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BAST CORDS FROM THE LATE BRONZE AGE AND EARLY IRON AGE IN POLAND, ON THE EXAMPLE OF FINDS FROM SUSZ, IŁAWA DISTRICT

ABSTRACT

Przymorska-Sztuczka M. 2025. Bast cords from the Late Bronze Age and Early Iron Age in Poland, on the example of finds from Susz, Iława district. *Sprawozdania Archeologiczne* 77/1, 305-316.

Artefacts made of organic materials from the 1st millennium BCE in Poland are relatively scarce, and products made of tree bast are even rarer than fabrics. There is limited evidence in the archaeological record for the production and use of bast cordage during this period. Tree bast cords have been preserved mainly in association with metal objects, like in the case of finds from Żelazo or Jodłowno. The remains of bast cordage were also identified among the hoard of bronze artefacts from Susz in northeastern Poland, which is the richest collection of bast cords in the region to date.

Keywords: bast cord, organic materials, Late Bronze Age, Early Iron Age
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INTRODUCTION

Recent years have brought new discoveries of deposits of bronze artefacts along with the organic remains preserved with them. These residues are increasingly attracting the attention of both archaeologists and biologists. Collaboration between researchers from these two very different fields often yields spectacular results. They are as valuable as the

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metal artefacts with which they have been preserved. These remains can be divided according to the origin of the raw material into plant and animal. These are both remnants of organic containers in which metal objects were deposited (*e.g.*, Papowo Biskupie, Gackowski *et al.* 2024, 2), such as birch bark baskets, leather or textile sacks/bags, and also plants themselves, *e.g.*, mosses, bark, leaves, grasses or straw, sometimes constituting additional protection for hidden objects, or the lining of the pit or vessel in which they were buried, as in the case of the finds from Cierpice, Jodłowno and Sanok (Noryśkiewicz and Kamiński 2022, 145; Kotowicz 2022, 17, 18; Gackowski *et al.* 2023, 663; Nowak *et al.* 2023, 97). There are also cases where individual metal artefacts were wrapped or tied, as in Brudzyń (Przymorska-Sztuczka 2020, 173) or Jodłowno (Nowak and Gan 2023a, 341). Organic material is also discovered inside objects, *e.g.*, in metal sleeves wrapping cords, as in the deposit from Susz (Przymorska-Sztuczka *et al.* 2024, 4) and Wola Sękowa (Kotowicz 2022, 11; Mueller-Bieniek and Cywa 2022, 143), or in the loops of axes and phaleras, as in the hoard from Żelazo (Krzysiak 2006, 202) and Kaliska (Przymorska-Sztuczka 2021, 406). Some of the artefacts also contain visible leather fragments, which are the remains of straps, belts or fastenings – such finds were discovered in the deposit from Kaliska (Kaczmarek and Szczurek 2022, 120, 121) and Sanok (Kotowicz 2022, 18, 28; Mueller-Bieniek and Cywa 2022, 142).

In this article, we focus on one category of organic finds: cords made of tree bast from the Late Bronze Age and Early Iron Age from Susz in northern Poland. We begin with a short overview of the history and processing of this raw material, highlighting its long and rich tradition in textile production. Bast undoubtedly ranks among the most important organic materials utilised by prehistoric communities (Hurcombe 2014, 29). Along with bark, grass stalks, reeds, and roots, it was one of the primary raw materials for producing everyday items, such as various mats, strands, and containers. The manufacture of tree bast cordage in Europe dates back to the Palaeolithic, and has an unbroken tradition to the present day (Myking *et al.* 2005, 67; Rast-Eicher 2005, 117). The craft was developed by nomadic hunter-gatherers and evolved to meet the growing need for cordage, likely associated with subsequent early farming cultures (Schjølberg 1988, 69). Bast can be obtained from many species of trees, including lime, birch, willow, hazel, beech, yew, pine, and spruce. However, analyses of bast product residues generally indicate that the material used came mainly from deciduous trees (Myking *et al.* 2005, 65, 66).

