stone with a diameter of 160 cm.

In this area, the first millstones made from buhrstone were used in the early 16th century (in 1518 in Besançon, and 1559 in Dole), and they eventually supplanted local rocks in the 18th and 19th centuries (Belmont 2006; Jaccottey 2009). The 160 cm diameter is recorded for millstones dated between the 14th and 16th centuries (Belmont *et al.* 2016). This allows the four fragments discovered at Sermesse to be associated with the dates obtained for the group of stakes farthest from the bank (15th-17th centuries). The presence in this area of fragments of millstones and stakes dated between the end of the 15th and the beginning of the 17th century suggests that a floating mill was stationed in

the same place as the mill that worked for some time during the 11th to 12th century, thus showing the perennial nature of such installations on the river.

2. The 16th century boat mill in Sermesse

In Sermesse, but 500 m upstream of the remains described in the previous section, underwater surveys also discovered a set consisting of two boats and a dike formed of two rows of stakes, corresponding to the vestiges of a complete boat mill on the bottom of the river (fig. 8). It is a structure dating from the pre-industrial modern period, more precisely from the 16th century, according to the ^{14}C dating of the hull and the stakes, and the study of the objects discovered in the wrecks. The potential of this site as well as its on-going dismantling by fluvial erosion have led to a programmed underwater excavation lasting several years. So far, the smaller of the two boats has been thoroughly excavated. The search for the larger craft will begin in June 2017.

2.1. The smaller boat, known as the forain

The smaller boat, which served as a stabiliser, and on which the end of the wheel shaft was supported, was called the *forain*, in the vernacular language of the Saone valley (Bonnamour 2009). The *forain* from the 16th century Sermesse mill has been almost entirely excavated (fig. 9). It dips sharply, with the stern buried in the riverbed sediment, while the prow remains partly free, causing considerable erosion of this part of the boat by the current, so that several elements have been worn away. Midway, the boat is covered by 1 m of sediment, and the state of conservation is even better in its rear section, buried under almost 3 m of sand. This burial has preserved the wood and some objects that were in direct contact with the hull.

The *forain* is a flat-bottomed boat, made from boards of varying widths, with a monoxyle bilge transition on each side. This design is a familiar construction pattern on all European rivers, and on the Saône in particular (see for example the wreck of Saint-Marcel on the Saône – Bonnamour 1999, or the 18th century wreck in the Saint-Georges carpark in Lyon: Rieth 2010).

The *forain* hull measures 1.90 m wide by 10.50 m long (9.10 m preserved + about 1.40 m destroyed). All the large wooden parts are made of oak. Smaller wooden elements used for repairs have not been sampled to determine species, in order to avoid further damage to the hull.

