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Beyond Technology: Pottery Reveals Translocal Social Relations at a Bell Beaker Monumental Site in Central Europe

ADAM GAŠPAR[1], JAN PETŘÍK[2], PAVEL FOJTÍK[3], ANNA TSOUPRA[4], BASIRA MIR-MAKHAMAD[5], ANA CARDOSO[4], MASSIMO BELTRAME[4], JOSÉ MIRÃO[4], NICK SCHIAVON[4] AND JAN KOLÁŘ[6]

[1]*Department of Archaeology and Museology, Masaryk University, Brno, Czech Republic*
[2]*Department of Geological Science, Masaryk University, Brno, Czech Republic*
[3]*Department of Archaeology, Charles University, Prague, Czech Republic*
[4]*HERCULES Laboratory, University of Évora, Évora, Portugal*
[5]*Max Planck Institute for the Science of Human History, Jena, Germany*
[6]*Institute of Archaeology, University College London, London, United Kingdom*

The Bell Beaker site near Brodek u Prostějova (Czechia) has yielded remains of a large timber construction accompanied by four symmetrical ritual deposits with numerous artefacts, including more than fifty ceramic vessels. Their decoration consists of incised patterns, in nineteen cases with preserved white inlaid incrustations. To investigate the social relations at this extraordinary site, a multi-analytical and micro-destructive approach was employed to determine the provenance and technology of the pottery and the composition of the white incrustations. The results indicate various origins for the pottery within the region and the presence of extra-regional fabrics and graphitic temper. The main raw materials for the white inlays were calcium carbonate (calcite), hydroxyapatite (bone), and bright clay. The mixing of decorative motifs and the variation in the shape and size of the beakers suggest unique manufacturing processes. These results lend support to the monumental site of Brodek serving as a ritual place for several communities from both local and wider areas.

Keywords: Bell Beakers, ritual deposits, ceramic, provenance, translocality, Czechia

INTRODUCTION

A rescue excavation in Brodek u Prostějova revealed a large timber structure in a possible circular ditch enclosure. The site is dated to the Bell Beaker period (*c.* 2500–2200 BC) by analogies and 14C dates from Moravia as well (Grömer et al., 2017). Four rectangular grave-like pits, considered to be ritual deposits, were arranged next to each other in front of two rows of nine massive postholes; the rows were oriented east–west and approximately twenty metres long. The eastern part of the monumental structure contains two more postholes between the rows, and at its south lie an irregular pit and a smaller wooden structure (Figure 1). The remains of large wooden

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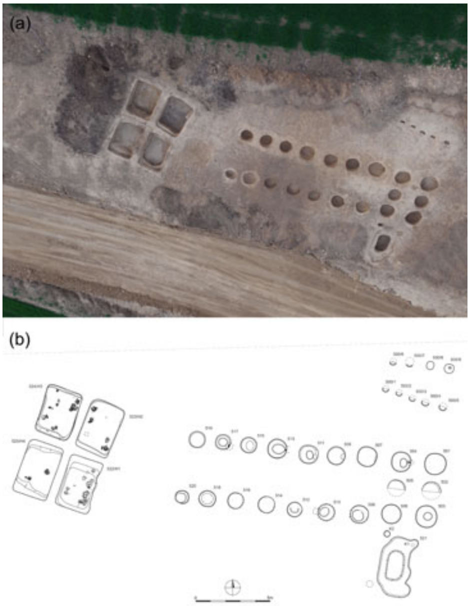

Figure 1. *a) Aerial photograph of the excavated site; b) plan.*

pillars were visible in sections (Fojtík, 2015, 2016: fig. 3). The absence of human remains in the pits led to them being initially identified as cenotaphs (Grömer et al., 2017). Characteristic and exclusive Beaker finds were encountered within the pits: bowls, jugs, an amphora, wrist-guards, arrowheads, a set of stones identified as metalworking tools, pure gold and silver artefacts, jade, amber, a bone-shaped pendant, bone beads, animal bones, and flint flakes.

Bell Beakers are a pan-European phenomenon, spread across Europe, dated to the end of the Neolithic and the beginning of the Early Bronze Age (*c.* 2500–2000 BC; Bilger, 2019). Characteristic finds are bell-shaped ceramic beakers, generally featuring a red surface and incised ornamentation that often contains the remains of a white inlay (Olalde et al., 2018: SI 1). Such beakers were most probably related to activities involving collective feasting or drinking (Rojo et al., 2006). The transport of artefacts, including pottery, could surely cover long distances (Heitz & Stapfer, 2017), whereas archaeometric analyses of Beaker pottery suggest local production practices and short-distance exchange (Rehman et al., 1992; Wilkin & Vander Linden, 2015; Dias et al., 2017). The Beaker ceramics within the Beaker sphere across Europe include vessels that are highly similar (beakers) but also vessels rooted in local traditions (e.g. bowls, jugs) (Besse, 2003; Strahm, 2004; Kleijne, 2019).

Czechia has one of the greatest numbers of excavated Beaker sites in Europe (Turek et al., 2003; Matějíčková & Dvořák 2012 Bilger, 2019; Kleijne, 2019), with a main cluster in the southern part of the Upper Morava valley, where the Brodek site (49° 22′36.65″N, 17°5′49.28″E) is located (Figure 2). Previous studies have demonstrated the existence of local traditions in the use of raw materials and the production of artefact categories such as white encrusted pottery (Všianský et al., 2014), lithic tools (Kolář, 2018), projectile points (Petřík et al., 2016b), and bracelets (Nicolas, 2020). However, the final execution or shapes of these artefacts show similarities between sites and regions. A network analysis conducted by Kleijne (2019) revealed strong similarities among the pottery from settlements in Czechia. These and other studies of the third millennium BC in Europe (e.g. Wilkin & Vander Linden, 2015; Holmqvist et al., 2018) suggest translocal communities with a large number of individuals moving between them (Furholt, 2017; Kolář, 2020).

The pottery deposits discovered at the monumental site of Brodek u Prostějova offer a unique opportunity to explore the relationship between local traditions and supra-regional interactions within the framework offered by the concept of translocality. Within this study, the following objectives were set: (i) to investigate the provenance of the pottery and the composition of the white incrustations; (ii) to

