Coin moulds of the 3rd century AD from Charleville-Mézières (Ardennes, France): From identification to experimentation

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ABSTRACT: The excavation of the copper cementation workshop at Le Clos-Paul site in Charleville-Mézières, Ardennes, France revealed forty-three fragments of coin moulds. Dating from to the end of the 3rd century AD, they are the only evidence of an opportunistic counterfeit production not directly linked to the metallurgical activity of the site. After studying the copied coins, metrological and structural observations allowed us to resume the study of the modus operandi *of this counterfeiting process, continuing the work of Hans Drescher.*

KEYWORDS: Antiquity, bronze, casting, denarii, chaîne opératoire, counterfeiting, experimental archaeology, Roman Empire

Introduction

The *Cellule d'archéologie du Conseil départemental des Ardennes* carried out the rescue excavation of Le Clos-Paul, a small Roman settlement, in Charleville-Mézières (France) in 2010 and 2013 (Marian 2016) (Fig. 1). Located about two kilometres from the ancient town of Charleville-Mézières, the settlement was identified over an area of 1.5 hectares and dated between AD 240 and 280. It is characterised by a small group of dwellings and a workshop for the production of brass, a copper-zinc alloy (Fig. 2). Within the workshop, the partially preserved remains of a carburising furnace (a process for producing brass from metallic copper and zinc ore; Doridot *et al.* 2006) and its working pit are unique to date. This pit was excavated to a quarter of its original volume, the rest having been destroyed prior to excavation. It was 1.9 m long, 1.8 m wide and at least 0.7 m deep. The backfill consisted of detrital debris from the neighbouring kiln (kiln wall, fragments of crucibles) and domestic items (ceramics, grindstone). This fill in the upper thirty centimetres of the pit contained almost all of the 10,000 crucible sherds (50 kg of remains), as well as 43 fragments of moulds used to counterfeit cast coins. All of the sediment preserved in these layers were removed and sieved, with the coin mould fragments coming from the rejected sieves. Most of the archaeological material consisted of fragments of crucibles, indicating the main production: brass. However, despite the opportunistic and limited nature of this secondary

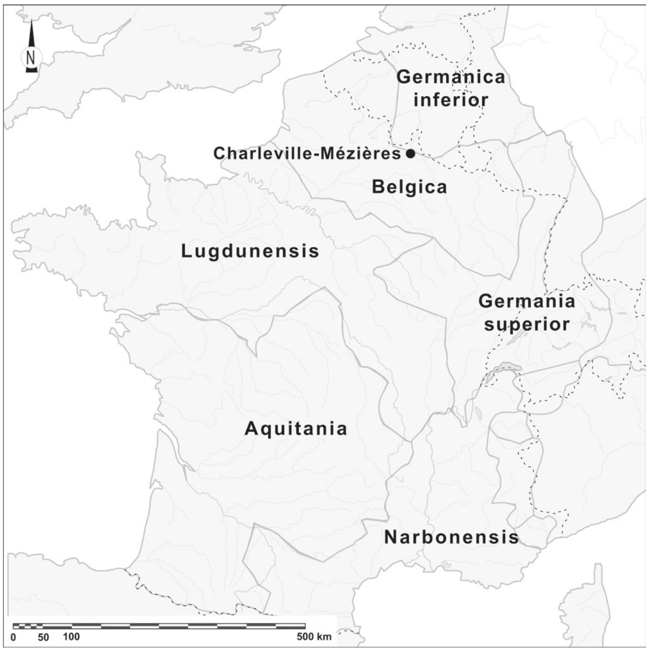

Figure 1: Location of Charleville-Mézières (France).

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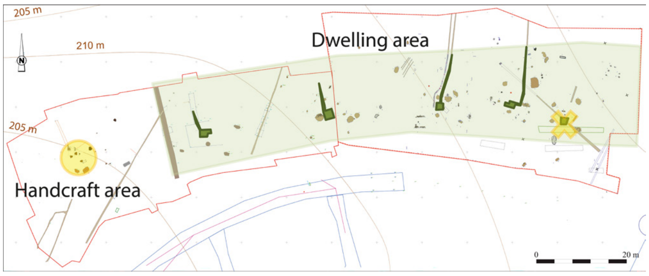

Figure 2: Charleville-Mézières, general map of Le Clos-Paul site with sector distribution.

activity, the coin mould fragments are typical of the work of a counterfeiter.

