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Vanessa Baratella Margarita Gleba Michele Cupitò Emanuela Faresin

THE IRON AGE IN BUTTRIO (UDINE): MULTIDISCIPLINARY APPROACHES TO THE STUDY OF MATERIALS PRESERVED AT THE ARCHAEOLOGICAL MUSEUM OF THE CIVIC MUSEUMS OF UDINE

L'ETÀ DEL FERRO A BUTTRIO (UDINE): APPROCCI MULTIDISCIPLINARI ALLO STUDIO DEI MATERIALI CONSERVATI PRESSO IL MUSEO ARCHEOLOGICO DEI CIVICI MUSEI DI UDINE

Abstract - The present study aims to present an interdisciplinary investigation of the sample of materials conserved at the Archaeological Museum of the Civic Museums of Udine, dating to the Iron Age. This analysis has included the typological study of the artefacts, their chronological and cultural framing, detailed examination through photographs and macrophotographs of the materials, and finally the archaeometric study of some bronze *situla* fragments bearing traces of mineralised textile. The re-exam of these artefacts has allowed the identification of high-ranking artefacts in the site of Buttrio and has enabled their contextualisation within the coeval evidence from the surrounding territory. **Key words:** Bronze Artefacts, Textiles, Iron Age, Cemetery, Buttrio.

Riassunto breve - Il presente lavoro ha l'obiettivo di presentare lo studio del campione di materiali conservati presso il Museo archeologico dei Civici Musei di Udine e attribuibili all'età del Ferro attraverso un approccio interdisciplinare, che ha compreso l'analisi tipologica dei manufatti, il loro inquadramento cronologico e culturale, l'esame di dettaglio attraverso foto e macrofoto dei materiali ed infine lo studio archeometrico di alcuni frammenti di lamina della grande situla in bronzo che presentano tracce di tessuto mineralizzato. Il riesame di questi manufatti ha permesso di evidenziare la presenza di elementi status symbol di alto rango presenti nel sito di Buttrio e di metterlo in relazione alle testimonianze coeve presenti nel territorio. **Parole chiave:** Manufatti in bronzo, Tessuti, Età del Ferro, Necropoli, Buttrio.

Introduction (V.B., M.C.)

The territory of Buttrio has yielded Iron Age finds since December 1880, when, during the excavation of a canal, in part near the cemetery of the town and part near the road called *Bariglaria*, some bronze objects of certain funerary provenance were found. According to a brief note published by Giuseppe Fiorelli in *Notizie* degli Scavi di Antichità in 1881, the batch of materials here mentioned, donated to the Archaeological Museum of Civic Museums of Udine "[...] dall'egregio ispettore agli scavi Francesco di Toppo [...]", consists of "[...] alcuni frammenti di aghi crinali o di stili di bronzo, un anello, un vasetto ed una coppa con costole a rilievo, dello stesso metallo [...]" (FIORELLI 1881, p. 131). From the old inventory of the Museum, it is also deduced that on December 21, 1880, Mr Romano and Mr da Ronco donated seven fragments of bronze pins, an axe broken in two parts – currently no. 884 in the inventory (CARANCINI 1984, p. 138, tab. 118, no. 3296) –, a *cista* and two lids, discovered, in the same December 1880, during the excavations of the Roja canal (BUORA et al. 2003, p. 134).

The extremely limited data obviously suggests caution. However, considering, on the one hand, the chronological coincidence of the findings and donations, as well as the similarity of the circumstances – *i.e.* the excavation of a canal – and on the other hand the different identities of the donors and, above all, the lack of correspondence between the compositions of the two batches of artefacts, it is plausible to think that they represent different recoveries, made nonetheless in the same area, namely between the cemetery and the *Bariglaria* road.

Another batch of Iron Age materials was added to the Museum's collection in January 1887. According to archival data, in this period Mr Giacomo Tomasoni⁽¹⁾ delivered an arm-ring and a bronze axe found in the courtyard of the house owned by Mr Luigi Tomasoni (BUORA et al. 2003, p. 134). These materials were unfortunately confused; nevertheless, the axe – fragmented in two parts and damaged by exposure to

¹⁾ There are some ambiguities regarding how the surname is reported. In the accompanying note to the materials, the surname is indicated as "Tommasoni", while in the publication by BUORA et al. 2023, the surname is cited as "Tomasoni".

the fire – is listed in the inventory as no. 871 (CARANCINI 1984, tab. 116, no. 3657).

The last acquisition of Iron Age artefacts by the Museum is dated to 1890, when Prof Alexander Wolf, following a donation again by Mr Tommasoni, deposited some artefacts discovered, in the same year, in the courtyard of the Bolzicco brothers and belonging, according to the note attached to the materials (Fig. 1), to a single grave. Here is the transcription of this note:

"[...] Oggetti trovati nel giugno 1890 nel cortile dei Fratelli Bolzicco in Butrio [sic] all'estremità della villa verso quella di Vicinale. Esistevano questi oggetti in una tomba a forma di pozzo profonda 70 cent. e del diametro di centimetri 50 a fior di terra e di 30 al fondo della buca. Le pareti ed il fondo sono rivestiti di pietra greggia.