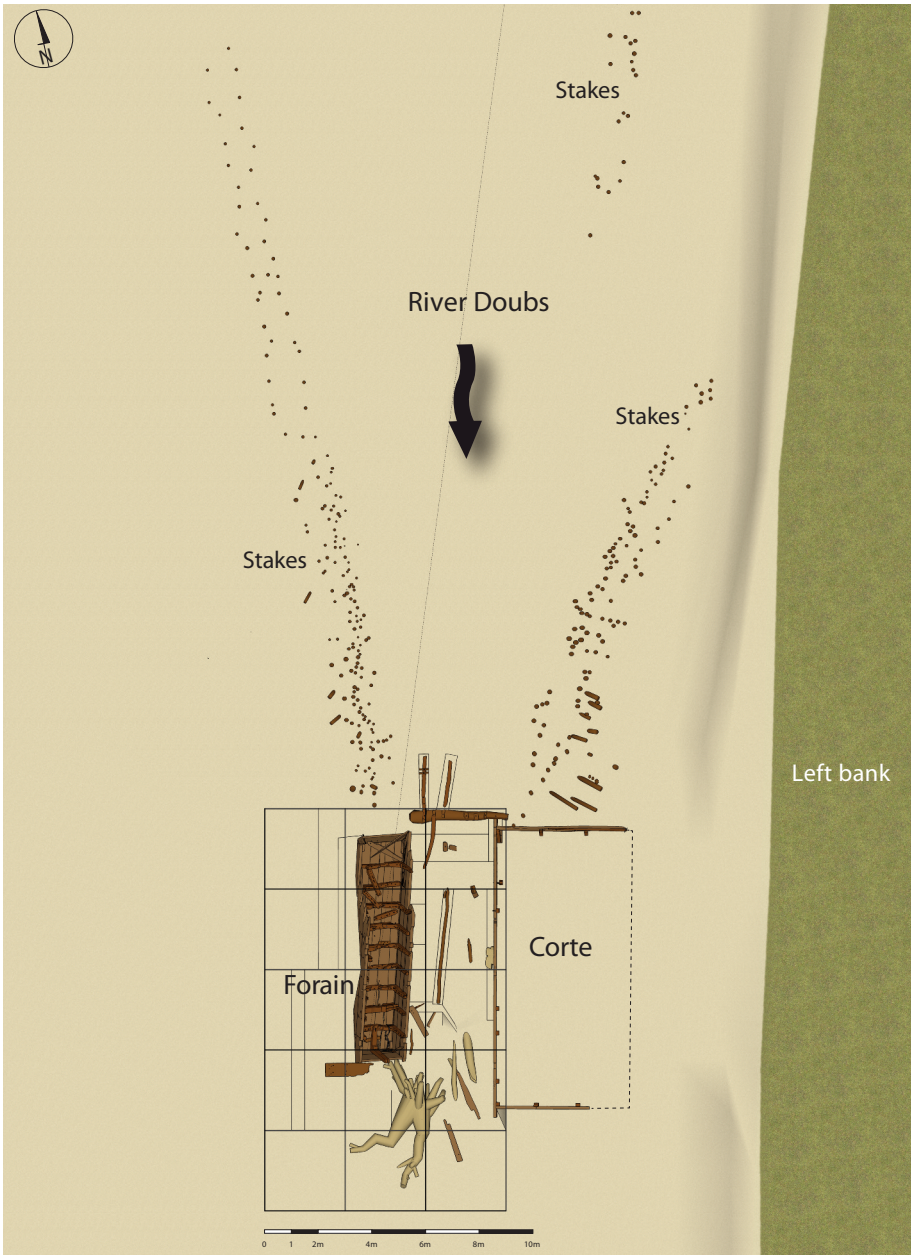


Fig. 8. The 16th century boat mill discovered at Sermesse. View of the remains at the end of the excavation in 2016 (A. Dumont, P. Moyat).