Under the Roman Empire, a coin was official and authentic as long as its metallic substance had not been tampered with or minted using fraudulent wedges. For this to be the case, it had to be given the *forma publica* by order of the state, using the official wedge and imprinting types and legends (Wolters 1999, 370). For the legislator, any currency that did not conform to this principle was counterfeit. While the phenomenon of counterfeiting is attested by texts, it is also attested by archaeological finds, including coin moulds. These moulds are not only evidence of counterfeiting, but also of a complex manufacturing process, which has led to various attempts at experimental restitution (Méaudre *et al.* 2021a). The study of the moulds unearthed at Charleville-Mézières was based on a two-pronged approach. Firstly, the study of copied coins, which contributes to our understanding of this economic phenomenon. On the other hand, metrological and structural observations of the moulds, aimed at detailing the *chaîne opératoire* associated with this complex production process. The aim here was to extend the work of Hans Drescher by considering the process as a whole, from the sampling and preparation of the raw materials to the casting of the alloy and the cleaning of the coins. However, as this article focuses on the corpus of coin moulds discovered at Le Clos-Paul and not on the overall experimental approach, only the related aspects will be discussed.

The coins issued at Le Clos-Paul

The forty-three fragments of coin moulds discovered at Charleville-Mézières bear some rare identifiable imprints, all of which correspond to Severian *denarii*. Specifically, item CP13_218_14_1 belongs to a mould centre (the edges are broken and unidentifiable) bearing the laureate effigy of a bearded emperor (Fig. 3A). The only possible candidate seemed to be Macrinus (AD 217–218), Caracalla's successor. In the same stratigraphic unit (US 14), fragments bearing a piece of the effigy of at

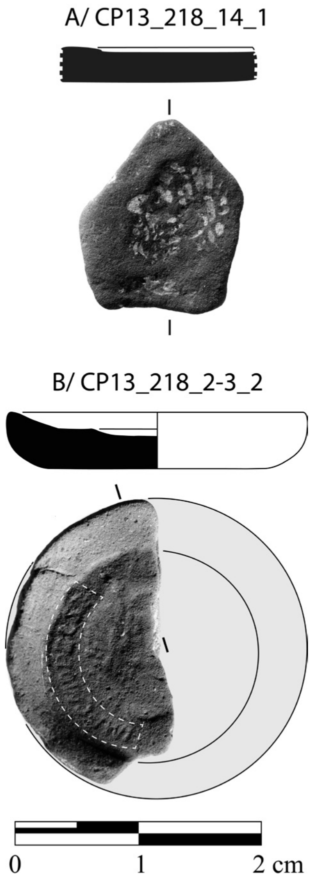

Figure 3: Pieces of effigies (B with mirror effect).

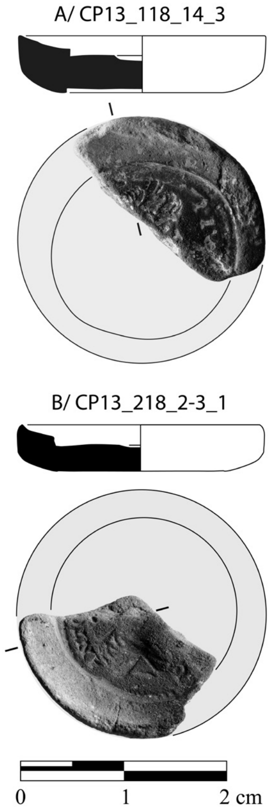

Figure 4: Pieces of effigies (A-B with mirror effect).

least one young prince of the Severan dynasty were unearthed. This was probably Elagabalus (AD 218–222) or perhaps Severus Alexander (AD 222–235). Finally, a broken reverse with a legend ending in]TAS [AVG] shows a deity carrying a cornucopia on his left arm. There is a good probability that this is [AEQVI]TAS [AVG], a type of coin attested in *denarii* for both Macrinus and Severus Alexander. Fragments from the stratigraphic unit 2-3 provide certainty and confirm previous evidence. Imprint CP18_218_2-3_2 shows the beginning of Macrinus's title in full: IMP C M OPEL[, with the reverse of a portrait which is indeed that of this emperor (Fig. 3B).

