Visible Repairs and Invisible Behaviour

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Hiatus, lacunes et absences : identifier et interpréter les vides archéologiques
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Visible Repairs and Invisible Behaviour
Comparative Study of Two Repair Systems during the IIIrd to the Ist Millennium BC in North Western Mediterranean

Réparations visibles et pratiques invisibles
Étude comparée de deux systèmes de réparation du IIIe au Ier millénaire avant notre ère dans le nord-ouest de la Méditerranée

Pauline Debels, Kewin Pêche-Quilichini, Julien Perthuison, Pierre Adam, Philippe Schaeffer, Maxime Rageot, Arnaud Mazuy, Martine Regert

Abstract: Ceramic vessels offer unparalleled performance characteristics that explains their success from the Neolithic forth: ability to hold liquids and sustain heat and shocks to a certain amount. They can also be made in a variety of convenient shapes and sizes. Because they are solicited in different aspects of daily life, they are also regularly broken. In this paper, we have considered pottery repairs from a functional standpoint and have attempted to repositioned them in the society that consumed them. Ceramic assemblages from two different chronocultural contexts were investigated: The Late Neolithic of the South of France (3600 BCE to 2000 BCE; MNI = 1,015) and the Protohistory of Corsica (1850-100 BCE; MNI = 10,115). Respectively, 39 and 126 pots have exhibited traces of repair, and using a variety of techniques. Organic residues associated with a repair operation have been identified on 63 pots and 25 of those residues underwent a chemical investigation bringing information on the use of repair adhesives in both contexts. Analysis of the acquired data has brough insights on invisible behaviour and has brought answers to fundamental questions: Which pots were chosen to be repaired and for what reason were the others discarded? What do the repair technics tell us about past function and value? Comparison between two different archaeological contexts from the western Mediterranean has allowed recurrences to be identified, possibly due to the physical attributes of pots but also dissimilarities, possibly linked to cultural traditions.
Keywords: Prehistory, Protohistory, Corsica, Languedoc, Repair, Function, Pottery.

Résumé : Les récipients en céramique offrent des caractéristiques de performance inégalées – capacité à retenir les liquides et à relativement bien supporter les chocs thermiques et mécaniques – qui expliquent leur succès dès le Néolithique. Ils présentent également une variété intéressante de formes et de dimensions. Parce qu'ils sont sollicités dans plusieurs aspects de la vie quotidienne, ils sont aussi régulièrement brisés. Dans cet article, nous avons considéré les réparations de poteries d'un point de vue fonctionnel et avons tenté de les repositionner dans les sociétés qui les ont mises en œuvre. Des assemblages céramiques provenant de deux contextes chronoculturels ont été étudiés : le Néolithique final du sud de la France (3600 à 2000 avant notre ère ; NMI = 1 015) et la Protohistoire corse (1850-100 avant notre ère ; NMI = 10 115). Respectivement, 39 et 126 pots ont montré des traces de réparation, mobilisant des techniques variées. Des résidus organiques liés à une réparation ont été identifiés sur 63 pots. Parmi eux, 25 ont fait l'objet d'une caractérisation chimique apportant des informations sur l'utilisation des adhésifs de réparation dans les deux contextes d'étude. L'analyse des données acquises a permis d'éclairer des comportements difficilement perceptibles dans les sociétés sans écriture et a apporté des réponses à des questions fondamentales : quels pots ont été choisis pour être réparés ? Pour quelle raison les autres ont-ils été jetés ? Que nous disent les techniques de réparation de la fonction et de la valeur que les sociétés anciennes accordaient à certaines poteries ? Les comparaisons

entre deux contextes archéologiques de la Méditerranée occidentale ont permis d'identifier des récurrences, peut-être dues aux attributs physiques des pots, mais aussi des dissemblances, potentiellement liées aux traditions culturelles.
Mots-clés : Préhistoire, Protohistoire, Corse, Languedoc, réparation, fonction, céramique.

INTRODUCTION

Because it is proof of interaction and use, broken objects can withhold information on the user. Objects are subject to different processes that take place in the systemic context: procurement, manufacture and use (Schiffer, 1972). However, because they are consumables, they may also be discarded or strategically maintained to extend their life (Schiffer, 1972, p. 158). This maintenance process may require the manufacture of additional elements or the modification of the structure of the object. Several reasons may explain the need to repair an object: its economic value, correlated with the energy, the skill and time dedicated to the procurement and manufacture processes. This is what Shott defined as "replacement cost" (Shott, 1996). Other reasons including symbolic value can be put forward. On the other hand, some societies have chosen never to bother to repair and always start anew. *What* and *how* objects were broken, *what* and *how* objects were repaired are meaningful elements gathered to understand a cultural system.

Since the end of Prehistory, pottery has been a part of daily life. They sustain a wide variety of activities better than any other material: they can be put directly on fire, hold liquids; they are resistant to mechanical shocks (Braun, 1983, p. 122-125; Rice, 1987, p. 230-231; Skibo, 1992, p. 162-168; Fanti, 2015, p. 114-115) and can be made in virtually any shape. However, these performance characteristics are successful only to a certain extent and almost inevitably end up breaking. Thus, pottery sherds are also one of the most represented materials found in the archaeological record, from the Holocene onward. The turnover rate of pots is entirely reliant on their function(s), some being static and seldom used (i.e. storage pots), while others are subject to important thermal and mechanical stress on a daily basis (i.e. cooking pots; Foster, 1960; Deboer, 1974; Mayor, 1994).