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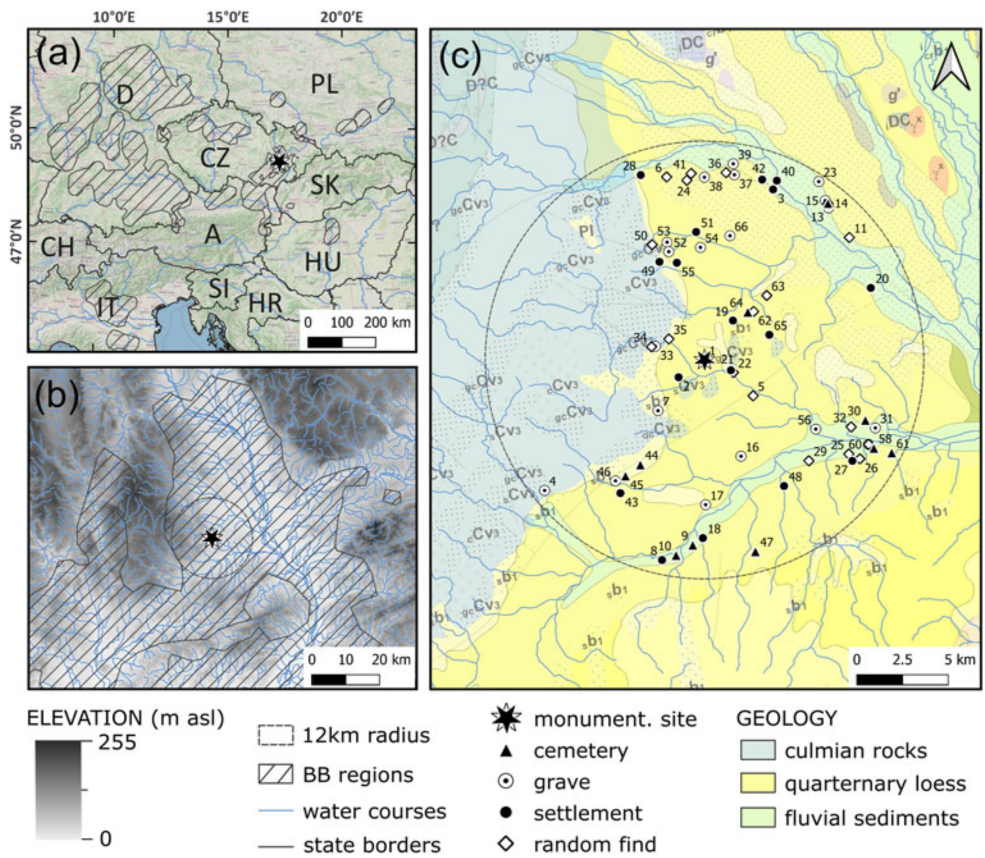

Figure 2. *a) Location of the monumental site at Brodek u Prostějova within central Europe and distribution of Bell Beakers (hatched); b) location of the site in Moravia (Digital Elevation Model); c) geological setting (DC: Devonian limestones; g': Orthogneiss; γ^{x}: Biotitic granites to granodiorites; D?C: Devonian-Carboniferous schists, calcareous sandstones, limestones; $_{c}Cv3$ $_{s}Cv3$ $_{gc}Cv3$: Carboniferous clastic sedimentary rocks: clayey schists, siltstones, greywackes, conglomerate; PI: Pleistocene deluvio-eolic sediment; $_{s}b1$ $_{cr}b1$: loess and loess soil). Map based on Czech Geological Survey, 2021 and Beaker sites mapped within a 12-km radius around the monumental site (see Supplementary Table S1).*

explore the depositional semantics and the patterns exhibited by the ceramics in the ritual features; and (iii) to study evidence of the circulation of ceramics and other artefacts to infer translocal social relationships.

Materials and Methods

During the excavation, small sample sherds were taken from most vessels for further analysis or material was later carefully sampled from the restored vessels (Figure 3). The ceramic assemblage consisted mainly of typical bell-shaped vessels: forty beakers, four bowls, two jugs, three fragments of unspecified vessels, and an amphora wrapped in textile (Grömer et al., 2017: fig. 4). Incrustations were preserved and sampled from nineteen vessels (see Supplementary Table S2).

Provenance analysis was based on commonly used petrographic analysis outlined by Quinn (2013) and supplemented by chemical bulk analysis performed by energy dispersive fluorescence spectrometry (ED-

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Figure 3. *a) Restored vessels from the ritual deposits (the numbers correspond to those in the Supplementary Table S2); b–d) details of the ceramic surface with the remains of red slip and decoration filled by incrustation (b: sample 13, c: sample 20, d: sample 37).*

XRF). For incrustation analysis by micro Fourier transform infrared spectroscopy (μFTIR) and micro X-ray diffraction (μXRD), a small portion of white material was removed under a low-magnification microscope. Scanning electron microscopy-electron dispersive spectroscopy (SEM-EDS) analysis was conducted on thin-sections of samples with preserved incrustation. Decorative motifs were recorded with the help of a formalized descriptive system (Supplementary Figure S1) for larger beaker sherds as well. The data were collected into an absence/presence matrix. For metric analysis, data was noted from the restored beakers. The data were statistically evaluated in R studio software (R Core Team, 2021) as well as in the case of petrographic results and XRF analysis. Details of all the procedures followed, as well as sources and used R libraries and literature, can be found in the Supplementary Material (Gašpar & Petřík, 2022).

Results

Ceramic petrography and chemical composition

To address the provenance of the ceramics, we evaluated the semiquantitative abundance of the inclusions and the granulometric results, as well as the attributes of the fabric's microstructure and groundmass (for values and descriptions of each sample, see Supplementary Tables S3 and S4). We distinguished two main groups, further subdivided into seven fabric groups (Figures 4 and 5; Supplementary Figure S2). Fabric group A, consisting of twelve samples (Fabric A1, A2, and A3),

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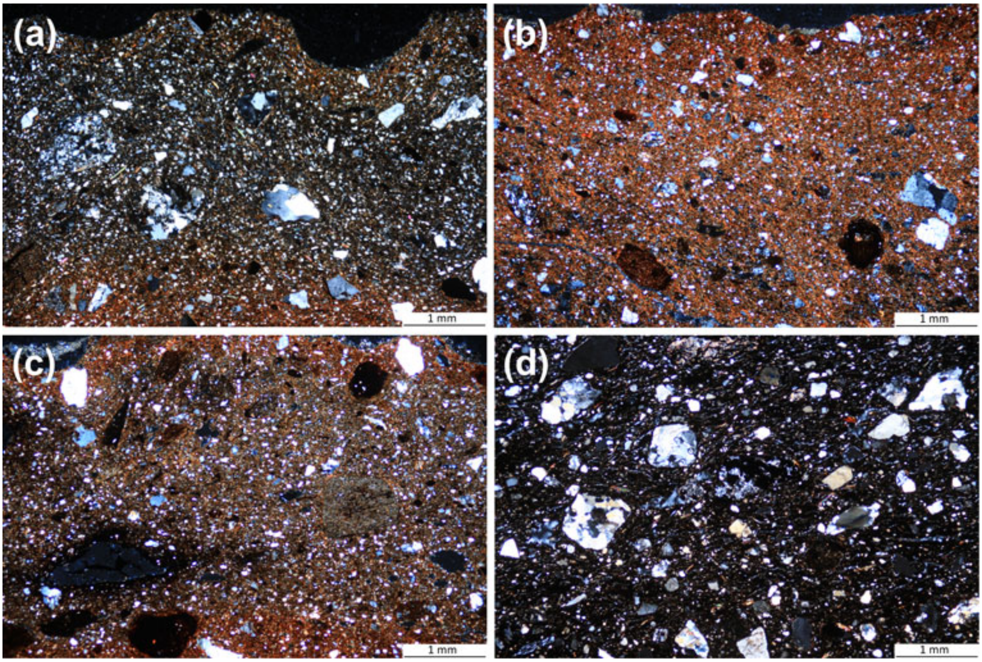

