Neolithic ceramic figurines
Several approaches to analytical study of the ceramic artefacts perceived as cultural heritage

Neolitické keramické plastiky
Několik možností analytického studia památkově cenných keramických artefaktů

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*The article aims to present the results of the analysis of eight Neolithic ceramic figurines from the Lengyel culture settlement Těšetice-Kyjovice – Sutny, Czech Republic. We indicated the possibilities for acquiring analytical data, although destructive methods were unacceptable. We included methods neglected to date, but widely available in the common archaeological laboratory. Information on the composition of the ceramic matrix, the provenance of inclusions, the techniques used for shaping, firing, operating and discarding are all of key importance for advancing the discussion on the interpretational potential of ceramic anthropomorphic figurines from typological and religionist discourses to analytically-focused discussions supported by hard data. Two serious factors have thus far prevented the widespread use of analytical methods: the destructive nature of the evidential analyses, which is contradictory to heritage protection and general awareness of the value and rarity of such finds. The second factor relates to the prohibitive cost of analyses when applied to a statistically robust number of samples. On the other hand, in the absence of broad mapping of measurable data, we will remain dependent on only individually published analyses of isolated samples, typically from a different culture, period or geographical territory. We believe the use of non- and semi-destructive methods offers a solution. With the aim of achieving the lowest destructive impact, we conducted an analysis of eight ceramic figurines by use-wear analysis, high resolution 3D analysis, portable-X-ray fluorescence (*p-XRF*) measurements and microscopy of polished sections.*

Neolithic – ceramic figurines – use-wear analysis – 3D analysis – semidestructive analyses – mass composition and shaping

Příspěvek představuje výsledky analýzy osmi neolitických plastik ze sídliště lengyelské kultury Těšetice-Kyjovice – Sutny. Chceme poukázat na to, že je možné získávat analytická data, přestože destruktivní analýzy jsou nepřípustné. Zapojujeme dosud opomíjené metody, které jsou dostupné v běžných archeologických laboratořích. Informace o složení keramické hmoty, provenienci inkluzí, způsobu tváření, výpalu, používání a skartace jsou zcela klíčové pro posun diskuse o interpretačním potenciálu keramických antropomorfních plastik od typologických a religionistických diskurzů k analyticky zaměřené diskusi, podložené tvrdými daty. Masivnímu nasazení obvyklých analytických metod pro výzkum keramiky dosud brání dva závažné faktory. Především jde o destruktivnost vypovídacích analýz, která naráží na památkovou ochranu a obecné povědomí o hodnotě a vzácnosti takových nálezů. Druhým faktorem je cenová nedostupnost analýz při aplikaci na statisticky robustní počet vzorků. Bez plošného zmapování měřitelných dat zůstaneme nicméně odkázáni na pouze jednotlivě publikované analýzy izolovaných vzorků, obvykle z jiné kultury, období nebo geografické oblasti. Domníváme se, že použití nedestruktivních a semidestruktivních metod může být řešením. S cílem co nejmenšího destruktivního dopadu jsme pomocí traseologie, 3D analýzy, p-XRF a mikroskopie nábrusů provedli analýzu na vzorku osmi lengyelských ženských keramických plastik.

neolit – keramické plastiky – traseologie – 3D analýza – semidestruktivní metody analýzy – složení a tváření hmoty

doi:10.35686/AR.2020.13

1. Introduction

The study of Neolithic ceramic figurines in Central Europe has stalled in a formal typology that does not result in any new information about the society of their creators. Unfortunately, archaeometric analyses of ceramic figurines published to date (e.g., *Applbaum – Applbaum 2002*; *Gregerová – Hložek 2009*; *Kreiter et al. 2014*; *Lička – Hložek 2011*; *Marangou 1996*; *Porčić 2012*; *Porčić – Blagojević 2014*) remain individual data for large areas, cultural units and chronological periods. Therefore, it is not possible to conclude whether these results are truly characteristic for the majority of ceramic anthropomorphic figurines in their specific geographic, chronological and cultural framework. If a single sample from a site is analysed, we do not obtain any information on the important phases of the operating chain, between manufacture and final deposition: phases of use (functioning in the designated social role), discarding, primary deposition and any accidental or intentional dispersion. These data are necessary to trace the deliberate processes and the established pattern of operating with figurines, which is a precondition for a deeper social analysis of this phenomenon. To this end it is necessary to analyse a representative sample, and ideally, all fragments from a particular settlement and (which is often neglected) compare their composition, technological, operating and spatial data with contemporaneous pottery of that site. The benefit of such comparisons was readily apparent in the analysis of several sites from the north of the Danube (*Kreiter – Szakmány – Kázmér 2009*, 113–116), where the analysis of fine pottery documented standardisation across settlements, whereas coarse pottery varied at individual settlements. The operating schemes and their sharing are also important for the interpretation of ceramic figurines. Hence, the aim of this article was to include analytical methods that could significantly contribute to the knowledge of the operating chain of production, use, discard and spatial dispersion of fragments, while also being financially affordable and minimising the destruction of artefacts. This meant those methods that led to or enable an analysis of a statistically significant number of samples. The main part of the methods employed thus far for ceramics analyses was avoided due to one or both of these limits. Micro-CT (μ-CT; *Kreiter et al. 2014*; *Lička – Hložek 2011*), and micro-sections (*Kreiter 2007*; *Gregerová – Hložek 2009*) were mainly employed for anthropomorphic figurines in Central Europe.

If the ratio of fragmented figurines was close to 100 %, we could use information not only from the figurine surface, but all available information from its fracture surface.

The effect of μ-CT could be partly substituted by high-resolution 3D analysis, and polished section microscopy. 3D documentation was able to differ distinct layers of ceramic mass and connections of parts of the figurine modelled separately. Microscopy of polished sections (*Daszkiewicz – Schneider 2001*; *Petřík – Nikolajev et al. 2016*;) shows the orientation of lengthwise inclusions and pores, which reflect the original direction of the shaping force and press. Thin-sections could be substituted by polished-sections in the majority of observed parameters. Inclusion shape and fraction, the matrix percentage, the orientation of lengthwise inclusions and pores could be easily observed on the fracture surface, lightly polished to create a small area in the figurine cross-section direction. Only optical identification of mineral inclusions (*Quinn 2013*; *Gregerová 2010*), which plays a role in provenance analysis (comparing them with local geological maps), could not be substituted by this lightly destructive method. Only some inclusions (graphite, mica, older ceramic particles) are identifiable on polished sections. Nevertheless, we believe, it is possible to obtain certain provenance information with the help of XRF measurement, and a comparison of large collections of original and experimental samples in future research. Thus, provenance data were not the goal of this study, as this required wide field sampling and creating a baseline for p-XRF measurements. This is the goal of our future research. We used p-XRF to measure chemical composition, with the goal of comparing analysed figurines with each other. The advantages of p-XRF are availability and mobility enabling measurement in individual museums and institutions, thus eliminating the need to transport fragile figurines. Although using *in situ* measurement with handheld p-XRF devices was opposed in the past (*Shackley 2011*, 12–15), this method was validated in recent years (*Papakosta et al. 2020*; *Scott et al. 2018*; *Petřík – Prokeš et al. 2016*). Detailed testing showed that a series of several measurements for 60 seconds or one measurement for 380 seconds produced a result comparable to laboratory XRF. Measurement of a fracture area produced a better result than that of a polished section (*Bergman – Lindahl 2016*; *Simsek Franci 2019*). The risk of certain dispersion of measured values, related to inhomogeneity in the mass composition in the case of prehistoric ceramics, could be minimised by sampling a small amount of material from the fracture area, after its topography was documented in high resolution 3D. This powder sample could be crushed and homogenised before p-XRF measurement. Better methods of non-destructive measurement of chemical or mineral composition exist (IR, Raman, PIXE); nevertheless, no one method is commonly available in archaeological institutions.

Qualitatively new data on operation and discard processes can be obtained by optical microscopy, use-wear analysis and micro-topography using high-resolution 3D photogrammetry. Figurine surfaces preserve many intentional and accidental traces related to pre-firing and post-firing treatment (connections of individual parts, coarsening, polishing, finger prints, thermic shock, pigment or graphite coating), frequently repeated manipulations, discarding impact and post-depositional processes. All of these data can be observed with sufficient magnification. 3D analysis plays a special role in fracture micro-topography, which can provide, in the analysis of a large collection and in comparison with experiments, data to identify the cause and process of fragmentation of the originally intact figurine. Moreover, digital analyses can freely rotate, cut and remove a heterogeneous texture that obscures the actual 3D data during real visual observation. If any analysis of valuable archaeological artefacts that will or may lead to its certain change (sampling, polished sections, completion, etc.) is considered, it is essential to document the intact figurine prior to any further procedure. Fractures provide potentially important data, which are all too often permanently covered by conservation and restoration impact in our practice. As we do not yet know with certainty whether the figurines were fragmented deliberately or were randomly damaged in post-deposition processes, we do not know how common or rare one or the other type of handling was, and the precise conservation and analysis of the microrelief of each fracture on each figurine is a necessary condition. It should be applied to all finds prior to their reconstruction, replenishment, etc. Neglecting this phase in the collection of archaeological data usually irreversibly deprives us of valuable information, as the breakdown of the reconstructed figurine into the original fragments usually damages the original surface of the fractures.

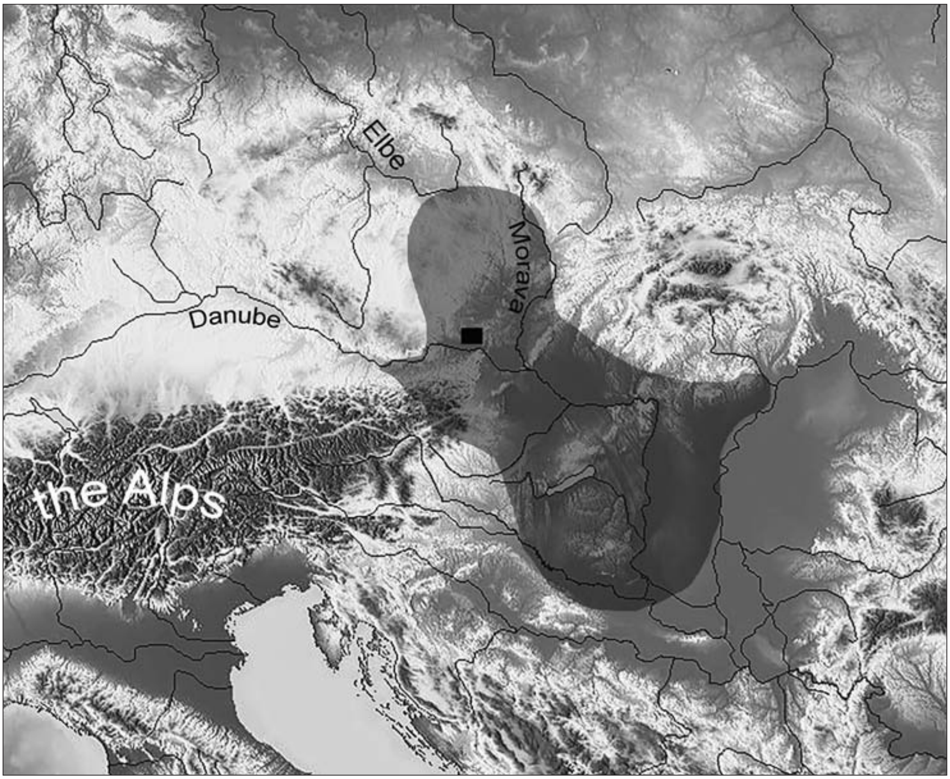

Fig. 1. Localisation of Těšetice-Kyjovice – Sutny site in Lengyel culture territory.
Obr. 1. Umístění lokality Těšetice-Kyjovice – Sutny v oblasti lengyelské kultury.