Gli oggetti sono:

- 1. Molti frammenti di un vaso in rame.
- 2. Frammenti di un vaso in terra cotta.
- 3. Un Palstaab di bronzo in due pezzi, quattro estremità bottonute di aghi crinali in bronzo ed un frammento di ago crinale in bronzo, più una lamina sottile in rame.
- 4. Frammenti di ossa umane [...]".

Most of the artefacts related to this discovery have been catalogued in the Museum collection as a single batch with the inventory no. 962, while the axe corresponds to the inventory no. 872 (CARANCINI 1984, tab. 118, no. 3687). The pins – unfortunately together with ones related to the previous recoveries – are inventoried in a single batch of materials no. 873.

As can be deduced from the chronicle of discoveries and recoveries, the materials above mentioned, even if most of these have to be considered as sporadic finds – actually, the only certain associations come from the 1890 recovery, *i.e.*, the grave goods belonging to the Bolzicco brothers' courtyard pit-grave – suggest that,

Oggetti towate nol fugno 1890 nel cortile Seifratili Bolzicco in Butrio, all'estremità Della villa verso quella "Vianale. _ Esistevano queste oggette in una formba forma & prozo, profonda fo cent. evel Hamelso Si con this 50 a find & terra 2 20 30 alfondo Della buca Le nosoli ed il fondo sono rivestili De metra greggia. gli oggetti somo 1. Malli grammenti diun vaso in same. 2. Frammente Si un vaso in terra cotta 3. Un Palstaab & bronzo in Sue preze, quattro estremità bottenute si'aghi crinale in bronzo Qua frammento Wage crinale in bronzo, jui una lamina soffile in same. 4. Frammenti D'assa umane. avuti amereo Pelprof. Wolf 10 Luglio 1890 Dono del Sig" Tracomo Comme

Fig. 1 - Note attached to the materials referred to the Bolzicco brothers' courtyard grave (photo: M. Piorico).
- Nota di accompagno del materiale riferibile alla tomba del giardino dei fratelli Bolzicco (foto: M. Piorico).

during the Iron Age, the Buttrio settlement – probably located at Castello Morpurgo (TOMADIN 1999, pp. 19-23; BUORA et al. 2003, p. 137, fig. 4) – featured at least two necropolises, one placed in the western part of the town, between the cemetery and the *Bariglaria* road, the other one in the eastern part, at Loc. Vicinale (Fig. 2).

After an initial publication of part of the material



- Fig. 2 Buttrio (UD). Localisation of the citated sites: 1. Cemetery;2. Actual via *Bariglaria*; 3. Loc. Vicinale; 4. Castle.
 - Buttrio (UD). Localizzazione dei siti citati nel testo: 1. Cimitero; 2. Attuale via Bariglaria; 3. Loc. Vicinale; 4. Castello.

preserved in the deposits of the Archaeological Museum of Udine (BUORA et al. 2003), a note published in 2020 proposed a reconstructive drawing of the large situla which, in 2022, along with the rest of the complex that arrived at the Museum in 1891, underwent restoration (VISENTINI 2020). This work, carried out by the L.A.A.R. company of Udine under the supervision of the Soprintendenza Archeologia, belle arti e paesaggio of Friuli Venezia Giulia, allowed for the confirmation of the reconstructive drawing of the situla, the isolation of other metal fragments not related to the large metal vessel, and most importantly, the identification of some traces of fabric and bone remains. This led to the decision by the Archaeological Museum to request from the Department of Cultural Heritage, Archaeology, Art History, Cinema and Music of University of Padua a more in-depth study on the fabric traces and the context of metal artifacts in general.

Thanks to this project it is now possible to organically re-examine this important and mostly unpublished sample of materials, both in traditional terms, *i.e.* through the chronological and cultural analysis of the finds, and also adopting innovative approaches such as archaeometry and digital techniques, specifically, to the analysis of the traces of mineralised textile which, as known, were found inside the largest bronze vessel and determine the principal characteristics and quality of this exceptional evidence.

The grave goods of the Bolzicco brothers' courtyard burial: some observations on the composition (V.B.)

As discussed above, the materials discovered in 1890 in the courtyard of the Bolzicco brothers' house derive from a single grave and therefore represent a context with certain associations of elements. The only description available for the recovery is detailed in the above-mentioned attached note, where the location, the grave typology and the nature of the finds are reported.