Figure 4. *Fabric group A (thin-sections in cross-polarized light). a) Fabric A1 (sample 27); F) fabric A1 (sample 33); c) Fabric A2 (sample 11); d) Fabric A3 (sample 28).*

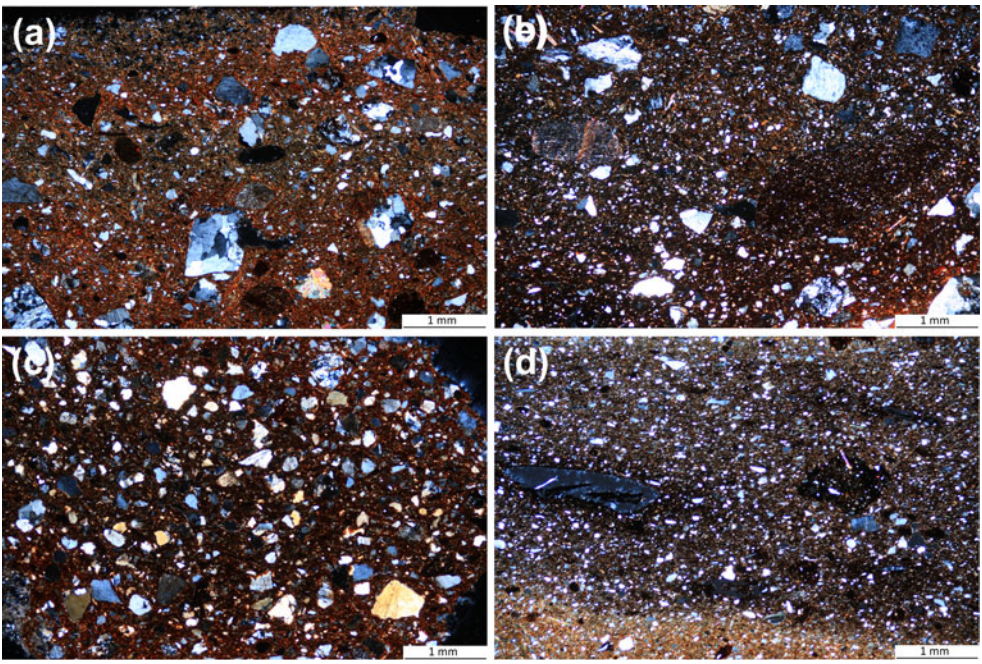

Figure 5. *Fabric group B (thin-sections in cross-polarized light). a) Fabric B1 (sample 8); b) Fabric B2 (sample 21); c) Fabric B3 (sample 47); d) Fabric B4 (sample 44).*

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is mainly characterized by frequent to abundant sedimentary rocks identified mostly as Culmian slates, siltstones, and greywackes (Figure 4). Fabric group B, consisting of five samples (Fabric B1, B2, B3, B4), is composed of other fabrics and outliers with rare sedimentary rocks (possibly Culmian) (see Table 1).

The chemical composition of each sample (Supplementary Table S5) allows us to apply a classification tree to establish which chemical elements distinguish the fabrics and to draw comparisons between observed and predicted fabrics (Figure 6). Strontium and rubidium are the most important elements for the classification (Figure 6b) and reflect the relation between the defined fabric groups and samples not examined petrographically. Given that the total number of available thin-sections (seventeen) is limited by the amount of material available for destruction, we extrapolated the chemical classification of fabrics obtained by ED-XRF (Figure 6; Supplementary Table S5). The concentration of Sr (81 ppm) separates petrographic group A from petrographic group B. Fabric group A contained less than 81 ppm of Sr, whereas the content of Sr in Fabric group B was noticeably higher (Figure 6). In total, thirty-eight samples (76 per cent) were classified as Fabric group A and twelve samples (24 per cent) as Fabric group B.

White Inlay Incrustations

Micro Fourier transform infrared spectroscopy (μFTIR)

Three main materials were identified: animal bone (hydroxyapatite), calcium carbonate (calcite), and clay (aluminosilicates) (Supplementary Figure S3). White pigment, containing primary hydroxyapatite, was clearly identified in five samples (1, 8, 20, 30, and 34); calcium carbonate was identified in five samples (13, 22, 41, 47, and 49); clay with quartz and hydrated aluminosilicates was identified in five samples (14, 32, 33, 37, and 45). Four other samples (11, 17, 18, and 21) exhibited FTIR spectra that diverged from those of the groups described and represent mixtures of white materials (Table 2; Supplementary Figure S3).

Micro X-ray diffraction (μXRD)

The mineral phases identified are presented in Table 2. The μXRD results are in accordance with the FTIR results and reveal the mineralogical composition of the materials studied (Supplementary Figure S4). In the clay samples, mainly quartz, mica, and feldspar were represented. In calcite-clay mixtures, besides other minerals such as quartz, muscovite/illite, and feldspar, calcite was identified only as a minor phase. In calcium carbonate incrustations, the peaks of calcite were highly significant, while it was also possible to distinguish smaller amounts of other minerals such as quartz and feldspar. For hydroxyapatite incrustations, it was mainly this material, i.e. bone, that was found.

Scanning electron microscopy-electron dispersive spectroscopy (SEM-EDS)

In two samples (11 and 17), clay was detected over the white inlay (Figure 7a and 7b). The clay used for incrustation (Figure 7c) had an aluminosilicate composition with a greater presence of potassium (Supplementary Table S6). Analysis of the sample where calcium carbonate and hydroxyapatite had already been detected by μFTIR (Supplementary Figure S3) revealed that the white material was mostly composed of calcium carbonate and that

Table 1. Fabric characteristics.

Fabric	Fabric A1	Fabric A2	Fabric A3	Fabric B1	Fabric B2	Fabric B3	Fabric B4
Samples	3, 7, 11, 17, 20, 22, 30, 33, 36	27, 32	28	8, 47	6, 21	47	44
Rocks	Sedimentary rock (common to abundant), chert (few and traces), and metamorphic rock (few) like gneiss, metaquartzite, and traces of phyllite	Similar to A1	Similar to A1 with the presence of graphite-bearing rocks and few metamorphic rocks (e.g. sillimanite gneiss)	Metamorphic rock, igneous rock, clastic sedimentary rock, micritic limestone associated with chert (few)	Clastic sedimentary rock (rare), and metamorphic rock (common) such as gneiss and phyllite	Igneous rock (few), clastic sedimentary rock (few), and metamorphic rock (traces)	Igneous rock – probably amphibolic diorite (rare) and sedimentary rock (few)
Minerals	Quartz (abundant), plagioclase (few), alkali feldspar (few), muscovite (traces to common), biotite (few to common), iron oxide/hydroxide (rare to few), amphibole (few in one case), glauconite (traces)	Similar to A1	Similar to A1	Quartz (dominant), plagioclase (traces) and alkali feldspar (rare or few), muscovite (common or few) and biotite (common or rare), iron oxide/hydroxide (rare or few), glauconite (few or traces)	Quartz (dominant), alkali feldspar (few), mica (common to abundant), and glauconite (few)	Quartz (dominant), plagioclase (common) and alkali feldspar (common), muscovite (few) and biotite (rare), iron oxide/hydroxide (few), glauconite (traces)	Quartz (dominant), plagioclase (common), alkali feldspar (common), amphibole (abundant), muscovite and biotite (both rare)
Inclusions %	~35–45%	~45%	~45%	~45–55%	~40%	~55%	~40%
Size of grains	Very fine to fine sand	Very fine sand with a presence of very fine gravel	Fine sand	Fine sand	Very fine sand	Very fine sand	Very fine sand
Roundness	Subangular to subrounded	Subangular to subrounded	Subangular to subrounded	Subrounded to subangular	Subangular	Subangular to subrounded	Subangular to subrounded
Spacing	Single-spaced or double-spaced	Single-spaced	Close-spaced to single-spaced	Close-spaced	Close-spaced	Close-spaced	Single-spaced
Groundmass %	~50–55%	~50%	~40%	~40–50%	~50%	~40%	~50%
Groundmass colour	Red to yellowish red (2.5 5YR4/6 8)	Yellowish red (5YR4/6)	Yellowish red (5YR4/6)	Dark red (2.5YR4/6) and yellowish red (5YR4/6)	Yellowish red (2.5YR4/6)	Yellowish red (2.5YR4/6)	Strong brown (7.5YR5/6)