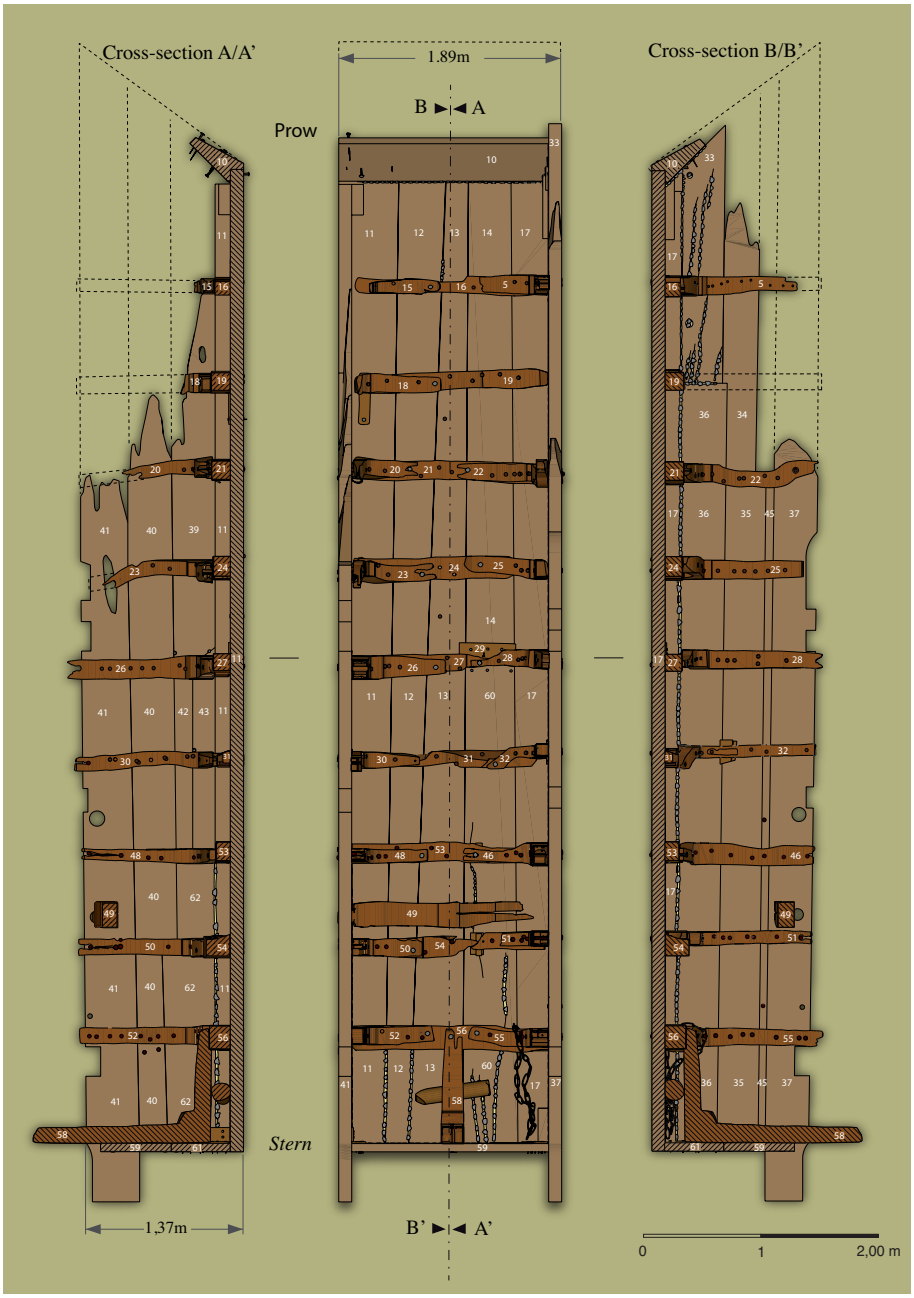


Fig. 9. Plan of the *forain* hull (P. Moyat, A. Dumont).

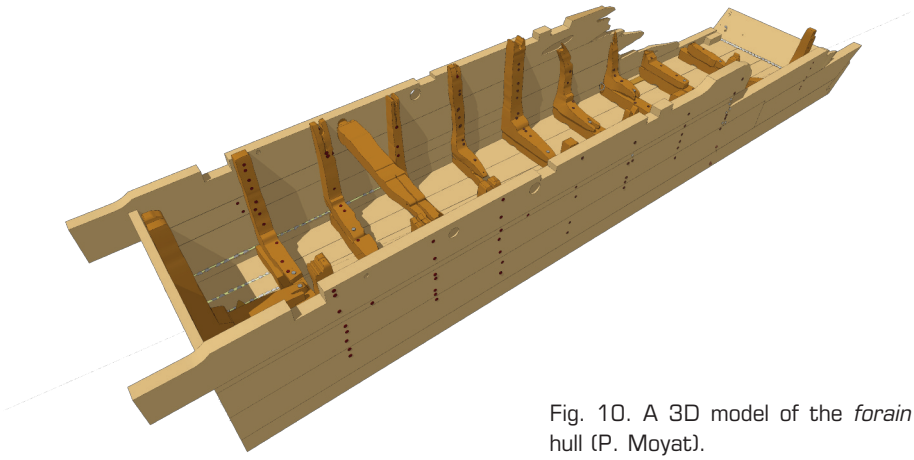


Fig. 10. A 3D model of the *forain* hull (P. Moyat).

The prow was quadrangular in shape, raised at an angle of 45°, and originally formed of several planks nailed and pegged together, one of which still survives today. The hull was reinforced internally by transverse reinforcements; nine still remain, but there was probably a tenth near the bow. The side frame was carvel-built, from oak planks. Despite the deformation due to sediment pressure and the tilt of the wreck, it was possible to see that the sides originally formed a right angle with the hull (fig. 10). The inside of the boat has been examined in some detail, but the outside, only partly released from the sediment, was more difficult to observe.

The entire vessel was sealed by moss caulking, which was inserted between the planks and covered with a wooden stick, held in place by sintels (metal staples). This method also was used for repairs, to plug any holes that appeared in the hull. These repairs may have been made immediately after the launch of the boat (weakness of planks that had not been noticed during construction?) or after tears due to shocks (floating tree trunks, or ice?).

A sample of moss caulking was removed and studied by Leica Chavoutier, a bryologist (Chavoutier 2011). Eleven bryophyte taxa were identified, but one species, *Anomodon viticulosus*, formed 98% of the sample. This result is similar to results for other medieval craft known in the Saône valley: Saint-Marcel/Port Guillot, Ouroux-sur-Saône/Port Sarrasin, and the *Savoyarde* found in Ouroux-sur-Saône (Rieth 2010, pp. 221-229).

This species, common in France, was probably chosen for several reasons. It is robust and relatively large, with thick, durable cellular tissue,

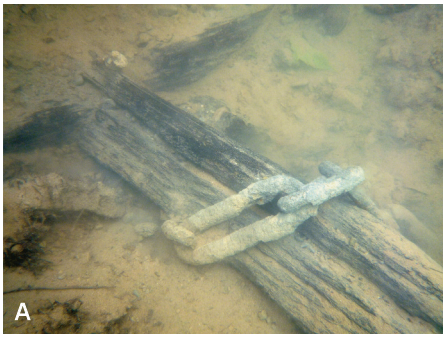
and it forms loose cushions that can cover about 10 dm^2, a large area for a bryophyte. It easily detaches from the substrate because the moss is more or less adherent, with upright stems. It probably was harvested in a forest or meadow-forest environment. Various media are possible, but it is likely that the trunks of old trees, offering the biggest covering area, were preferred.