The grave had a structure of a pit lined with unworked stone blocks. Inside the pit, numerous fragments of a bronze sheet vessel, a bronze axe, fragments of a pin/pins, some potsherds apparently belonging to a single vessel, and, finally, some bones were found. The information about the general context is therefore quite limited, and, based on the current state of knowledge, it is not possible to reconstruct the original grave's layout, either in terms of the overall composition of the grave goods assemblage or in relation to other graves potentially present in the surrounding area. In addition,



Fig. 3 - Small nucleus of cremated human remains from the Bolzicco brothers' courtyard grave (photo: V. Baratella).
 - Piccolo nucleo di ossa umane combuste provenienti dalla tomba del giardino dei fratelli Bolzicco (foto: V. Baratella).

the extreme fragmentation of the material suggests that the grave was probably damaged by post-depositional actions, such as agricultural works. Furthermore, it has been possible to confirm that this grave is a cremation burial, since some cremated human remains have been found, some of which bear traces of contact with bronze (Fig. 3), while some cremated bones still adhere to certain artefacts.

As mentioned, the artefacts belonging to this grave and now included within the Museum's collection are the no. 962 large bronze vessel, some fragments of pins, inventoried as no. 873, and the no. 872 bronze axe (Fig. 4).

Thanks to the important restoration intervention carried out by the L.A.A.R. company, it was possible to recompose, as much as possible, the original shape and to reconstruct the general profile of the bronze large vessel. This object corresponds to a bronze situla, composed of a larger sheet shaping the upper part of the vessel and two other sheets forming the lower portion; the sheets are fixed with flat-headed rivets, both horizontally and vertically. In the published reconstruction drawing of the situla (VISENTINI 2020, p. 40, fig. 4), the vessel is reproduced without the base. Although there are no fragments that directly connect the lower part to the base, the latter was recognised during the new analysis of the fragments (Fig. 5). The base presents incomplete edges, making it impossible to hypothesise whether it was fixed directly by rivets to the lower sheet or if there was instead a system with an additional fixing ring. The base sheet is slightly convex, its outer surface is smooth while on the inner surface multiple hammering marks are present, arranged both following the circular shape of the base and linearly, creating occasional intersections between them.

As already observed during the restoration of the artefact, some fragments of the body of the *situla* conserve traces of mineralised textile on the inner surface. The textile can be interpreted as a container of the deceased's cremated remains, since bone fragments are adhering to the textile surface in places.

Among the materials referable to the inventory no. 962, a fragment of a bronze sheet vessel not pertaining to the *situla* was recognised: specifically, the fragment belongs to a *Rippenziste*, *i.e.*, a *cista* with raised ribs, of which only a small upper part is preserved (Fig. 6a, b).

Finally, two highly damaged fragments of other bases have been identified, one of which can reasonably be attributed to the above-mentioned *cista* (Fig. 6c). A peculiar characteristic of *cista* bases is that they have, in almost all known cases, a concentric grooved pattern, generally spaced apart, covering almost the entire surface of the sheet, except for the most central part, which may be smooth. Since one of the bases presents a very slight concentric pattern at the edges and a smooth surface towards the centre, it could be reasonably interpreted as the central part of a *cista* base. The second base, on the other hand, does not find any further match; in fact, among the extant materials, there are many fragments of bronze sheets that have not been attributed either



Fig. 4 - The bronze axe no. 872, part of the grave goods of the Bolzicco brothers' courtyard grave (photo: E. Faresin, D. Vicenzutto).

> - L'ascia in bronzo n. 872 parte del corredo della tomba del giardino dei fratelli Bolzicco (foto: E. Faresin, D. Vicenzutto).



- Fig. 5 Base of the bronze *situla* from the Bolzicco brothers' courtyard grave (photo: E. Faresin, D. Vicenzutto).
 - Fondo della situla in bronzo della tomba del giardino dei fratelli Bolzicco (foto: E. Faresin, D. Vicenzutto).



- Fig. 6 Front (a), back (b) and base (c) of the *Rippenziste* recognised in the no. 942 batch of materials and referred to the Bolzicco brothers' courtyard grave (photo: E. Faresin, D. Vicenzutto).
 - Visione frontale (a), del retro (b) e fondo (c) della cista cordonata riconosciuta tra i materiali del lotto n. 942 e riferibile alla tomba del giardino dei fratelli Bolzicco (foto: E. Faresin, D. Vicenzutto).



- Fig. 7 Fragment of a cremated bone adhering to the bronze axe no. 872 (photo: E. Faresin, D. Vicenzutto).
 - Frammento, di assa combusta aderente all'ascia in
 - Frammento di osso combusto aderente all'ascia in bronzo n. 872 (foto: E. Faresin, D. Vicenzutto).

to the *situla* or to the *cista* and they could potentially belong to other unrecognised vessels.