2. Material/collection

We chose Těšetice-Kyjovice (*fig. 1*) as our model Neolithic settlement site, specifically the Lengyel period of its occupation. The main reason for this choice is the low extraction of archaeological data from the largest and most spectacular assemblage of Neolithic figurines from the same site in Central Europe. The site at the "Sutny" location was discovered in 1956, and greater archaeological work began here in 1964. Systematic excavations have been conducted at five areas designated as Sutny I–V since 1967 (*Podborský 2001*, 13–36; *Podborský – Kazdová – Kovárník 2005*, 43–70; *Vostrovská 2018*, 33–37). A systematic geophysical survey was conducted over an area of 17.2 ha in 2007–2011 (*Milo 2013*). Besides Lengyel occupation, a vast community area of the Linear Pottery culture (13.5 ha) and a Stroked Pottery culture settlement and graves are also documented in the Neolithic period (*Kazdová 2005a*, 80–87). The size of the settlement in the Lengyel culture period was at least 7.7 ha (294 settlement features, four graves, a rondel). It is situated in the southern part of the "Sutny" location and partially overlaps with the areas of the two other Neolithic cultures (*Kazdová 1984*; *Kazdová 2005b*, 88–112; *Milo 2013*, 86; *Podborský 1988*; *Vostrovská 2018*, 35–36). More than 350 fragments of anthropomorphic figurines (*Kazdová 2005b*, 104) were discovered here, making it the largest collection from a single site in the whole of Central Europe (*Kalicz 1998*, 65). The next largest collections of Lengyel anthropomorphic figurines was from the Sé site in Hungary and Unterpullendorf in Austria, each with around 130 fragments (*Kalicz 1998*, 65), which are also exceptionally large assemblages for the Lengyel environment (*Pavúk 2003*, 311). Moravia appears to be a specific territory with more than 1,600 anthropomorphic figurines (*Kovárník 2010*, 91); in contrast, Lower Austria has approximately 200 (*Berg – Maurer 1998*), Hungary approximately 300 (*Ilon 2007*), and southwest Slovakia just over 40 specimens (*Beljak Pažinová 2016*).

The anthropomorphic figurines chosen for analysis (*fig. 2*) were selected on the basis of their macroscopic differences (colour and texture of ceramic matrix) and their localisation in distinct features of the site (*fig. 3*). Four of them were found in the space between the ditch and the outer palisade of the rondel (TK001, TK005, TK006, TK008), two (TK002, TK003) were from feature 170 (clay pit in superposition with the palisade (it preceded the construction of the rondel; *Podborský 1985*, 104–105), and the last two (TK004, TK007) were from a feature to the east of the rondel's outer palisade (*tab. 1*). Nine fragments were from seven standing female figurines of the so-called "Střelice type" attributed to phase Ia of the Lengyel culture in Moravia (*Podborský 1988*, 65–66). One fragment belongs to a sitting figurine (TK006). The arm part (understood as a typological-dating element) is missing, and the sculpture was dated (phase Ia) based on a parallel to the figurine from Střelice-Bukovina (*Podborský 1983*, 54).

ID	Evidence n./Inv. č.	Feature/Objekt	Depth/Hloubka	Type/Typ	Relative chronology
TK001	205A_5070	205A	50–70	Střelice	MMK Ia
TK002A, B	–	170	–	Střelice	MMK Ia
TK003	170J_100-120	170J	100–120	Střelice	MMK Ia
TK004	504D_P	504D	povrch	Střelice	MMK Ia
TK005	K72592 48B_0-20	48B	0–20	Střelice	MMK Ia
TK006	K81096_153A_20-40	153A	20–40	Střelice	MMK Ia
TK007	494C_120-140_3599	494C	120–140	Střelice	MMK Ia
TK008A, B	K 35947	KB5, příkop, JV segment	240–260	Střelice	MMK Ia

Tab. 1. Overview of finding context of analysed figurine fragments.
Tab. 1. Přehled nálezových kontextů analyzovaných fragmentů plastik.

3. Methods

The 3D photogrammetric method of a submillimetre resolution was used both for documentation purposes and for digital observation of both the intact and fractured surface of figurines. Initial images (80–120 images of the object) were taken with a Nikon D7200 digital SLR and a Nikon 18–140 mm lens at a fixed focal length of 35 mm. The minimum resolution of the 3D model was defined using GSD (ground sample distance) so that at a photograph resolution of 6,000 × 4,000 pixels, 0.1 mm corresponded to a single pixel on the surface. The accuracy was actually higher in practice: according to the generated software record, the ground resolution averaged 0.02 mm pixel, which corresponds to one pixel covering an area of 4 × 4 µm, while the error in the reprojection and reconstruction

Fig. 2. Analysed samples of Neolithic ceramic figurines from settlement of Lengyel culture in Těšetice-Kyjovice – Sutny.
Obr. 2. Analyzované vzorky neolitických keramických plastik ze sídliště lengyelské kultury v Těšeticích-Kyjovicích – Sutnách.

of the three-dimensional model morphology was approximately 0.5 pixel. The images were evaluated using Agisoft Metashape (version 1.5.2) with an emphasis on the resulting quality, not on time efficiency: the computing time in the Lenovo Legion y740 docking station was on average around 3 hours per artefact.

A reflected-light microscope (Olympus BX51M) with 50×, 100× and 200× magnification was used in the use-wear analysis of the figurine surface, residue identification, observation of thermic cracks, and in the analysis of the polished section area.

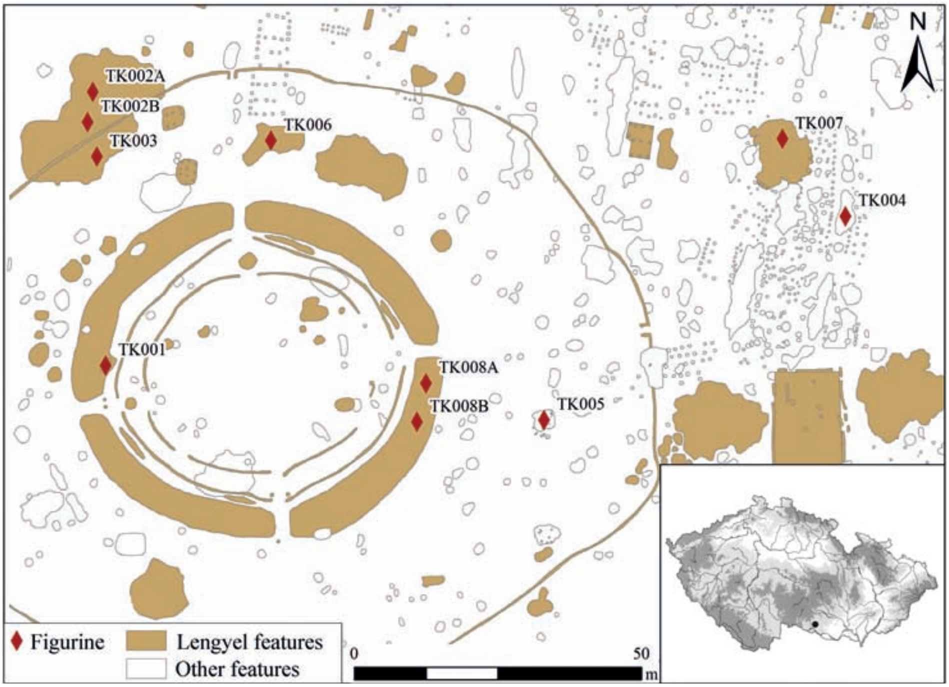

Fig. 3. Position of analysed fragments of Neolithic ceramic figurines in settlement features.
Obr. 3. Poloha analyzovaných fragmentů neolitických keramických plastik v sídlištních objektech.

Polished sections were prepared *in situ* on the original fracture surface of each sample, in the direction of the figurine cross-section. The surface was documented before sampling. Soft wet-grinding was applied in a small area of the figurine fracture (1 cm^2) using the wet-grinding set LaboPol-20, without any cleaning or impregnation. Semi-destructive impact meant that the destruction was limited to a very small area and without any impact on the visual quality of the artefact, its integrity, colour, mass structure etc. Basic petrographic parameters (matrix/temper ratio, shape, sharpness and sorting of inclusions, orientation of lengthwise inclusions and pores, homogeneity and colour of matrix, ratio and shape of pores) were documented based on common methodology (*Quinn 2013*).

A benchtop Rigaku NEX CG EDXRF (Pd anode 50W, SSD detector 145 eV resolution) and a portable Olympus Delta Professional device (Rh anode, penetration of X-ray radiation 3–4 mm) were used to acquire chemical composition data. The benchtop device measured a total of 15 elements in the samples (Al, Si, K, Ca, Ti, Cr, Mn, Fe, Ni, Cu, As, Rb, Sr, Ba, Pb). The portable device measured the same elements, except Ba. Some other trace elements were measured only in some cases. Each sample was first measured with a p-XRF in the "light matrix" mode, which is suitable for studying elements with a lower percentage in the matrix. The p-XRF device was calibrated periodically by plate 139 of BAS (ISO 9001:2016). Heavily represented earth elements such as Si and Al were screened out. The values are given in parts per million (ppm). Three *in situ* measurements for 90 seconds were conducted on three different areas (nine measurements in total): an original fracture surface, on a refreshed fracture surface, and the outer surface of the figurine. As is common with this methodology, the median was used for the results of the p-XRF measurements (individual median values were rounded). One gram of material was then collected from each sample (from the fracture surface) for analysis with the benchtop XRF in the form of compressed powder tablets (in indirect excitation mode using secondary disks, one measurement per disk, 120 seconds). Data were processed only by PAST program (normality tests, Wilcoxon test), due to a low number of measurements and samples; and Office Excel was used to visualise the plotting of p-XRF values to benchtop XRF values.

4. Results

4.1. Ceramic petrography

Samples that were macroscopically different were chosen so that the greatest variability of used materials and technologies could be captured. Even the results of polished section analyses were highly differentiated from the perspective of the ratio of the matrix and inclusions, fractions and the sharp-edged nature of inclusions, and the shape and orientation of pores (*tab. 2*; *fig. 4–7*). The ratio of inclusions in the matrix ranged from 5 % (TK003 and TK004) up to 40 % (TK002 and TK006). The matrix was homogeneous in seven of eight samples, brown or greyish in colour, and alternating in one sample in some cases (TK002, TK006 and TK007). Inclusions were oval and rounded in the majority of samples, whereas sharp-edged inclusions were few or absent. Regular non-random presence of sharp-edged inclusions, i.e., drilled and intentionally prepared temper were observed only in sample TK005. Slightly sharp-edged inclusions were detected in samples TK002 and TK007. Also inclusion sorting was proven in only two samples (TK003 and TK004), which probably correlated with the low ratio of inclusions in the matrix. Typical lengthwise inclusions were identified in only one sample (TK002), oriented in one direction. Oval elongated inclusions also seemed to be oriented in one direction (TK005, TK006 and TK007). Pores were present in only half of the samples, and even their ratios were low, up to 1 %, and exceptionally up to a maximum of 5 % (TK003). Their orientation was organised. In the case of sample TK004, elongated channel-shaped sharp-edged cracks formed a rough semi-arc. This probably reflected the method of mass formation.

Sample	Observed parameters
TK001	1. 20 % inclusion, 80 % matrix.
	2. Oval and round, several irregular in shape, slightly elongated, slightly sharp-edged.
	3. No direction is dominant.
	4. Poorly sorted.
	5. Homogeneous, fine, brown-gray matrix.
	6. About 1 %, elongated slightly channel-like vids with irregular edges, one orientation predominates.
TK002	1. 40 % inclusion, 60 % matrix.
	2. Most elongated oval or rounded with rounded edges, occasionally elongated sharp-edged.
	3. One direction predominates (slightly diagonal from the upper left to the lower right corner in the image).
	4. Poorly sorted.
	5. Homogeneous, fine matrix, alternating light gray and dark gray areas (speckled pattern).
	6. About 1 %, rounded or irregular in shape, here is not the dominant direction.