Mentions of pottery repair are numerous in the archaeological literature although scattered and rarely studied as a standalone subject. Because of a preservation bias, the identification of holes drilled on either side of a crack represents the largest proportion of these mentions. Some anaerobic contexts have allowed the description of complex repair techniques using organic product (Pétrequin and Pétrequin, 1989, p. 280). The development of organic chemistry in archaeology has also increased our understanding of the use of resins and tars as well as documenting their precise composition (Evershed et al., 1985; Regert et al., 1998, 2003 and 2008; Rageot et al., 2016 and 2021).

In this paper, we provide insights on the cultural significance of maintenance processes in the framework of pottery traditions. Examples of recycling and reuse will be left aside to only concentrate on maintenance processes. We will be focusing on the technical aspects of repair operations (technology and composition) as well as their representation on the different assemblages. Several questions have guided this study: Is the repair technique correlated to either the form or the function? Which forms are not repaired? Do techniques evolve over space and time? Two different contexts were chosen for this study, close in time and space: the Late Prehistory of the Hérault, Gard and Ardèche regions and the Protohistory of Corsica.

1. MATERIALS AND METHODS

1. 1. Materials

Instigated as part of two PhD thesis (Pêche-Quilichini, 2011; Debels, 2019), this study focuses on two different frameworks: the Late Neolithic of the Hérault, Gard and Ardèche regions and the Bronze and Iron Ages of Corsica (fig. 1).

A total of 1,015 vases coming from 13 sites of the Hérault, Gard and Ardèche regions have been studied. Their chronology spread from 3600 BCE to 2000 BCE Several contexts are represented: 6 caves, 3 open field settlements from plains, 4 open field settlements from plateaux and 5 isolated storage structures (some sites account for one or more contexts). All 13 contexts have delivered repaired pots (total pots n = 7,460, total of repaired pots n = 39).

A total of 10,115 vases coming from 48 Corsican sites were studied. They consist essentially of settlements (only one certain case of rock shelter grave dating from the beginning of the Late Iron Age) covering the entire island although the south-western area is the most represented in the assemblage (n = 31). The chronology of the Corsican sites spread from the Early Bronze Age 2 (1850-1650 BCE) to the 2nd Iron Age (250-100 BCE). Only 26 of those sites have delivered repaired vases (total pots n = 7,460; total of repaired pots n = 126).

1.2. Methods

The protocol in place to identify and record repair operations on pre- and protohistoric vases is considered as a stage of pottery studies. In both study areas, one of the main focuses was to understand the uses of vessels through technological and use-wear approaches. In this framework, each vessel on every site was observed macroscopically to detect and document, among other infor-

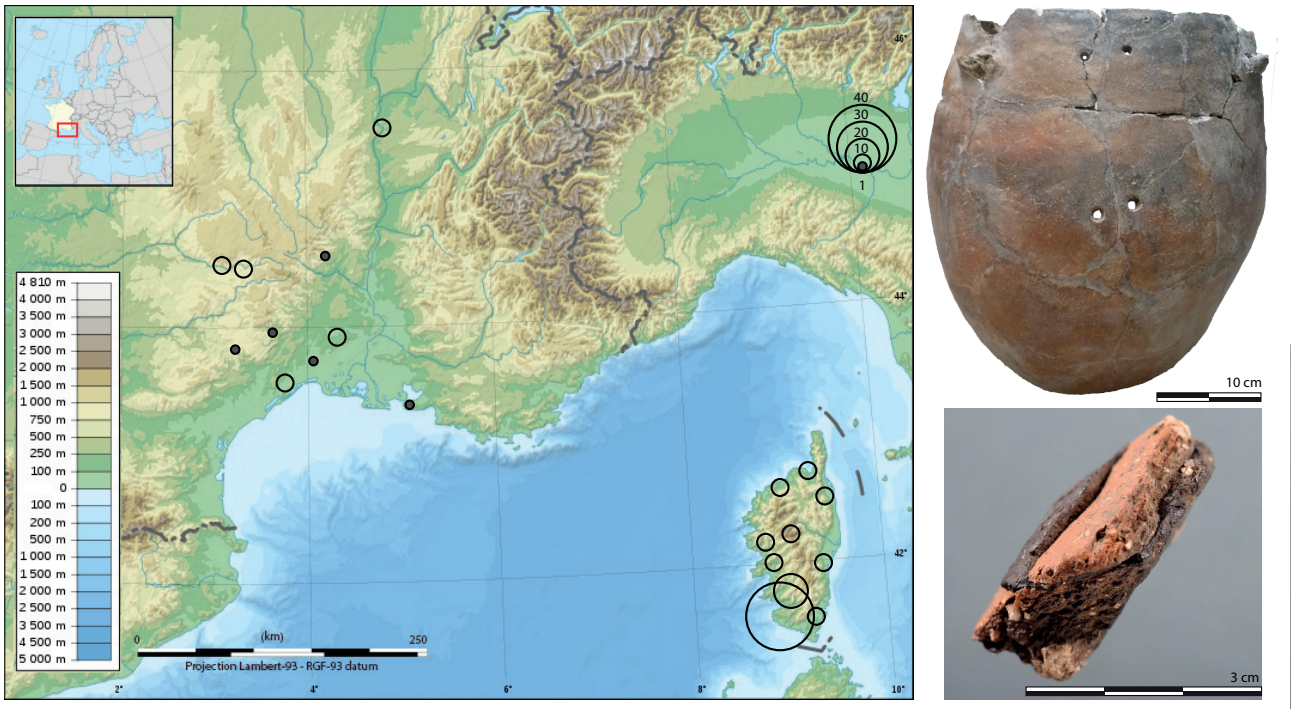

Fig. 1 – Distribution map of sites that delivered repaired vases mentioned in this study, circles represent occurrences (left). Holes left from the stitching technique from the site of La Capoulière (Hérault; photo P. Debels; top right); adhesive residues from Cuciurpula (Corsica; photo CEPAM; bottom right).