Among the less well-preserved materials belonging to the inventory no. 962 is a highly corroded iron fragment that could correspond to a *fibula* brooch. Based on the re-exam of preserved artefacts, it can be affirmed that, differently from what can be deduced from the archival note, the grave goods of the pit-burial in exam contained at least a large bronze *situla* used as an ossuary, a *Rippenziste*, a third bronze vessel, a pottery vessel, a bronze axe, some fragments of bronze pins and probably an iron *fibula*. The presence of burnt bones adhering to the surface of both the axe (Fig. 7) and the alleged *fibula* (Fig. 8) indicates that these objects had certainly been placed inside the *situla*, perhaps inside the container for the ashes.

Typochronological and cultural analysis of the Buttrio Iron Age materials

A typological and chronological framework of the Buttrio Iron Age materials preserved in Udine's Museum it is possible only for the *situla*, the *cista*, the axes and the pins. Due to the bad state of preservation, for the third bronze vessel and the possible iron *fibula* any observation cannot be performed.

The situla and the cista (V.B.)

The bronze *situla* (Fig. 9) has a short, distinct, straight neck with an externally folded rim, and the shoulder is very pronounced and wide, high, with a slight angularity. The dimensions of the vessel are remarkable, with a diameter at the mouth of about 50 cm and 60 cm at the shoulder, corresponding to its maximum expansion. Within the panorama of *situlae* documented across Italy, this specimen belongs to a type that has not been



Fig. 8 - Iron *fibula* brooch with a fragment of cremated bone recognised in the no. 942 batch of materials and referred to the Bolzicco brothers' courtyard grave (photo: E. Faresin, D. Vicenzutto).

attested until now. The best comparison comes from an unnumbered grave in the Slovenian cemetery of Stična-Griže and is of the type defined "Eimer mit konvex gebogenem mantelunterteil" (JEREB 2016, pp. 25-26, tab. 11, no. 12). This grave is dated to the Stična 1 phase, *i.e.*, around the middle of the 7^{th} century BCE⁽²⁾. As we have seen, during the re-examination of the sheet metal fragments catalogued together with the situla, a base that can be attributed to this specimen has been recognised; it is partially preserved, with a maximum diameter of 21 cm, and displays peculiar manufacturing traces. This part of the vessel presents a very important technological detail. As highlighted by the macro-photograph (Fig. 10), on the outer part of the base there are evident traces of beating/hammering, arranged in a concentric and transverse manner across the entire surface. The radial and subsequently transverse beating of the sheet is a preparatory process of the workflow used to obtain the desired curvature of the bronze sheet, and was carried out on the less visible surface of the finished artefact. The technique is called "raising" (Aufziehen) (IAIA 2005, pp. 26-27), and was used to create the desired concavity or convexity of a situla base. In the case of the situla under investigation, the base, once finished, appears slightly convex, as also demonstrated by the comparison type identified for the specimen. Similar hammering traces can be found, *i.e.* on the inner surface of a helmet from the Grave Impiccato II in Tarquinia (IAIA 2005, p. 30, fig. 2.1).

The small fragment of a *Rippenziste* (Fig. 11) presents evident traces of corrosion that make it difficult to read its profile. Only part of a short, externally folded rim is preserved, and at least one raised rib is recognisable below it. Just below the rib there is a looped attachment for a movable handle, fixed with two flat-headed rivets. The small size of the attachment and its specific shape could suggest a *cista* with a single attachment and handle: if it had been a double attachment, there would have been a connecting *septum* between them, as documented in the majority of cases⁽³⁾.

The lack of further attributes such as the number of ribs, the shape of the handles or a complete base prevents a more precise typological attribution and chronological definition of the artefact.

⁻ Arco di fibula in ferro al quale aderisce un frammento di osso combusto riconosciuto tra i materiali del lotto n. 942 e riferibile alla tomba del giardino dei fratelli Bolzicco (foto: E. Faresin, D. Vicenzutto).

²⁾ The Stična 1 phase is compared to the Novo Mesto 1 phase, *i.e.*, Ha C1 phase; for the parallels, see Gabrovec 1987; Gabrovec & Teržan 2008.

³⁾ In the description of the single components of the *Rippenzisten*, Stjernquist presents, in the case of the "AH2" attachment typology, a first variant with the two attachments connected by an intermediate *septum*, and a second with two single attachments placed side-by-side (STJERNQUIST 1967, p. 31). As far as is currently known, the variant of the two side-by-side single attachments occurs exclusively in the repertoire of the Slovenian *cistae*, as evidenced by the *cistae* from Novo Mesto, Tumulus 4, Grave 3 (JEREB 2016, tab. 98, no. 187) and Santa Lucia di Tolmino/ Most na Soči, Grave 1670 (JEREB 2016, tab. 101, no. 192).



Fig. 9 - Bronze situla from the Bolzicco brothers' courtyard grave (VISENTINI 2020, p. 40, fig. 4).
- La situla in bronzo della tomba del giardino dei fratelli Bolzicco (VISENTINI 2020, p. 40, fig. 4).