Another, listed as CP13_218_14_3 and taken from unit 14 (Fig. 4A), shows a fragment of a title which could be that of Septimius Severus (AD 193–211) in the second part of his reign [SEVERV]S PIV[S AVG], but also that of Caracalla in the same period [ANTONINV]S PIV[S AVG]. As the locks of hair visible behind the laurel crown are not curled, Caracalla is the most likely candidate. In addition, fragment CP13_218_2-3_1 bears the beginning and end of the legend ANTO[ ]G with a draped bust seen from three quarters behind (Fig. 4B), again reminiscent of those of the adolescent Caracalla (with the legend ANTO[NINVS PIVS AV]G), the eldest son of Septimius Severus, who was appointed Augustus in AD 198.

The coins used as models therefore certainly date from the first two decades of the 3rd century, possibly extending into the third decade with Elagabalus or the beginning of the reign of Severus Alexander. This does not mean, however, that the moulds were made precisely at that time. In fact, with the extreme scarcity of *denarii* from AD 238 onwards and especially after AD 241, the demand for the earlier types of laureate became progressively stronger, when the *antoninianus* (created in AD 215) was resumed on a very large scale. This demand for Severan *denarii* (combined with their better fineness and the public's rejection of *antoniniani* due to unfavourable exchange rates) led to the production of numerous cast counterfeits. These counterfeits lasted until the AD 260's and even 270's (Aubin 2003, 131-132, fig. 2). The workshop at Le Clos-Paul was in operation from AD 240 to 280 which is clearly defined by the ceramics found together with the fragments of monetary moulds and crucibles (Marian 2016, 5-112)[1]. This deposit forms a coherent group with no identified prior item. The moulds were clearly made after AD 240 and not in the late 210s or early 220s, as the identifiable prototypes might suggest. From a geographical point of view, the map of coin moulds finds (Méaudre *et al.* 2021a, fig. 2) shows that the find at Le Clos-Paul fills a relative gap in the border area between the bordering provinces of *Germania inferior* and *Belgica* (Fig. 1). The latter provided a large number of finds of monetary moulds.

It is therefore worth emphasising the obvious interest of the discovery of these moulds, which are part of an overall phenomenon that is better studied and understood by contemporary research (Lallemand 1994; Aubin 2003). Nevertheless, many questions remain unanswered in the absence of any coins used as models or fraudulent coins similar to those found (Marian 2016, 393-396)[2]. In fact, it is only the convergence of a number of elements (moulds, as well as slag from casting, casting failures, defective specimens glued or not in valves, etc.), that could make it possible to define the extent and limits of the production of counterfeit coins identified by the excavation of this site. The experimental approach can go some way to fill this gap, but it means that we must first have a good understanding of how this archaeological material was produced before we can begin to produce experimental analogue coins.

Facies and mould shaping

Macroscopic observation reveals the relative homogeneity of the mould matrix. All of these elements are actually made up of a sandy clay loam with no trace of plant elements or charcoals. It is a raw soil simply rubified by contact with molten metal, rather than ceramic. Colours range from blackish to beige, with orange in the rubified areas. This colorimetry reflects the wide variation in heating conditions, from a reducing to oxidising atmosphere, without any impact on production. As it stands, the deterioration of the skin of the moulds does not support the use of a surface treatment designed to facilitate the casting of the alloy, such as the application of charcoal dust or talc. Analyses to determine the endogenous nature of the soil used to shape the moulds were carried out on an archaeological mould and on soil taken *in situ*, untreated and decanted (Méaudre *et al.* 2021b, 241, 264-265)[3]. These analyses do not identify a local source of supply, but there are no qualitative characteristics to rule it out. Local sourcing should be favoured, especially as the qualities of this soil have been demonstrated in experiments. This sandy clay loam has low drying shrinkage (4.5 %) (Méaudre *et al.* 2021a, 4). As metal shrinkage during cooling is not significant, it is the shrinkage of the loam that determines the smaller size of cast counterfeits compared to the originals. As the moulds are raw, this loam rich in non-plastic compounds seemed appropriate. Non-plastic compounds reduce the risk of cracks or deformation during drying or casting.