***Fig. 1** – Carte de répartition des sites ayant livré les vases réparés mentionnés dans cet article, les cercles représentent les effectifs (gauche). Exemple des trous laissés par la technique de la suture provenant du site de la Capoulière (Hérault ; cliché P. Debels ; en haut à droite) ; exemple de résidu d'adhésif provenant de Cuciurpula (Corse ; cliché CEPAM ; en bas à droite).*

mation, traces of repair. The morphometry of the vessels concerned were documented whenever possible.

Vessels and sherds presenting organic matter at strategic places such as in the close neighbourhood of cracks or on the section of a sherd, were isolated for additional chemical investigation. In total, 25 organic residues considered as plausible repair elements were chemically investigated. The majority comes from the Bronze and the first Iron Age of Corsica (n = 17) and the rest from the Late Neolithic of Hérault, Gard and Ardèche (n = 9). They represent respectively 35% and 100% of the observed repair residues on each assemblage. One of the samples from the Late Neolithic came back negative of any preserved organic molecules. The samples were stored in aluminium foil prior to analysis at the CEPAM-UMR 7264 and at the Institut de Chimie de Strasbourg-UMR 7177.

The samples from the cave of Les Jarres (Ardèche) and the Corsican contexts are detailed in a study report[1] and a publication (Rageot et al., 2016). Briefly, micro-samples, the size of pinhead, were carefully withdrawn with a sterile scalpel blade or a needle. Exctraction was performed with dichloromethane and the extract was then trimethysilyated before GC and GC-MS analysis (for the detailed protocol, see Rageot et al., 2016).

The samples from La Rouvière (n = 4) and the cave of Le Claux (n = 1) are detailed elsewhere (Perthuison et al., 2020)[2]. In summary, they were extracted by sonication (20 min) using a mixture of CH2Cl2/MeOH (1:1 v/v) followed by filtration of the supernatant through celite and removal of the solvent under reduced pressure. An aliquot of the extract was acetylated (Ac2O, pyridine, 2 h, 60 °C) and, after removal of the solvents and excess reagents under a stream of Ar, esterified with a solution of diazomethane in diethyl ether. The derivatized extract was fractionated by liquid chromatography on silica gel into an apolar fraction eluted with CH2Cl2/EtOAc (8:2, v/v; 3 dead volumes – Dvol) and a more polar fraction, not further investigated, eluted with CH2Cl2/MeOH (1:1, v/v; 2 Dvol). The apolar fraction was analyzed by GC-MS. GC-MS analyses were carried out using a Thermo Trace gas chromatograph (Thermo Scientific) coupled to a Thermo Scientific TSQ Quantum mass spectrometer equipped with an autosampler Tri Plus and a programmed temperature vaporizing (PTV) injector. The temperature of the source was set at 220 °C. The mass spectrometer was operating in the electron ionization (EI) mode at 70 eV and scanning m/z 50 to 700. Gas chromatographic separations were performed on a HP5-MS column (30 m × 0.25 mm; 0.1 µm film thickness) using He as carrier gas. Oven program: 70 °C (1 min), 70-200 °C (10 °C/min), 200-320 °C (4 °C/min), isothermal at 320 °C for 40 min.

1. 3. Definitions and key concepts

Maintenance processes include repair and relining of pottery. The sole role of a maintenance operation is to prolong the duration of a pot. Repair may occur when a pot has lost one of its "primitive properties" (Deboer,

1983, p. 27-28), which are determinant to use-life, such as being a "hollowed form". The ability to contain is acquired by pots since the very first stage of the manufacture of the pot (Roux and Courty, 1997, p. 21). When a pot is broken in two or more pieces, it can no longer hold commodities. Repair operations usually aim at restabilising a primitive property. However, one can note that there is a distinction between *curative repair,* which intervenes when the pottery is substantially damaged and *preventive repair* that occurs before anticipated substantial damage, such as a crack in formation. It is often difficult to distinguish between preventive and curative repairs in the archaeological record as pots are fragilized and end up breaking in the soil. Moreover, retrieved pots are usually very lacunary and prevent complete analysis.

Maintenance processes also include relining operations. This follows the loss of a secondary property, watertightness, or when a gradual loss has been observed. The pottery is considered less efficient in the function it was assigned to do but not completely unable and relining will re-establish its full capacity as often as needed. Pots can also be perceived unusable for cultural reasons and this is usually missed in archaeological studies.

Four different techniques of pottery repair were documented during Pre- and Protohistory. They can be classified in two main categories: those that need adhesives and those that do not (fig. 2).

Stitching is perhaps the most common pottery repair noted by archaeologists, although this may be caused by post-depositional bias. Holes are drilled on either side of a crack in order to insert a mending element which can be organic (such as strings or sinew) or metallic (such as clips) depending on the time period and culture. Tightening the edges may prevent the spread of a crack (preventive repair) or may reform a broken pottery (curative repair; Pétrequin and Pétrequin 1989, Bosquet et al., 2001; Regert et al*.,* 2008; Fanti, 2015; Pêche-Quilichini et al*.,* 2017).

Gluing: An adhesive is applied on the edges of two or more sherds and maintained together until solidification (Pétrequin and Pétrequin, 1989; Bosquet et al*.,* 2001; Fanti 2015; Drieu, 2017; Pêche-Quilichini et al., 2017; Regert et al., 2000).

Sealing: An adhesive is applied in the form of a generous lump in order to fill a crack, usually to making it watertight again (Pétrequin and Pétrequin, 1989).

Patching: Close to the sealing technique, the patching techniques ads a piece of fabric (such as bark) to cover a hole or crack (Pétrequin and Pétrequin, 1989; Fanti, 2015).