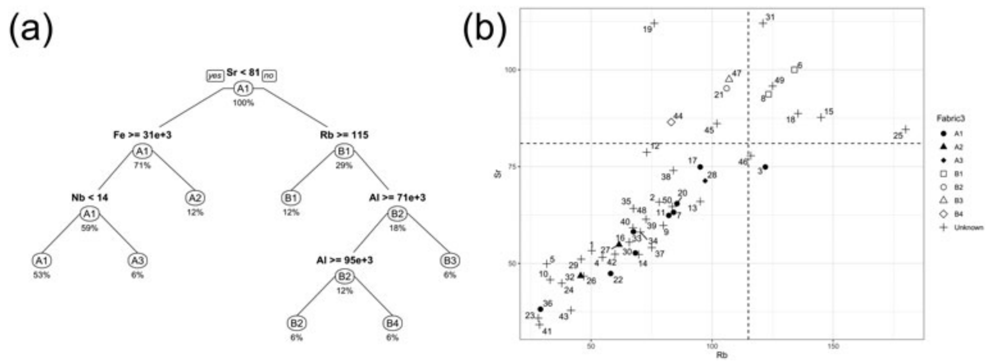

Figure 6. *a) Classification tree of fabrics according to their chemical composition; b) Sr–Rb (ppm) scatter plot; the dashed separating lines are based on the classification tree.*

bone was present in the form of sporadic small particles (Figure 7d). The BSE (backscattered electrons) imaging revealed that the hydroxyapatite incrustation contained primarily larger particles of crushed bone, whereas the calcium carbonate incrustation was a more compact, finely crushed and cemented material. The clay incrustation was a dusty material with various rock and mineral particles in a range of sizes. Grains were in all cases mostly subangular (Figure 7).

Metrics and Decoration Analysis

The metric data and their principal component analysis (PCA) revealed two groups of beakers defined mainly by their size (smaller and larger). The rim diameter of the beakers was, in most cases, smaller than their maximum body diameter. Their width and height were similar, but a few were taller and thinner than the rest. The results of the covariance (CV) analysis (PCA1: 83.6 per cent, PCA2: 60.8 per cent, PCA3: 80.1 per cent, PCA4: 50 per cent, PCA1–PCA4: 46.1 per cent), however, indicate greater variation among beakers and supposes individual differentiation in their manufacture. Both smaller (diameter: *c.* 130 mm, height: 120 mm) and larger beakers (diameter: *c.* 175 mm, height: 160 mm) were placed in all the ritual deposits. The metric analysis does not reveal any clear patterning among the ritual deposits and fabrics (Supplementary Material: Beakers).

The analysis of the decorative motifs identified the first three dimensions of the correspondence analysis (CA) as being significant, and the scree plot estimated four clusters. Based on observations of plots with the CA dimensions and the result of the cluster analysis (Supplementary Material: Beakers), the following motif variations were significant: (a) series of diamonds; (b) motif of triangles; (c) series of zig-zag stripes; and (d) embedded hourglasses or small triangles (Supplementary Figure S1). Decoration cluster 2 mainly related to positive values and decoration cluster 3 to negative values in Dimension 2 of the PCA metric, suggesting two different patterns in variously shaped beakers; however, some decorative motifs were present in all clusters (Supplementary Material: Beakers).

In terms of the relation of the decorative motifs to the Fabric groups A and B, vertical dots, triple horizontal lines, and vertical zig-zag lines are connected only with the local or regional Fabric group A. Other decorative motifs (e.g. series of squares) are

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Table 2. *Results of the analyses of the white material and incrustation group.*

Sample no.	Feature	µFTIR	µXRD	SEM-EDS	Final result
1	1	Hydroxyapatite/ivory black	Hydroxyapatite		Bone
8	1	Hydroxyapatite/ivory black			Bone
11	1	Hydroxyapatite/ivory black, alumino-silicate with OH region, quartz, PVA	Quartz, mica	Bone, clay	Bone, clay
20	2	Hydroxyapatite/ivory black	Hydroxyapatite, quartz		Bone
30	3	Hydroxyapatite/ivory black			Bone
34	3	Hydroxyapatite/ivory black, inorganic compound	Hydroxyapatite, quartz, feldspar		Bone
13	1	Calcite, aluminosilicate, inorganic compound	Calcium carbonate		Calcite
22	2	Calcite, aluminosilicate, inorganic compound	Calcium carbonate, quartz, feldspar, hematite		Calcite
41	4	Calcite, aluminosilicate, quartz (traces), PVA	Calcium carbonate, quartz		Calcite
47	4	Calcite, aluminosilicate, quartz	Calcium carbonate, quartz		Calcite
49	?	Calcite, aluminosilicate, quartz (traces)	Calcium carbonate, quartz		Calcite
21	2	Calcite, hydroxyapatite/ivory black, aluminosilicate, quartz	Calcium carbonate, quartz	Calcite, bone	Calcite/ bone
17	1	Aluminosilicate, quartz (traces)	Quartz	Calcite/ clay	Calcite/ clay
18	2	Aluminosilicate, calcite (traces)	Calcium carbonate, quartz, mica, feldspar		Calcite/ clay
14	1	Aluminosilicate with the high peak in OH region, quartz	Quartz		Clay
32	3	Aluminosilicate with the high peak in OH region, quartz	Quartz, mica, feldspar	Clay	Clay
33	3	Aluminosilicate with the high peak in OH region, quartz	Quartz, mica, feldspar, clinochlore		Clay
37	3	Aluminosilicate with the high peak in OH region, quartz	Quartz, mica, feldspar		Clay
45	4	Aluminosilicate with the high peak in OH region, quartz			Clay

more frequently associated with the extra-regional Fabric group B, although none of the motifs are exclusive to the non-local fabric. Variations in the use of motifs, and their partial mixing on the beakers, are exemplified by sample 45: it belongs to an extra-regional fabric and features elements of a supra-regional decorative grammar but also a couple of local decorative patterns (Supplementary Material: Beakers).

