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CAULKING TEXTILES FROM THE LYON SAINT-GEORGES 4 SHIPWRECK: RECORDING AND CONSERVATION QUESTIONS

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Abstract

The conservation of the 2nd century AD Roman barge Lyon-Saint-Georges 4 (LSG4) in 2014 provided the opportunity to remove 26 linear meters of the caulking, consisting of a mixture of tar and textiles from between its sides and the flat-bottom. Attempts were made to unfold the material based on prior experience, but this resulted in the destruction of the samples. A new and readily accessible solution had to be found, which would better conserve the material. This new process consists of heating the samples in demineralized water to 100 °C, thus the tar becomes plastic enough to unfold the textiles. Two questions arose during this project: first, how to record each step of the process, because material changes are irreversible, and secondly, how to conserve the textile, avoiding as much degradation as possible during the unfolding process.

The study of the textiles suggests that the material is caulking (used after the wooden ship was assembled) as

opposed to luting (utilized during the construction of the wood). This helped provide new data for archaeological assessment. Additionally, the analysis of the images of the partially unfolded textiles will help us to understand the way Roman caulkers prepared and used the textiles. Due to the good preservation conditions (an anaerobic environment, impregnation with tar and the constriction between the planks in the wreck itself) this component of the LSG4 conservation project allowed us to recover the most important group of Roman textiles in Europe consisting of nearly 3 m². This has led to new research questions: were these textiles specifically chosen for that use? Were they recycled from nearby? Do they present specific technical properties?

Keywords: Roman; Lyon; pitch; shipwreck; textiles; caulking.

Introduction

Sixteen wrecks dated from the 1st century AD to the 18th century were excavated between October 2002 and June 2004 at the site of the future Parc Saint Georges' carpark in Lyon (Figure 1). The Institute of Preventive Archaeological Research (INRAP) carried out the excavation of this harbour site at the request of the Ministry of Culture (Guyon and Rieth, 2010). Grégoire Ayala was the manager of this huge archaeological operation and Marc Guyon was responsible for the wrecks' excavation, which took place in a 4000 m² cofferdam to a depth of 10m.

Lyon Saint-Georges 4 (LSG4) belongs to a larger set of three Gallo-Roman wrecks, which were removed and stored in a lake near Lyon until funding could be secured. In 2013, treatment of LSG4 began and included consolidating the waterlogged wood, restoring the ship, creating a presentation support and making a complete archaeological study.

During the dismantling of the barge, 26 m of caulking materials were removed for further study. They mainly came from the space between the bilge and the side. Initially, they looked like a piece of wood (Figure 2), but after more detailed examination, textiles were evident. The boat was made watertight with textiles impregnated with pitch, a well-known technique on the Rhône-Saône route between the first and the third century AD. Several wreck sites are known to contain pitch-coated textiles, including the Roman wrecks of the Chalon-sur-Saône bridge from the first century AD (Lonchambon *et al.*, 2009), the Arles Rhône 3 wreck from the first century AD (Marlier, 2014), the Arles-Rhône 5 wreck dated to between the first century BC and the second century AD (Marlier *et al.*, 2019), and the Tolozan shipwreck from the first century AD (Rieth 2011). The Lyon Saint-Georges site provided six additional