TK003	1. 5 % inclusion, 95 % matrix.
	2. The vast majority of inclusions are rounded or oval with rounded edges.
	3. There is no dominant direction, elongated inclusions are almost absent.
	4. Well sorted.
	5. Homogeneous, fine matrix with a slightly marbled pattern (in which a certain uniform orientation can be observed), light gray and dark gray.
	6. About 5 %, elongated irregular shape with rounded edges, very similar orientation with direction of marbling in matrix.
TK004	1. 5 % inclusion, 95 % matrix.
	2. Most inclusions are very small, occasionally larger, rounded edges, probably without the addition of slag.
	3. Elongated inclusions are not present.
	4. Well sorted.
	5. Matrix slightly heterogeneous, one type of material very fine structure, light brown-gray color. The second type is gray to dark gray, slightly coarser fraction.
	6. Less than 1 %, elongated channel-shaped sharp-edged cracks, form a roughly semi-arc, which may indicate the method of mass formation.
TK005	1. 30 % inclusion, 70 % matrix.
	2. About half of the inclusions are oval or round with rounded edges, the other part of the inclusions is oval or oval in length with slightly sharp to sharp edges.
	3. Typical elongated inclusions are not present, but slightly oval elongated yes. Their orientation is approximately the same (in the image diagonally from the upper left corner to the lower right.
	4. Poorly sorted.
	5. Matrix homogeneous, small grains, gray, brown or darker gray.
	6. They have not been identified.
TK006	1. 40 % inclusion, 60 % matrix.
	2. Most inclusions of irregular shape, slightly sharp-edged, a smaller part oval or irregular in shape, rounded edges.
	3. There are no typical elongated inclusions, but thicker elongated irregular shapes have a very similar orientation in the photo from the lower left corner to the upper right.
	4. Poorly sorted.
	5. Homogeneous, slightly coarser matrix, speckled pattern, alternating light brown-gray with gray.
	6. They have not been identified.
TK007	1. 30 % inclusion, 60 % matrix.
	2. The vast majority of inclusions are oval or circular in shape with rounded edges. Only occasionally slightly sharp-edged pieces.
	3. Oval slightly elongated inclusions (of which there are very few) point diagonally from the upper left edge to the lower right edge (pictured).
	4. Poorly sorted.
	5. Matrix homogeneous, alternating two dominant colors, orange-light brown and light brown.
	6. They have not been identified.
TK008	1. 40 % inclusion, 60 % matrix
	2. About half of an irregularly shaped inclusion, slightly sharp-edged, the other part oval or irregular with rounded edges.
	3. Elongated inclusions are not present.
	4. Poorly sorted.
	5. Homogeneous, fine, brown-gray matrix.
	6. Less than 1 %, irregular in shape, without dominant direction.

Tab. 2. Petrographic description of ceramic figurine mass based on polished sections. 1 percentage of inclusions in the basic matrix; 2 shape of inclusions; 3 orientation of elongated inclusions; 4 material sorting; 5 properties and appearance of matrix; 6 prientation and shape of pores.
Tab. 2. Petrografická deskripce hmoty keramických plastik. 1 procentuální podíl inkluzí v základní matrix; 2 tvar inkluzí; 3 orientace protáhlých inkluzí; 4 vytřízenost materiálu; 5 vlastnosti a vzhled matrix; 6 orientace a tvar pórů.

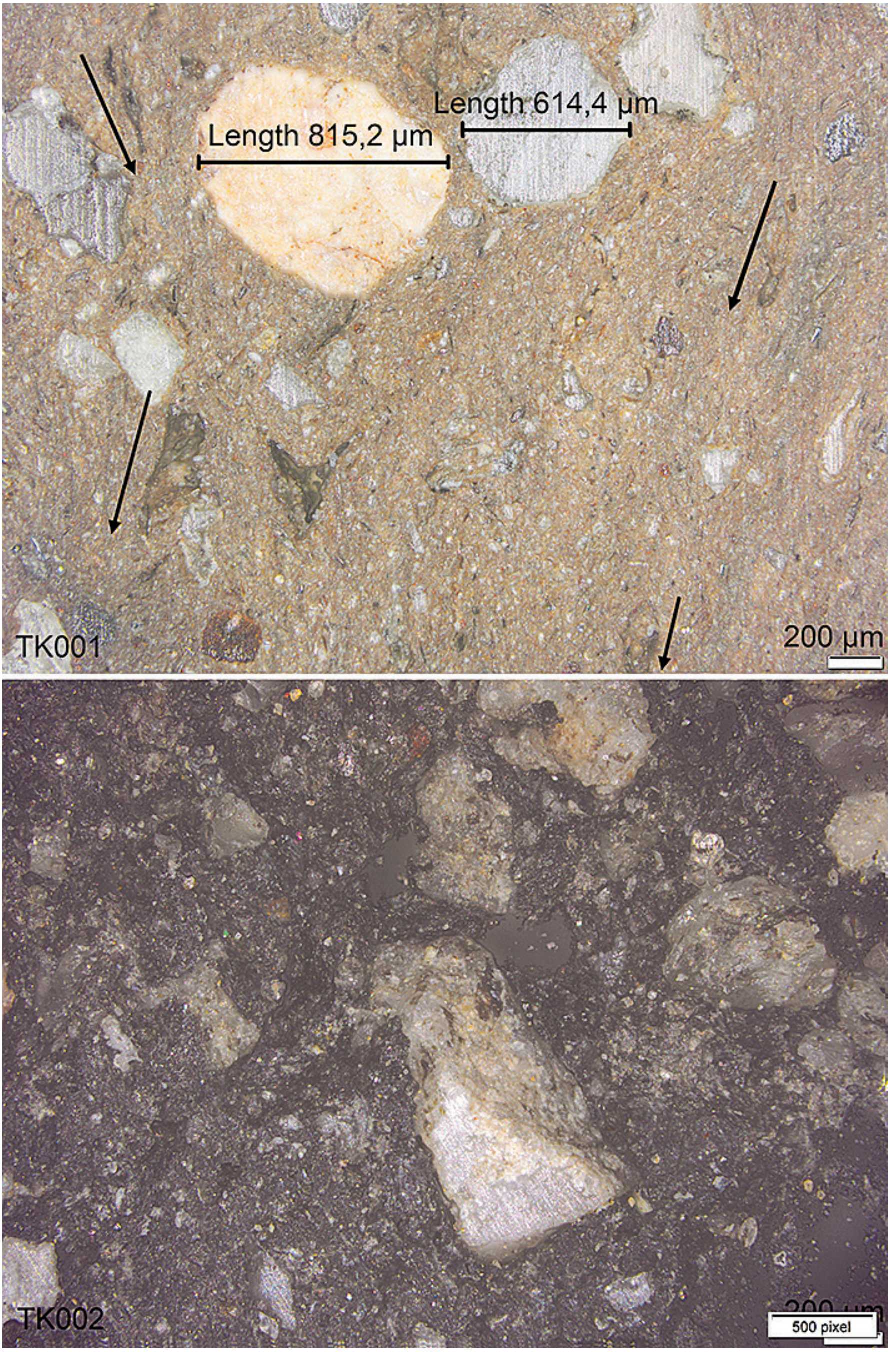

Fig. 4. Overview of polished-section microscopy of ceramic figurines mass. Magnification 50x. Numbers of photos correspond with figurine ID. Arrows show orientation of lengthwise inclusions and pores.
Obr. 4. Přehled nábrusů keramické hmoty analyzovaných plastik při zvětšení 50x. Označení fotografií koresponduje s ID plastik. Šipky označují orientaci podélných inkluzí a pórů.

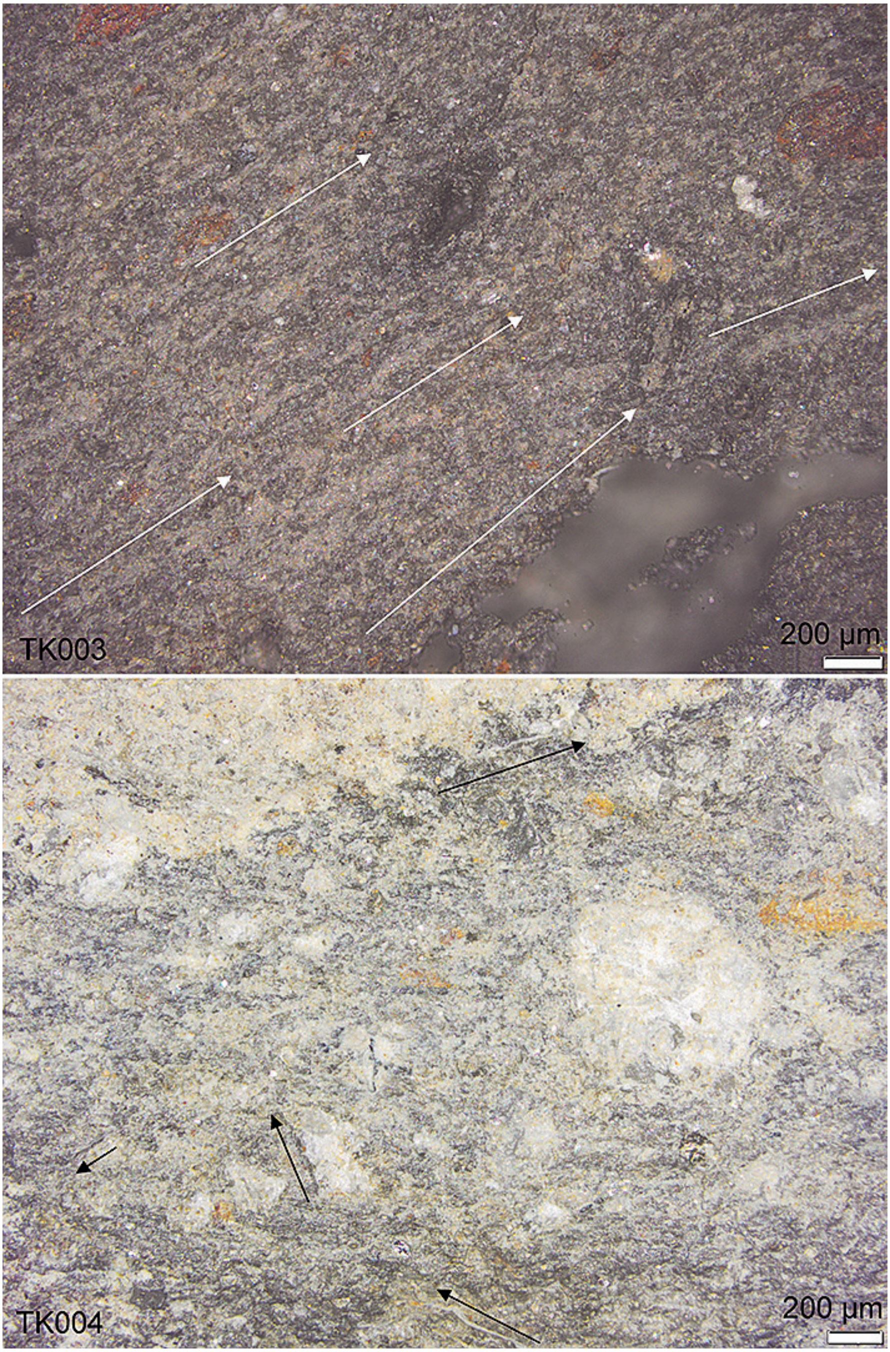

Fig. 5. Overview of polished-section microscopy of ceramic figurines mass. Magnification 50x. Numbers of photos correspond with figurine ID. Arrows show orientation of lengthwise inclusions and pores.
Obr. 5. Přehled nábrusů keramické hmoty analyzovaných plastik při zvětšení 50x. Označení fotografií koresponduje s ID plastik. Šipky označují orientaci podélných inkluzí a pórů.