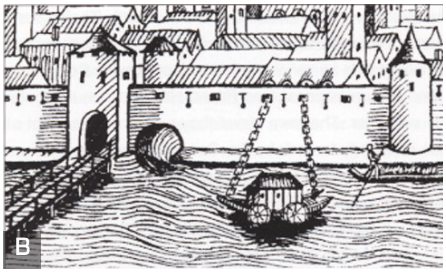
Many sintels and nails were found in the sediment excavated around and behind the boat. These elements may come from the erosion of the hull, but it also is possible that a supply of both may have been kept on board to repair any damage.

2.2. The larger boat, known as the Corte

The larger boat, housing the mill mechanism, was called *corte* or *courte*, in old French. So far, only the rear left angle of the Sermesse *corte* has been sounded, in order to assess its state of conservation and to learn more about the main elements of its architecture.

The *corte* was made out of oak, and measures 11.40 m in length and 5.30 m in width. Its structure has been preserved to a height of 1.50 m. The edge lying against the bank has not been completely cleared, be-





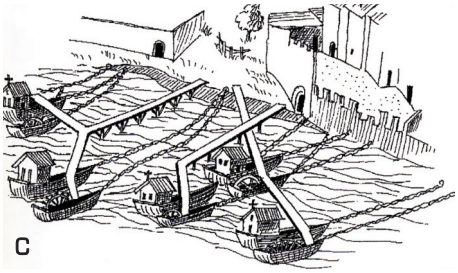


Fig. 11. A. A chain still in place, on the wreck of the *corte*, wrapped around the hull planking, leading towards the bank (photo by P. Moyat). B. The town of Regensburg, Germany (1493), showing a boat mill on the River Danube, moored with a chain (after Gräf 2006, p. 22, fig. 14). C. Map of the city of Lyons (1550), showing boat mills on the River Rhone, moored to the bank by chains (after Gräf 2006, p. 23, fig. 16).

cause of the many tree roots that partially cover it. At the base of the survey zone, against the bank, a chain is still in place, wrapped around the hull planking, leading towards the bank. It was probably part of the docking system for the boat mill, confirming that it must have sunk while in its operating position (fig. 11).

This flat-bottomed boat also was made from oak planks, with water-tightness guaranteed by moss caulking. The hull structure was reinforced to ensure its strength and robustness, with squared ribs in two sections, joined by treenails and by metal nails. Underneath the sand, the wood is in excellent condition. Along the bows, a repair can be seen, confirming that this mill must have been in use for a long time before it sank. The bottom is covered with fragments of millstones, arranged more or less contiguously, used as ballast. The rock used was again *meulière* (buhrstone), imported from the Paris Basin from the beginning of the Modern era, consistent with the radiocarbon dating of the wrecks and stakes. Three objects were found among the stones: a hammer, a rynd, and a pewter bowl.

A 3D reconstruction has already been proposed from the elements available so far (fig. 12), but further details of the assemblages will be recovered during the forthcoming excavation campaigns.

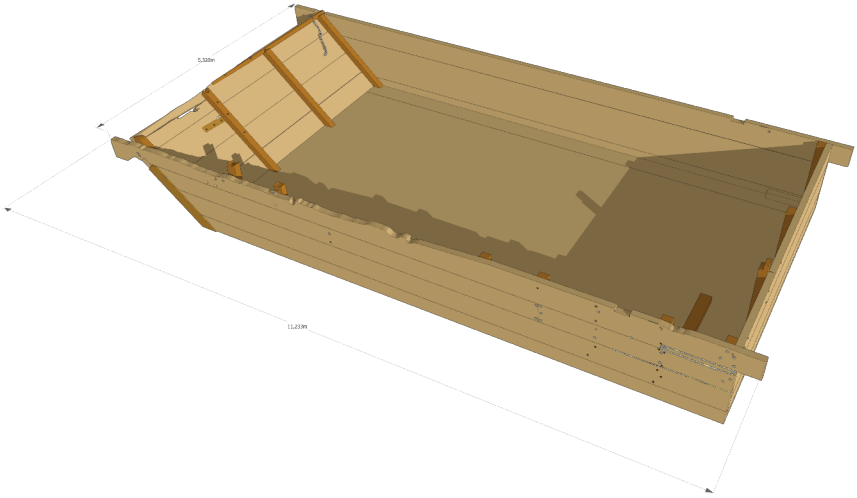


Fig. 12. Preliminary 3D model of the *corte* hull (P. Moyat).

2.3. Archaeological artefacts discovered in and around the boats

One of the many interests of the Sermesse site is that, in addition to the boats that supported the mill, it has also preserved many objects relating to shipbuilding and milling techniques, which bear witness to daily life on board for the miller and his family. The abrupt sinking of this boat mill, which obviously had not given its occupants time to save their possessions, means that it now forms a closed set, containing many undamaged objects (wooden tool handles and unbroken pottery). Their state of conservation is linked to rapid burial by sediment, and to the absence of any trampling or subsequent attempts at recovery, which were rendered impossible by their dual burial under both water and sand.