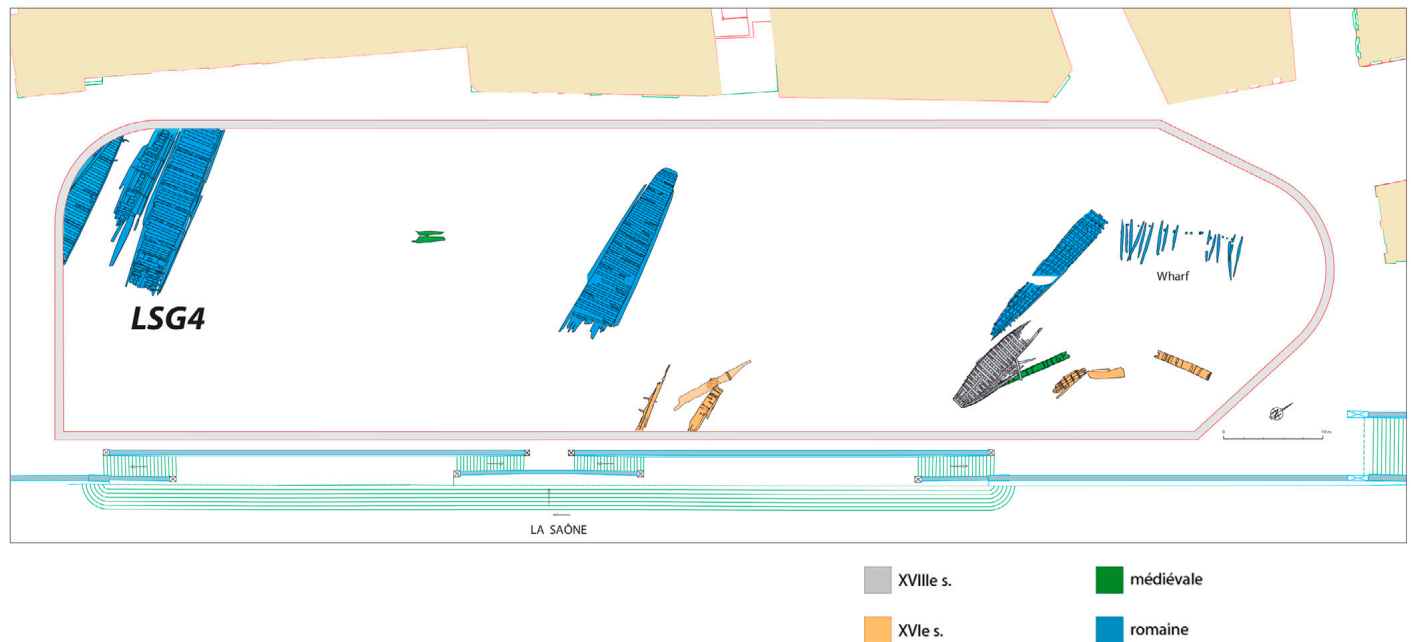


Figure 1 Position of the wrecks and wharf, during excavation in 2003 © Graphic designer W. Widlak, Inrap.



Figure 2 Before unfolding, the material used to provide water proofing looks like a piece of wood. © ARC Nucléart

Gallo-Roman wrecks dating from the first to the third century AD, all of them caulked with pitch-covered textiles. The Lyon Saint-Georges 7 wreck, which dated to the end of the third century AD, was also caulked with moss (Guyon and Rieth, 2010).

During the manufacture of the flat bottom planks of the LSG4, carpenters created a particular shape to the profile of the edge. This profile, once the two planks are positioned against each other, forms an inverted “V” with a slight protrusion downwards to keep the caulking material in place without any other means to secure it. The initial profile of the edge was cut with an axe. When the caulking

was replaced, a gouge was used to remove the pitch-coated cloth, and this led to the disappearance of the protrusion, allowing us to precisely record where the caulking has been replaced in the past.

The discovery of the caulking and the desire to identify a safe method for unfolding the textiles led us to ask how we could answer historical questions with this new data. Previous studies of textiles have focused on their characterization (Médard, 2010; 2014). Our aim was to link the textiles used as waterproofing material to the barge in order to better understand how the caulker did his job, and which techniques were employed.

Previously, caulking textiles were unfolded by chemically removing the pitch in order to clean and flatten the textile for archaeological study (Plantec, 2010; Schoeffer, 2004). Trials following this procedure led to partial or total disappearance of the samples because the pitch completely impregnated the textile and held them together. This explains the fragmentation of many of the textiles unfolded previously. A lack of communication between conservators and archaeologists also contributed to data loss. This unsatisfying state of affairs drove us to explore a new protocol. The new treatment needed to be efficient and fast, non-toxic and limited in terms of the cost and the amount of waste it produced. Additionally, each step of the treatment needed

to be documented because changes in condition and shape needed to be recorded.

