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Recent discoveries of mat imprints on pottery from Cucuteni-*Cetățuie* (Iași County, Romania). Thoughts and experimental tests on the use of braided supports in forming prehistoric ceramics

Maria-Cristina Ciobanu[1]*, Felix-Adrian Tencariu[2]*

Abstract. In the context of the resumption of archaeological excavations in the eponymous site of the Cucuteni culture, the investigation of a burnt dwelling from the Cucuteni B1 sub-phase provided some unique observations on the architecture and internal organization of the construction. At the same time, it led to the retrieval of a rich archaeological material, sprinkled with various "surprises". Of these, on this occasion we turn our attention to three fragments of pot bases that retain the imprint of woven mats. The observations made on the basis of these discoveries and similar ones from the Cucuteni-Trypillia settlements allowed us to formulate hypotheses regarding the use of textiles in certain stages of the technological chain of ceramic manufacture, possibly in association with a rotating device, precursor of the potter's wheel. These innovations, along with the generalization and refinement of bicameral pottery kilns, are part of a trend of efficiency and standardization visible in the potter's craft, starting with the Cucuteni B1/Trypillia C1 phase, a consequence of a significant population growth. Several experimental tests have also been performed, on how to form and cover such impressions with fresh clay, as well as the potential for such behaviour to provide clues regarding the modelling duration of a large vessel.
Keywords: Cucuteni-Trypillia culture, pottery forming, textile imprints, archaeological experiments, ceramic production.

Descoperiri recente de impresiuni de rogojină pe ceramică de la Cucuteni-*Cetățuie* (jud. Iași, România). Considerații și teste experimentale privind utilizarea suporturilor împletite în modelarea ceramicii preistorice. În contextul reluării săpăturilor arheologice în situl eponim al culturii Cucuteni, cercetarea unei locuințe incendiate din sub-faza Cucuteni B1 a prilejuit, pe lângă unele observații inedite privind arhitectura și organizarea internă a

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construcției, recoltarea unui bogat material arheologic, presărat cu diverse „surprize". Dintre acestea, cu această ocazie ne îndreptăm atenția asupra a trei fragmente de baze de vase care păstrează amprenta unor materiale textile împletite. Observațiile făcute pe baza acestor descoperiri, și a altora asemănătoare din așezări Cucuteni-Trypillia, ne-au permis formularea unor ipoteze privind utilizarea materialelor textile în anumite etape ale lanțului tehnologic al prelucrării ceramicii, posibil în asociere cu un dispozitiv rotativ, precursor al roții olarului. Aceste inovații, alături de generalizarea și perfecționarea cuptoarelor bicamerale de ardere a ceramicii, se înscriu într-o tendință de eficientizare și standardizare vizibilă în meșteșugul ceramicii, începând cu faza Cucuteni B1/Trypillia C1, consecință a unei creșteri demografice importante. De asemenea, s-au efectuat câteva teste experimentale privind modul de formare și de acoperire cu lut proaspăt a unor astfel de impresiuni, precum și potențialul unui astfel de comportament de a aduce indicii în legătură cu durata de modelare a unui vas de dimensiuni mari.
Cuvinte cheie: cultura Cucuteni-Trypillia, modelarea vaselor, amprente de împletituri, experimente arheologice, producția de ceramică.

.....

Introduction

Cucuteni pottery, both as expression of remarkable artistic manifestations (shapes and painted motifs) and as result of a constantly evolving technology, fascinated archaeologists and the general public, underlying manifold studies on almost all aspects of Cucuteni civilization: chronology, spread and regional characteristics, crafts, art and spirituality. Undoubtedly the prerogative of specialists, the potter's craft was practiced in certain dedicated spaces (workshops), equipped with setups for storage and primary processing of clay, devices and various tools used for forming and decorating the pottery, pigments for painting, spots for drying vessels; to these the pottery firing installations (kilns) are added, possibly located outside the settlements, due to the danger of fire. However, unfortunately, if we relate to the large and very large quantities of pottery discovered in the Cucuteni-Trypillia settlements, the archaeological evidence to attest and nuance the various stages of pottery manufacture is disproportionately rare. With a few notable exceptions – e.g., the pottery workshop from Dumești-*Între Pâraie* (Alaiba 2007), the kilns and groups of pottery kilns from Ariușd (Tencariu 2015), Costești IX, Stolniceni, Maidanetske, Taljanky, Zhvanets (Țerna *et alii* 2019) and others – the techniques, tools and installations used during the pottery technological chain are generally deduced from the frequency, appearance and physical-chemical characteristics of the finished products (vessels and other ceramic objects).

There are many situations in which the common shard, beyond its role of "fossile directeur" for the cultural-chronological framing of a context (through its morphological and stylistic characteristics), also provides valuable information on the technical choices, actions and instruments of the Cucuteni potter. Thus, various

types of fractures may suggest the vessel forming technique (from coils or clay strips, horizontally superimposed, or from vertically welded clay sheets); certain stigmas (traces of smoothing/polishing, various imprints – e.g., fingerprints, textiles –, empty spaces left over from the burning of some organic matter in the paste) may give indications on the type and nature of tools used during forming and/or decorating ceramics. Of the latter, the textile imprints, preserved mainly on the basis of medium and large vessels, occupy a special place; these are practically "double witnesses" – both of the actions and techniques of the potter's craft and of the (generally ephemeral) finished products of the weaving craft. The study of archaeological textiles, with a rich history of research in western Europe (Barber 1991; Grömer 2016), has seen in the last decades a rising interest in Romanian literature as well (Marian, Ciocoiu 2005; Marian 2009; Mazăre 2010, 2014; Mazăre, Lipot, Cădan 2012).