As a raw material for cordage making, lime bast fibres are excellent. Even a single strand is difficult to break and is resistant to decay. Bast fibre is collected from the inner bark surrounding the stems of certain plants. It must be extracted and prepared before such fibres can be worked into rope, cordage, or textiles. Usually, the bark is stripped off in the spring or early summer and submerged in water for retting. This causes a separation of the individual bast layers and releases the bast from the outer bark. Depending on the weather conditions, it can take between 2 and 8 weeks for the bark to transition from a solid structure to a soft, fibrous sheet of many layers (Myking *et al.* 2005, 68). These straps can

be plied to form a strong cord or a rope, which is flexible and resistant to mould. Limited swelling and low weight made the lime bast cordage float well, making it ideal for use in fishing (Myking *et al.* 2005, 70). Making a sewing thread or cordage for netting from a millimetre-thick fine strand is possible. Thicker strands can be plied to make ropes (Leaf 2007, 24).

The archaeological finds provide a limited scope of evidence for the production and use of bast cordage during the Late Bronze and Early Iron Age in present-day Poland. Such finds are only evidenced from northern Poland and have been mainly preserved in association with metal objects. Fragments of cords from the hoard near Susz are an excellent example of this phenomenon and will be discussed in more detail. In the description that follows, cords are plied yarns more than 1 mm to 10 mm. An asterix (*) in front of the single strand is added to denote spliced yarn/cord structure (Rast-Eicher and Dietrich 2015, 36; Harris and Gleba 2024, 459). In this article, a cord composed of two spliced strands of s-twist, plied in a Z direction, is annotated Z2*s. If the twist in the singles is loose, it is placed in brackets Z2*(s). When strands/yarns have no discernible twist, they can be annotated by Z2*, or Z2*i (Gleba and Harris 2018, 2330; Harris and Gleba 2024, 459). All observations were made at macroscopic and microscopic levels, using a Dino-Lite Edge digital microscope (10-50× magnification) and an Axio Zeiss Scope A1 stereomicroscope.

BAST CORDS FROM SUSZ

In 2023, the Regional Museum in Susz received an anonymous package containing bronze objects: a phalera, a bracelet, and 21 sleeves made of sheet metal wrapped with cords. Unfortunately, the context of this discovery is unknown (Przymorska-Sztuczka *et al.* 2024, 2). Fragments of cords were preserved inside 11 of the sleeves. In contrast, a small fragment was found separately (Fig. 1). Since the cords were not removed from the sleeves to avoid damaging them, no direct diameter measurements could be taken. This was only made on a 'loose' fragment, which was then sent for radiocarbon testing. The date obtained was 900-790 cal. BC, which corresponds to the Ha B2 period according to Reinecke (Przymorska-Sztuczka *et al.* 2024, 4). A botanist also analysed the cord fragments, confirming archaeologists' assumptions about tree bast as the raw material used to produce it (Przymorska-Sztuczka *et al.* 2024, 7).

In seven objects, the cords were preserved along almost their entire length (from 30 to 90 mm), while in four, they were preserved only in a small fragment. The cords filled the inside of the sleeves tightly. Therefore, the original thickness of the cords was quite close to the diameter of the bronze objects, which was approximately 10 mm. The loosely preserved fragment was about 8.4 mm in diameter. These cords were probably plied from two strands of bast. Some of the fragments were made with a right twist (Z), and some with a left twist (S) (Fig. 2). Based on this, it was concluded that there were probably two types of cords in the bronze sleeves – Z2* and S2* (Przymorska-Sztuczka *et al.* 2024, table 1).

Consequently, the hypothesis that these sleeves were threaded onto a single long cord for transport can be ruled out. The preserved residues have a form typical of cords made from tree bast. As a rule, these are two- or three-strand cords, *i.e.* they are made of two or three strands twisted together (Fig. 3).

It is difficult to determine the function of the cordage in the Susz ensemble. They were not simple ropes intended to secure or transport the bronze sleeves. The edges of the sleeves were additionally bent inwards to prevent them from sliding along the cordage. Perhaps bast cords were a structural element of a larger whole, consisting of a set of sleeves and phalera, *e.g.*, a horse harness, or maybe they were related to the construction of a female outfit, such as a skirt made of cordage or a belt (Przymorska-Sztuczka *et al.* 2024, 10, fig. 9). Although strong, a bast cordage with a diameter of approximately 10 mm is not a suitable raw material for use in horse harnesses. Analyses of organic remains indicate the use of leather straps for this purpose, as seen in the cases of Kaliska, Sanok, or the Danish Bćkkedal (Sarauw 2015, 6; Korupka 2022, 149; Szczurek and Kaczmarek 2022, 120).