Organic solvents have a tendency to attack fibers, which become more fragile leading to tearing along the folds. The new protocol uses hot water to plasticize the pitch enough to permit the unfolding of the textile (Figure 3). First, demineralized water was used, but after advice from Véronique de Bühren (textile conservator in the Musée des Tissus de Lyon), fresh water was used, to avoid losing ions and further damaging the textile. The piece of caulking material was completely immersed in water, and then heated to approximately 100 °C. After careful examination the textile was unfolded from one edge while a plan of the shape was built (Figure 4). After this the textile was placed on a mosquito net of fibers covered by plastic (8 threads/cm in warp and weft) to air-dry naturally. Often, after the first unfolding attempt, some parts remained folded. After another examination a second intervention with localized hot water from an electric kettle could be attempted. After drying, the textiles were removed from their net and wrapped in a Tyvek® textile, put in a polyethylene board with polyethylene foam around a central excavation. Then another polyethylene board is used as lid, and a double Velcro strap is used to maintain the two boards. This permits the textile to be turned without touching it. The technique allowed the recovery of larger pieces of textile than solvent cleaning permitted.

Using this process, pitch was not removed from the textile, so as the temperature decreases (quite quickly near 95 °C), the textile becomes hard and “freezes.” The pitch impregnated textiles are more difficult to study and visual examination can be tricky, but the advantages are that they repel moths, and they are less brittle and lose fewer fibers than textiles that have had the pitch removed. These properties can be interesting for long-term conservation. Further cleaning to facilitate interpretation can be carried out locally, with a 50/50 solution of acetone and ethanol, applied with a brush and blotted from the surface with an absorbent paper (Figure 5). The pitch is easier to remove from plant fibers than woolen fibres, probably because of the differences in affinity between cellulosic and proteinaceous fibers and the pitch.

Recording the different steps

The different steps of the treatment were recorded. First as part of the documentation, a photogrammetric record of



Figure 3 Heating the material to approximately 100°C allows pitch to be plastic enough to unfold the textiles. © Marc Guyon, Inrap.

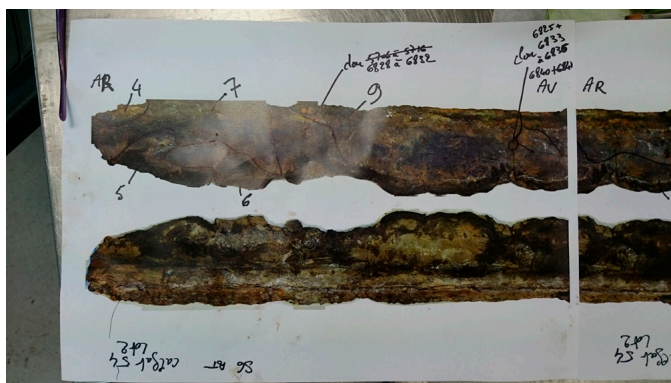


Figure 4 A map of the location of the various textiles is drawn while unfolding. © Marc Guyon, Inrap).



Figure 5 Additional cleaning by application of a mix of organic solvents with a brush, then dried. © ARC Nucléart

the caulking material was made providing a 3D memory of the shape of the caulking material before any intervention. (Figure 9). Once unfolding began, a Go Pro® film was made to document the process, and at the same time the location of the different pieces of textile were drawn on a picture to map their location. This first unfolding left the textile in a transitional state, between unfolded and flat. Some

observations about weaving and sewing could be made, but more results could be documented once the textile was fully flattened. This transitional state was also recorded, and a relief map was made to understand how the textile was folded to fit between the planks. The folds are still visible, and can be read by transferring the relief map into an adapted picture (Figure 10). Through this technique, we could compare the different ways of folding the textiles.



Figure 9 A 3D model is made from photogrammetry before beginning the unfolding operations. © Marc Guyon - Inrap.

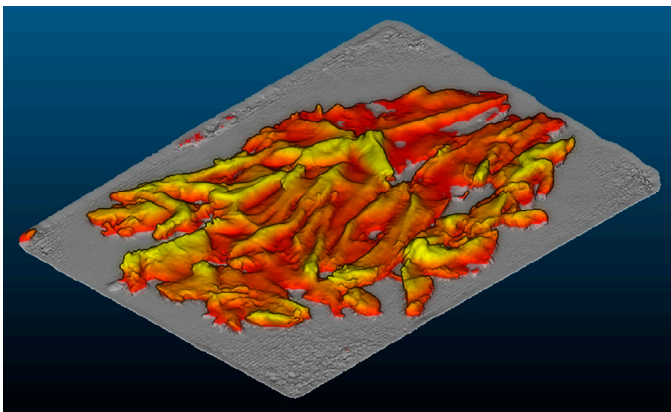


Figure 10 Based on an ortho-projection, an image can be transferred into a software allowing an adapted view with the ability to change the orientation of the light to highlight the folds. © Marc Guyon - Inrap.