Our article brings to the attention of specialists some new discoveries of braided mats imprints on the bases of Chalcolithic pottery, unearthed on the occasion of resuming archaeological excavations in the eponymous settlement of the Cucuteni culture. Also, some experiments performed in the laboratory are presented, performed to test the authors' hypotheses on how these imprints were formed and preserved, as well as the role of textiles within the process of pottery forming.

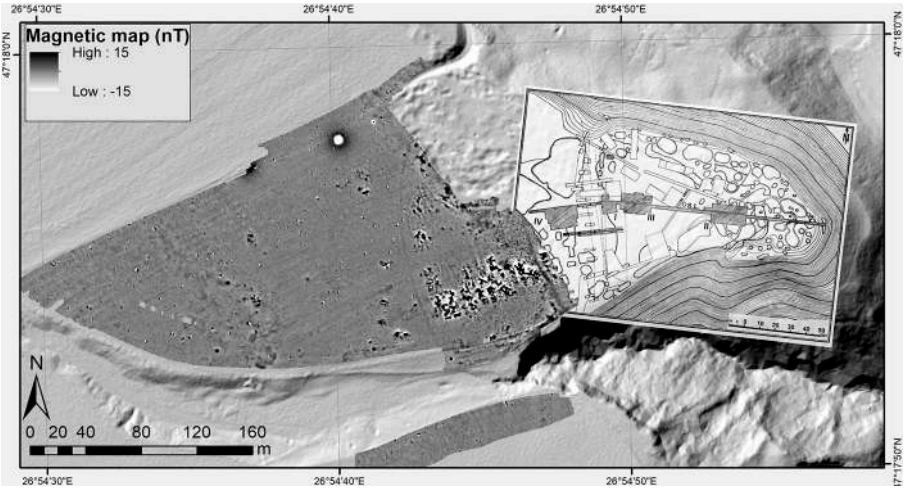


Fig. 1. Magnetic map of the Cucuteni-*Cetățuie* site overlapped on LiDAR DEM, in relation with the previous excavations (map by A. Asăndulesei)
Fig. 1. Harta magnetometrică a sitului Cucuteni-*Cetățuie* suprapusă pe modelul numeric al terenului (DEM) derivat din măsurători LiDAR, în relație cu săpăturile anterioare (hartă de A. Asăndulesei)

The context and the characteristics of the mat imprints from Cucuteni-*Cetățuie*, discovered in 2021

More than 50 years after the last excavations in the eponymous site of the Cucuteni culture (Petrescu-Dîmbovița, Văleanu 2004), the new investigations (archaeological topography, magnetometry, aerial photography, test trenches) revealed an extension of the settlement from *Cetățuie* towards west, following the promontory, in the form of at least two rows of burnt dwellings, delimited by two ditches, hemicycle shaped (**Fig. 1**). In this context, through a small test trench (2017) (Tencariu *et alii* 2019), followed by an extensive excavation (2021), a dwelling from the B1 sub-phase of the Cucuteni culture was fully investigated. It is a surface-dwelling (**Fig. 2**), of medium size (approx. 8×5.50 m), strongly affected by fire and numerous disturbances, both ancient (pits) and contemporary (agricultural works). However, we were able to document some aspects related to its architecture and material inventory (Tencariu *et alii* 2022). An AMS radiocarbon dating (Poz-144238) on bone material of animal origin, collected from the house, indicates the interval 3771-3641 BC, in accordance with the known data for the Cucuteni B1 sub-phase (Popovici, Drașovean 2020, p. 356-357). Among many aspects more difficult to elucidate, related to this dwelling, we mention the absence of a hearth, a ubiquitous element of the Cucuteni housing structures.

A possible explanation (hard to prove with solid arguments) could be given by the presence of a consistent disturbance in the area of the north-western corner of the house – a pit (Cx. 3), quasi-circular in plan, with slightly rounded walls (diameter about 1.90 m, 1.10 m in depth). The pit was quickly filled, immediately after its digging, the filling materials consisting exclusively of a very large amount of pottery and daub from the burnt walls, all dislocated from the dwelling. If we add the premises that for the Cucuteni B1 dwellings on *Cetățuie* there is a predilection for placing the hearths towards the western wall (Petrescu-Dîmbovița, Văleanu 2004, p. 107), as this pit is positioned, and that the ritual disturbance or destruction of the hearths is a relatively common behaviour of the Cucuteni communities (Frînculeasa 2006; Cotiugă 2015, p. 352), then we can think of a possible ritual of desecration/abandonment of the house, consisting in its strong burning, followed by digging the pit and removing the hearth.

As mentioned, the filling of this pit consisted of a considerable amount of pottery shards from the dwelling (in the north-western part of the construction a concentration of vessels of various shapes and sizes was noted – **Fig. 3**). Among them, we will focus on three fragments from the bases of ceramic recipients, which kept the imprints of spiral braids on the outside. In addition to the usual measurements and photographs, in order to obtain details of the impressions,



Fig. 2. Overview of the dwelling excavated in 2021 (photo by A. Asăndulesei)
Fig. 2. Vedere generală asupra locuinței cercetate în 2021 (fotografie de A. Asăndulesei)

a condensation silicone used for dental impression was applied to each of the artefacts, obtaining positive moulds of the materials "stored" in the ceramic paste.