- Fig. 10 Manufacturing traces recognised on the outer surface of the bronze *situla* (photo: E. Faresin, D. Vicenzutto).
 - Tracce di lavorazione riconosciute nella parte esterna del fondo della situla (foto: E. Faresin, D. Vicenzutto).





Fig. 11 - The Rippenziste (drawing: S. Tinazzo). Scale: 1:1. - La cista cordonata (disegno: S. Tinazzo). Scala: 1:1.

The axes $^{(4)}$ (M.C.)

The axe no. 872, belonging as above mentioned to the Bolzicco brothers' grave, was categorised as a variant of the "Asce ad alette con occhiello laterale tipo Albiano" or of the "Asce ad alette con occhiello laterale tipo Ponso", both dated to the first half of the 6th century BCE (CARANCINI 1984, pp. 135-139, tab. 118, no. 3687). In fact, the specimen (Fig. 12) has a narrow blade like some exemplars of the "tipo Ponso" and a less slender haft like the "tipo Albiano", but no exact comparisons have yet been identified. For the rounded wings and blunted angles, it can generally recall the "tipo Albiano" axes from Vigo di Cavedine, Trento and Caldaro (Bolzano) (CARANCINI 1984, tab. 118, nos. 3678-3679).

Regarding the shape of the blade, the axe is actually more similar to some examples from Este and belonging to the "*tipo Ponso*", one from the Grave *Alfonsi* 13 and another one generically from Este or the Ponso area (CARANCINI 1984, tab. 118, nos. 3696-3697).

The axe no. 871, come from the area between the Buttrio cemetery and the *Bariglaria* road, was included in the category of "*ad alette con occhiello laterale tipo Este*" axes, for which an 8th century BCE date was proposed (CARANCINI 1984, pp. 132-133, tab. 116, no. 3657). The recent identification of the blade of the object (Figs. 13, 14) – not previously published – allowed to propose some additional observations. Due to its notably narrow and elongated proportions, it recalls the specimen from Frög, Tumulus I, which has likewise been categorised under "*Lappenbeile vom Typ Hallstatt, variante Klein-Klein*", a type attested over a very long period, between the late Urnfield and the later Hallstatt



Fig. 12 - Axe no. 872 (drawing: S. Tinazzo). Scale: 1:1. - L'ascia n. 872 (disegno: S. Tinazzo). Scala: 1:1.

phases (MAYER 1977, pp. 167-168, tab. 62, no. 841).

Finally, the axe no. 884, without a punctual provenance, was published among the "ad alette con occhiello laterale tipo Padova" axes, a type dated to the second half of the 6th century BCE (CARANCINI 1984, p. 138, tab. 118, no. 3692). However, for its particular decoration, characterised by close bundles of grooves on the wings, this specimen recalls more closely eastern specimens such as those of Pozzuolo del Friuli cemetery (VITRI 1983, tab. 49, 8; CORAZZA 2011, p. 264, fig. 4), Santa Lucia di Tolmino/Most na Soči, Grave 3299, in Western Slovenia (BOIARDI 1983, p. 185, 2, fig. 52), and finally Hallstatt, Grave 607 (MAYER 1977, tab. 62, no. 842) and Frög, Tumulus 10, in Austria (MAYER 1977, tab. 62, no. 844). In order to point out the chronology, it is important to underline that in Austria the axes characterised by the decoration under discussion - all included in the category of the "Lappenbeile vom Typ Hallstatt, variante Klein-Klein" - seem to belong to the most ancient context of the period (MAYER 1977, pp. 167-168).

The pins (V.B.)

The six pin fragments – all catalogued with no. 873 – can be attributed to two specimens. The first one – here designated as Spl_873_1 (Fig. 15a) – presents four

⁴⁾ The drawings of the axes nos. 871 and 872 were revised as part of this study, while the axe no. 884 is here re-examined through the drawings published in CARANCINI 1984, tab. 118, no. 3692, as this object is part of the exhibition of the Archaeological Museum.



- Fig. 13 Axe no. 871 with the blade found among the unnumbered materials (photo: E. Faresin, D. Vicenzutto).
 - L'ascia n. 871 con la lama rinvenuta tra gli oggetti non numerati (foto: E. Faresin, D. Vicenzutto).



Fig.14 - Axe no. 871 (drawing: S. Tinazzo). Scale: 1:1. - L'ascia n. 871 (disegno: S. Tinazzo). Scala: 1:1.

knobs with a median rib and a small disc placed below the knobs. The object could be attributed to the broad type "*a capocchia complessa tipo Este*" (CARANCINI 1975, pp. 296-303), which includes all pins with one to four knobs that have a rib/small disc at the beginning of the conical expansion of the dress fastener. For this pin, the best comparison – established on the basis of the number of knobs, their profile, and the presence of a flat disc – has been identified in the Grave *Randi* 34 at Este (CARANCINI 1975, p. 301, tab. 74, no. 2388), dated between the end of the 7th and the beginning of the 6th century BCE.