Discussion

The assemblage of ceramic vessels from the remarkable Bell Beaker monumental site of Brodek u Prostějova allows us to explore how communities of the second half of the third millennium BC built and used this structure. The depositional practices observed seem to be widespread in Europe, ranging from Spain to Poland (e.g. von Lettow-Vorbeck et al., 2014;

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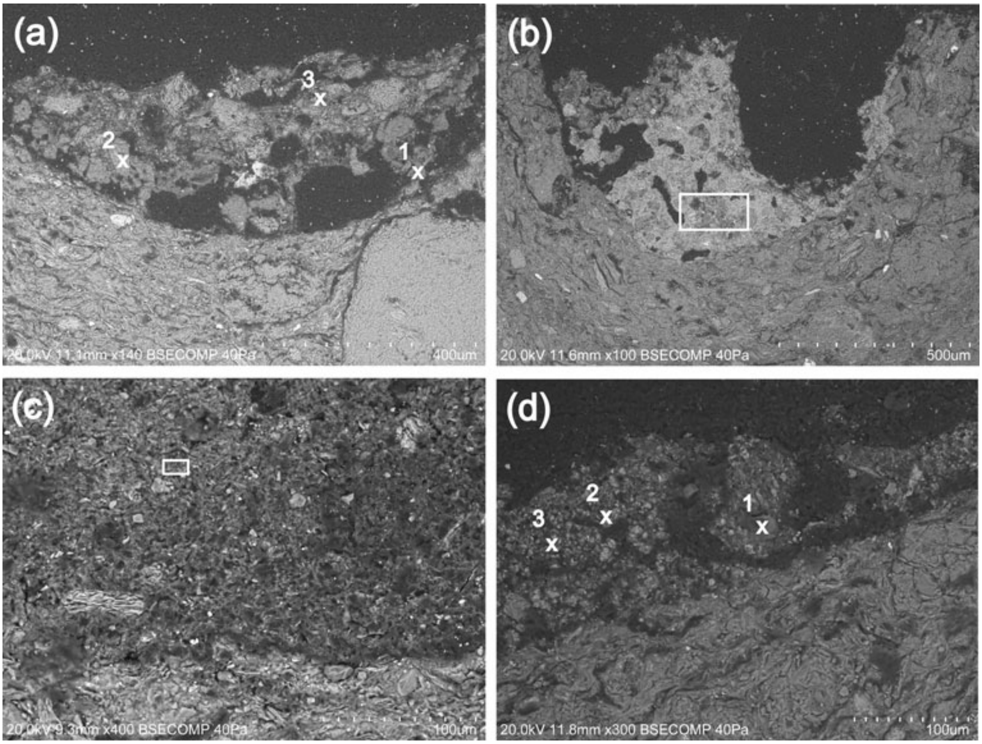

Figure 7. *SEM-EDS analysis of thin-sections: a) bone incrustations (1, 2), clay (3) (sample 11, Fabric A1); b) calcium carbonate incrustation (sample 17, Fabric A1); c) detail of incrustation made of clay (sample 21, Fabric B2); d) detail of bone (1) and calcium carbonate incrustations (2, 3) (sample 32, Fabric A2) (see Supplementary Table S6).*

Wawrusiewicz et al., 2015; Manasterski et al., 2021). That said, Beaker communities referred to universal ideas, but they modified their material culture and behaviour according to local traditions and preferences (e.g. Vander Linden, 2004; Lemercier, 2018). Here, we turn to what role the monument at Brodek may have played at different spatial scales.

Ceramic provenance and materials of white incrustations

To investigate where the ceramic vessels were manufactured, we must consider the composition of the raw materials available in the regional geology. The Drahanská upland near Brodek consists of carboniferous Culmian rocks (Růžička, 1995). Fabrics of Fabric group A are composed of these rocks, common in clays available in the nearby valley as well as from an area of the nearby upland. The distribution of Culmian rocks (Figure 1c) suggests that Fabric group A includes fabrics produced locally or in the nearby region (up to 15–30 km west, north-west and south-west). A special case is Fabric A3, which is composed of local and/or regional clay with Culmian rocks and added graphitic temper. Graphitic rock is connected to Devonian metasedimentary rocks in the eastern part of Czechia and does not occur any closer to Brodek than Velké Tresné (about 60 km to the north-west) and Velké Vrbno (about 90 km north) (Harazim, 1976). It follows that

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this raw material was brought in but, while the graphitic temper is exogenous, the fabric is made of a clay containing regional Culmian rocks.

In the case of Fabric group B, sparse clastic sedimentary rocks and/or other rocks indicate the regional and/or extra-regional provenance of fabrics produced at distances over 15–55 km (see Salanova et al., 2016). Fabric B1 containing limestone must come at least from another valley because the nearest small outcrop of Devonian limestone lies about seventeen kilometres north in another water catchment zone (Figure 1c, ¡DC). Fabric B2 contains metamorphic rocks derived from the Silesicum (Jeseníky Mountains) and deposited on the floodplain of the river Morava, which flows to the south at least fifteen kilometres from the site. Fabric B3 is surely non-local, but its origin could not be ascertained. Fabric B4 contains amphibolic diorites that indicate an origin from the Brno Batholith area, about fifty-five kilometres to the south-west of Brodek (Petřík et al., 2016a).

About a quarter of the deposited vessels were recognized as belonging to the non-local Fabric group B produced by more distant communities, as indicated by the petrography and chemical classification. Moreover, the local or regional provenance of the other three-quarters of the assemblage could be overestimated because clays with Culmian rocks are available in the vast area of the nearby Drahanská vrchovina upland and the Nízký Jeseník Mountains (Chlupáč et al., 2009). Regardless of uncertainties, there seems to be a notable presence of vessels originating from regions further away, particularly from the adjacent river catchment zones and from the Brno Batholith area. Furthermore, as we have seen, graphite was brought in to temper some local and/or regional pottery (Fabric A3). Such a quantity of non-local pottery is remarkable compared to other assemblages from Beaker or even Early Bronze Age sites in central Europe (e.g. Rehman et al., 1992; Gherdán et al., 2002; Kreiter et al., 2007; Earle et al., 2011; Petřík et al., 2016a) and elsewhere in western Europe (Jorge, 2009; Salanova et al., 2016; Dias et al., 2017).

Allochthonous pottery is usually rare in domestic settlement contexts and such scarcity does not lend support to the idea of intensive transcultural interactions, as noted by Sarauw (2007). The only exceptions are sites in Switzerland (Convertini, 2001, 2005), which some scholars have interpreted as partly seasonal (Salanova & Ducreux, 2005). On the other hand, the long-distance circulation of beakers is known from megalithic graves in Brittany (Querré & Salanova, 1995; Salanova et al., 2016) and in a rare instance at the metallurgical centre of Puente de Santa Bárbara in south-eastern Spain (Dorado Alejos et al., 2021).