It should be noted that these techniques can be combined in many different ways on a single pot and during a single repair operation. For instance, the association between the stitching technique and the use of adhesives (for sealing and/or gluing) was documented at Cuciurpula (Corsica; Pêche-Quilichini et al., 2017), as well as La Rouvière (Gard; Debels et al., 2021)

The repair of a pot sometimes leads to a functional reassignment, which is called a secondary function. This happens when the initial performance characteristics are not met again (watertightness, heat resistance, aesthetics etc.). For instance, a liquid-storing jar may be reused to store solids if its watertightness is insufficient, or even be reused as a chicken coop if it is too damaged (Deal and Hagstrum, 1995, fig. 9.3). This is why the choice of repair technique is far from trivial and rather strategic depending on whether the vessel will pursue its function or will be assigned a new one.

Perforations are the only trace of repair left in contexts that are not suitable for the preservation of organic matter. This delivers a simplified version of ancient repair techniques and processes. In fact, it is much more plausible that the different techniques enumerated above mix and match together into a more hybrid system of repair techniques.

Furthermore, it is clear that post-depositional processes jeopardize the identification of repair operations, such as organic repair elements, found in gluing, sealing, patching, and also the interpretation of repair operations, whether curative or preventive. This is particularly aggravating as the chosen response to a problem can be culturally driven. During our analysis and discussion, we will endeavour to recognize the importance of this conservation bias and the means to by-pass it.

2. RESULTS OF OBSERVATION AND CHEMICAL ANALYSES

2.1. Repair techniques and evolution of tradition

Whatever the cultural differences of the assemblages investigated, the stitching technique represents the majority in both study areas: In Corsica, the stitching technique represents 61,9% of repaired vases (total of repaired vases n = 126, total of stitching techniques n = 78); In Hérault, Gard and Ardèche, stitching represents 76,9% of repaired vases (total of repaired vases n = 39, total of stitching techniques n = 30).

Organic repair residues were found on 38% of repaired vases in Corsica (total of repaired vases n = 126; total of repair residues n = 48) and 23% in Languedoc and Ardèche (total of repaired vases n = 39; total of repair residues n = 9). These disparate numbers obviously depend on highly variable conservation conditions that are difficult to estimate. A total of 17 repair residues from Corsica and 8 from Hérault, Gard and Ardèche were successfully chemically investigated. These investigations have shown that the repair residues are systematically made of birch bark tar (24 out of 25). Sometimes, the birch bark tar is associated with other products such as bee products, resins and/or fats.

One vessel from the prehistoric assemblage showed a combination of birch bark tar with long chain esters, possibly from beeswax (sample MR6205). However, bee products were also identified on a sherd from the belly of