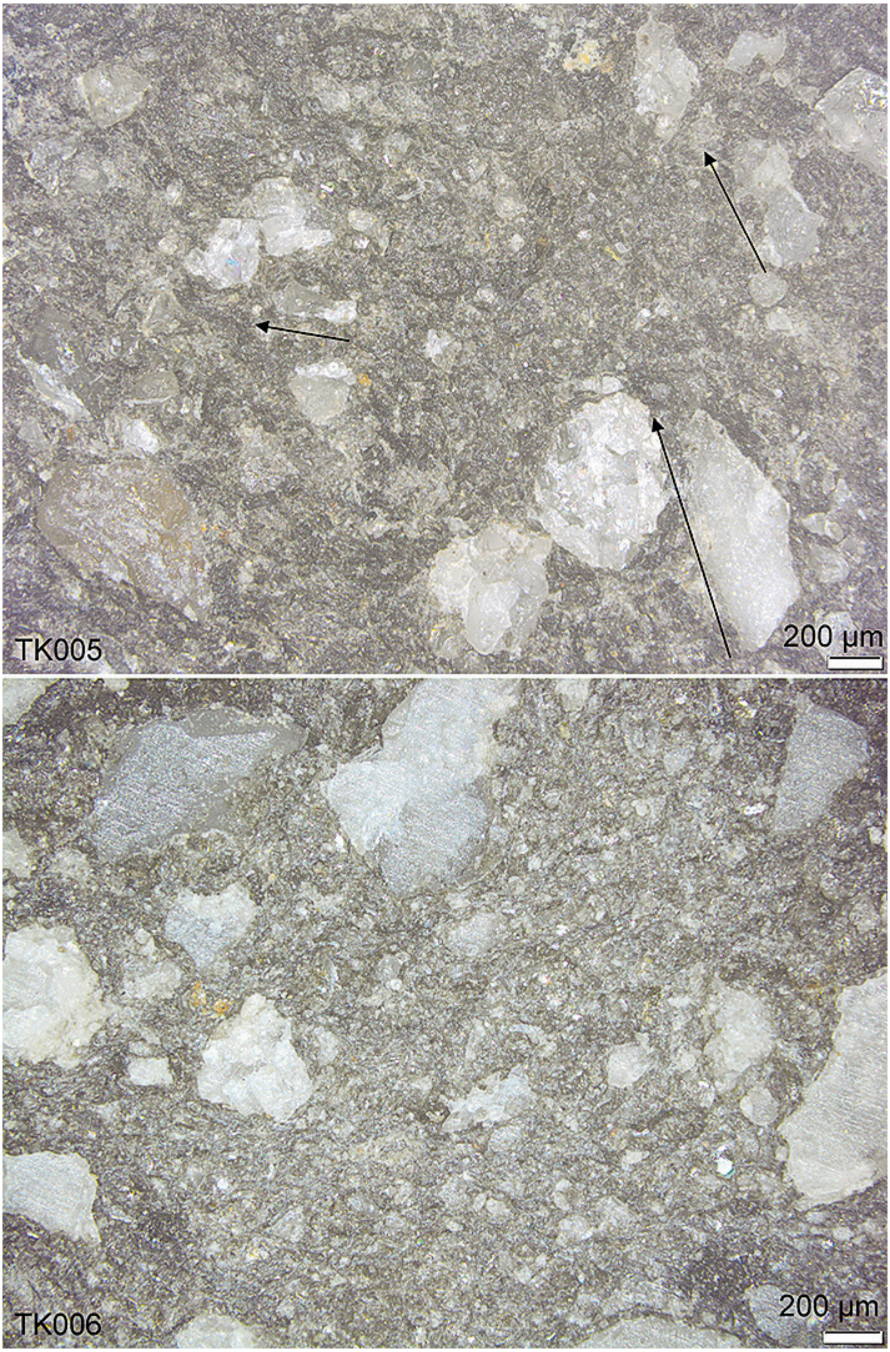

Fig. 6. Overview of polished-section microscopy of ceramic figurines mass. Magnification 50x. Numbers of photos correspond with figurine ID. Arrows show orientation of lengthwise inclusions and pores.
Obr. 6. Přehled nábrusů keramické hmoty analyzovaných plastik při zvětšení 50x. Označení fotografií koresponduje s ID plastik. Šipky označují orientaci podélných inkluzí a pórů.

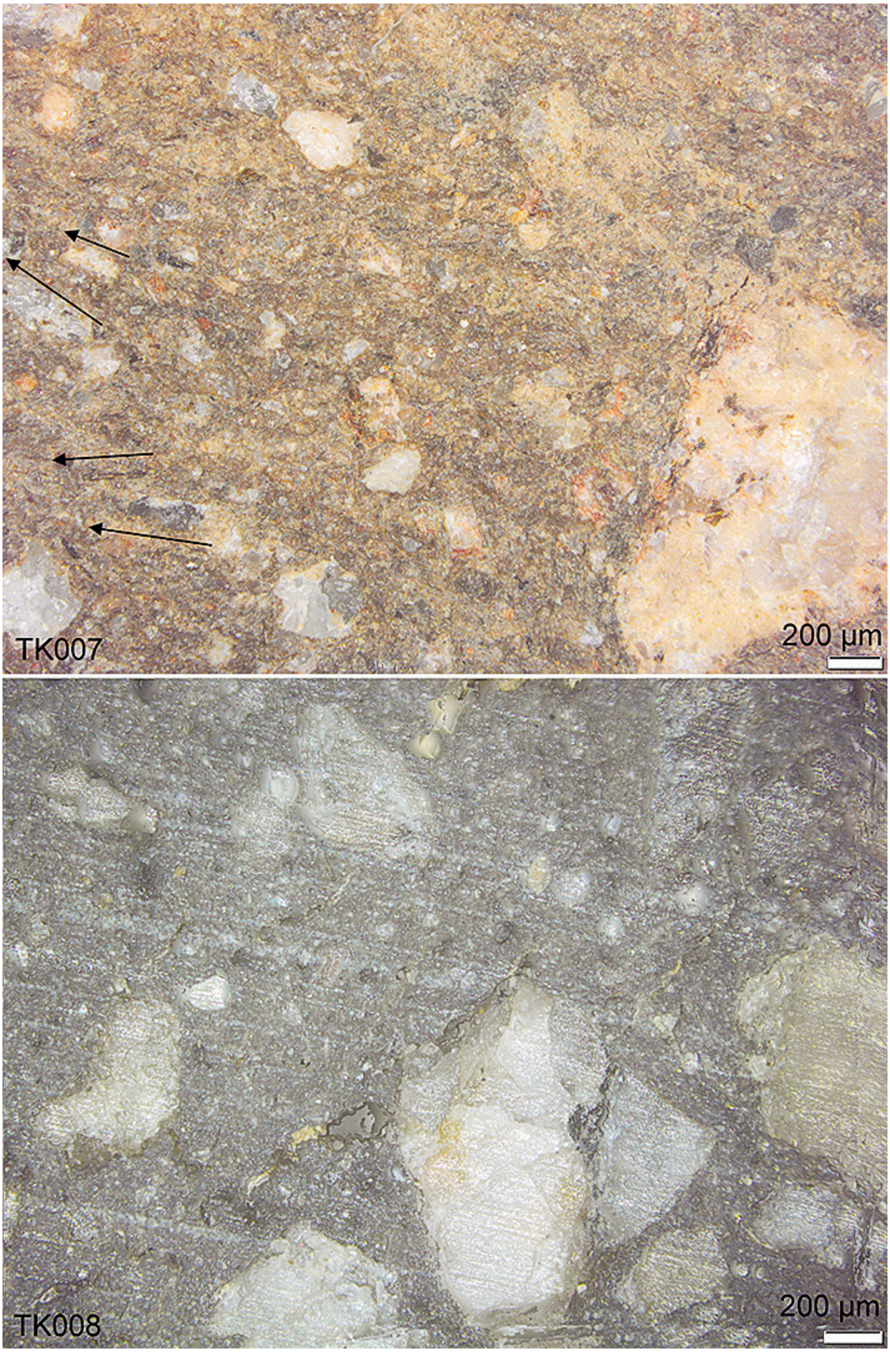

Fig. 7. Overview of polished-section microscopy of ceramic figurines mass. Magnification 50x. Numbers of photos correspond with figurine ID. Arrows show orientation of lengthwise inclusions and pores.
Obr. 7. Přehled nábrusů keramické hmoty analyzovaných plastik při zvětšení 50x. Označení fotografií koresponduje s ID plastik. Šipky označují orientaci podélných inkluzí a pórů.

Sample/ Vzorek	Equipment/ Zařízení	Sample state/ Forma vzorku	K	Ca	Ti	Cr	Mn	Fe	Ni	Cu	As	Rb	Sr	Pb
Figurine/ Plastika TK001	Benchtop/Stolní	Powder/Práškový	15900	16500	4900	74	310	27000	32	33	16	137	151	30
	Portable/Ruční	Solid: sampling area/Pevný: místo odběru	21100	23600	6200	170	252	34400				123	178	30
	Portable/Ruční	Solid: outside/Pevný: vnější	16400	14600	6900	121	386	23900	31			90	131	21
	Portable/Ruční	Solid: fracture/Pevný: lom	15400	58700	5200	94	269	21600	23			88	151	22
Figurine/ Plastika TK002	Benchtop/Stolní	Powder/Práškový	15200	8720	3000	51	210	19600	28	30	7	138	149	21
	Portable/Ruční	Solid: sampling area/Pevný: místo odběru	12500	8600	3200		236	18600				81	111	14
	Portable/Ruční	Solid: outside/Pevný: vnější	18700	12600	3900	52	365	25500	21			88	110	
	Portable/Ruční	Solid: fracture/Pevný: lom	11200	7200	3100	31	185	15600	19			78	106	
Figurine/ Plastika TK003	Benchtop/Stolní	Powder/Práškový	21700	16200	4200	68	299	26500	31	41	9	157	114	23
	Portable/Ruční	Solid: sampling area/Pevný: místo odběru	19600	19500	4100	23	250	20600	20			101	96	18
	Portable/Ruční	Solid: outside/Pevný: vnější	21400	8900	4400	54	616	19500	37			106	105	
	Portable/Ruční	Solid: fracture/Pevný: lom	20900	7100	4300	49	370	20600	19	16	4	108	91	
Figurine/ Plastika TK004	Benchtop/Stolní	Powder/Práškový	13200	18800	4000	96	328	29300	31	32	15	84	126	29
	Portable/Ruční	Solid: sampling area/Pevný: místo odběru	11400	36900	3500	45	501	17900	20		4	54	95	15
	Portable/Ruční	Solid: outside/Pevný: vnější	19600	70100	4800	71	576	27500	41			71	117	
	Portable/Ruční	Solid: fracture/Pevný: lom	11300	22700	5700	34	762	25800	31		9	61	107	18
Figurine/ Plastika TK005	Benchtop/Stolní	Powder/Práškový	11100	15100	3400	84	200	23200	31	31	13	93	151	26
	Portable/Ruční	Solid: sampling area/Pevný: místo odběru	14500	19500	4700	34	326	22300	25			71	137	16
	Portable/Ruční	Solid: outside/Pevný: vnější	12000	13100	4200	59	189	16700	32			63	140	
	Portable/Ruční	Solid: fracture/Pevný: lom	14200	9200	3700	16	185	15700				75	117	16
Figurine/ Plastika TK006	Benchtop/Stolní	Powder/Práškový	26800	13600	2500	80	238	18300	29	24	20	187	182	36
	Portable/Ruční	Solid: sampling area/Pevný: místo odběru	21100	13900	2300	182	238	13600	13			105	151	40
	Portable/Ruční	Solid: outside/Pevný: vnější	28500	11700	3400	103	259	15100	29			131	163	33
	Portable/Ruční	Solid: fracture/Pevný: lom	23800	13800	2800	116	213	13900	23			117	164	35
Figurine/ Plastika TK007	Benchtop/Stolní	Powder/Práškový	20300	14300	6400	79	382	36700	39	35	11	155	198	24
	Portable/Ruční	Solid: sampling area/Pevný: místo odběru	18800	21600	6000	23	386	27600	19			95	148	11
	Portable/Ruční	Solid: outside/Pevný: vnější	20500	48200	6800	36	965	31400	36			109	184	
	Portable/Ruční	Solid: fracture/Pevný: lom	18800	36600	5900		490	31800	35			100	162	12
Figurine/ Plastika TK008	Benchtop/Stolní	Powder/Práškový	16000	18700	4000	139	346	23300	32	31	12	107	154	26
	Portable/Ruční	Solid: sampling area/Pevný: místo odběru	13300	18000	4200	204	298	18400	22			83	142	19
	Portable/Ruční	Solid: outside/Pevný: vnější	14600	33900	6300	76	429	23600	15			82	204	25
	Portable/Ruční	Solid: fracture/Pevný: lom	16900	27500	7100	64	351	29900	17			95	197	26

Tab. 3. Results of XRF and p-XRF measurements.
Tab. 3. Výsledky měření XRF.