The second pin – Spl_873_2 (Fig. 15b) –, characterised by alternating and very close-set knobs and ribs, falls into the "*tipo Randi*" (CARANCINI 1975, pp. 304-306). In particular, based on the position and closeness of the knobs, it can be compared to a specimen again from the Randi cemetery at Este, Grave 12 (CARANCINI 1975, p. 304, tab. 75, no. 2427). This burial has been dated to the middle of the 6th century BCE, but the type is nonetheless attested over a very long period, between the middle of the 7th and the middle of the 6th century BCE.

The overall framework of the Bolzicco brothers' courtyard grave (V.B.)

Based on the typochronological analysis, the Bolzicco brothers' courtyard grave can be dated to a broad time span, between the middle of the 7th and the middle of the 6th century BCE. It presents a quite peculiar



- Fig.15 The pins: a) Spl_873_1; b) Spl_873_2 (drawing: S. Tinazzo). Scale: 1:1.
 - Gli spilloni: a) Spl_873_1; b) Spl_873_2 (disegno: S. Tinazzo). Scala: 1:1.

structure: a shallow pit-grave, lined on the bottom and walls with unworked stones, about 70 cm deep and 50 cm in diameter, narrowing towards the bottom to 30 cm; no covering/closure element of the pit is recorded. The use of lithic material in graves is attested in several cemeteries of the Friuli area, such as the nearby Pozzuolo del Friuli (Càssola Guida 1980; Vitri & Corazza 2022) or Misincinis (CORAZZA 2001; CORAZZA & VITRI 2001). However, in these contexts, the pits are covered by a stone slab and never lined inside with stone blocks. A comparison with the Slovenian cemeteries, as in the case of Santa Lucia di Tolmino/Most na Soči, indicates that, while the use of lithic material in graves is quite frequent, the use of rough stone blocks inside the pit is not common, and, if present, the blocks are always arranged in an irregular manner; as in the majority of cases, including the Friulian cemeteries, the graves present a stone slab covering the pit (MARCHESETTI 1893; SVOLJSAK & POGACNIK 2001). For the time being, the structure of the grave in discussion has no exact comparanda.

In terms of grave goods composition, the burial shows very important elements of singularity. It is characterised



Fig.16 - Fragments A (top left), B (top right), C (bottom left), D (bottom right) showing differential preservation of textile traces (images: M. Gleba).

- Frammenti A (in alto a sinistra), B (in alto a destra), C (in basso a sinistra), D (in basso a destra) che mostrano una conservazione differenziale delle tracce tessili (immagini: M. Gleba).

by a consistent number of bronze vessels and, as far as known for the period in exam, is the only attestation of a bronze *situla* used as an ossuary in the Friuli region. The *situla* of the coeval *dolia*-type burial found at the foot of the *Ciastiei* hillfort near Pozzuolo del Friuli is actually part of the grave goods (CASSOLA GUIDA 1980, p. 31).

Digital and archaeometric studies of mineralised textile fragments on the Buttrio *situla* (M.G., E.F.)

During the conservation of the situla, textile traces were identified on the interior of four bronze sheet fragments (fragments A, B, C, D as numbered during the conservation) (Fig. 16A-D). Textile traces were also found on the highly corroded iron *fibula* (Fig. 17). Textiles are generally rare finds in most archaeological contexts but can survive in mineralised form (CHEN et al. 1998). Mineralised textiles are formations in which metal (iron or copper) corrosion products form casts around fibres retaining their external morphology and size almost unaltered. Even when very small, such traces can provide important information about the raw materials and techniques of production (e.g. GLEBA 2017). As the Buttrio situla fragments preserve the only Iron Age textile remains from this region discovered to date, a suite of diverse methods was used to analyse them. The study required thorough macro and micro documentation of the textile remains in 2D and 3D. Structured light scanning technique and 3D models allowed a clearer view of the textile surface and visual information on the overall preservation of the object, reducing interference of texture and colour during technical analysis (FARESIN et al. forthcoming).



Fig. 17 - Textile traces on the highly corroded iron *fibula* (image: M. Gleba). *Trace di tessuto nella* fibula *in ferro molto corrosa (im-*

- Tracce di tessuto nella fibula in ferro molto corrosa (immagine: M. Gleba).



Fig. 18 - High-resolution 3D model of Fragment D (processing: E. Faresin).

- Modello 3D ad alta risoluzione del Frammento D (elaborazione: E. Faresin).

tem ngle	Tab. I - Structural characteristics of textiles (thread counts
lium	are in threads per cm; di- ameters measured in mm).
lium	- Caratteristiche struttura- li del tessuto (il numero di
lium	fili è espresso in fili per cm; i diametri sono misurati in
łium	mm).