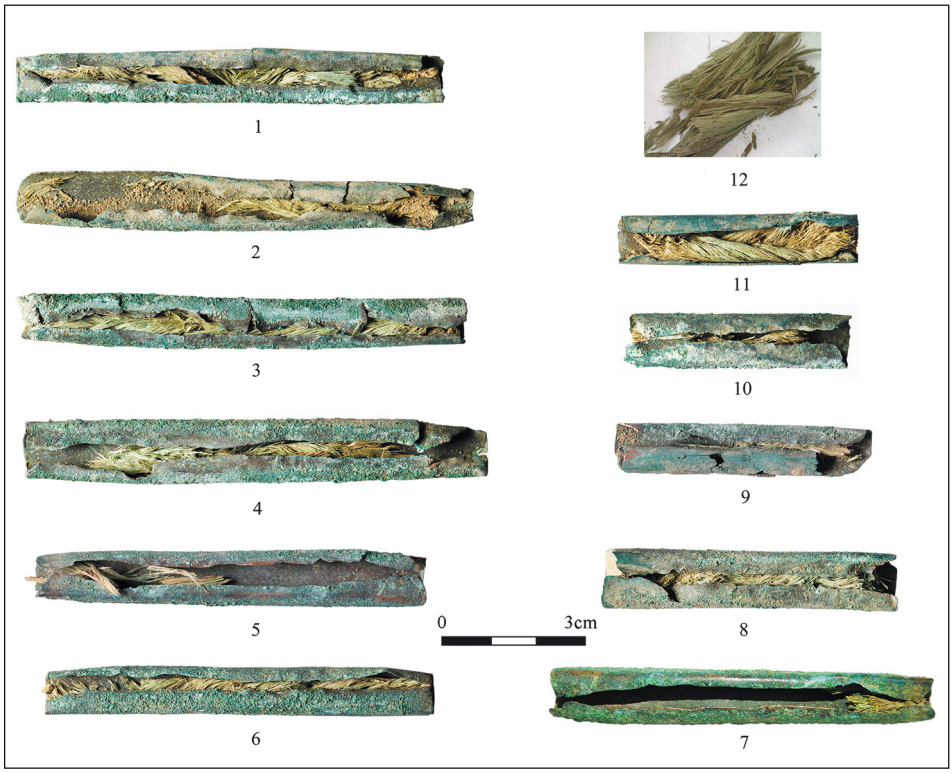

Fig. 1. Bronze sleeves from the Susz hoard with preserved fragments of a bast cord:
1-11 – sleeves; 12 – fragment of a bast cord under a Dino-Lite microscope, magnification ×20
(photo: M. Przymorska-Sztuczka)

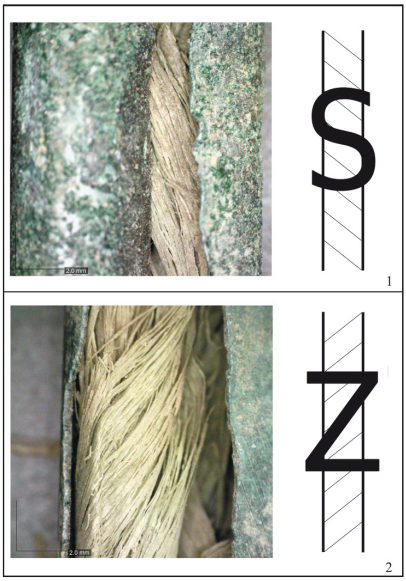

Fig. 2. Direction of a twist: 1 – left (S); 2 – right (Z) (photo: M. Przymorska-Sztuczka)