The first shard (A1) is part of a large vessel, partially restored (the lower part, the shoulder and a little of the upper part - **Fig. 4/a**). Thus, it is a biconical vessel, with a height of about 50 cm; the exterior is well smoothed, with a yellowish-white (mostly detached) engobe on which, starting immediately below the shoulder,



Fig. 3. The pit (Cx. 3) and the pottery assemblage from the north-western corner of the dwelling (photo by A. Asăndulesei)
Fig. 3. Groapa (Cx. 3) și aglomerarea de ceramică din colțul nord-vestic al locuinței (fotografie de A. Asăndulesei)

brown decorative motifs were painted in the ε style. The inside of the vessel was smoothed rather carelessly, which, however, offered the possibility of other interesting observations: the smoothing (or rather the thinning of the vessel walls) was carried out using a spatula-type tool, with the width of the active part of 1.5 cm; also, the active part of the spatula was not smooth, leaving very visible streaks on the walls. These smoothing traces are continuous, at least on the restored parts of the vessel, but we can assume that they were uninterrupted on its entire inner circumference (**Fig. 4/c**). We believe that such a trace would not be possible to obtain by the movement of the hand with the instrument on the immobile vessel, but, most likely, by a rotational movement of the vessel conjugated with keeping a constant pressure with the spatula on the wall. Therefore, we cautiously propose the use by the potter of a rotating device (a "tournette" wheel, operated by hand), where the pivoting component was or had glued above a spiral braid, on which the vessel was formed.

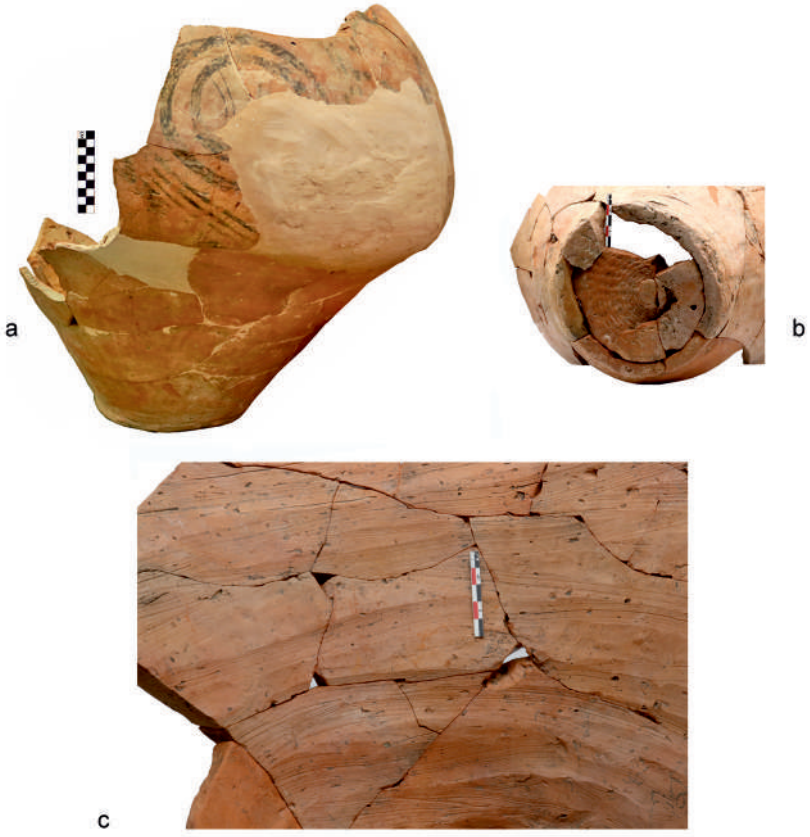


Fig. 4. (a) The biconical vessel, partially restored; (b) the base of the vessel, with mat impression; (c) the inside of the vessel wall, with continuous thinning traces (photos by the authors)
Fig. 4. (a) Vasul bitronconic, parțial restaurat; (b) baza vasului, cu impresiune de rogojină; (c) interiorul peretelui vasului, cu urme continue de subțiere (fotografiile autorilor)

The diameter of the base of the vessel, on which the spiral imprint has been kept, is 18 cm, and the thickness of the base varies between 1.3 cm and 2 cm. This variation results from an interesting peculiarity of the vessel: probably after forming, at the moment of detachment from the braided support, a layer of clay was added over the spiral imprint; its thickness varies from 1 to 6 mm, from one side to the other of the base (**Fig. 4/b**). This extra-clay did not have an aesthetic role, to cover the imprint, but rather to balance the vessel by correcting a defect of the base, which shows a visible deformation, from the outside to the inside. At one point, after using the vessel, or perhaps due to heavy secondary firing, some of the added clay came off, revealing the



Fig. 5. (a) The first base fragment (A1) with spiral mat impression; (b) mould of A1 (photos by the authors)
Fig. 5. (a) Primul fragment de bază (A1) cu impresiune de rogojină; (b) mulajul A1 (fotografiile autorilor)

imprint; this is clearer towards the centre of the base of the vessel, and rather blurred towards the edges. Following the observations made on the ceramic fragment and on the mould (**Fig. 5/a-b**), we can say that the impression comes from a spiral mat, made up of two elements: a spirally spooled base (we counted 12 visible coils) and a connecting element, pulled above and below the base coils. The thickness of the base element varies between 3 and 4 mm, and the connection between 3 and 5 mm. Due to the fact that the ceramic fragment has a rather friable ("dusty") consistency, the imprint has deteriorated over time, so we could not capture details, such as the nature and composition of the constituent elements. It is worth remembering that the centre of the mat coincides perfectly with the centre of the base of the vessel.