It is a corpus of original and varied 16th century objects, in a good state of preservation because of their long stay in fresh water. All objects have been systematically deposited in a conservation laboratory in order to apply the treatments necessary for conservation. The cleaning of the metal objects has revealed new information, such as the marks of craftsmen on tool blades.

2.3.1. The remains of the wheel paddles and the rynd

In the sediments removed during the excavation of the *forain*, and lying between the two boats, several assembled planks as well as large wooden dowels (or treenails) were discovered. They undoubtedly form part of the paddles of the mill wheel. These wheels could be dismantled and stored for safety during periods of high floods or ice.

The sounding in the *corte* recovered an iron rynd (fig. 13). This large element (35 x 32.5 x 7 cm thick), with a weight of 11.7 kg, served to transmit the rotation of the runner shaft, connected to the lantern, to the rotating runner stone. On one side, traces of wear (grooves and streaks) are clearly visible; the other side has a craftsman's mark repeated twelve times around the central hole. These marks were not visible before the laboratory treatment.

In the archaeological repertory, rynds are rare discoveries and it is thus difficult to find a direct comparison for the same period (16th century). Only one has been described for the medieval period in France, which was found at the Crouillard island site, in Méry-sur-Marne (Bauchet 2016). It has four branches, which form an X, with a central hole in the shape of a figure eight. It is among the vestiges of a mill that operated between the 10th and 14th centuries.

This rarity is undoubtedly the result of refurbishment, as such ironwork was reused, as evidenced by a text evoking the reconstruction of

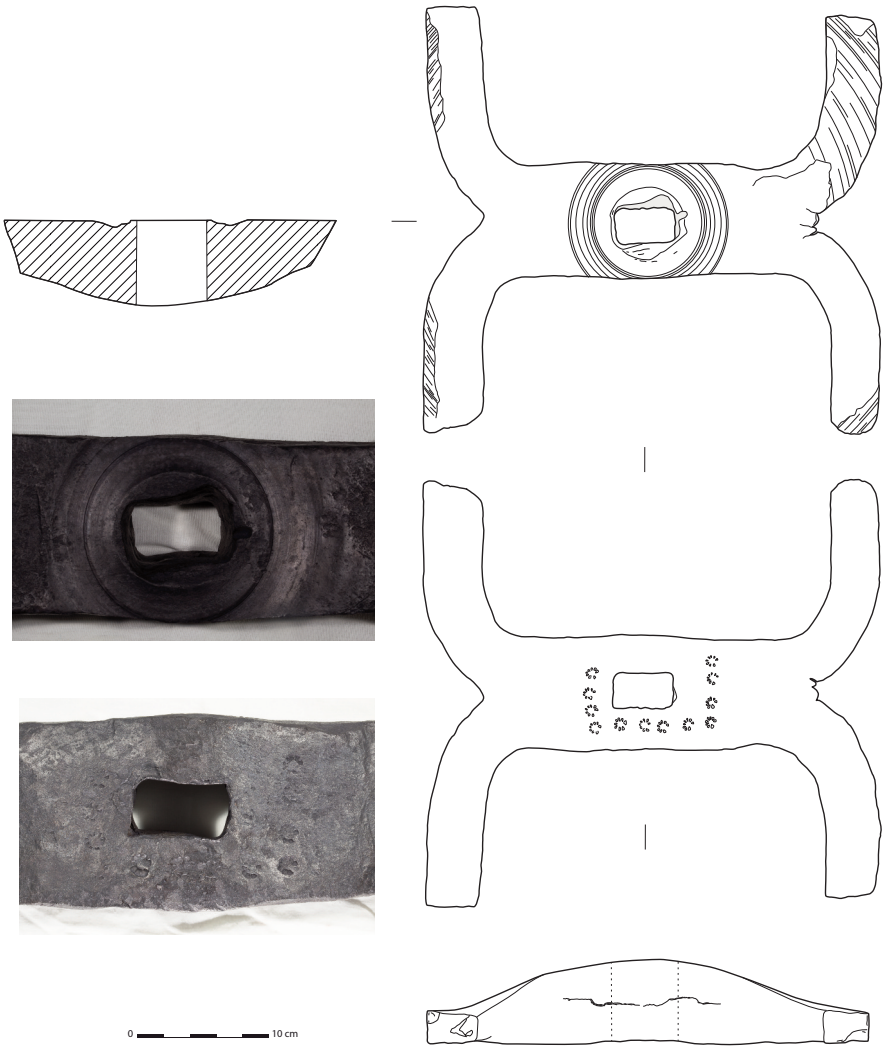


Fig. 13. The rynd discovered in the *corte* hull (drawing M. Treffort, photo CREAM).

a mill in Troyes, at the beginning of the 15th century, and where the rynd was reused on a windmill (Rouillard 2016). The Sermesse rynd obviously was not recovered after the boat mill sank. Its X-shape with a rectangular hole is similar to that presented in the *Encyclopaedia of Diderot and d'Alembert*, which has been republished in numerous works on mills (Rivals 2000, p. 24).