Great variability has also been identified among the white incrustations on the Brodek vessels. Materials such as bone (n = 5), calcium carbonate (n = 5), bright clay (n = 5), and mixtures of these materials (n = 4) were used (Table 2). The study of white incrustations in Beaker pottery found in the Morava river catchment in Czechia revealed that the prehistoric makers of such pottery were flexible in how they obtained and prepared fine white pigment, reflecting distinct recipes (Všianský et al., 2014). The preparation of white pigments consisted of crushing and mixing a white material with some silt, water, or organic binder (Kulkova et al., 2020). Secondary calcification may occur in loess sediments (Golitko et al., 2021), as it naturally contains a calcium carbonate; however, calcite was not identified in our distinct groups of samples (e.g. hydroxyapatite or clay) and hence we can rule out this possibility.

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Bone is most likely to have been kept for several hours in an open fire (oxidizing atmosphere) and then crushed, as hydroxyapatite showed thermal transformation at a temperature of about 700°C (Marques et al., 2018). The mineralogical composition of bright clay (Supplementary Figure S4) is comparable to a sample of clay incrustation from a Beaker cemetery in Hrubčice, approximately eleven kilometres north-east of Brodek (Všianský et al., 2014: tab. 1: 16). There is no significant amount of kaolinite in our samples. The most important silicate mineral is quartz, followed by illite/muscovite, and feldspar. The SEM-EDS analysis indicates a clay material with muscovite particles (Figure 7c; Supplementary Table S6). In the cases of samples 11 and 17, contamination from the subsoil cannot be excluded, but the clay could be an incrustation applied over the previous white inlay (Figure 7a and b). Incrustations had been applied after the vessels had been fired and only slightly heated or just left to dry, as calcite is preserved in large amounts (Všianský et al., 2014; Sofaer & Roberts, 2016; Kulkova et al., 2020).

Depositional semantics and ceramic patterns in the ritual features

The assemblages recovered in the four deliberate deposits at Brodek, summarized here, are illustrated in Figure 8. Ritual deposit 1 contained archery equipment (arrowheads and two wrist-guards), some personal jewellery made of electrum, a pearl disk, and a characteristic drinking set (Rojo et al., 2006) consisting of an amphora as a storage-transport vessel, a black encrusted 'Nagyrév jug' (Peška & Králík, 2013), a small jug, and thirteen decorated beakers. Our petrographic investigation suggests that the amphora and two of the beakers were made from non-local materials. The high variability of the incrustations with a prevalence of hydroxyapatite, the presence of calcium, clay, and calcium mixed with clay corresponds to the raw materials previously examined among incrustations in the broader region around the Brodek site (Všianský et al., 2014: fig. 6).

Ritual deposit 2 is most likely to have been related to craft activities. This is suggested by a set of six oval stones interpreted as tools (anvils, cushion stones) for metal processing (see Freudenberg, 2009; Peška, 2016) and other artefacts such as amber beads, a small gold spiral, a copper rod, a bone-shaped pendant, bone beads, and twenty chert flakes. Some of the materials, like amber or gold, indicate distant contacts. The pottery consisted of a set of eight beakers and a small jug, with local/regional and extra-regional vessels represented in equal proportions. The presence of different fabrics is matched by the high variability of incrustation materials attributable to an extra-regional scale.

Explaining the meaning or symbolism of the assemblage in ritual deposit 3 is more challenging. Apart from ceramic vessels, it contained a rough fragment of quartz, a chert flake, two fragments of electrum jewellery, and animal bones. The pottery, represented by three bowls probably used for serving food (two with a flaring rim and one with feet) and thirteen beakers, could represent a feasting set (Rojo et al., 2006). Here we observed the smallest quantity of non-local pottery (only one beaker). The incrustations were produced from only two kinds of raw materials, clay and animal bone, common in the central Moravian region (Všianský et al., 2014: fig. 6).

Ritual deposit 4 had the fewest artefacts. Unlike the other ritual deposits, it contained only ceramics, i.e. eight vessels, a bowl and seven beakers placed mainly in the feature's backfill. Three beakers were

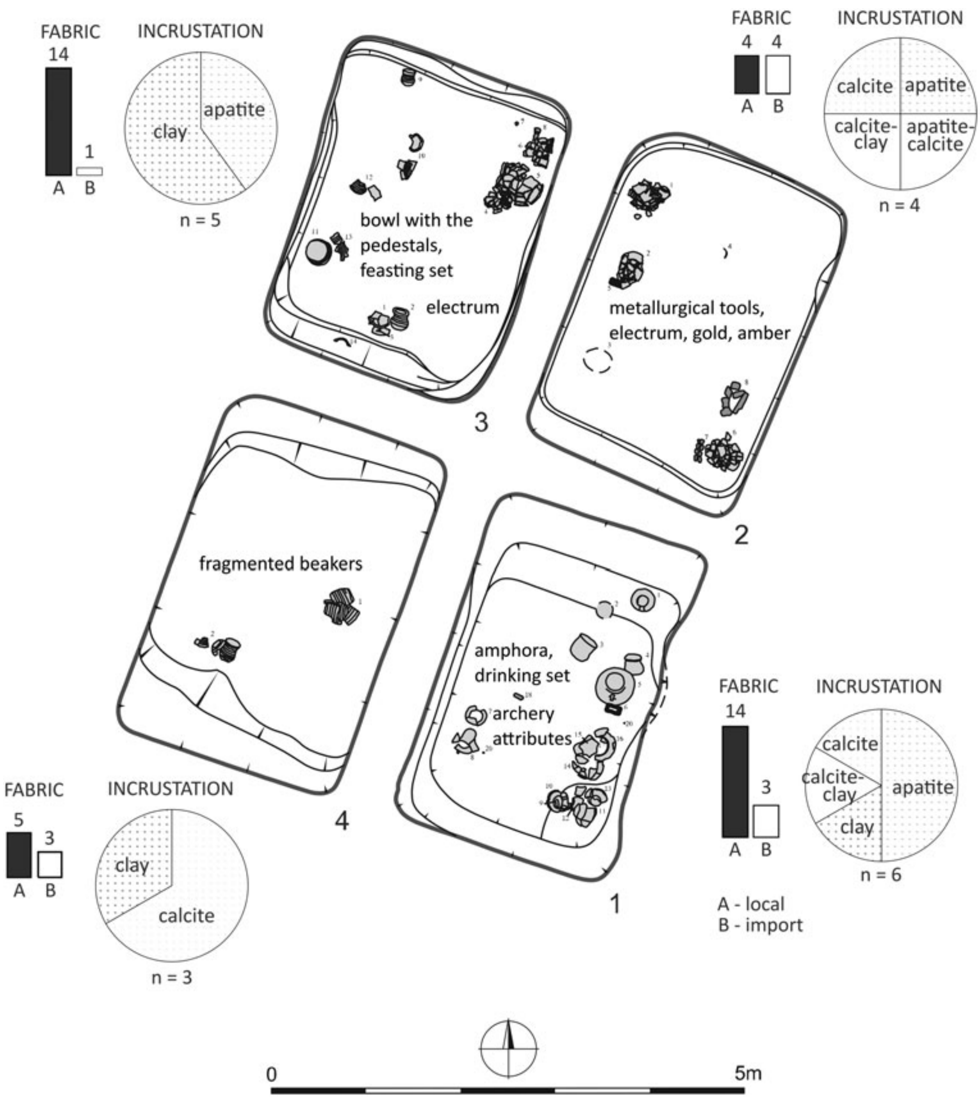

Figure 8. *The four ritual deposits with assemblages and graphs representing the number of fabric groups in each assemblage and the proportion of incrustation materials used.*

non-local. Calcium carbonate incrustations prevailed, and since calcium carbonate was the main raw material used for incrustation in the Brno district (Všianský et al., 2014: fig. 6), we conclude that it was imported from this region in accordance with the presence of Fabric B4.