Although all figurines were of the same type, chronology and site, their mass significantly varied in macroscopic and microscopic observations. The chosen parameters proved to be very appropriate for classifying larger collections into technological groups. Certain other aspects must also be noted, especially that larger figurines were formed gradually in several layers. These layers could differ significantly by material, as was evident macroscopically in several samples (TK004). Each layer must be evaluated separately. The gradual layering of the volume of figurine material could even occur over a longer period of time (*Kreiter et al. 2014*, 140). Hence, in addition to documenting the forming method, the layering can also provide information on other aspects of the production process.

4.2. Chemical composition

Values measured by the portable system and subsequently with the benchtop XRF were similar (*fig. 8–13*), although the benchtop XRF was more sensitive in detecting trace amounts of elements, which the handheld device did not (Cu, As, and in some cases Cr and Pb). There were several extreme fluctuations in the manual measurements compared to the desktop XRF, which were probably caused by the presence of a specific inclusion in the measurement field. Deviated values were related mainly to measurement on the solid external surface of the figurine (TK004 and TK007 in Ca, TK003 and TK007 in Mn), which were could be coated by colour or other residues, whereas deviation in measurement was lower on the original surface of the fracture (TK001 and TK007 in Ca, TK008 in Ti, TK004 in Mn). Measurements on the solid surface of the prepared sampling area on the fracture deviated only in the case of Cr (TK001, TK006 and TK008). These deviations can be easily eliminated by multiple measurements. All elements were measured (including Si and Al), but trace values were detected only by the benchtop device (*tab. 3*).

We identified several samples with significantly different values in some elements (TK001 Ba value, TK004 Rb value, TK005 K and Fe values, TK 007 Ti and Fe values, TK008 Cr value), perhaps indicating a different origin of either whole figurines or just the components of the material (inclusions) brought to the production site. To confirm or refute this hypothesis, it was necessary to conduct a statistical evaluation (PCA or DA) of a much larger number of samples, followed by verification using a comparison with standardised samples fired from local clays, and with fine and coarse pottery of the site and phase. Multivariate or statistical analyses were not conducted due to a low number of samples. None of the analysed samples had the same composition; collection variability corresponded with variability in petrography. Raw p-XRF data are presented in *tab. 4*.

4.3. Optical microscopy of figurine surface and use-wear analysis

Identified on the surface of the studied samples were use-wear traces of the final surface treatment (polishing – samples TK001, TK008A), repeated contact with soft organic materials (samples TK001, TK004, TK005, TK007, TK008A), post-depositional processes (TK008A) and even technological deficiencies in production (*fig. 14*). In the case of the superposition of several different layers applied to the surface of figurines, it was possible to identify their sequence (sample TK007). The most conspicuous abrasion impact was identified in a large, clearly demarcated zone of the neck area of figurine TK008 (*fig. 15*). Isolated striations were typical evidence of random post-depositional contact (samples

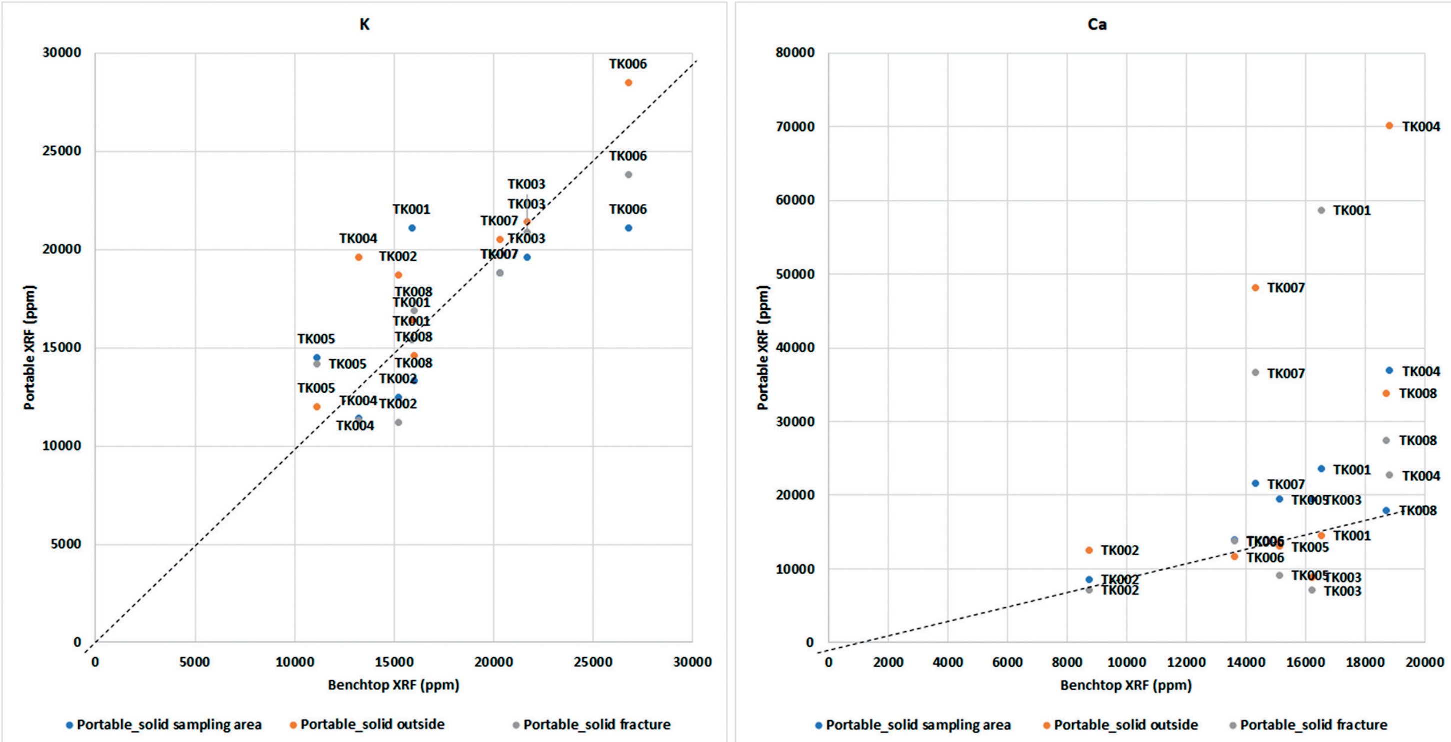

Fig. 8. XRF measurement results of ceramic figurines mass – K and Ca. Every individual figurine is presented by four measurements, except the cases in which portable device did not catch values of some trace elements.
Obr. 8. Výsledky měření XRF u keramických plastik – K a Ca. Každá plastika je zachycena čtyřmi měřeními, s výjimkou případů, kdy přenosné XRF nezachytilo hodnoty některých stopových prvků.

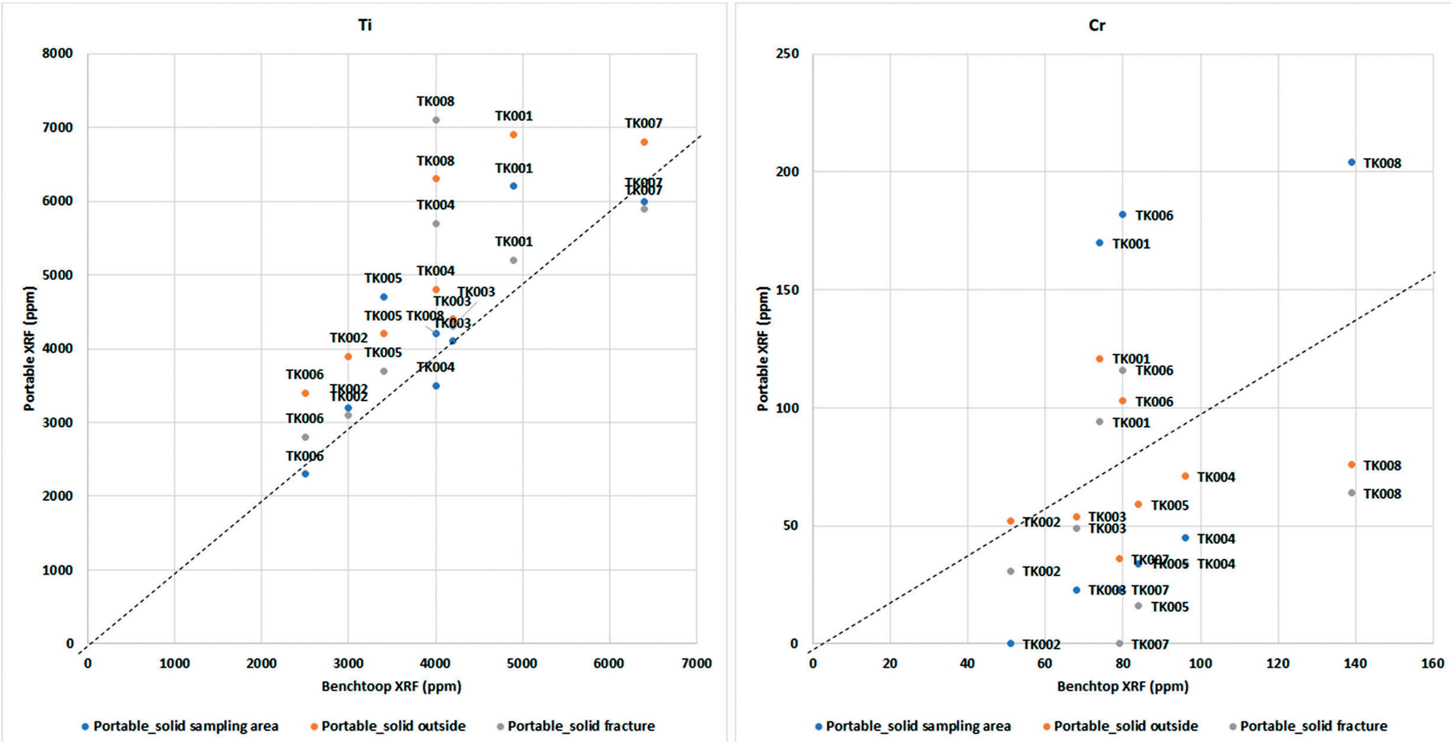

Fig. 9. XRF measurement results of ceramic figurines mass – Ti and Cr. Every individual sample is presented by four measurements, except the cases in which portable device did not catch values of some trace elements.
Obr. 9. Výsledky měření XRF u keramických plastik – Ti a Cr. Každá plastika je zachycena čtyřmi měřeními, s výjimkou případů, kdy přenosné XRF nezachytilo hodnoty některých stopových prvků.