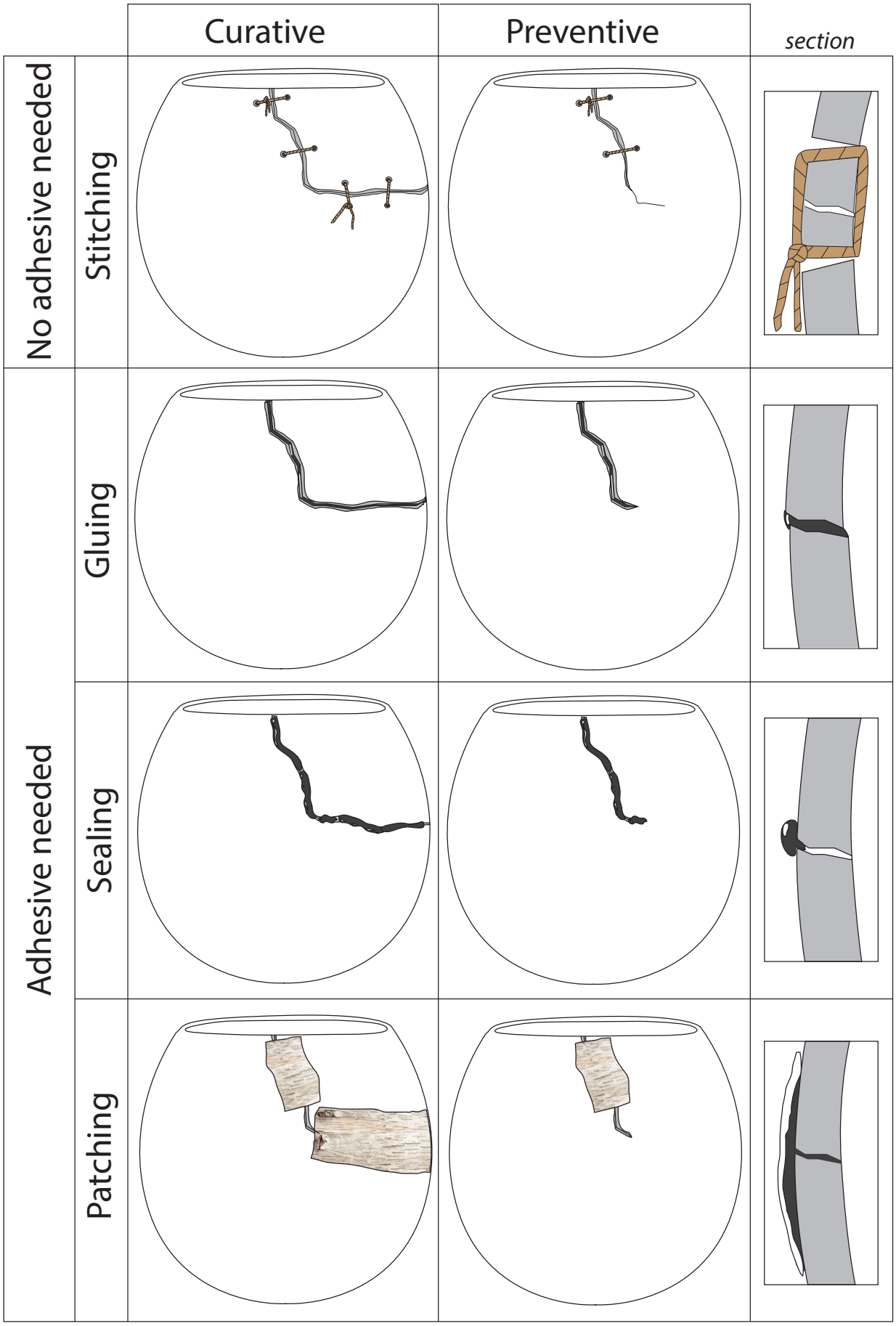

Fig. 2 – Representation of different repair techniques using according to their use of adhesive and the nature of the operation.
***Fig. 2** – Représentation de différentes techniques de réparation selon si de l'adhésif est utilisé ou non et selon la nature de l'opération.*

the pot, showcasing two possibilities: 1) the pot was used to contain a bee product at a certain time (beeswax and/or honey?), or 2) the pot was waterproofed with beeswax. Thus, we cannot attest of an adhesive recipe that uses both birch bark tar and bee product as the combination of two products might come from involuntary interaction. In the Protohistoric assemblages from Corsica, two residues are made of a combination of birch bark tar and beeswax (MR0909 and MR2687), another one of birch bark tar and pine resin (MR2675; fig. 3), while the rest is systematically pure birch bark tar. It is not possible to assert with certainty that the mixing of products is part of a technical recipe although the question is raised.

Birch bark tar appears to be preponderant and seems to be commonly used to repair ceramic vessels in the late Prehistory and the early Protohistory of Mediterranean France. The high number of repaired vessels studied in Corsica has allowed a chronological and spatial reflexion which was not possible in the Languedoc and Ardèche assemblages. The use of adhesive on the island was only attested in the South-West (n = 48), although this is also where archaeological activities are most intense regarding Metal Age sites, and almost exclusively in domestic settlements (exception at the burial of Cuciurpula, shelter 3). The occurrence of adhesives is rare during early and middle Bronze Age and only limited to the western coast, but they become frequent during the final Bronze Age and on a larger area. Finally, the altimetric distribution is quite large: between 20 m up to more than 1,000 m, and more frequent between 500 and 1,000 m which unintuitively corresponds to the level under birch groves growth (1,000 to 1,800 m). Moreover, birch is not attested in the palynological spectres (Reille et al., 1999).

2.2. Choosing the pots to repair

While the stitching technique is used alike on any shape and volume of pottery in the ceramic assemblages of the Late Neolithic, the use of adhesives, whenever retrieved, is overrepresented on large volume jars (8 cases out of 9; fig. 4 and fig. 5). Only one case of birch bark tar residue was found on a small vessel (less than