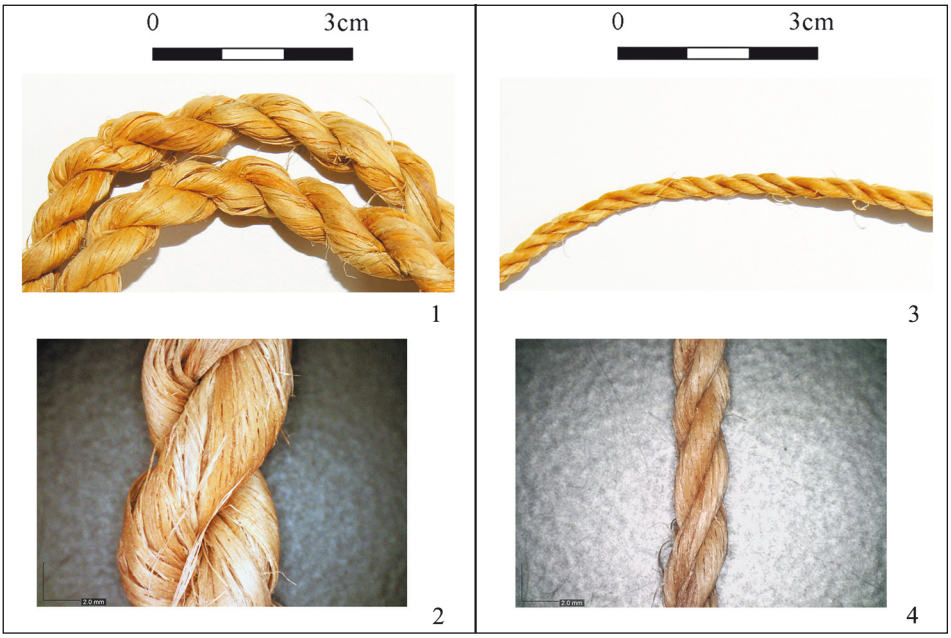

Fig. 3. Modern bast cords: 1 – thick cord made of two strands of bast; 2 – cord under a Dino-Lite microscope, magnification ×20; 3 – cord made of three strands of bast; 4 – cord under a Dino-Lite microscope, magnification ×20 (photo: M. Przymorska-Sztuczka)

Bronze sleeves and phaleras are also elements of women's attire associated with the Nordic cultural circle. Such examples come from Danish female burials and deposits dating primarily to the Early and Middle Bronze Age. There are over 20 known examples of the use of sleeves as parts of skirts made of cords. An example of the co-occurrence of bronze sleeves, phalerae and bracelets as elements of women's clothing are burials from Ølby and Gjedsted Sogn (Broholm and Hald 1940, 150, 151). In several Danish burials, larger fragments of skirts made of cords with metal sleeves have also been preserved, *e.g.*, Bustrup, Nellikehøj, and Hagendtrup (Broholm and Hald 1940, 147-152; Fossøy 2012, 39-41; Przymorska-Sztuczka *et al.* 2024, 10). However, it should be noted that analyses of these residues indicate wool as the raw material used to make them. The only example considered by M. Hald to be a cordage skirt made of bast is the find from Vester Doense (Broholm and Hald 1940, 104, 152).

Unfortunately, the lack of information regarding the arrangement of the artefacts from the Susz find and their relationship effectively hinders the interpretation of the purpose for which these objects were deposited and their original purpose. The fragments of bast cords from Susz are Poland's most extensive and well-preserved set of this type of cord. This find significantly expands the available source base and is a valuable example of an artefact made of tree bast.

OTHER FINDS OF BAST CORDS

Artefacts made of tree bast from the Late Bronze Age and the Early Iron Age in Poland are scarce. This is due to various causes such as the state of research, the state of publication, the methodology implemented during excavations and the fact that organic artefacts are rarely preserved except under exceptional conditions. Only a few artefacts made of tree bast have been published so far. These are fragments of cords from Jodłowno, Kaliska and Żelazo. Remains of cords come from deposits of bronze objects and other archaeological contexts, such as those found in the defensive settlements of the Lusatian culture in Mirakowo-Grodno and Słupca.

1. Jodłowno, Gdańsk district

Several fragments of cords, probably made of bast, were discovered in a deposit of bronze objects, dated to the Early Iron Age. They were found on necklaces, blades and bronze bars (Nowak *et al.* 2023, 98; Nowak and Gan 2023b, 106-110). The hoard from Jodłowno was presented at the exhibition accompanying the 8th Meeting of the Research Team on the Phenomenon of Mass Deposition of Goods, which took place on 17.05.2024 at the Institute of Archaeology of the Nicolaus Copernicus University in Toruń. The author of this article had the opportunity to look at the mentioned remains, although only through the glass of a display case. Based on available photographs and observations, it can be assumed that these are remnants of at least two types of cords. The first one is an untwisted strand of bast (Nowak and Gan 2023b, fig. 4: 16, fig. 5). The remnants adhering to the