Local or regional Fabric group A was dominant in ritual deposits 1 and 3. Ceramics of deposits 2 and 4 consisted of more than thirty-seven per cent of non-local vessels (Fabric group B). Deposit 2 even contained fifty per cent of non-local beakers, reflecting the highest diversity in ceramic provenance among the deposits, also supported by the variability of incrustation materials (Figure 8). Moreover, the assemblage from deposit 2 is remarkable for containing materials including amber, gold, and copper, whose origin can be traced much further afield. There is no strict link between any of the decorative motifs, the beakers' metrics, and any of the ritual deposits. The different incrustation materials in the clusters of decorative motifs (Table 2; Supplementary Material: Beakers) indicates great diversity. It underlines the possible role of the monumental site in translocal social relations. A parallel can be cited at the Beaker megalithic burial ground of Sion-Petit-Chasseur in western Switzerland (Derenne et al., 2020), where exogenous technological components were identified in the ceramic assemblage.

Translocal social relationships and the circulation of ceramics and other artefacts

Some of the beakers studied here were made of clays not available locally, reflecting the involvement of regional and extra-regional communities. The petrographic analysis also shows that some vessels were made of materials sourced over fifteen and even fifty-five kilometres from the Brodek monument, giving us an idea of the extent of the social groups linked to the monument. Bringing non-local graphite to temper regionally available clay could indicate detailed knowledge of the local environment or possibly imply that a community relocated or that its members brought their own tempering material to a new location (see Holmquist et al., 2018). The most likely explanation, however, lies in close relations between relatively distant communities.

Greater mobility seems to be an important feature of European societies of the third millennium BC and one of the theoretical concepts applied recently is translocality (e.g. Furholt, 2017, 2020; Kolář, 2020). Such a model, involving 'frequent intermixing of local settlement communities' (Furholt, 2017: 311), leads to 'communities of practice' covering larger areas. The timber monument at Brodek seems to provide evidence of such a community of practice. Our in-depth archaeometric analyses show that several communities met there and deposited their traditionally manufactured pottery within the ritual features of the monumental structure. The intermixing of local and non-local communities at Brodek u Prostějova (and most probably not only there) led to the relative homogeneity of pottery decoration, as already suggested by Kleijne (2019) for the whole of Czechia. Whether these translocal relations had a substantial impact on the overall pottery *chaîne opératoire* requires further investigation.

The relative similarity of the beakers suggests multiple deposition events over a shorter period at the Brodek monument; however, it is still not clear whether the depositions were created during one season or if the ritual practices were repeated yearly over a longer period (up to fifty years). Typo-chronologically, the material should be from the later Bell Beaker phase in Moravia, pointed out by a prevalence of epi-maritime/Bohemian beakers (Peška, 2013; Grossmann, 2016), a jug from the pit south-east of the monument suggests later Bell Beaker dating (Grömer et al., 2017). The monumental site most likely served as a node in a translocal network where several communities, local, regional, and extra-regional, met, feasted, and ritually deposited artefacts symbolizing craftsmanship, access to distant networks, the sharing of ideas and values, and embeddedness within the regional society. We thus argue that the ritual activities performed, the relationships maintained, and the communities established in the densely settled region (Figure 1c) constituted a community of ritual practice.

From the perspective of the polythetic model of culture and the concept of translocality, pottery production and consumption were only one part of the manifold aspects of social life (Furholt, 2020). The Beaker communities of practice involved in pottery making were most likely to have differed (smaller, household-based) from those related to other categories of artefact production (copper production, architecture) or burial behaviour (Vander Linden, 2004). These aspects of social life seem to be more bound to wider, regional or even subcontinental shared values and traditions.

Conclusion

The timber monument at Brodek u Prostějova served as a ritual place for several communities, which is reflected in a significant quantity of pottery brought to the site. The four ritual deposits excavated there show distinct patterns of variability in the material composition of the ceramics and other artefacts. Some raw materials, such as graphite, were brought in from further afield. The technological variability of the pottery and the variety of incrustations and decorative styles reflect different potting traditions, encompassing settlement communities, and ceramic communities of practice from both local and from more distant regions. The individuals or social groups meeting at Brodek were related through translocal social relationships requiring mobility and intermixing at several spatial levels: settlement, potting practices, and ritual practices. These social gatherings, which resulted in building an extraordinary monument and making ritual depositions, gave rise to the formation of a new community of practice, in this case related to ritual activities. These activities, performed over a relatively short time, involved materials and objects rooted not only in local and regional manufacturing traditions, but also symbolizing more universal ideas and exchange networks at the continental scale.

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Supplementary Material

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Biographical Notes

Adam Gašpar currently studies for a PhD in archaeology. From 2017 to 2019 he successfully completed the Erasmus Mundus Joint Master in Archaeological Materials Science with a scholarship funded by the EACEA agency of the European Commission (EMJMD ARCHMAT). His interests include prehistory, the analysis of ceramic, past landscape study, and geophysical prospection.

Address: Department of Archaeology and Museology, Faculty of Arts, Masaryk University, Arne Nováka 1, 602 00 Brno, Czech Republic; and Institute of Archaeology of the Slovak Academy of Sciences, Department for Research of Eastern Slovakia, Hrnčiarska 13, 040 01 Košice, Slovakia. [email: gaspar.a@saske.sk]. ORCID: 0000-0001-6263-6651

Jan Petřík has mainly focused on geoarchaeology, the use of stone raw materials in prehistory, and the material analysis of ceramics. His current work on archaeological ceramic production addresses the social identity of its creators and users, the mechanisms of distribution, and their relationship to the dynamics of social complexity.

Address: Department of Geological Science, Faculty of Science, Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic. [email: jpazourek@email.cz]. ORCID: 0000-0002-5269-2411

Pavel Fojtík studied archaeology at Masaryk University in Brno and then joined the Institute of Archaeological Heritage in Brno at its Prostějov Regional Office, where he still works. He has a long experience of conducting rescue excavations and archaeological research in the Prostějov region. His professional interest lies mainly in the Bronze and Iron Ages. Currently he is a PhD student at the Department of Archaeology of Charles University.