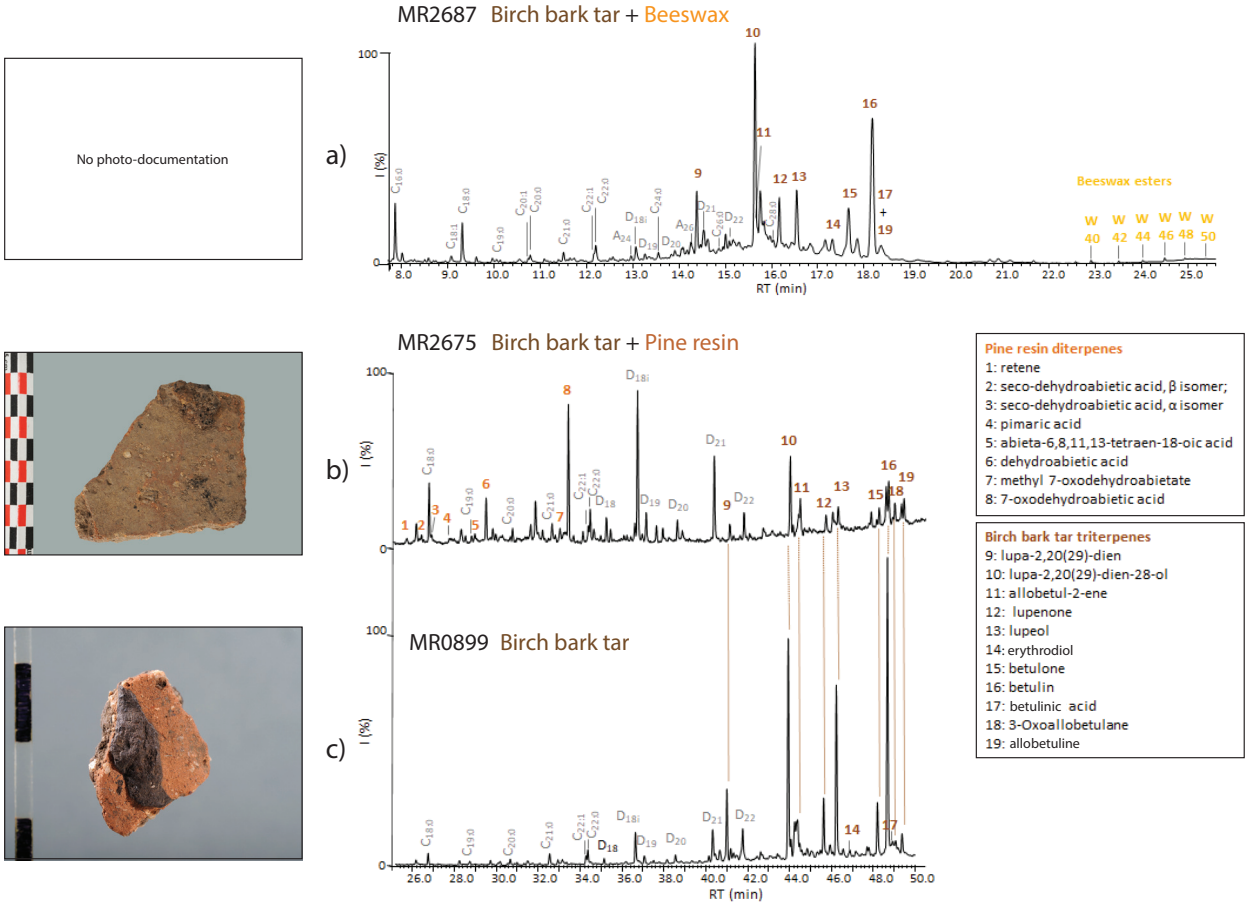

Fig. 3 – Chromatograms of three adhesives: a, Beeswax associated with birch bark tar (MR2687; no photo-documentation); b, Pine resin associated with birch bark tar (MR2675); c, Pure birch bark tar (MR0899). Cx: y = fatty acid with x carbon atoms and y unsaturations; D = diacids; Ax = straight chain alcohol with x carbon atoms; Wx = long chain esters with x carbon atoms.

***Fig. 3** – Chromatogramme de trois adhésifs : a, cire d'abeille associée à du brai de bouleau (MR2687 ; pas de photo-documentation) ; b, résine de pin associée à du brai de bouleau (MR2675) ; c, brai de bouleau pur (MR0899). Cx:y = acide gras avec x atomes de carbone et y insaturations ; D = diacides ; Ax = alcool à chaîne droite avec x atomes de carbone ; Wx = esters à longue chaîne avec x atomes de carbone.*

5 L; sample Sd 99 dec 2). The tar, however, was not used to fill a crack or glue sherds, but in combination with the stitching technique, and was extracted from a drilled hole. It has been proposed that the tar was used to plug the hole once the ligature was passed, making it waterproof again (Sd 99 dec 2).

The exceptional contexts of preservation found in the Late Neolithic of the South of France, such as the cave contexts, has allowed the retrieval of whole vessels, sometimes even intact. Only then can a distinction be made between preventive and curative repair operations. Out of the 39 inventoried repaired vases, 7 undoubtedly provided indication of repair on a crack that did not split apart the vessel (fig. 4). This could be observed as large chunks of black matter, tested to be birch bark tar (see above) were applied on or holes were drilled next to limited cracks that did not continue to spread during post-deposition. Those repair operations were consequently preventive. Among the studied assemblages, adhesives were used 6 times out of 7 on them, and the stitching technique once. It has to be noted that the vase that used the stitching technique preventively (La Capoulière, Hérault) comes from the only funerary context of the study, the rest being domestic. The bones of a child were contained inside the reclining vessel. Consequently, the vessel was re-employed for funerary purposes and did not pursue its primary function.

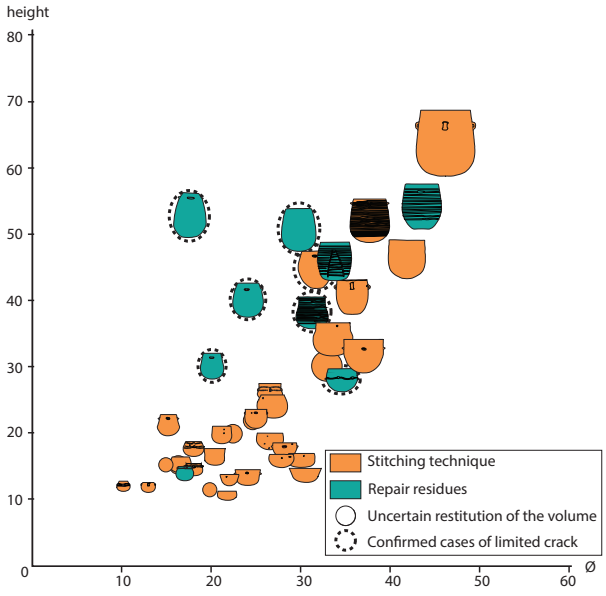

Fig. 4 – Representation of the stitching technique and repair residues on a height/diameter of pottery diagram (in cm). Data from the Late Neolithic corpus.

***Fig. 4** – Représentation de la technique de la suture et des résidus de réparation sur un diagramme hauteur/diamètre (en cm). Données provenant du corpus du Néolithique final.*