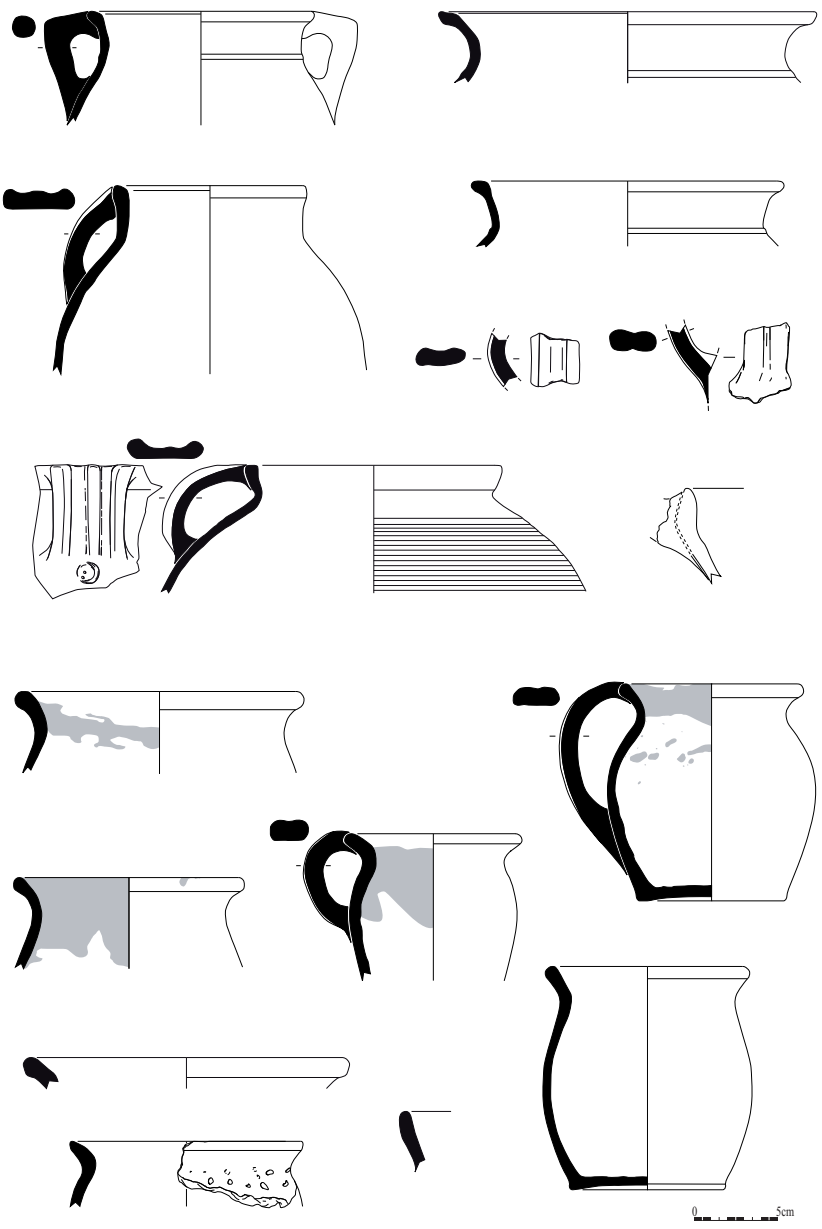


Fig. 14. Pottery from the Sermesse boat mill (drawing C. Vélien).

Fig. 15. Metal containers and pottery from the Sermesse boat mill (photo D. Le Cornu).

2.3.2. Objects from everyday life

The pottery is typical of the dressers that equipped houses in the region at the end of the 16th and the beginning of the 17th century (fig. 14). The corpus discovered so far includes objects used for cooking, with a large number of cooking pots, stewpots, and also *miliassieres*, large baking dishes for cooking pancakes, as well as objects used in food preparation, and serving dishes (including a large number of bowls and cups, soup plates and large dishes). Drinking vessels include pitchers, and a goblet or mug (*mazagran*).

There is also a set of metal containers: three cast-iron pots, two bowls and a pewter pitcher (fig. 15). An iron lid may have been used for one of the three cast-iron cooking pots. A metal spoon and a wooden spoon are the only serving utensils that have been found.

As all the dishes were found on the *forain*, except for a pewter bowl at the bottom of the *corte*, it is likely that the space devoted to cooking and meals was on the smaller boat rather than on the larger one, which housed the mill. This organisation may stem from the need to keep fire far away from the highly inflammable flour dust. The distribution of the living and working spaces on these mills is never mentioned in the archives, and so only archaeological excavations on well-preserved complexes can serve to obtain this type of information.