The second shard (A2) is another fragmentary vessel base, with an original diameter of 22 cm and a thickness of 1.5 cm, probably also coming from a large vessel. On one side it keeps a piece of the vessel wall, on a height of 9 cm. This fragment too has a mat imprint (**Fig. 6/a-b**), but barely perceptible; some traces of the connecting element, arranged radially, with a thickness varying between 2 and 4 mm, can be seen rather on the mould than on the ceramic fragment. It was not possible to count the coils of the braid. As in the case of A1, it is noted that the linear strings of the imprint of the connecting element converge towards the centre of the vessel base.

As for **the third ceramic fragment (A3)**, this one is small in size, being part of the edge of a vessel base, which was originally about 20 cm in diameter and 1.4 cm thick. The mat imprint is quite visible, but blurry (**Fig. 6/c-d**) – there are four coils of the base, but the connecting element is not distinguishable. However, from the orientation of the coils versus the edge of the base we can assume that, again, the centre of the braid coincided with the centre of the base of the vessel.

Impressions of textile materials on Cucuteni-Trypillia pottery: characteristics, interpretations, experimental approaches

The textile imprints preserved on the bases of the ceramic vessels represent a category of rather rare discoveries in the set of artefacts of the Cucuteni-Trypillia culture. However, the different contextures of the materials printed in the yielding clay body of the vessels allowed the identification of several textile techniques and technologies, from simpler or more complex braids of twigs, fibres, grass plants, etc., to fabrics with various structures: needle looped textiles, textiles made by interlinking, twined textiles, woven textiles (Kosakivskiy 2004; Marian 2009; Mazăre 2011; Skrzyniecka 2020).

Of these, of major interest to our article, as analogies for the fragments of vessels from Cucuteni, are the impressions of spiral and rosette mats, both made by braiding two elements: the skeleton of the structure and the braiding/binding

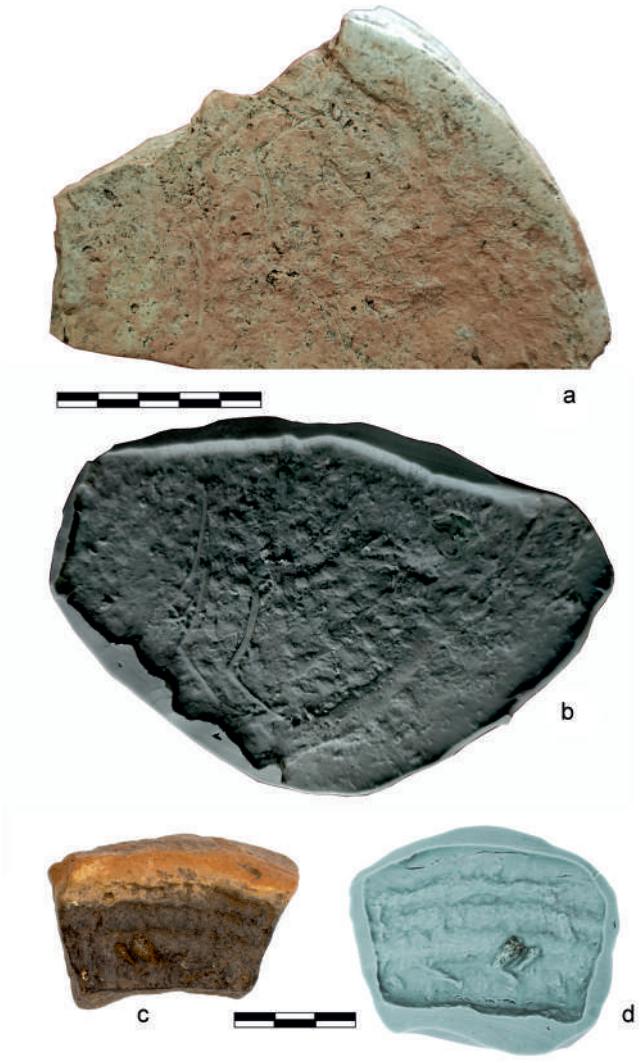


Fig. 6. (a) The second base fragment (A2) with spiral mat impression; (b) mould of A2; (c) the third base fragment (A3); (d) mould of A3 (photos by the authors)
Fig. 6. (a) Al doilea fragment de bază (A2) cu impresiune de rogojină; (b) mulajul A2; (c) al treilea fragment de bază (A3); (d) mulajul A3 (fotografiile autorilor)

element (Marian 2009, p. 58). Certainly not by chance, most of these discoveries also come from the eponymous site, from the older excavations (1961-1966), coordinated by Mircea Petrescu-Dîmbovița. We refer to five fragmentary bases of vessels (**Fig. 7/a-e**) that keep quite well the contexture of spiral mats, made by braiding vegetable strands, 3-4 mm thick, on a base also of vegetal nature (grass,

reed, rush, sedge, etc.), spirally coiled (Văleanu, Marian 2004, p. 322-323; Marian, Bigbaev 2008, p. 44-45; Marian 2009, p. 57-59). All these ceramic fragments are placed chronologically inside the Cucuteni B phase. Although the cited sources do not specify morphometric information and the published photographs have no scale, we can estimate that they are fragments from large or medium-sized vessels (diameters of the bases over 15 cm). It should be noted that the centre of these braids, recorded in the clay body, coincides with the centre of the vessel bases.