New finds for archaeology

During the unfolding of the textiles, a clue appeared about the caulking technique used on the LSG4 shipwreck. Usually, on the Rhône-Saône route between the first to the third century AD, luting was used. This technique consisted of applying the waterproofing material during the boat's construction before adding the next timber. On the LSG4 shipwreck we found a nail with textile wrapped around it (Figure 6). Careful examination showed that the nail was

not driven through the textile, suggesting that the waterproofing was added after the nail had been driven through the wood. Similar conditions were found in proximity to other nails, suggesting that all the waterproofing materials had been added after the initial construction of the boat. The revelation that rather than utilizing the luting technique the waterproofing consisted of caulking adds to our understanding of Roman shipbuilding techniques and questions some long-held beliefs.

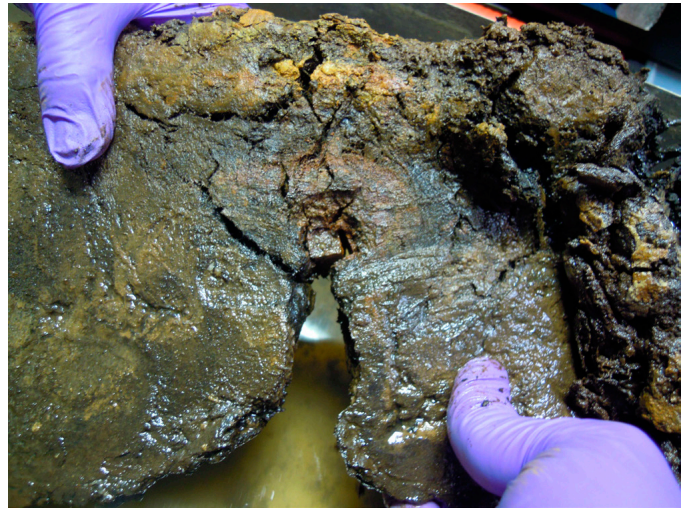


Figure 6 The nail is nailed into the caulking material, but did not penetrate. © Marc Guyon, Inrap.

As a result of the careful unfolding work, new perspectives and new data appeared. With nearly 3 m² of Roman textiles, the Lyon Saint-Georges set is already the most comprehensive one for its time period in Europe. Although present, plant fibers compose only a small proportion of the textiles. Two types of weaving are present: toile and twill. Twill has been identified on other sites from the 3rd century AD, such as Vindolanda where it was used as a substrate to which metal plates were sewn in armor production (Wild, 2019). The remaining textiles are mainly made of animal fibers (essentially sheep or goat, and it is very difficult to differentiate them).

All the textiles seem to be reused. In order to better understand the conditions under which the textiles were reused we created a general catalogue of all the textiles recovered from the Lyon Saint Georges wrecks. We were particularly interested in determining whether the textiles were specifically chosen for use as caulking material or whether the reuse exhibited a random quality. To try to answer these questions we looked at whether the textiles came from the

shipyard and whether they appeared to be everyday textiles that were reused or textiles that had been brought in from a distance. Interestingly, one of the fragments from the LSG8 shipwreck (1st century) is a reinforcement strip that is approximately 5 cm wide and has two types of sewing points, one with wide stitches and with a three twisted thread, and an invisible sewing on the other side. (Figure 7). It is similar to a piece of sail from the *Jeanne-Elisabeth* ship (Figure 8), which was wrecked in 1755 (Bartoš and Sanders, 2012), suggesting that perhaps parts of sails were reused for waterproofing, which would be a logical way to recycle old nautical textiles available in the shipyard. It also implies that there has been a technological continuity in the fabrication of sails over the last 1700 years, although the Roman fragment is made of wool, while the fragment



Figure 7 A textile used to provide waterproofing from the wreck Lyon Saint-Georges 8, from 55 AD. The sewing points form a strip nearly 5 cm wide, with large point on a side and invisible ones on the other. © ARC Nucléart



Figure 8 A piece of sail from the *Jeanne-Elisabeth*, wrecked in 1755, made of plant fibers. © DRASSM (Direction de la Recherche Archéologique Subaquatique et Sous-Marine).

from the *Jeanne-Elisabeth* is made of plant fibers. Woolen sails have been identified from Viking ships (Cooke *et al.*, 2002), but this represents a first for Roman shipbuilding.