From a typological point of view, these fragments fall into two families: the first, family A, known as the 'bevelled edge' family and the second, family B, known as the 'flat crown' family (Fig. 5). Family A makes up half of the corpus (twenty-two fragments) and the family B a third (thirteen pieces). A group of indeterminate moulds them (Fig. 6). Moulds with a 'bevelled edge' are characterised by an unusual almond-shaped lip. The vast majority of 3rd century coin moulds found throughout the Empire have a 'flat crown' facies. However, both the 'bevelled edge' and 'flat crown' families are designed to be assembled in stacks, generally of a dozen or so (Barakat and Picard 2002, 277; Hiver 1837, 175), with the single-printing valves positioned at the ends. Of the forty-three fragments in our possession, thirty-two have a specific number of imprints, namely seven moulds

[1] 1195 shards were found in the handcraft area (Marian 2016, 5-112).

[2] Only four sesterces were uncovered during the diagnostic and rescue excavation.

[3] X-Ray spectrometry analyser (p-XRF Niton XL3t GOLDD+, p-XRF Niton XL 3t-980 GOLDD+) and ICP-AES atomic emission spectrometry (Optima DV 2100, Perkin Elmer).

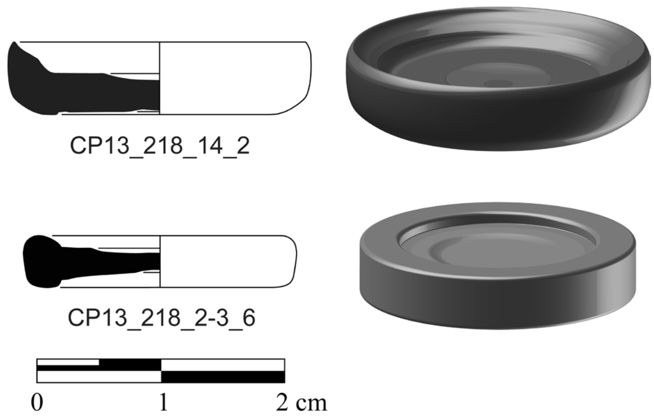

Figure 5: Family A with 'bevelled edge' (top) and B with 'flat crown' (bottom).

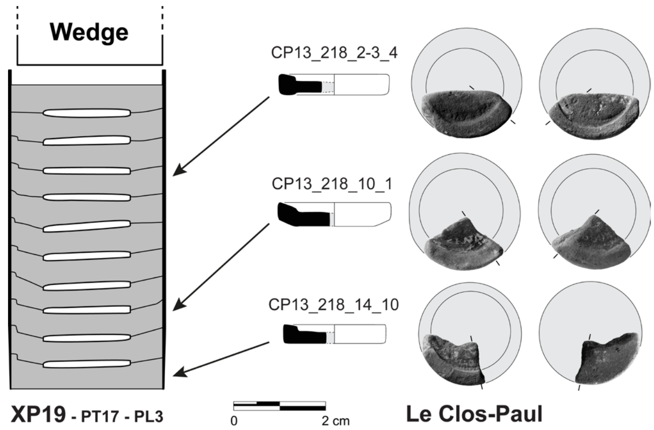

Figure 8: Comparison of an experimental pile and archaeological moulds.

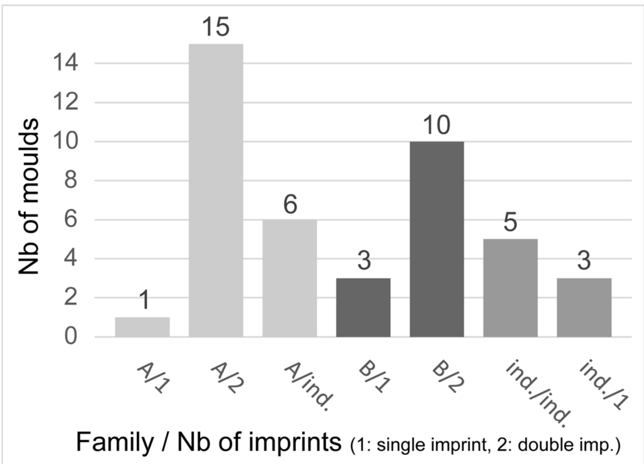

Figure 6: Typological breakdown of the corpus.

with a single imprint and twenty-five with a double imprint. From a statistical point of view, it is not relevant to speculate on the number of moulds per stack on the basis of such a weak reference (Pilon 2016, 66), especially as it cannot be excluded that several fragments belong to the same mould.