Apart from these, also from the Cucuteni-*Cetățuie* settlement, phase B, there are other fragments of pottery bases with impressions of textile materials made by different, more advanced techniques – knitting and weaving (Văleanu, Marian 2004, p. 323-326). Of these comes a different analogy for the first case presented (A1) from our recent excavations. It is also a fragment from the base of a large vessel (**Fig. 7/f**) which partially retains the imprint of a woven material, most likely made with a loom (Văleanu, Marian 2004, p. 321, 324). The imprint is very spectacular itself, due to the complexity of the contexture and the information it provides, regarding techniques (spinning, weaving) and technologies (loom), otherwise very "discreet" in the prehistoric archaeological records. As far as we are concerned, it seems even more interesting that this imprint was not kept on the surface of the bottom of the vessel, but embedded in it (as in the case of A1). As the authors assume (Văleanu, Marian 2004, p. 321), the vessel was probably formed on and by means of this textile support; at one point, after finishing and removing it from the fabric, the potter found necessary to straighten the surface of the base by applying a thin layer of clay (2-3 mm, according to our estimate). The clay body of the vessel, which was in a medium or advanced stage of drying, has not made a good grip with the freshly applied one; therefore, during the initial firing, or after a period of use (following a thermal or mechanical shock), or during the secondary firing, the added layer came off partially, revealing the textile impression.

Similar discoveries of spiral braided textile impressions can be found in other settlements of Cucuteni culture (**Fig. 7/g-j**): Costești IV, Brânzeni III-*Țiganca* (both from Republic of Moldova, dated Cucuteni B3/Trypillia CII – Marian, Bigbaev 2008; Marian 2009), Bil'che Zolote (Ukraine, Trypillia CI-CII – Skrzyniecka 2020), Liveni (Romania, Cucuteni B2 – Marian 2009, p. 66) and Buznea (Romania, Cucuteni B1).

We chose to treat separately and more thoroughly one of the analogies found for our findings, namely the fragment of the vessel from Buznea-*Siliște/După Grădini* (Iași County). The reason is that the ceramic fragment is unpublished[3] and preserves a very clear imprint of a spiral braid, with details on the components

[3] The artefact is displayed in the Museum within the "Ion Neculce" High School from Târgu Frumos, coming from the excavations from the '70s from the Buznea-*Siliște/După Grădini* site (Mihai 1973). We thank our colleagues Dumitru Boghian and Sergiu Enea for permission to analyse and publish the ceramic fragment.