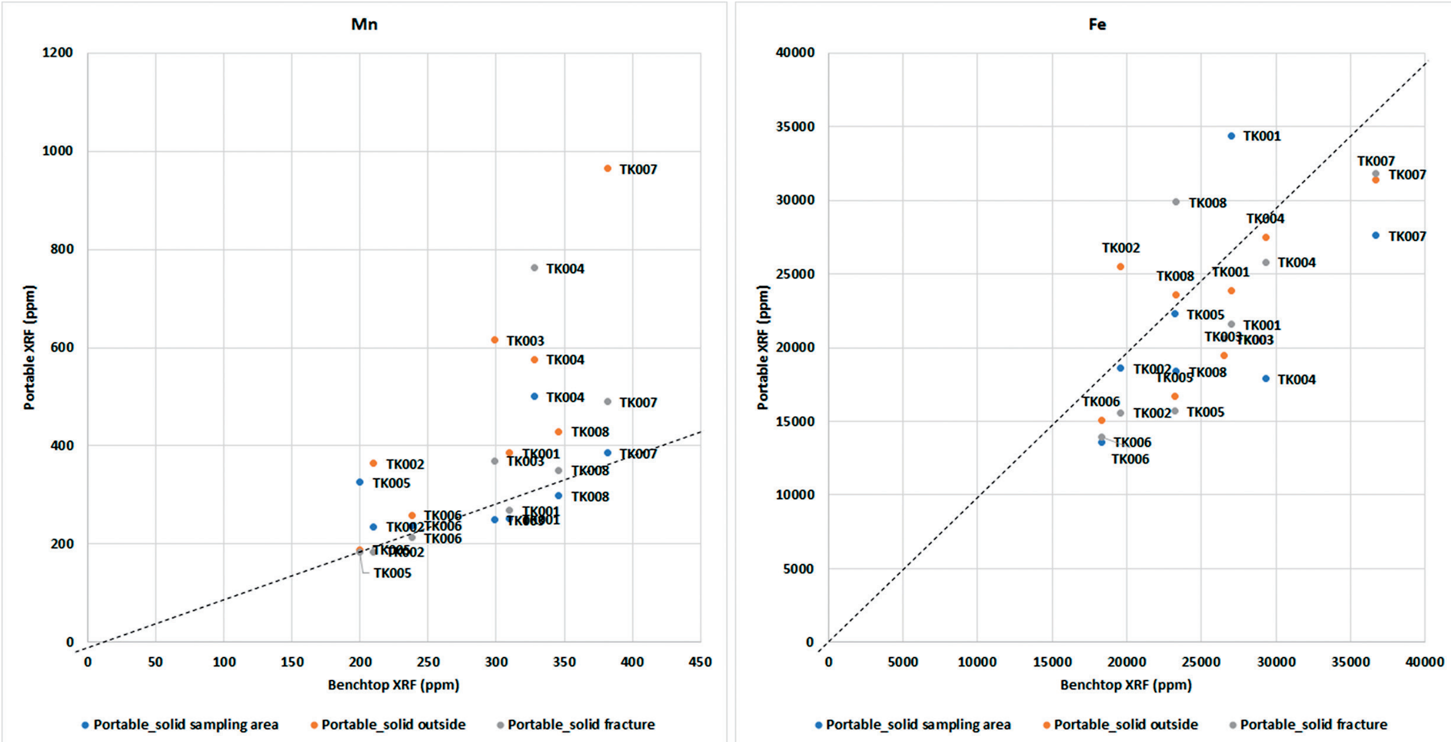

Fig. 10. XRF measurement results of ceramic figurines mass – Mn and Fe. Every individual figurine is presented by four measurements, except the cases in which portable device did not catch values of some trace elements.
Obr. 10. Výsledky měření XRF u keramických plastik – Mn a Fe. Každá plastika je zachycena čtyřmi měřeními, s výjimkou případů, kdy přenosné XRF nezachytilo hodnoty některých stopových prvků.

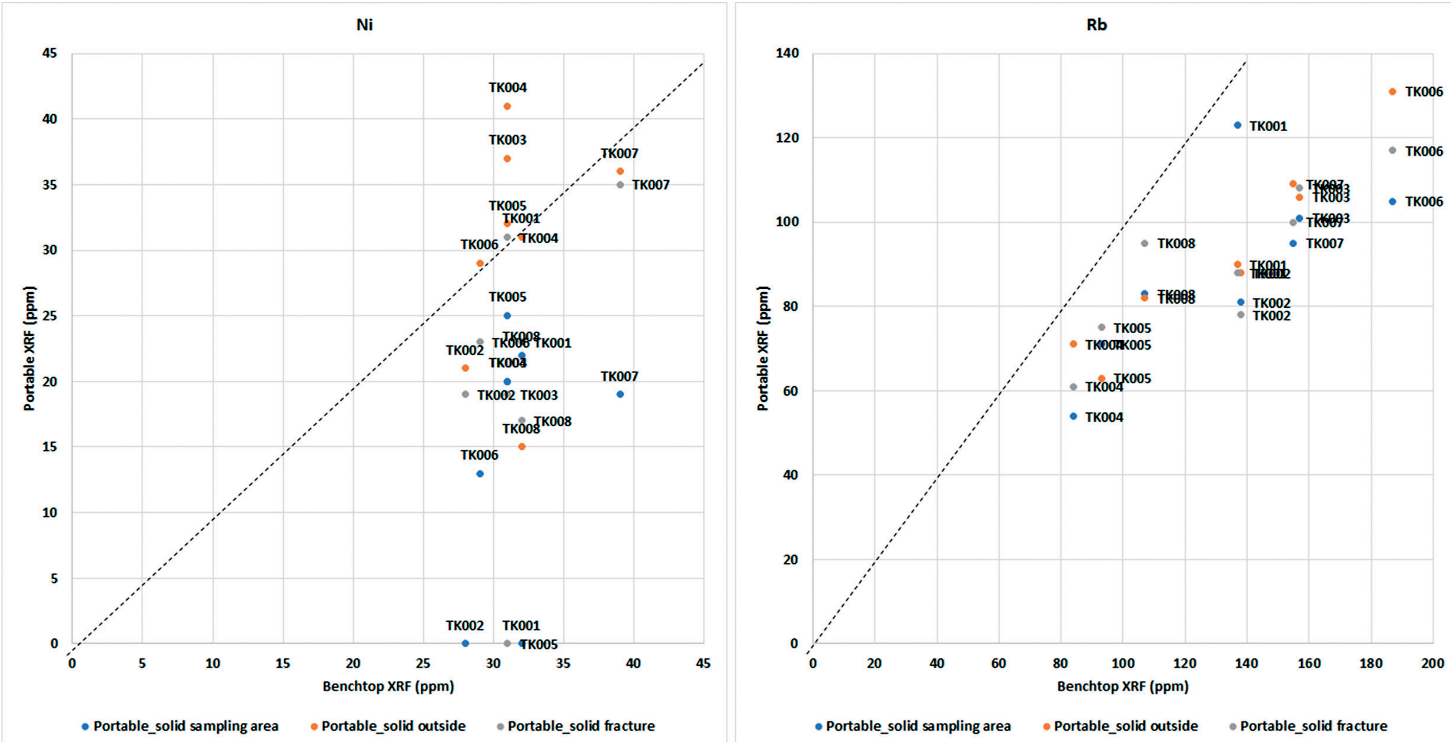

Fig. 11. XRF measurement results of ceramic figurines mass – Ni and Rb. Every individual sample is presented by four measurements, except the cases in which portable device did not catch values of some trace elements.
Obr. 11. Výsledky měření XRF u keramických plastik – Ni a Rb. Každá plastika je zachycena čtyřmi měřeními, s výjimkou případů, kdy přenosné XRF nezachytilo hodnoty některých stopových prvků.

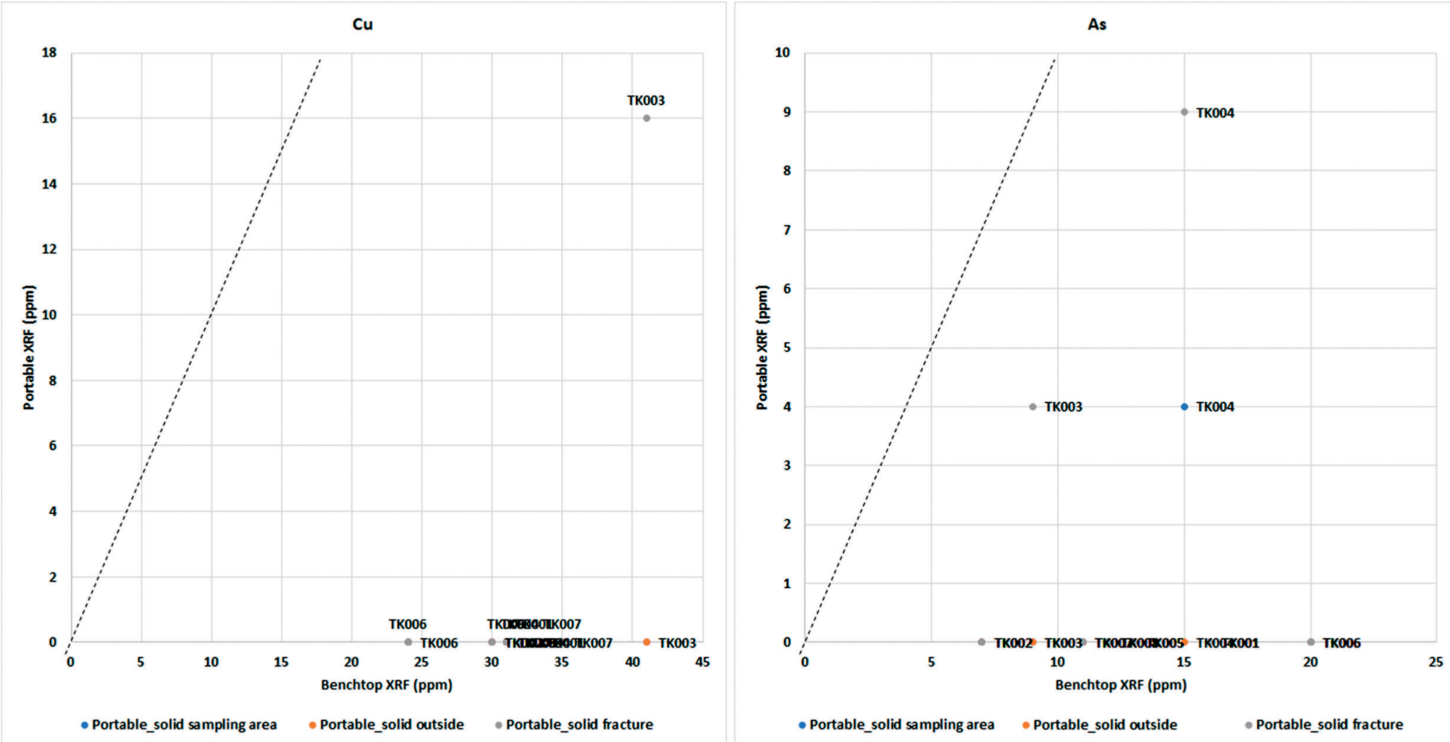

Fig. 12. XRF measurement results of ceramic figurines mass – Cu and As. Every individual figurine is presented by four measurements, except the cases in which portable device did not catch values of some trace elements.
Obr. 12. Výsledky měření XRF u keramických plastik – Cu a As. Každá plastika je zachycena čtyřmi měřeními, s výjimkou případů, kdy přenosné XRF nezachytilo hodnoty některých stopových prvků.