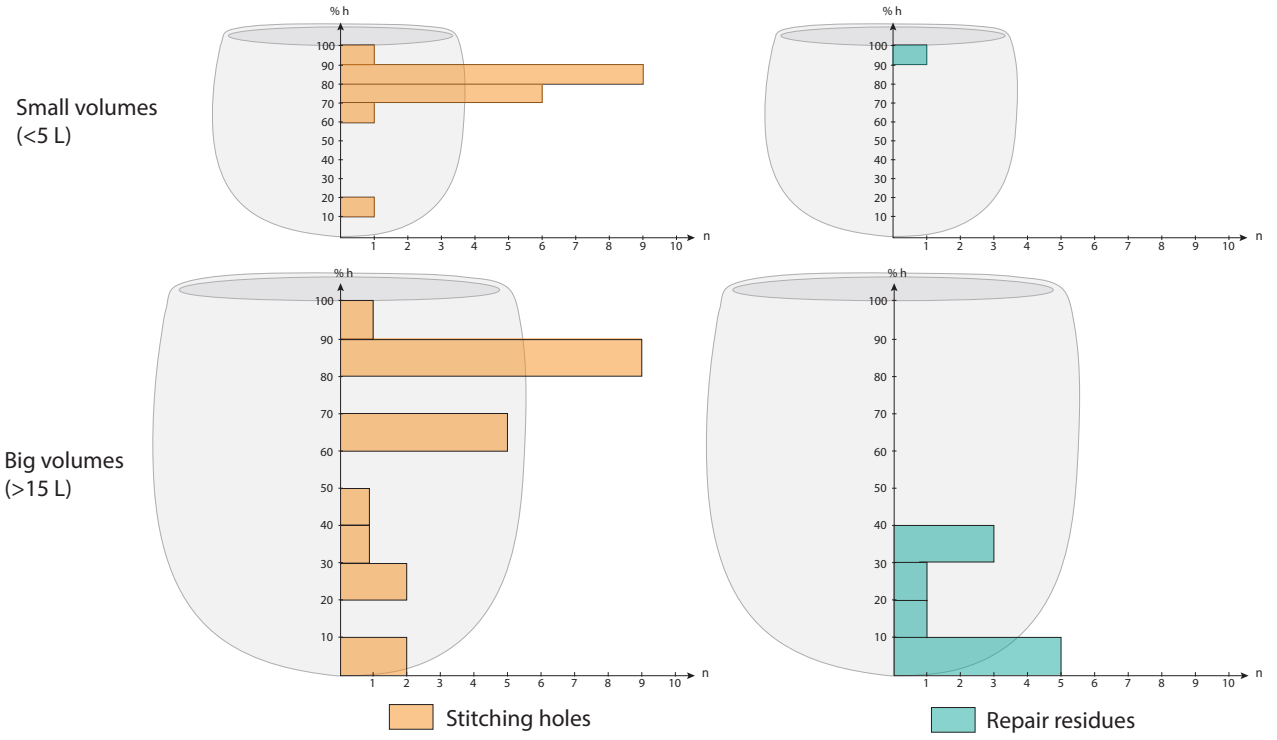

Fig. 5 – A comparison between the relative position of stitching holes (left), and repair residues (right) on big (bottom) and small volumes (top). X axis = number of occurrences, y axis= relative height of the pots. One pot may account to more than one occurrence. Data from the Late Neolithic corpus.

***Fig. 5** – Comparaison entre la position relative des trous de réparation (à gauche) et des résidus de réparation (à droite) sur des poteries de grande contenance (en bas) et de petite contenance (en haut). Abscisse = nombre d'occurrences, ordonnée = hauteur relative des pots. Une poterie peut donner plus d'une occurrence. Données provenant du corpus du Néolithique final.*

Our study also sought to determine which ceramic vessels were not repaired and why. It is a very difficult exercise to understand the formation processes of the archaeological record as it is not possible to account for the precise number of vessels in use simultaneously in a given time. Therefore, it is not possible to evaluate the percentage of pots repaired per active functional category. The 39 repair operations inventoried in the Late Neolithic sites from Hérault, Gard and Ardèche were observed on small and large vases regardless: 17 large vases (> 15 L), 3 medium vases (between 5 and 15 L) and 19 smaller vases (< 5 L). However, although repair operations intervene on any parts of the larger vases (8 occurrences on the base and 9 occurrences on the rim, belly and base). The smaller vessels mostly account for repair operations (systematically drilled holes) located in the upper part (n = 18), close to the rim (fig. 5), whichever the surface treatment and ornaments (total of repaired small vases n = 19).

The same observations could not be made in Corsica due to the fragmentation of the assemblages. However, it can be noted that in a similar fashion, one large jar was the subject of numerous repairs (Nuciaresa), showcasing relentlessness in trying to prolong its life. It is interesting to note that the same phenomenon at the same time is described in Sardinia, where very large pots show traces of repair by means of lead staples (Antona et al., 2010, fig. 5). Moreover, in the Corsican context, out of the 126 repaired pots, not a single one belonged to the production B type, which is the finest ware during the Final Bronze Age. This probably means that a certain technical-aesthetic status was accorded to certain categories of vessels in the Final Bronze Age, that this disappeared with the fracture of the pot.

3. DISCUSSION AND CONCLUSION

3.1. Repair techniques, repair choices and evolution of tradition

The prehistoric contexts from the Hérault, Gard and Ardèche regions and the Protohistoric contexts from Corsica show similar repair know-how. The stitching technique is favoured in both contexts and tars and resins are also commonly used for gluing and sealing cracks. Doubtless that the poor preservation of organic matters on both contexts offers only a partial view of the complexity of repair techniques of the time.

The chemical investigations carried out on the black matter associated to cracks has provided significant results regarding technical recipes.

Previous chemical investigations in the region have showcased the continuity of birch bark tar use through the Neolithic, although rare in the early Neolithic, and the tendency to diversification during the IVth millennium BCE onward (Rageot et al., 2021). This study has also demonstrated that Pinaceae products in their pure form were used for waterproofing pots, while pure forms of bitumen and birch bark tar and their mixing with other products (Pinaceae resins, beeswax, fat) could be used in a variety of different ways.

From a functional point of view, the use of tars ensures the relative watertightness of pots by filling in cracks. Although we cannot attest that drilled holes associated to the stitching technique in our assemblage were not clogged with tar (as observed with sample Sd 99 dec 2), it seems that the stitching technique was avoided in the case of large vessels and preferred for smaller vessels (p-value = 0.004). The context is to be taken into account as some may be more favourable to the preservation of tars. In the assemblage coming from the late Neolithic of the south of France, examples come from two cave contexts and one open field settlement from karstic plateaus and none from the alluvial plains. Although further research is needed to dismiss any preservation bias, it can be hypothesised that large vessels repaired with the stitching technique were not used to contain liquids but rather dry goods, or that they were reemployed to contain dry goods. It can be wondered to what extent the repair technique could be an indirect indication of the last function of the pot.