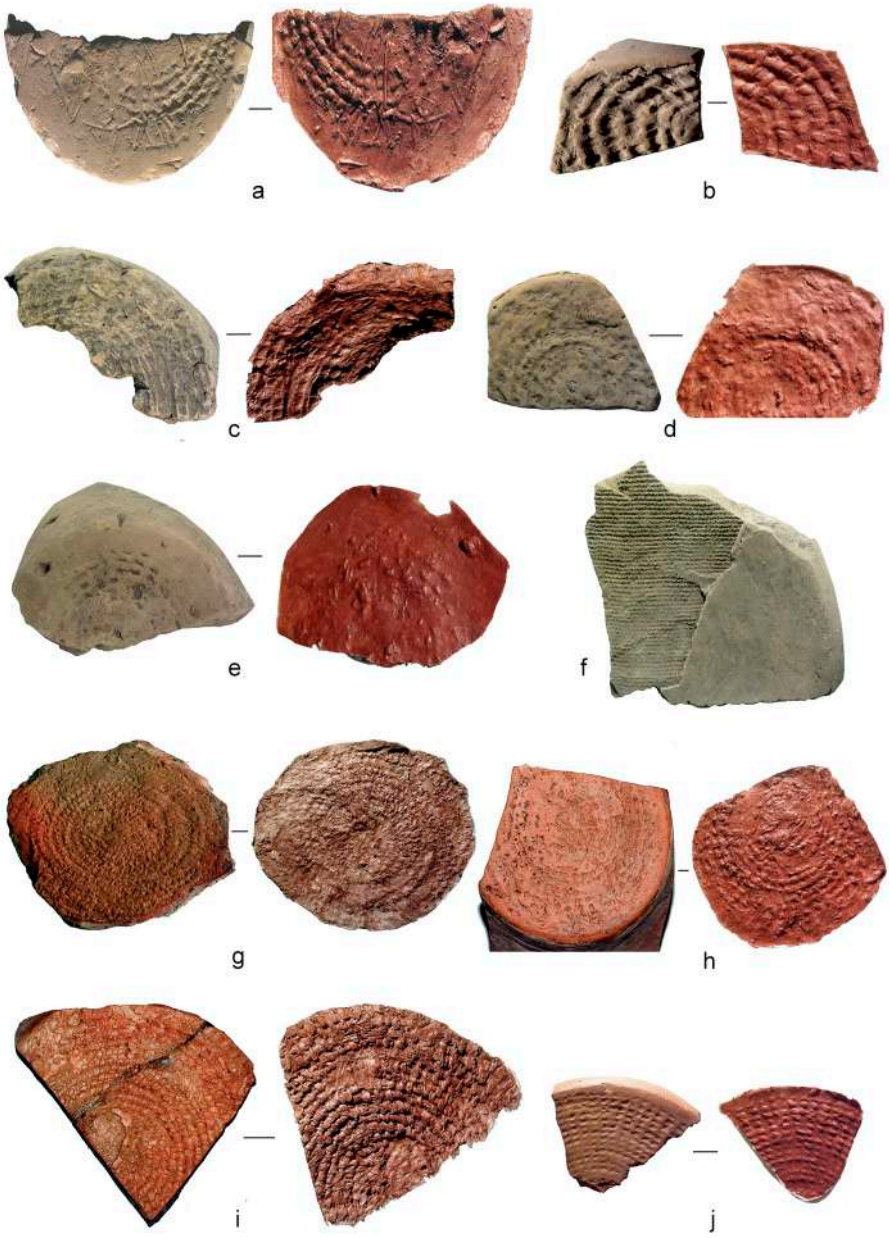


Fig. 7. Cucuteni-Trypillia pottery bases with textile impressions: (a-f) Cucuteni-*Cetățuie*; (g, i) Costești IV; (h) Brânzeni III-*Țiganca*; (j) Liveni (different scales, after Marian 2009)
Fig. 7. Baze de vase Cucuteni-Trypillia cu impresiuni textile: (a-f) Cucuteni-*Cetățuie*; (g, i) Costești IV; (h) Brânzeni III-*Țiganca*; (j) Liveni (scări diferite, după Marian 2009)

and the method of execution. Therefore, it is a fragmentary vessel base (**Fig. 8/a**), restored from three pieces which make about 65% of the whole. Its original diameter was 23 cm and its thickness is 1.5 cm, coming probably from a large storage vessel; on its side, the wall of the vessel is also partially preserved (about 5 cm high), with traces of relatively sloppy smoothening on the outside (possibly barbotine). The mat imprint, visible on the entire surface of the bottom of the vessel, is very clear towards the centre, slightly blurred towards the edges and almost erased at the edge (after a period of use, the base of the vessel has blunted towards the edges, even getting a polished appearance).

The mould (**Fig. 8/b**) made on this impression revealed much clearer details than those observed on the original fragment. As mentioned, it is a braided mat consisting of a spiral base element (skeleton or filler), reinforced with a binding element (**Fig. 8/c**). The base element, ranging in thickness from 5.4 to 7.2 mm, appears to be, given the longitudinal streaks, a bundle of thin vegetable fibers (Ø <1 mm), very slightly twisted in the Z direction (to the left – Mazăre 2010, p. 15). The connecting element is much thinner, with a diameter of about 2.5 mm, arranged radially below and above the coils of the filler. It is also a composed element, made of two threads also twisted in the Z direction (to the left). 14 coils of the base element could be counted, and the centre of the braid coincides perfectly with the centre of the vessel's base.

In addition to the above, there are many other discoveries from the Cucuteni-Trypillia settlements which, through the imprints kept on the bases of the vessels, attest other types of textile techniques: rosette-shaped braid – Brânzeni-*Țiganca* - Brânzeni-Gordinești/Trypillia CII (Marian 2009, p. 66-67); braid with right angles, similar to weaving – Trinca, Costești IV and Gordinești - Brânzeni-Gordinești/Trypillia CII (Marian 2009, p. 67-70); weaving – Cucuteni-*Cetățuie* - Cucuteni B1, Liveni-*Săraturi* - Cucuteni B2, Costești IV - Brânzeni-Gordinești/Trypillia CII, Văratic-*Holm* - Trypillia C2 (Marian 2009, p. 71-88), Solca - Cucuteni B (Nicola *et alii* 2007), Ghelăiești - Cucuteni B (Cucoș 1999, fig. 27/5), Bernashivka II, Yaltushkiv - Trypillia CI (Kosakivskiy 2004), Bil'che Zolote (Skrzyniecka 2020); interlinking (net-like structure) – Cucuteni-*Cetățuie*, Trușești-*Țuguieta* - Cucuteni B (Marian 2009, p. 88-95); braids made by knitting or by nalbinding techniques – Bodești-*Frumușica* and Cucuteni-*Cetățuie* - Cucuteni B (Marian 2009, p. 101-105).

In all the cases mentioned above, given the dimensions of the bases, it can be assumed that they generally come from large or medium-sized vessels. The bases of ceramic containers that preserve textile impressions are not only characteristic of the Cucuteni-Trypillia complex, but are also found in other major European Neolithic and Chalcolithic cultural areas, such as Starčevo-Criș (Makkay 2001), Vinča, Tiszapolgár (Mazăre 2011) or Gumelnița-Karanovo VI (Andonova 2021; Andonova, Nikolov 2022).