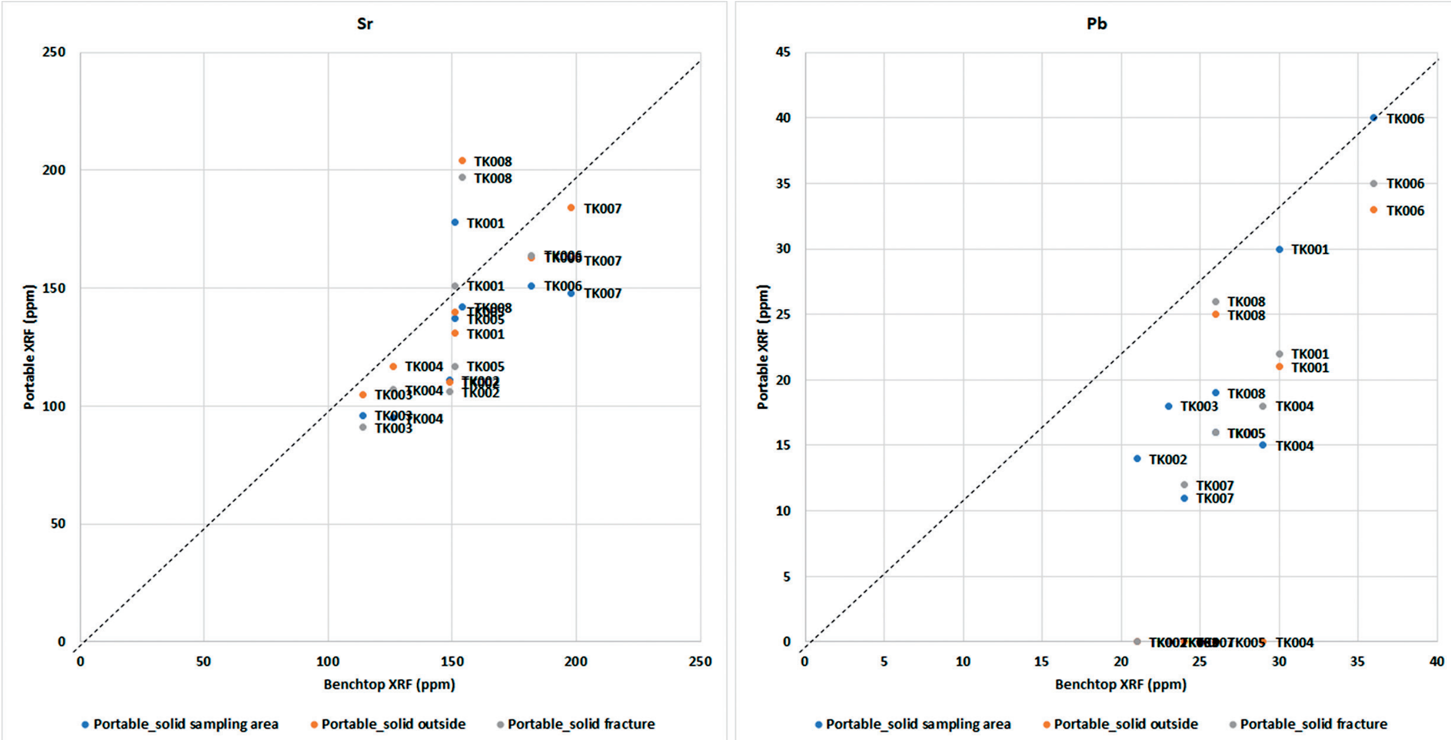

Fig. 13. XRF measurement results of ceramic figurines mass – Sr and Pb. Every individual sample is presented by four measurements, except the cases in which portable device did not catch values of some trace elements.
Obr. 13. Výsledky měření XRF u keramických plastik – Sr a Pb. Každá plastika je zachycena čtyřmi měřeními, s výjimkou případů, kdy přenosné XRF nezachytilo hodnoty některých stopových prvků.

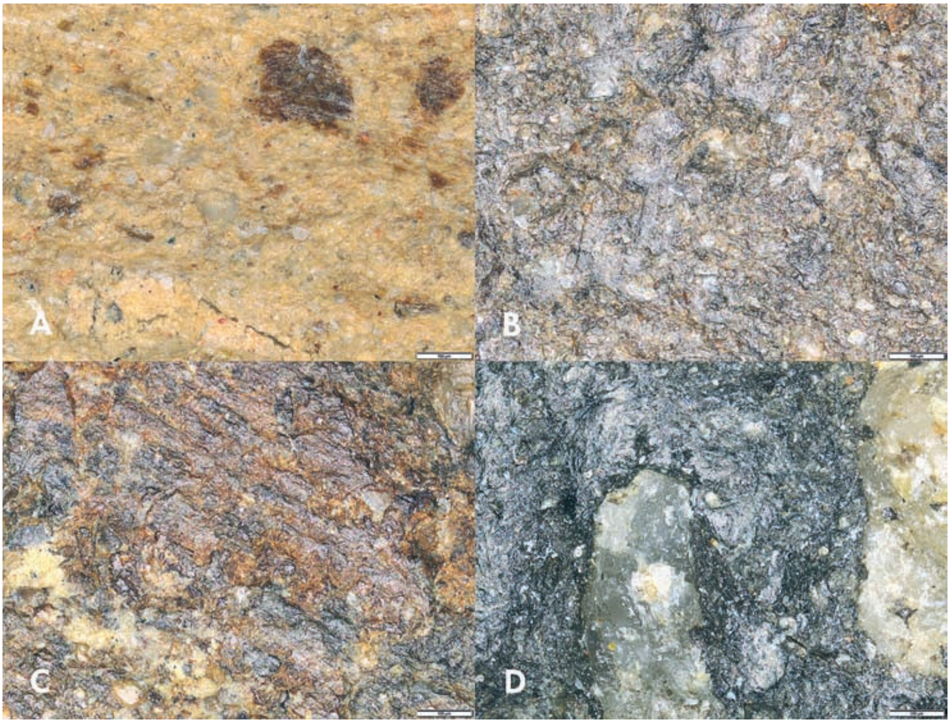

Fig. 14. Overview of identified traces on the figurine surface. A – sample TK001 isolated striations and thermal crack, B – sample TK001 rounding, C – sample TK004 – contamination, D – sample TK008A rounding. Magnification 200x.
Obr. 14. Přehled identifikovaných stop na povrchu plastik. A – vzorek TK001 izolované striace a termické praskliny, B – vzorek TK001 otěrové zaoblení, C – vzorek TK004 kontaminace, D – vzorek TK008A – otěrové zaoblení. Zvětšení 200x.

TK001, TK004, TK008). The frequent presence of thermal cracks was an important finding. These were by no means only occasional macroscopically identifiable cracks tenths of a millimetre wide, but abundant microscopic cracks (up to 50 μm wide) that secretly predetermined the durability of the entire figurine (samples TK001, TK002, TK008A). However, the examination of cracks did not indicate that the monitored samples were evidence of deliberate disposal by burning. As seen at point 02 on sample TK005 (*fig. 16*), the micro-crack runs between large inclusions (0.6 mm fraction), which could already have been a weak point in the homogeneity of the matrix during firing.

A large number of post-excavation intrusive traces were also identified, a finding that could improve the handling of artefacts during excavation and especially during conservation work. These intrusions could be macroscopically misinterpreted as shiny abrasion points or as evidence of a surface finishing process. The surface of the figurines was most often contaminated by accidental contact with a brush dipped in lacquer, glue or other substances (sample TK002, TK004). Frequent traces of brushing, including on painted figurines, were regrettable, as this method of cleaning has resulted in the loss of the original pigment layer in large areas (sample TK004).

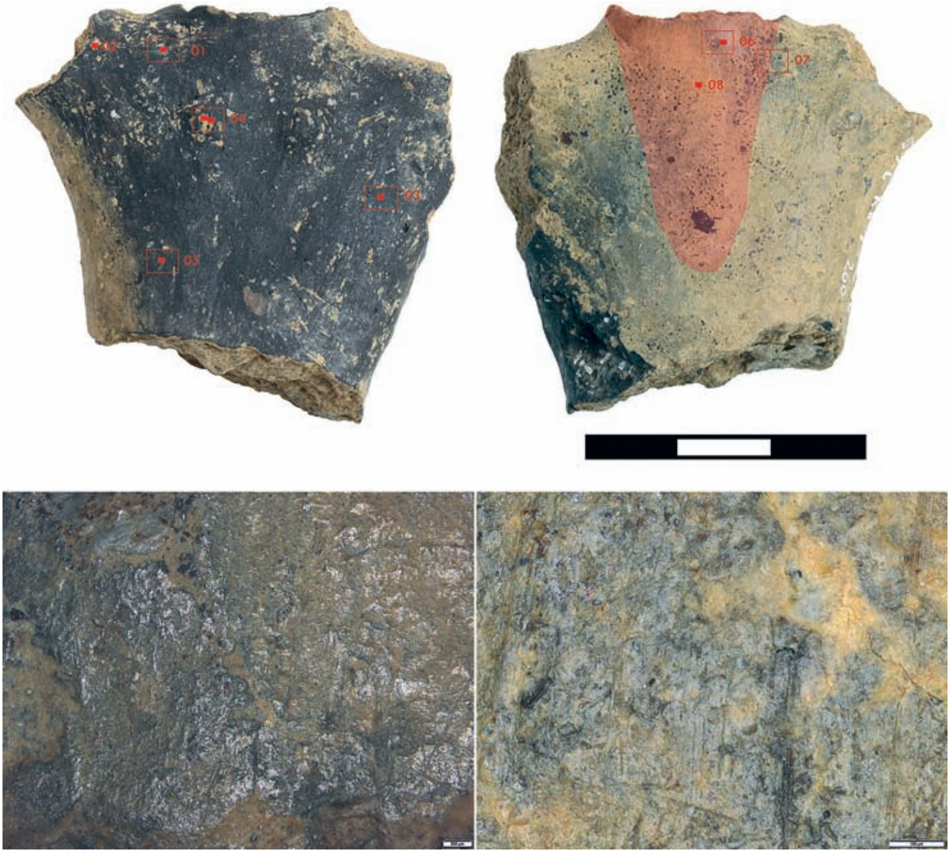

Fig. 15. Use-wear traces on upper back part of the fragment TK008A. Microphotos in location point 6. Magnification 50x (bellow left) and 200x (bellow right).
Obr. 15. Stopy opotřebení na horní části zádové partie fragmentu TK008A. Mikrosnímky v místě bodu 6. Zvětšení 50x (dole vlevo) a 200x (dole vpravo).