3.2. Discard, replacement and repair rates

In this paper, we have attempted to understand the reasons behind the discard or repair of a pot. In order to do so, several aspects have to be considered: discard rate, replacement rate and use-life. Although these concepts correlate, they are not synonyms. As M. J. Shott (1989) stated, under equilibrium, replacement should immediately follow discard, so replacement rate should be equal to discard rate. However, pots are not always replaced immediately or replaced at all. Some are assigned a secondary function that is more urgent to comply than its first function. Moreover, use-life and replacement rate have sometimes been demonstrated to be non-correlated (Deal, 1983, p. 161; Longacre, 1985, p. 341). As such, estimations based on the archaeological record are bound to be biased. Relative frequencies may be a useful tool, but they cannot account to behaviour, population or occupation span (Orton, 1993, p. 178-180).

It has been demonstrated however, that pot lifespan is correlated to vessel size, itself correlated to use. Larger vessels tend to have a longer life span (DeBoer, 1985; Longacre, 1985, p. 340; Mayor, 1994; Shott, 1996, p. 454). The study let by A. Mayor (1994) on Malian ethnographic pots has shown that large vessels typically live more than twice longer (7.4 years) than vessels from the medium and small category (3 years). This is because large vessels tend to be used as storage jars. They are indeed heavier, especially when full and this is why they are mostly static and less frequently manipulated than transport or cooking pots that are also fragilized by thermal and mechanical shocks.

In the Late Neolithic assemblage, every dimensional class shows traces of repair, from small cups of less than 2 L to big storage jars superior to 50 L. Large capacity vessels account to 40% while smaller size pottery account to 56%. This observation is somewhat surprising in regard of the results obtained from ethnoarchaeological investigations on the life duration of vessels categories, as a bigger difference was expected. In fact, the archaeological data has shown that small size pottery shows repair almost exclusively in the upper part suggesting a selection of pottery suffering limited breakage, the rest being discarded or recycled. Small size vessels in this context, have a high discard and/or replacement rate.

We offer several hypotheses to explain this difference:

Large vessels have a higher replacement cost. They require enhanced skills to manufacture and need more raw material. This alone might explain the reluctance of its replacement, and the more frequent choice to repair it compared to small pots. One can even wonder if the same potters produced every vessel size of the assemblages in a typical household.

Replacement cost might play a role in this choice but maybe it can simply be explained that large vessels that suffer cracks were not considered broken beyond repair. Given that they are typically used as storage jars, and thus static, they are less solicited and repair operations can truly prolong their life. Smaller vessels used to transport, cook or consume may be too solicited to be continued to be used for an acceptable amount of time after repair. It is then no use to spoil energy and supplies to repair a pot that is bound to break again soon.

Conversely, the case of fine ware (Production B) from Final Bronze Age Corsica seems to be a typical case loss of projected value. Not a single pot of this high-end production has shown traces of repair. The pot is considered broken under cultural standards even though repair might have been physically possible.

3.3. In summary

The ceramic assemblages of the late Prehistoric contexts of Hérault, Gard and Ardèche and the Protohistoric contexts of Corsica delivered respectively 39 and 126 pots that show repair operations, distributed among 13 and 26 sites. In both contexts, the stitching technique is the most frequently used with 30 cases in the Late Neolithic and 78 cases in the Metal Ages. This may be explained as stitching requires less skills and less valuable materials than repairs that use adhesives. Birch bark tar indeed requires advanced technical know-how to be produced (Rageot et al., 2016, 2019 and 2021). However, the stitching technique requires to further damage the walls of the pot by drilling through it, compromising its performance characteristics, particularly its watertightness.

The production of birch bark tar is common to both of these contexts even though birch seems to be absent according to the rare palynological spectra of the Corsican sites. Chemical investigations of repair residues from the Neolithic Northern Mediterranean have demonstrated the importance of this product through time (Rageot et al., 2021) and its modularity according to needs and possibly traditions.

This study has also demonstrated that not all pots are chosen to be repaired the same way. This discrimination seems to rely on morphometrical criteria in both the Late Neolithic of Hérault, Gard and Ardèche. For Corsica, the analysis of the relationship between typology, template and repair process is not yet complete. The Late Neolithic context has showcased that repair operation using adhesives, i.e. birch bark tar, mostly concerns large vessels (> 15 L). This could be explained as big jars are more prone to limited cracks than breakage as they are less manipulated. Tar is thereby overrepresented on big jars. It might also imply that they were more often than other sizes used primarily and secondarily for a demanding performative activity for which watertightness is a requirement, such as holding liquid contents.

In this paper, we have ambitioned to understand the reasons behind the discard or repair of a pot. We have observed that small pots (< 5 L) are less prone to repairs as only vases showing cracks and breakage limited to the upper part are repaired and always by using the stitching technique. Bigger jars (> 15 L) have less important requirements and show repair even when they were accidented in the lower parts of the pottery. Similarly, in Protohistoric Corsica, one big jar also demonstrated an insistent objective to be repaired. This might be due to matters of replacement costs. It might also be because the larger pots were only considered broken well beyond the norm of what a regular size pot was considered broken. Conversely, the finest ware found in Corsica during Final Bronze Age time (Production B) is never to be found among the inventory of repaired pots. This could indicate a loss of value once the vase is damaged.

We have argued throughout this article that the choice of which pot should be repaired and which techniques to use bring a significant amount of information regarding the function of the pot and its consideration by past societies.

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NOTES

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