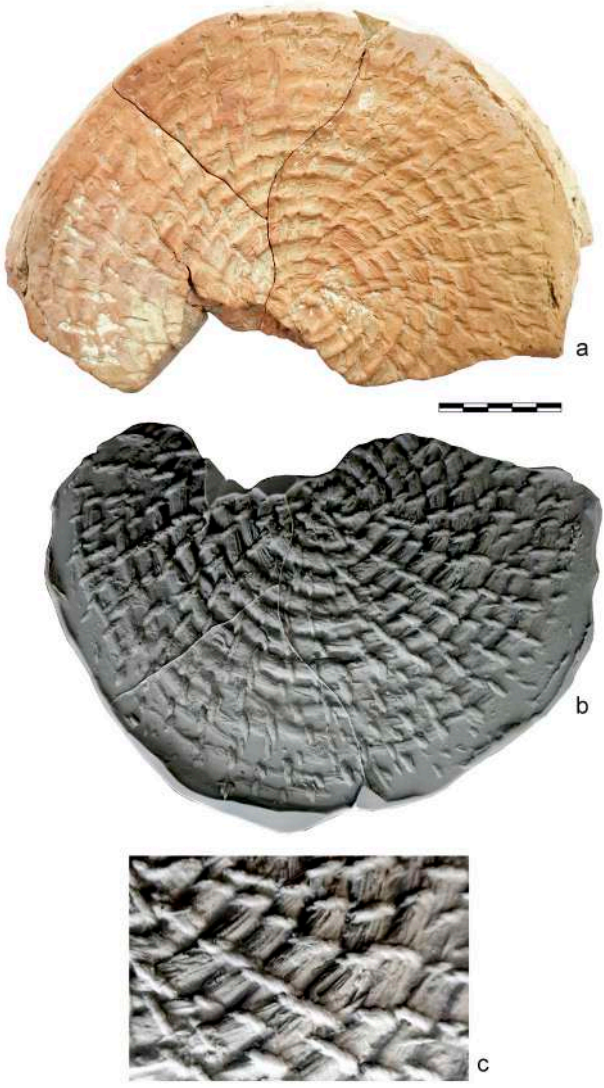


Fig. 8. The vessel base from Buznea-*Silișteː/După Grădini*: (a) original; (b) mould; (c) detail of the braid (photos by the authors)
Fig. 8. Fragmentul de bază de la Buznea-*Silișteː/După Grădini*: (a) originalul; (b) mulajul; (c) detaliu al împletiturii (fotografiile autorilor)

The presence of these textile imprints on the outside of the vessel bases cannot be considered as intentional, since they don't have a decorative or functional purpose. On the other hand, given their frequency and specificity, the accidental nature of these features is not supported either. Therefore, they can be considered

technological stigmas, being a direct effect of a stage in the operating chain of pottery manufacture.

As the impression could only take place during the time interval when the clay body of the vessel was soft enough, it is obvious that these traces were related to the forming and/or drying the vessels (Văleanu, Marian 2004, p. 321; Marian 2009, p. 54). Thus, one can assume the use of various textile materials as an intermediate support between the vessel and the work surface, in order to avoid sticking the wet clay to the flat surface and, at the same time, to facilitate the rotation of the vessel during the forming of the walls. The pressure exerted by the potter on the clay during forming and the weight of the clay itself determine the very clear impression of the contexture of the support. There is also the possibility of placing the still-drying recipients on the textile supports, the weight of the vessel causing their pattern to be printed on the outside of the base.

These hypotheses, in fact very consistent, are also tempting for experimental testing. Recently, such experiments have been performed, all having in common various types of archaeological textiles, immortalized in the clay body of ceramic vessels. Here are some of them, without claiming exhaustivity.

Starting from almost 100 vessels with braid impressions discovered at Gülpinar, a Chalcolithic site in north-western Anatolia, and from a series of ethnographic observations in Africa, an experiment was conducted to test the formation of impressions during pottery forming on such small braided mats (Özdemir 2007). The author's conclusion is that such supports were used by ancient potters, to avoid direct contact of the soft clay body with the soil surface in the early stages of forming, being a method to enhance the manufacture of vessels, in the absence of a rotating device.

A series of experimental tests focused directly on the formation of impressions on Cucuteni-Trypillia pottery (Marian, Mihuleac 2011), by making textile materials similar to those identified on pottery bases, and simulating the forming/drying of ceramic recipients using these fabrics. One of the conclusions is that only drying the vessels on textiles leads to the formation of superficial, poorly defined impressions. Instead, forming and drying the vessels on the same support, followed by their firing together with the textile material, would determine impressions similar to those found on the bottoms of Cucuteni culture vessels.

A more complex experimental approach, based on discoveries from the European Neolithic and Chalcolithic, but with a special focus on those from Romania, aims at four theoretical models of using perishable fibre structures in the technological chain of pottery manufacture: drying vessels on textile support; forming pottery on textile support (as a variant of a rotating device); the use of textiles to create areas of adhesion between separately shaped bodies of vessels; firing pottery with embedded textiles, as elements to strengthen the walls or the

base (Mazăre, Lipot, Cădan 2012). Analysing the results, the authors conclude that various textile products used as a rotating support in forming ceramics determine the appearance of clear impressions, being also helpful in the faster realization of symmetrical and well-balanced vessels. Also, drying the ceramic on these supports can produce stronger or less defined impressions, depending on the weight and humidity of the vessel when placed on the textile material.

Experimental tests on spiral imprints coated with fresh clay

The recent discoveries from Cucuteni-*Cetățuie*, as well as our acquaintance with the subject of textile impressions on Cucuteni-Trypillia pottery have determined us to start some experimental tests of our own. Of course, we did not intend to resume hypotheses already tested; we agree that textile impressions were caused by forming the clay body or drying vessels on such supports, just as we agree that the reason for using textile supports is the easier handling (rotation) of the vessel during forming.