We also compared the textile type with their location, to see if there was a link between the space available and the fabric used. Textiles from the bilge are often thicker, and their preparation looks rougher; they seemed to have been used as they were, to fill the space quickly. Those from the flat bottom are thinner, to fit with the small space to be filled, and the edges are more regular and prepared.

Conclusion

All these textiles provide exceptional information on Roman waterproofing techniques. The way that the caulking worked needs further research but this study has begun to provide valuable information. We already have more than 3 m² of unfolded textile from six linear meters of folded material and there are still 20 m to do! They are an important reference collection, which will continue to provide important information about a poorly understood but vital industry within the ancient Roman Empire.

References

- Bartoš, L. and D. Sanders. 2012. The sail of the Swedish merchantman *Jeanne-Elisabeth*, wrecked off Montpellier, France, in 1755. *International Journal of Nautical Archaeology* 41(1): 67-83.
- Cooke, B., C. Christiansen, and L. Hammarlund. 2002. Viking woolen square-sails and fabric cover factor. *International Journal of Nautical Archaeology* 31(2): 202-210.
- Guyon, M and E. Rieth (eds). 2010. *Les épaves de Saint-Georges. Lyon - I^{er}-XVIII^e siècles. Archaeonautica n°16*. Paris: CNRS Editions.
- Lonchambon, C., L. Bonnamour, J. Connan *et al.* 2009. Les bateaux du pont romain de Chalon-sur-Saône (Saône-et-Loire) : des témoins de l'évolution des techniques de construction navale au I^{er} s. apr. J.-C., *Gallia*, 59-112.
- Marlier, S. 2014. Arles-Rhône 3, un chaland gallo-romain du I^{er} s. ap. J.-C. *Archaeonautica* n°18. Paris: CNRS Editions.
- Marlier, S. S. Greck, D. Djaoui, P. de Viviès, F. Médard *et al.* 2019. L'épave Arles-Rhône 5, un nouveau chaland

gallo-romain, D. Djaoui, M. Heijmans and J. Mélanges. à paraître <https://editions-mergoil.com>. <hal-01936513>, p. 25.

Médard, F. 2014. Les tissus associés à la construction du chaland Arles-Rhône 3: qualité et gestion de la matière première. *Archaeonautica* 18 : 116-125.

Medard, F. 2010. Les tissus associés à la construction des chalands gallo-romains du Parc Saint-Georges (Lyon), I^{er}-III^e siècles ap. J.-C. *Archaeonautica* 16 : 136-146

Plantec, M. 2010. *5 ensembles de tissus gallo-romains de calfatage, dossier de conservation-restauration*, rapport inédit.

Rieth, E. 2011. L'épave gallo-romaine de la place Tolozan à Lyon : approche d'une tradition régionale en construction « sur sole » en relation avec l'architecture navale maritime méditerranéenne. In *Batellerie gallo-romaine, pratiques régionales et influences maritimes méditerranéennes*, G. Boetto and P. Pomey, 61-72. Errance ; Centre Camille Jullian.

Schoefer, M. 2004. *Textiles issus des fouilles des berges de la Saône, Saint-Georges, Lyon - 2003*, Rapport d'intervention inédit, Musée des Tissus de Lyon.

Q and A

IDA HOVMAND: That was very, very nice to see that we are important. Not only to ourselves (because we think that what we do is fantastic) but also to other people, that the archaeologists appreciate the work that we do!

AMANDINE COLSON: Very briefly about the pictures –so these were pictures treated with Agisoft scan and then you aligned the two acquisitions? When you align the data, how are you doing that? I don't see any targets.

LAURE MEUNIER: Yes, we use targets and we also use referential points to match the photos together.

AMANDINE COLSON: Do you know the accuracy that you get?

LAURE MEUNIER: Yes, 0.1mm