Object	Weave	System 1 count	System 2 count	System 1 twist	System 2 twist	System 1 diameter	System 2 diameter	System 1 angle	System 2 angle
Fragment A (bronze)	2/2 twill	25	30	s, z	s, z	0.2-0.3	0.2-0.3	medium	medium
Fragment B (bronze)	2/2 twill	28	30	s, z	s, z	0.2-0.3	0.2-0.3	medium	medium
Fragment C (bronze)	2/2 twill	28	30	s, z	s, z	0.2-0.3	0.2-0.3	medium	medium
Fragment D (bronze)	2/2 twill	26	26	12s, 12z	12s, 12z	0.2-0.3	0.2-0.3	medium	medium
Fragment 7 (iron)	2/2 twill	28	30	s, z	s, z	0.2-0.3	0.2-0.3	medium	medium
							% rol	Skon	mass

Sample	No fibres	Median	Mode	Mean	StD	Range	% rel. variab. **	Skewness of distrib. *** 2 angle
D	126	19.1	19	21.7	10.12	9-39, 52. 63, 66, 80*	0.47	0.77

Tab. II - Wool fibre quality data.

* Diameter outside the main range listed separately, ** % relative variability = standard deviation/mean, *** Pearson's coefficient of skewness = 3x(mean-median)/standard deviation.

- Dati qualitativi sulla fibra di lana.

* Il diametro al di fuori della gamma principale è elencato separatamente ** % variabilità relativa = deviazione standard/ mediana *** Coefficiente di Pearson = 3x(media-mediana)/deviazione standard.



Fig. 19 - SEM micrograph of positive fibre casts of finer fibres

and one coarse fibre in Fragment D (image: M. Gleba).
Micrografia SEM di calchi positivi di fibre più fini e di una fibra grossolana nel Frammento D (immagine: M. Gleba).

The acquisition of textile traces was conducted using the structured light scanner Aurum 3D (Open Technologies, now Faro rebranded), with an accuracy of 40 μ m and a camera resolution of 2 x 1.3 MP. The samples were acquired through the implementation of partially overlapping range scans and to ensure optimal overlapping, an automatic turntable connected to the

scanner and the acquisition software was employed. Each scan was rotated by 32° and 11 scans were taken to complete the 360° rotation angle. The data collected by the scans is represented by X, Y, Z coordinate triplets for each point analysed. The acquired data was processed using Optical RevEng 2.4 to create a single, complete, non-redundant and optimal 3D model. The data processing was conducted following the standard steps of the 3D scanning post-processing pipeline. The initial stage involved aligning the range maps in a common coordinate system and this was essential to ensure that all scans were accurately positioned within the overlapping area. The pairwise ICP alignment algorithm was then employed, followed by a global registration. The range map merger (or fusion) was employed to construct a single, non-redundant triangulated mesh, with the objective of ensuring the highest possible standards of precision. A tolerance of 0.0050 mm was set for the meshing parameters, with particular attention on the definition and characterisation of the mineralised textile traces. The mesh was edited to improve the quality of the computed mesh (Fig. 18). This step requires the correction of topological mistakes, such as cross-section triangles and anomalous vertices.

Digital microscopy using a DinoLite AM7115MZT in combination with structured light scanning allowed the determination of weave type and thread structure. Despite variable preservation, based on structural



Fig. 20 - Histogram showing fibre diameter distribution (processing: M. Gleba). - Istogramma che mostra la distribuzione del diametro delle fibre (elaborazione: M. Gleba).



- Fig. 21 SEM micrograph of organic matter adhering to bone (image: M. Gleba).
 - Micrografia SEM della materia organica aderente all'osso (immagine: M. Gleba).

characteristics and overall appearance, all analysed fragments appear to have traces of the same or at least very similar fabric. The fabric preserved on all four situla fragments and on the iron *fibula* is a 2/2 twill. In a twill, the horizontal weft threads pass over and under vertical warps in a regular staggered pattern (in the case of a 2/2 twill every two threads in each system), each row being stepped to one side of the row above, creating a diagonal effect. The quality of the weave is very high, with one system (possibly the warp, as it is slightly less dense) having 25-28 threads/cm and the other (possibly the weft) 26-30 threads/cm. The textile is woven in a single spun yarn and is spin- or shadow-patterned, that is woven with alternating groups of z- (or clockwise) twisted and s- (or counterclockwise) twisted yarn alternating in both systems. In fragment D, which has the best-preserved traces, groups of at least 12 threads of the same twist appear to alternate in both systems. The technical data are summarised in table I.

The raw material was identified using a Coxem EM-30AX Plus Scanning Electron Microscope, which permits the acquisition of a detailed sample surface image that allows the observation and identification of morphological characteristics of mineralised fibre samples. Fibre casts in the remains of Buttrio are mostly preserved as positive casts (Fig. 19). The raw material is of animal origin, likely sheep wool, as indicated by the overall cylindrical shape of the fibres, presence of coarse hairs and fibre quality analysis (see below). The cuticular scales are visible in places but are mostly obscured by the conservation layer.