The pewter pitcher, discovered in the *forain* hull with one of the three cast-iron pots, was cleaned in the laboratory, thus making it possible to discover a name engraved on its base. As deciphered by Marcel Treffort, it reads *Jeunon*, together with a first name beginning with the letter C. This discovery may make it possible to retrace the precise history of this particular mill, and perhaps to find information about the miller, his origins and his family, through better-targeted research in the archives. If the miller engraved his own name (the surname *Jeunon* is very frequent in Sermesse and Saunières), it means that he knew how to write. Consultation of parish registers may help to trace the sinking, as the miller or a member of his family may have died in the accident. This research will continue in the coming years.

Tools related to carpentry and woodworking are abundant, since the miller had to have on board everything necessary for the repair and maintenance of the mill (boats and dikes), where wood was ubiquitous. The marks of craftsmen are almost always uncovered as the cleaning of the objects progresses, sometimes with personifications that go as far as the inscription of surnames or first names, notably on the blades of knives. These marks and inscriptions will be the subject of more detailed study when all the tools have been processed. Three wooden handles are preserved: that of an axe and two folding knives. One of the two knife-handles has revealed decoration that could not be seen when it was taken from the water.

Tools for wood-cutting (billhooks) or for the upkeep (or even cultivation?) of the riverbank are also part of the corpus (hoes and a spade), as well as navigation tools, necessary for steering the boat, or for recovering or pushing away any floating objects.

There are also small sewing accessories (two thimbles, scissors, and a needle) and several steelyard scales, probably intended to weigh fish baskets, as they are too small to support the weight of sacks of grain or flour. Moreover, archival documents show that mill dikes could also serve as fish traps.

Four pieces of leather have been discovered: a piece of sheepskin, finely worked, circular in shape, which may have served to trim the inside of a basket; part of a shoe; and two leather soles trimmed with nails.

A single coin has been discovered, providing the first relatively precise date. It is a *double tournois* from the reign of François I, of a type issued between 1541 and 1547-1548. The date of minting gives a *terminus post quem*; the sinking took place after 1541, and although such coins may still have been in circulation some time after the end date of emission (mid-16th century), such a find reinforces the arguments for dating

the loss of the Sermesse mill to the second half of the 16th century. It may have been one of the two mills mentioned at Sermesse in the archival document, *Terrier de Verdun*, dated 1581 (Farion 2004, p. 92).

2.4. The cause of the sinking

After having remarked on the presence of repairs and the state of wear of certain wooden elements, an initial analysis of the remains suggested that bad maintenance and the dilapidated state of the mill might have caused it to sink after being abandoned. In his study of the mills of Franche-Comté, Mordefroid (2013) analysed the replacement by windmills, in 1630-1631, of the aging boat mills of Champdivers Peseux, Longwy, and Petit-Noir on the River Doubs. The upkeep of these mills was a permanent problem even in times of peace. Any unrepaired weak point in the hull could well have fatal consequences in the case of flooding or when the river froze.

However, after three excavation campaigns and the discovery of numerous objects, it seems more likely that the Sermesse boat mill sank as it operated, accidentally and abruptly, leaving no time for the occupants to rescue the objects, tools, dishes, etc. that were on board. This would explain the position of the mill, exactly where it operated, and the presence of the mooring line that still connects it to the bank. The fact that it sank on the spot, without drifting, can be explained by the fact that the moorings did not break, and also by the fact that it was heavily laden.

The cause of the shipwreck still remains unknown, but the most plausible hypothesis is that of a tree carried by a strong flood. During the

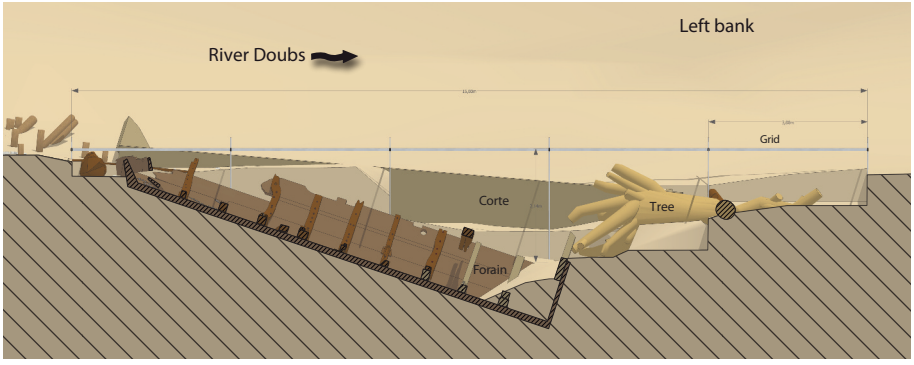


Fig. 16. The *forain* hull and the tree that may have caused the shipwreck (P. Moyat).