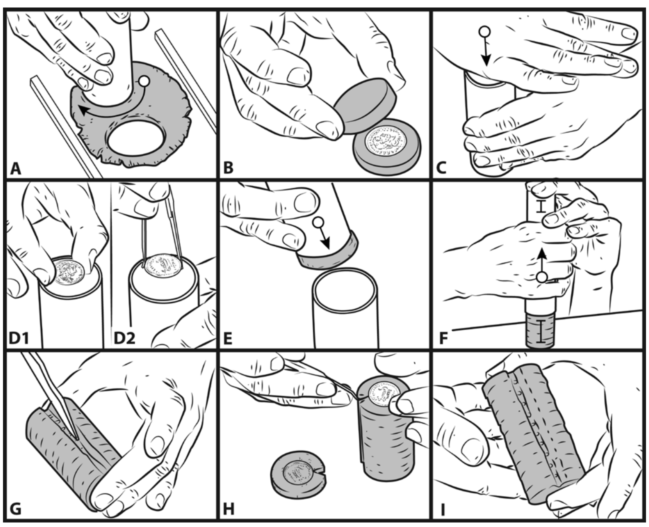

Figure 7: Shaping protocol inspired by the work of Hans Drescher.

Are these two families symptomatic of distinct processes? Experimental archaeology campaigns carried out at *La Plateforme des Arts du Feu in Melle* (France) have disproved this hypothesis. The *modus operandi* is based on work carried out by Hans Drescher on moulds excavated at Pachten, Germany (Drescher 1974) and can be summarised as follows (Méaudre *et al.* 2021a): A piece of loam is flattened with peripheral guides to control the thickness of the dough. A tube is then used to cut discs using a circular movement (Fig. 7A). Once the valves have been made, an oiled coin is placed between two of them (Fig. 7B). After positioning in a tube, vertical pressure is applied to the clay discs using the wedge (Fig. 7C). A new coin is placed on the disc in the tube, either by simply throwing it down (Fig. 7D1) or by positioning it with a pair of pliers, which facilitates centring and prevents the coin from falling off at an angle (Fig. 7D2). A new disc is positioned in the tube and a new pressure is applied (Fig. 7E). Once the dies have been made, the tube is turned upside down and the roller is extracted (Fig. 7F). After the loam has partially dried, the casting channel is incised (Fig. 7G), the coins are extracted (Fig. 7H) and the roller is finally reconstituted (Fig. 7I). This method of production requires both the use of a sandy clay loam, *i.e.* one rich in non-plastic compounds, such as that used at Le Clos-Paul, and oiled coins. The combination of these two factors makes it easier to separate the valves and remove them from the mould. The use of a clay rich in non-plastic compounds not only avoids excessive shrinkage during drying, but also limits thermal shock when casting the alloy.

The use of experimental archaeology has made it possible to resolve the question of the variability in the facies of archaeological moulds. These variations are not due to different working methods, but simply to their positioning within the pile. The cumulative pressure exerted by the wedge gradually deformed

Figure 9: Experimental cast denarius with mark.

the moulds, so that those at the bottom of the cylinder had 'bevelled edges', while the last valves inserted retained an almost 'flat crown' profile. Variations in the depth of the indentations, ranging from 0.1 to 2 mm, with an average of just over 0.8 mm, are simply the vagaries of the manufacturing process. A comparison of experimental moulds and archaeological specimens sheds some light on the subject (Fig. 8).

The experimental approach also allowed us to think about the maximum number of valves per stack. The step of inserting the coins into the metal cylinder conditions it. It is technically difficult to insert the coins into the base of a cylinder measuring more than ten centimetres in height. Insertion without a tool (Fig. 7D1) often causes the coin to fall out at an angle, resulting in stigmata on the mould and then on the casting (Fig. 9). The use of pliers facilitates the operation (Fig. 7D2), but also has its limitations. The use of a cylinder of about ten centimetres in height allows the production of stacks of eleven to thirteen moulds, or ten to twelve cast coins, as attested by archaeology. The number of moulds observed in the archaeological piles is therefore linked to this technical limitation.