However, previous experiments in Romania were carried out mainly by specialists in archaeological textiles, obviously having textile materials as focus. Our approach, on the other hand, leans towards the potter's craft, with reference to the particular situations where the impressions of textiles were covered with a layer of clay. We started from the premise that the additional clay was added as soon as the vessel was detached from the spiral support – that is, probably, at the end of the forming. Another premise is that, from a certain drying point, the clay at the bottom of the base can no longer bind with the fresh added clay; in that case the whole won't withstand firing and subsequent handling, something known to an experienced potter. Thus, the time elapsed from the start of forming to the point where the clay no longer "accepts" additions may be an indication of the maximum duration of forming a large biconical vessel.

At the same time, we tested three possible scenarios for the moment and the conditions that determined the detachment of the additional clay layer: the initial firing, a mechanical shock during use, the secondary firing during the burning of the house (higher, as temperature, than the initial firing). Several tests were performed by making round vessel bases, formed on spiral textile supports (**Fig. 9/a**). On each of them were pressed and uniformed two or three rolls of clay, in the coil technique (**Fig. 9/b-c**), simulating the first steps of forming the vessels (moments when the texture of the supports is imprinted in the soft clay body). A ready-made pottery clay was used, with optimum working humidity (approx. 30%); we worked in the laboratory, at a constant temperature of 18-20°C. At different intervals from the beginning of forming (+3, +4, +5, +6, +8 and +10 hours), the experimental samples were extracted from the supports, and the impressions, very clearly imprinted (**Fig. 9/d**), were covered with a thin layer of fresh clay (**Fig. 9/e**).



Fig. 9. Experimental tests: (a-c) steps in making pottery bases on spiral mats; (d-e) covering the mat impression with fresh clay (photos by the authors)
Fig. 9. Teste experimentale: (a-c) pași efectuați în modelarea bazelor de vase pe suporturi spiralice; (d-e) acoperirea impresiunilor cu lut proaspăt (fotografiile autorilor)

Under the same (laboratory) conditions, the samples were left to dry for six days, then fired in an electric kiln at 850°C (an average firing temperature accepted for Cucuteni pottery – Măţău *et alii* 2013). The samples +8 and +10 did not withstand the firing, the added part coming off completely. The clay samples +3, +4, +5 and +6 hours withstood the initial firing. One of the samples with clay added after 6 hours was subjected to a mechanical shock (hitting with a wooden object), breaking into two pieces and revealing, at the same time, a good part of the impression of the braided material (**Fig. 10/a**). Three other samples (+3, +4 and +5) were fired again at 1100°C, simulating the secondary firing (which occurred when the house caught fire). In this case, the clay addition came off partially from the +5 sample (**Fig. 10/d**), but resisted on +3 and +4, leaving, instead, a few cracks; in these cases, the additions detached easily as a result of a slight hit with a wooden stick (+3) (**Fig. 10/c**) and throwing on the floor (+4) (**Fig. 10/b**).

In conclusion, at the end of this deductive chain of reasoning we can propose the idea that the maximum time for forming a large vessel (~50 cm high) could not have exceeded 5-6 hours. Also, the clay layer added by the potter did not come off during initial firing, unless it was added too late (which is unlikely); rather, the detachment appears to have occurred as a result of a mechanical shock or of a secondary, stronger firing.



Fig. 10. Experimental tests – different scenarios for revealing the mat impressions: (a) +6; (b) +4; (c) +3; (d) +5 (photos by the authors)
Fig. 10. Teste experimentale – diverse posibilități de dezvelire a impresiunilor de rogojină: (a) +6; (b) +4; (c) +3; (d) +5 (fotografiile autorilor)

Conclusions

Undoubtedly, the presence of textile/mat impressions on pottery bases from the Cucuteni-Trypillia culture can be linked to a stage in the technological chain of pottery manufacture, namely pottery forming (and possibly drying). However, there are some aspects that leave room for more nuanced interpretations.

First, it is observed that in the case of all imprints of spiral braided materials, their centres coincide with the centres of the vessel bases; also, they always come from large vessels. Correlating the information with the continuous traces from the thinning/smoothing of the interior of the vessel from Cucuteni-*Cetățuie*, we can hypothesize the use of an installation with a pivoting support on which the

braided material was fixed, for forming certain types of vessels. The spiral aspect of the braided support serves to centre the clay on the pivoting support, and forming the base of the vessel until a certain coil can be a way to achieve standardized sizes and shapes of the vessels. Of course, in the case of such a device it is not a question of using the rotational kinetic energy, as in the case of fast, later pottery wheels, but its use surely increases the efficiency and quality of forming vessels in the coil technique. Such devices are already attested, for the 5th millennium BCE, in the Levant (Baldi, Roux 2016) and for the 4th millennium BCE, in East Asia - Mesopotamia, Iran and the Indus Valley (Roux, Courty 1998).

Secondly, the vast majority of the artefacts in question come from settlements from the last phase (B) and from subsequent related manifestations (Horodiștea-Erbiceni/Trypillia C2) of the Cucuteni-Trypillia complex. If we consider that, in the same phase, the double chamber kilns for pottery firing are generalized and perfected (Țerna *et alii* 2019; Tencariu *et alii* 2021), then we can add the appearance of rotary devices on the list of technological innovations in the potter's craft, meant to increase efficiency. These innovations probably appear as following the increased demand for ceramic vessels, which is a direct and logical consequence of a significant population growth, visible in the number and sizes of human settlements during this period (culminating in the Trypillia mega-settlements). Withal, these may be a clue of an increased social stratification and differentiated wealth distribution (new requirements of the elites).

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