Address: Department of Archaeology, Faculty of Arts, Charles University, Celetná 20, 116 42 Prague, Czech Republic; and Institute of Archaeological Heritage, Kaloudova 30, 614 00 Brno, Czech Republic. [email: fojtik@uapp.cz]. ORCID: 0000-0001-6407-252X

Anna Tsoupra is currently a PhD researcher at HERCULES Laboratory with a focus on ceramic studies in the Mediterranean region. She holds a BA degree in archaeological conservation and successfully completed the Erasmus Mundus Joint Master in Archaeological Materials Science (ARCHMAT). She participated in research projects focused on material science applied on CH at HERCULES Laboratory, and as CH conservator, in several projects mainly in Greece and in the Middle East.

Address: HERCULES Laboratory, University of Évora, Largo Marquês de Marialva 8, 7000-809 Évora, Portugal. [email: atsoupra@gmail.com]. ORCID: 0000-0002-0661-296X

Basira Mir-Makhamad graduated from the Department of Anthropology at the

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American University of Central Asia in 2017. From 2017 to 2019 she successfully completed the Erasmus Mundus Joint Master in Archaeological Materials Science with a scholarship funded by the EACEA agency of the European Commission (EMJMD ARCHMAT). She is currently a PhD student at the Department of Archaeology, Max Plank Institute for the Science of Human History.

Address: Department of Archaeology, Max Planck Institute for the Science of Human History, Kahlaische 10, 07745 Jena, Germany. [email: mirmakhamad@shh.mpg.de]. ORCID: 0000-0002-1414-0392

Ana Margarida Cardoso has a Masters degree in materials engineering. Currently she works as a senior technician in materials characterization through vibrational spectroscopy and microscopic techniques, and she is a PhD student in chemistry at the University of Évora.

Address: HERCULES Laboratory, University of Évora, Largo Marquês de Marialva 8, 7000-809 Évora, Portugal. [email: amcardoso@uevora.pt]. ORCID: 0000-0002-4935-3398

Massimo Beltrame concluded a Masters degree in heritage sciences and technologies at the University of Padova (Padova, Italy). He also earned a Masters degree in prehistoric archaeology and rock art from the University of Trás-os-Montes and Alto Douro in Portugal. He concluded an archaeometric PhD dissertation at the University of Évora in Portugal dedicated to the study of Islamic pottery in Portugal.

Address: HERCULES Laboratory, University of Évora, Largo Marquês de Marialva 8, 7000-809 Évora, Portugal. [email: massimo@uevora.pt]. ORCID: 0000-0003-2718-3807

José Mirão obtained his PhD in geology in 2004 from the University of Évora, Portugal. He is the director of the HERCULES Laboratory, focusing on the integration of physical and material sciences methods and tools in interdisciplinary approaches, especially to materials of geological origin, and patrimonial heritage assets.

Address: HERCULES Laboratory, University of Évora, Largo Marquês de Marialva 8, 7000-809 Évora, Portugal. [email: jmirao@uevora.pt]. ORCID: 0000-0003-0103-3448

Nick Schiavon has been carrying out research and teaching activities since 1988 in geoscience/conservation science as a postdoctoral research associate and lecturer at academic institutions across Europe. Since 2009 he is a senior research associate at the Geophysical Center and HERCULES Laboratory.

Address: HERCULES Laboratory, University of Évora, Largo Marquês de Marialva 8, 7000-809 Évora, Portugal. [email: schiavon@uevora.pt]. ORCID: 0000-0002-9744-0808

Jan Kolář studied archaeology at the Masaryk University in Brno, obtaining his PhD on regional and territorial aspects in the third millennium BC in 2015. He specializes in the interdisciplinary study of human–environment interactions, archaeological demography, and European Neolithic and Early Bronze Age.

Address: Institute of Archaeology, University College London, 31-34

Gordon Square, London, WC1H 0PY, UK; Department of Vegetation Ecology, Institute of Botany of the Czech Academy of Sciences, Lidická 25/27, 60200 Brno, Czech Republic; and Department of Archaeology and Museology, Faculty of Arts, Masaryk University, Arne Nováka 1, 60200 Brno, Czech Republic. [email: j.kolar@ucl.ac.uk]. ORCID: 0000-0001-8013-6992.

Au-delà de la technologie : relations sociales translocales révélées par la céramique d'un site monumental campaniforme en Europe centrale

Les restes d'une grande structure en bois accompagnée de quatre dépôts rituels symétriques contenant de nombreux objets (y compris plus de cinquante récipients en céramique) ont été découverts sur le site campaniforme de Brodek u Prostějova en Tchéquie. La décoration de ces récipients comporte des motifs incisés qui dans dix-neuf cas éraient remplis d'incrustations blanches. Les auteurs de cet article ont effectué une série d'analyses sur des micro-prélèvements afin de déterminer les techniques de production et la provenance de ce matériel céramique ainsi que la composition des incrustations dans le but d'examiner les relations sociales liées à ce site extraordinaire. Leurs résultats indiquent que la céramique provenait de divers endroits dans la région et que certaines pâtes et matières, tel le graphite servant de dégraissant, provenaient de régions plus lointaines. Le carbonate de calcium (calcite), l'hydroxyapatite (ossements) et une argile claire étaient les matières premières utilisées pour les incrustations. Le mélange de motifs décoratifs et les variations dans la taille et la forme des gobelets font penser à une production de type unique. Les résultats obtenus semblent confirmer que le site monumental de Brodek était un lieu rituel ou cérémonial servant plusieurs communautés, tant locales que plus lointaines. Translation by Madeleine Hummler

Mots-clés: campaniforme, depots rituels, céramique, provenance, translocalité, Tchéquie

Über die Technologie hinaus: Keramik und translokale soziale Beziehungen auf einer glockenbecherzeitlichen Denkmalstätte in Zentraleuropa

Die Überreste einer sehr großen Holzstruktur und dazugehörigen vier symmetrisch angeordnete rituelle Deponierungen mit einem reichen Befund (u. a. über fünfzig Keramikgefäße) wurden auf der glockenbecherzeitlichen Stätte von Brodek u Prostějova in Tschechien entdeckt. Die Gefäße waren mit eingeritzten Mustern verziert und darunter gab es neunzehn Muster mit einer weißen Einlage. Um die Herkunft und Produktionstechniken der Keramik und die Zusammensetzung der Einlagen zu bestimmen, wurden mehrere Analysen von Mikroproben durchgeführt; das weitere Ziel war es, die sozialen Beziehungen auf dieser außergewöhnlichen Stätte näher zu erforschen. Die Untersuchungen ergaben, dass die Keramik verschiedener regionaler Herkunft war und dass außerregionale Tonarten und Magerungsmaterial (Grafit) vorhanden waren. Der Hauptrohstoff der weißen Einlagen war Kalziumkarbonat (Kalzit), Hydroxylapatit (Knochen) und heller Ton. Die Mischung der Verzierungsmotive und die verschiedenen Größen und Formen der Glockenbecher weisen auf einen einzigartigen Herstellungsprozess. Die Ergebnisse der Untersuchungen deuten darauf hin, dass Brodek eine rituelle Stätte und ein Versammlungsort für mehrere lokale und fernere Gemeinschaften war. Translation by Madeleine Hummler

Stichworte: Glockenbecherzeit, rituelle Deponierungen, Keramik, Herkunft, Translokalität, Tschechien