With twenty-seven measurable elements, the average external diameter was around 24.2 mm (standard deviation 1.2 mm) (Fig. 10). The variations observed in the estimation of external diameters can be easily explained by the use of a punch made of bent and welded sheet metal by the Ancients. With forty-eight usable values, the average of the internal diameters, i.e. of the copied coins, is 17.3 mm (standard deviation 1.2 mm), with a tendency between 16.7 and 17.7 mm. Finally, the average external thickness of the moulds, based on thirty-eight measurements, was 4.7 mm (standard deviation 0.9 mm). Although these values are indicative of the diameter of the tube used to shape the stacks and that of the coins copied, they should be increased due to the shrinkage observed on Le Clos-Paul soil (Méaudre

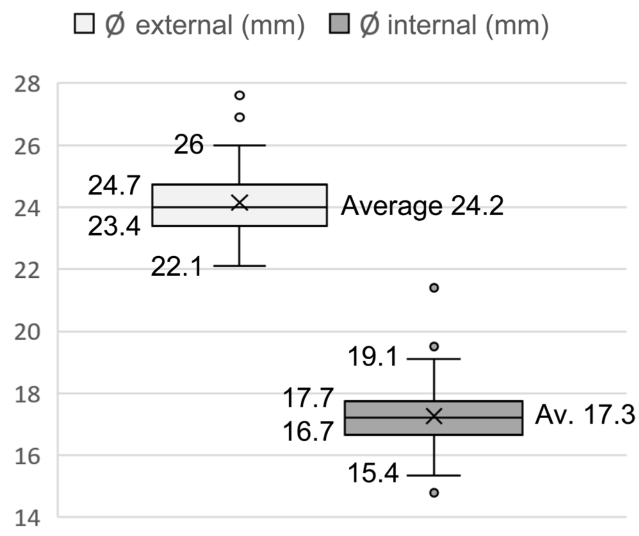

Figure 10: Estimated external and internal diameters.

et al. 2021a, 4). In addition, the fragmentary nature of the corpus puts these measurements into perspective.

The mould fragments from Le Clos-Paul show no evidence of pouring holes and we have no casting jets. Were the channels triangular in cross-section, like the piles uncovered in Trier (Guihard 2015, 268, fig. 3) and Corseul (Aubin 1990, 258, fig. 1), or conical, like the associated moulds in the RGZM collection (Chameroy 2007, 562, pl. 2, C, Nr. 17 u. 7)? Nor do we have any information on how the stacks were assembled. Roll assemblages actually take three forms: a single stack arranged horizontally, at Qasr-Qārūn (Guihard *et al.* 2019, 51) or vertical stacks grouped in pairs, at Lingwell Gate (Akerman 1838-1839, pl. 1, fig. 5) or in threes at Damery (Hiver 1837, pl. VI, figs. 12-16), Châteaubleau (Pilon 2016, 60 & fig. 52) and Pachten (R.- Alföldi 1974, pl. 53), the latter being the most common.

Conclusion

The corpus of monetary moulds discovered at Le Clos-Paul is modest, but interesting for several reasons. It fills a gap on the border between the neighbouring provinces of *Germania inferior* and *Belgica*. It is also instructive to compare the coins copied (dated to the first two decades of the 3rd century AD, possibly extending into the third decade) with the period of activity of Le Clos-Paul workshop (AD 240–280). This chronological gap once again underlines the attraction of the Ancients from the second half of the 3rd century AD for Severian *denarii*, an attraction linked to their higher proportion of fine silver and the public's rejection of *antoniniani*.

The metrological and qualitative study of these valves, coupled with the possibility of sampling the raw material *in situ*, led to an experimental phase. Following on from the work undertaken by Hans Drescher (Drescher 1974), this experimental approach enabled the variability of facies observed in Le Clos-Paul moulds to be resolved. The moulds at the bottom of the cylinder, which are successively subjected to pressure, are bevelled, while those at the top remain flat. This approach also highlighted a technical limitation inherent in this protocol, the result of which is the maximum number of eleven to thirteen moulds per pile observed on the archaeological samples. This work also demonstrated that, when the complete *chaîne opératoire* was carried out with care, the main indicator for detecting counterfeits remained the smaller dimensions of the cast coins (approximately 5 %), a phenomenon mainly linked to the shrinkage of the clay during drying.

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