blades were about 5-8 mm wide. Perhaps a small fragment of a strip, also an untwisted strand, is a small fragment (approximately 2-3 mm wide) found at the end of the necklace (Nowak and Gan 2023b, fig. 9: 8). The second type is a thin cord, with which fragments of two bronze objects were tied together (Nowak and Gan 2023b, fig. 6: 1). It is made of two strands – Z2* ply. Its thickness is approximately 5 mm, and the width of individual strands is approximately 2 mm – the given measurements are approximate, based on the scale attached to the photographs in the publication Nowak and Gan (2023b).

2. Kaliska, Szczecinek district

Fragments of thin cord were discovered on the phalera. These artefacts were part of a hoard of bronze objects, dated to the Late Bronze Age. The cord is preserved in five small fragments (Fig. 4: 1). It was made of bast, probably from deciduous trees, in a Z2*(s). Its average thickness was about 1.66 mm, while the thickness of individual strands was about 1.05 mm (Przymorska-Sztuczka 2021, 407). The raw material was determined on the basis of microscopic analyses conducted under the supervision of M. Grupa from the Institute of Archaeology at Nicolaus Copernicus University in Toruń.

3. Mirakowo-Grodno, Toruń district

A fragment of a bast cord discovered at a defensive settlement of the Lusatian culture in Mirakowo-Grodno, dated to the Late Bronze and Early Iron Age. The cord was 55 mm

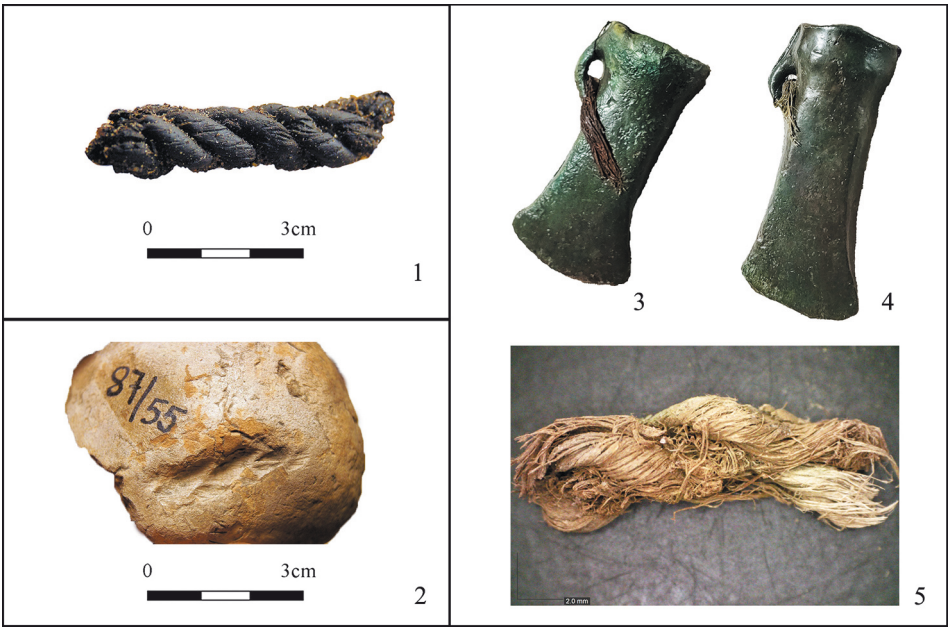

Fig. 4. Bast cords and cord imprint from Poland:
1 – Mirakowo-Grodno; 2 – cord imprint on the top of a loom-weight from Słupca; 3, 4 – bronze axes with residues of cords from Żelazo (without a scale); 5 – bast cord from Żelazo under a Dino-Lite microscope, magnification ×23 (photo 1: Ł. Gackowski, photo 2-5: M. Przymorska-Sztuczka)

long and 10 mm in diameter, ply Z3*S (Fig. 4: 2). Each strand is about 4 mm in diameter (Przymorska-Sztuczka 2022, 109). It was probably made of bast obtained from a lime tree. M. Grupa performed microscopic analyses from the Institute of Archaeology, Nicolaus Copernicus University in Toruń.