The relatively good preservation of the fibre casts on Fragment D permitted wool quality analysis to be carried out. Analyses of wool fibre quality are used to determine the fleece type of prehistoric sheep, enabling comparisons with fleeces from modern sheep, particularly the so-called primitive or "unimproved" sheep breeds, and leading to conclusions about ancient breeds (overview in SKALS et al. 2018). A fleece consists of the outer coat containing coarse kemp (over 100 μ m in diameter) and hair (over 60 μ m in diameter), and the much finer underwool. The assessment of fibre quality is based on a technique used in the modern textile industry and consists of the diameter measurement of 100 fibres per thread or staple, and statistical analyses resulting in a distribution histogram. The analysis of the Buttrio remains reflects the entire textile since it was not possible to investigate the warp and weft separately. The results are summarised in table II and the histogram is presented in figure 20.

The wool appears to be of medium quality, with a mean diameter of 19 μ m, an uninterrupted range of 9-39 μ m as well as some coarse outliers of 52, 63, 66 and 80 μ m, which are visible in micrographs. The coarse fibres were likely pigmented as suggested by their still brownish colour when observed under the microscope. The Buttrio wool is comparable in quality to the Iron Age wools from Northern and Central Italy (GLEBA 2012).

The presence of bone fragments still adhering to the mineralised surface (Fig. 21) indicates that the cremated remains were in direct contact with the textile. This suggests that the cloth was used to wrap the cremated bones before being deposited inside the bronze sheet *situla*. The presence of textile remains on the iron *fibula* could indicate that the brooch could have been used to fasten the textile containing the bones, or was in any case in direct contact with the cloth.

Conclusions (V.B., M.G., M.C.)

The funerary evidence from Buttrio analysed and discussed here clearly indicate that, between the middle of the 7th and the middle of the 6th century BCE, this centre assumed a key role in the settlement system of the Eastern Friuli region, thanks in particular to the control of the Torre River axis, which was one of the most important features of connection between the pre-Alpine area, the lower plain, and the Adriatic Sea⁽⁵⁾.

The characteristics of the funerary evidence and, in particular, the Bolzicco brothers' courtyard grave assemblage, indicate indeed that the political apex of the Buttrio centre was a powerful *élite* that manifested its eminent position through the use of the same codes of self-representation of the leading class that can be observed not only in another central place of the Friuli area, *i.e.* Pozzuolo del Friuli, but also in the Eastern Hallstatt Circle.

⁵⁾ For a recent, general overview on settlement dynamics of the Bronze and Iron Ages in Friuli, see Borgna et al. 2018.

The power of the *élites* who controlled Buttrio is moreover confirmed by the textiles preserved inside the *situla*: the fabric remains likely belong to a textile used to wrap the cremated remains that were deposited inside the *situla*. The use of a wool twill for wrapping is unusual, as in most cases a linen tabby is used in the ritual that was prevalent during the Iron Age across Europe (RUTA SERAFINI & GLEBA 2018). The textile traces examined are made of wool, woven in a 2/2 spinpatterned twill using a single yarn with a variable twist. While we cannot reconstruct the original colour of these textiles due to their mineralised state of preservation, it is clear that the fabrics had a spin- or shadow-pattern of checks or rectangles. Spin-patterned twills are typical of the Italian-Central European textile culture during the Iron Age (GLEBA 2017). Twills woven in a single yarn are characteristic of Italy and the Eastern Hallstatt milieu, including Slovenia and Croatia. The quality of the fabric is extremely high, demonstrating some of the highest thread counts recorded in Europe during the Iron Age, possibly reflecting the high status of the individual they were found in association with. Twills of comparably high quality have recently been found in high-status tumuli of the 8th-7th century BCE in Kaptol and Kagovac in North-East Croatia (unpublished).

The overview presented here demonstrates how a detailed re-analysis of legacy material, with an application of both standard and archaeometric methods, may result in important clarifications and even additions to the data about areas and periods that are poorly represented in the archaeological record. We hope that the data presented here will serve as a useful starting point for the future archaeological investigation in the Buttrio area.

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- Margarita Gleba
- Michele Сиріто̀
- Emanuela Faresin
- Università degli Studi di Padova, Dipartimento dei Beni Culturali: archeologia, storia dell'arte, del cinema e della musica

Piazza Capitaniato 7, I - 35139 PADOVA

- e-mail: vanessa.baratella@unipd.it
- e-mail: margarita.gleba@unipd.it
- e-mail: michele.cupito@unipd.it

e-mail: emanuela.faresin@unipd.it

Author's address - Indirizzo dell'autore

⁻ Vanessa Baratella