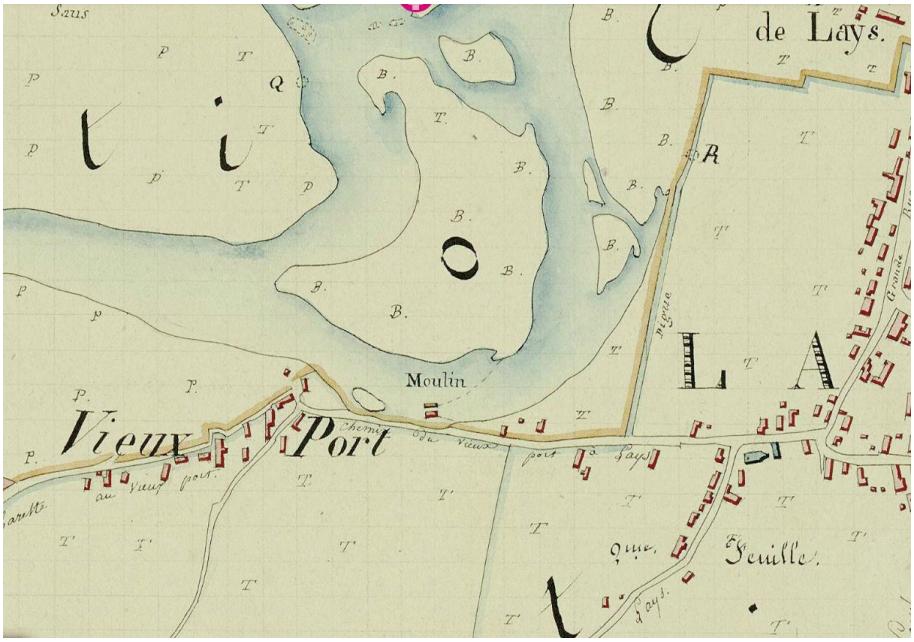


Fig. 17. The boat mill of Lay-sur-le-Doubs, on a map dated 1830.

complete excavation of the *forain*, a very large tree trunk could be seen just above the stern of the boat (fig. 16). A fragment of wood was sampled for radiocarbon analysis to check whether the tree was contemporary with the mill or from a later period.

The time range at 95.4% probability (1491-1659) is very close to that obtained on a sample taken in 2009 from the *forain* (1460-1640), and from the dated stakes in the dike on the channel side (stake 57: 1435-1631; stake 2: 1450-1640; stake 5: 1480-1650), and the dike on the bank side (stake 196: 1442-1634; stake 134: 1417-1615; stake 94: 1421-1616). The tree is therefore quite probably contemporaneous with the mill and may thus have been the cause of the shipwreck. A tree of this size, carried by a flood, could quite easily have caught in the millwheel, thus causing a catastrophe. Its location could also explain why the *forain* sank in an almost vertical position, with the stern of the boat quite evidently having been dragged by a great weight to the bottom of the deep ditch that usually forms behind floating mills because of the turbulence generated by the millwheel.

This context confirms the violence of the event, as already suggested by the presence of objects testifying to the impossibility of recovering the goods present on board at the time of the drama, or later, despite the relatively low water level. The hypothesis of a sudden sinking followed by rapid burial under sediment remains the most plausible to explain the position and conservation of this boat mill. The event may have occurred during a relatively exceptional flood.

The mill at Sermesse is one of the rare archaeological remains of a boat mill known in Europe with relatively easy access (Gräf 2006). Its dating to the pre-industrial modern era (end of the 16th century), and the possibility of finding parts of the mill mechanism make it a prime subject of study for better knowledge of milling, shipbuilding and fishing techniques, as traces of these three activities can all be identified on the boat mill. This accidental shipwreck, although a tragedy when it occurred, nevertheless provides a wealth of unpublished information for historians and archaeologists. It escaped destruction by dredging in the

Fig. 18. The remains of the mechanism of the Longepierre boat mill, which sank in the River Doubs at the end of the 19th century (photo by P. Moyat).

1960s and 1970s (Bonnamour 2010), but the remains are very fragile because they are exposed to destructive currents. The degree of erosion of the stakes in the dike and of the older remains (11th-12th century) discovered in the vicinity confirm the need to study this submerged heritage with great dispatch.

3. The remains of the last boat mills on the Doubs

Archaeological surveys and historical research have revealed the remains of two mills that operated on the River Doubs until the end of the 19th century.

In Lays-sur-le-Doubs, in a palaeo-channel, stakes now visible in a cattle pond correspond to the location of a boat mill drawn on a map dated 1830, and visible in a photograph (fig. 17).

At Longepierre, an underwater exploration on the Doubs riverbed located the remains of the mechanism of a mill, which is mentioned in the archives as sinking at the end of the 19th century (fig. 18).

These vestiges show that there is great potential for an archaeological study of the last boat mills on the River Doubs, to be combined with existing iconographic and historical documentation. They also provide an interesting point of comparison with the remains of the mill at Sermesse, which also sank in the same river, a few kilometres away, three centuries ago.

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