4. Słupca, Słupca district

An imprint of a cord was located on a fragment of a fired clay loom-weight. It was found during archaeological excavation in a defensive settlement of the Lusatian culture, dated to the Early Iron Age. The imprint measures 30 mm in length and 8 mm in diameter, exhibiting a left twist. That means that the cord that left it was made in the opposite direction, most likely made of three strands Z3*(s) (Fig. 4: 3), of a diameter of about 4 mm each (Przymorska-Sztuczka 2022, 111). It is difficult to identify the raw material from which the cord was made. However, it seems that it was indeed bast. This is indicated by the similarity of the imprint to the fragment of the cord from Mirakowo-Grodno, as well as experimental work carried out (Przymorska-Sztuczka 2022, 191).

5. Żelazo, Słupsk district

Fragments of cords were preserved in the loops of a few bronze axes. These artefacts were part of a deposit of objects dated to the Early Iron Age (Krzysiak 2006, 202). Analyses were carried out on a cord fragment found separately (Fig. 4: 4). The remaining fragments were covered with a substance that preserves the metal objects. The raw material was determined based on microscopic analyses carried out at the Conservation Department of the Archaeological Museum in Biskupin. The cord was made of two strands of bast (Z2*s). Its average thickness was about 4.5 mm, individual strands about 2.1 mm, while the preserved length was about 15 mm.

The hoards from Beston Regis I and II in Great Britain also provide an example of using bast cords to tie several axes together (Lawson 2013, 28, 38).

DISCUSSION

The Susz cords must be interpreted within the broader context of organic remains associated with metal deposits. Across northern and central Europe, such assemblages include birch bark baskets, leather or textile sacks, and vegetal packing material such as moss, bark, leaves, grasses or straw. These served both as containers and as protective linings for hoards, as seen at Papowo Biskupie, Cierpice, Jodłowno and Sanok. Individual artefacts were sometimes wrapped or tied with organic fibres, while others contained residues preserved in hollows, loops or fittings. Leather straps and fragments are also attested, often associated with belts, fastenings, or harnesses. The Susz cords thus join a broader category of perishable items deliberately related to the deposition and use of bronze artefacts.

The comparative background underscores the deep antiquity of bast use. Finds from Palaeolithic and Mesolithic sites such as Lascaux, Noyen-sur-Seine, Gönnersdorf, Friesack,

Tybrind Vig, and Ærø demonstrate the early exploitation of bast fibres (Rast-Eicher 2005, 117). Neolithic and Bronze Age lake dwellings in Switzerland (Auvernier-Port, Egolzwil, Wetzikon-Robenhausen, Zürich-Mythenquai), Germany (Degersee) and Britain (Must Farm) have yielded nets, ropes and woven textiles of bast (Messikommer 1913; Vogt 1937; Médard 2012; Banck-Burgess 2015; Rast-Eicher and Dietrich 2015; Grömer 2016; Harris and Gleba 2024). These finds highlight both the durability of bast and its role in technological traditions spanning millennia. The Susz cords, therefore, continue a well-established European trajectory of bast utilisation, though their context within a bronze sleeve assemblage appears regionally distinctive. From a functional perspective, the evidence suggests that bast cords served multiple roles: both practical (tying, binding, and securing) and as elements of dress or composite artefacts. The rarity of preserved specimens reflects depositional and taphonomic biases rather than actual scarcity in the past. In all likelihood, prehistoric households made extensive use of many bast products such as baskets, ropes and mats, of which only a minute fraction has survived.

CONCLUSIONS AND PERSPECTIVES

The Susz assemblage represents the most substantial corpus of bast cords preserved from prehistoric Poland, significantly enhancing our understanding of organic technologies in the Late Bronze Age and Early Iron Age. Although their precise function remains unresolved, the cords demonstrate advanced knowledge of fibre properties and cord-making techniques. When combined with comparative evidence, the finds point to a long-standing European tradition of bast utilisation for both practical and decorative purposes. Future research should systematically document even the smallest organic remains, undertake experimental replication of cord-making, and further integrate archaeological, botanical, and microscopic analyses. Such approaches will situate bast cordage within broader technological and social frameworks, reassessing the role of perishable organic materials in the daily practices and symbolic expressions of Bronze and Iron Age communities.

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