4.4. High-resolution 3D analysis

By removing textures and using visualisation renderers and filters, it was possible to identify production traces such as smoothing and obscuring connection areas of the figurine parts (*fig. 17*), smoothing traces and surface formation (*fig. 18*). In the normal rendered view, traces of the connection of individual parts could be identified. With still images, these traces on the surface of artefacts were tracked and presented with much less efficiency than when a real-time 3D model was used with different filter settings and illumination levels. For this reason, 3D models of the analysed figurines were made available using the Sketchfab publication platform for 3D models: (https://sketchfab.com/vojtanosek/collections/neolithic-idols). The layering of material could also be studied by analysing the digital model in high resolution. Although it was sometimes macroscopically apparent, 3D analysis was able to identify differences in, for example, the nature of the fracture, which may be related to the interior properties of the material and to the different pressure with

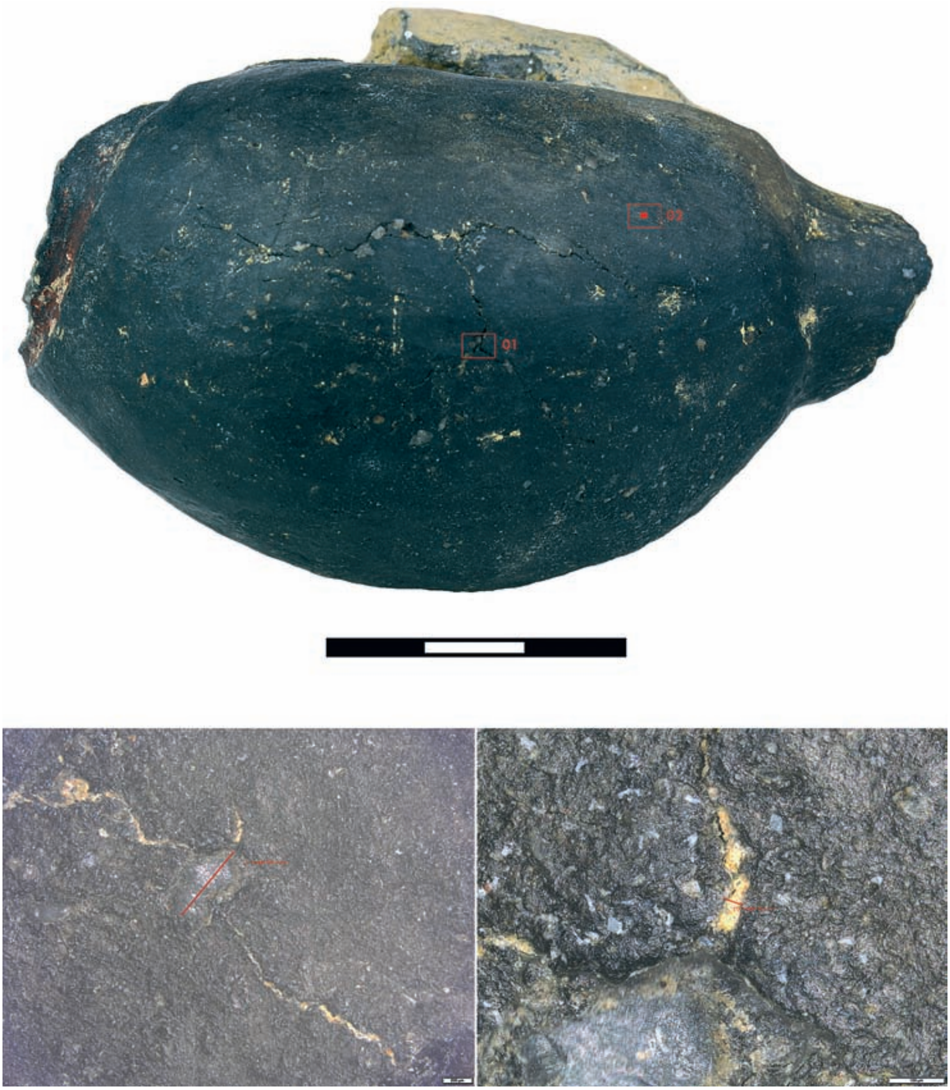

Fig. 16. Microscopic thermic cracks. Fragment TK005. Both those macroscopically visible (above) and those invisible by naked eye (bellow) advance between inclusions, both larger and tiny. Magnification 50x (bellow left) and 200x (bellow right).
Obr. 16. Mikroskopické termické trhliny. Fragment TK005. Jak ty viditelné makroskopicky (nahoře), tak ty prostým okem nezjistitelné (dole), postupují od inkluze k inkluzi bez ohledu na jejich velikost. Zvětšení 50x (dole vlevo) a 200x (dole vpravo).

which the layers were formed (*fig. 19*). Also identified were traces of surface roughening, which served both for the improved adhesion of the individual parts to be joined and for the bonding of individual layers (*fig. 20: a*). Production traces also included fingerprints left on the surface before firing (*fig. 20: b*), without intending to speculate that they belong to the manufacturer or result from accidental touch.

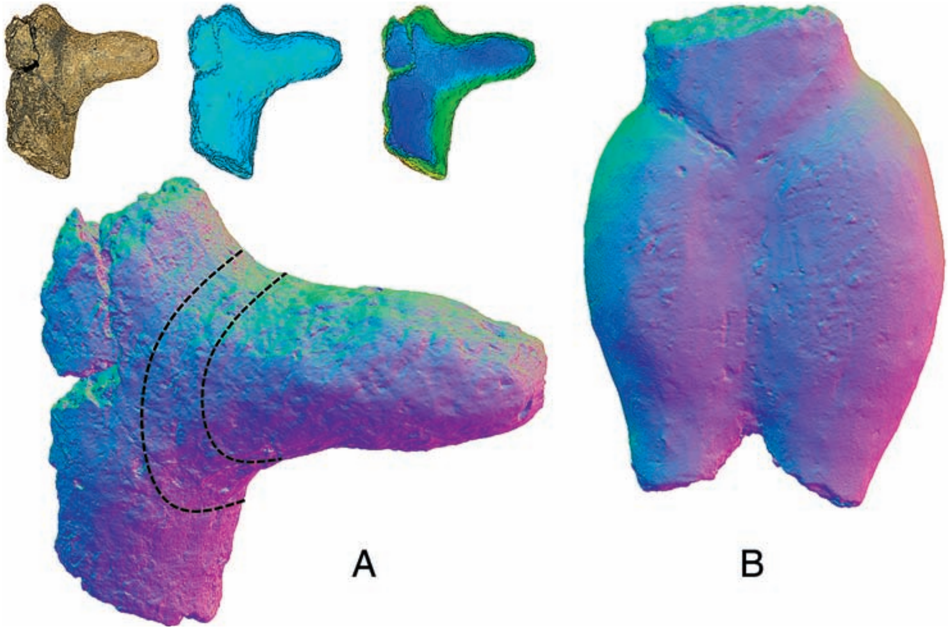

Fig. 17. 3D traces – joint covering traces, and legibility opportunities of digital observation based on high-resolution 3D photogrammetry. A – fragment TK002A, B – fragment TK001. For scale see fig. 2.
Obr. 17. 3D příznaky – zahlazení spoje jednotlivých dílů, zvýšení čitelnosti při pozorování digitálního 3D záznamu s vysokým rozlišením. A – fragment TK002A, B – fragment TK001. Měřítko je uvedeno na obr. 2.

5. Discussion

One of the aims of this article was to clarify whether and to what extent certain widely available non- and semi-destructive methods could completely, or to a large extent, replace destructive approaches. That is, whether it was relevant to replace a thin-section on most of the samples with a polished-section and a benchtop XRF with the p-XRF, which is a readily available and non-destructive device. We carefully reflect the limits of polished-sections and p-XRF in provenance data. We hope to bridge this gap in further research by carrying out the following: 1) sorting the figurine collection based on polished-sections, and p-XRF data processed by DA or PCA, 2) determining representatives of these groups for further analysis in-situ or with the sample removed from the fracture area to determine mineral inclusions and explore data related to provenance, 3) creating a p-XRF local baseline, and 4) analysing statistically significant thin-sections of the ceramic collection from the site.

Sorting based on polished sections and p-XRF, statistically evaluated, will identify the degree of their randomness or stability. In the case of sites with high dispersion and fragmentation of finds, these results may lead to the identification of figurines from the same batch of prepared clay, including the further use of their interconnected spatial data.

The p-XRF baseline will be based on field sampling of the site and its vicinity, firing of these local clays at several appropriate temperature levels and measuring them by the same device, under the same calibration standard and sample treatment. The p-XRF data

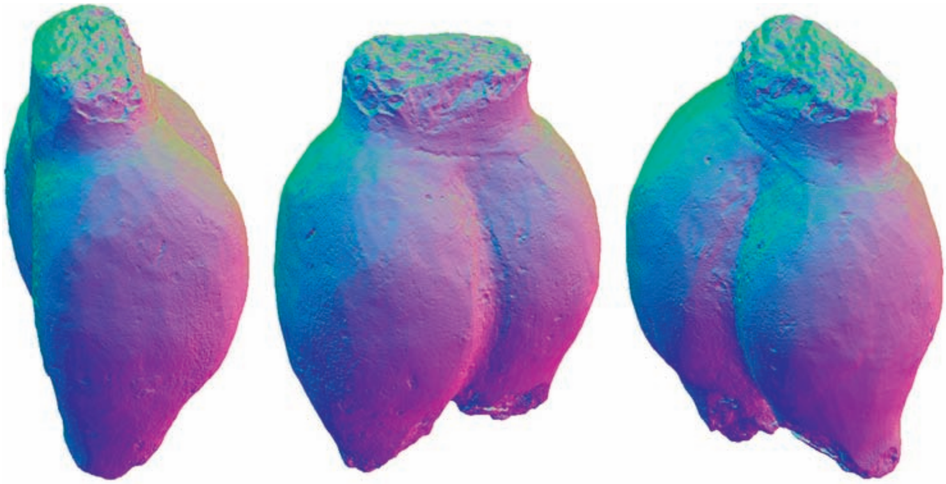

Fig. 18. 3D traces of fragment TK001 – surface polishing. For scale see fig. 2.
Obr. 18. 3D příznaky na fragmentu TK001 – hlazení povrchu. Měřítko je uvedeno na obr. 2.

of powder samples of contemporary pottery, both fine and coarse, supported by thin-sections of the same samples, will also be compared with these data. This could identify an objective frame for future reconstruction of figurine provenance based on p-XRF at least in terms of local/non-local. Those samples identified as non-local, could be analysed in a specialised laboratory by XRD, IR or other methods to identify mineral or chemical composition. This will result in a significantly reduced collection of samples, which will be financially affordable.

The number of analysed samples was too small to interpret the results above in more general terms, which will be possible only when the analyses of dozens or hundreds of samples are processed. However, it offers a way to reliably classify heterogeneous (form, size, colour, and other parameters) assemblages into individual technological groups. The randomness or stability of the production processes was a valuable piece of information necessary for the modern interpretation of Lengyel culture ceramic figurines. The fragmentarity of figurines offers a good opportunity for careful sampling after high-resolution 3D documentation preserves topographical data. Although thin sections could remain limited due to heritage preservation, even powder sampling for the differentiation of local and non-local inclusions is an important contribution to the issue of distribution mechanisms. However, it is necessary to assess from a comparison with local materials whether the inclusions themselves were transported (the matrix is local) or whether the finished products, ceramics or figurines, were transported (the matrix is also non-local).

If we insist that only thin-sections and the collection of samples for XRF or other destructive methods provide meaningful information, our knowledge will remain based on individual data from diverse chronological, geographical and cultural contexts. It will never be determined whether these individual data are relevant to other ceramic figurines in the region, culture, period, or even the same settlement. We, therefore, considered semi-destructive methods, which produced at least part of the analytical data, as a good compromise between both undesirable positions, unique analytical data versus the cutting and destruction

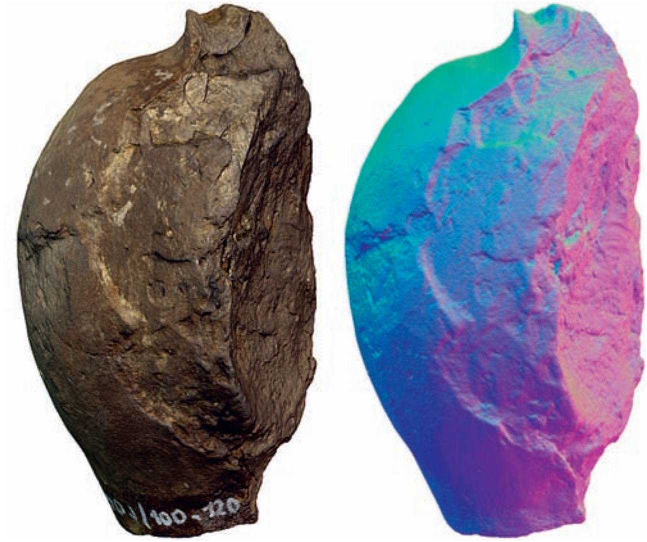

Fig. 19. 3D traces of fragment TK004 – different fracture features of individual levels of the mass. For scale see fig. 2.
Obr. 19. 3D příznaky na fragmentu TK004 – rozdílné znaky fraktur jednotlivých vrstev keramické hmoty. Měřítko je uvedeno na obr. 2.

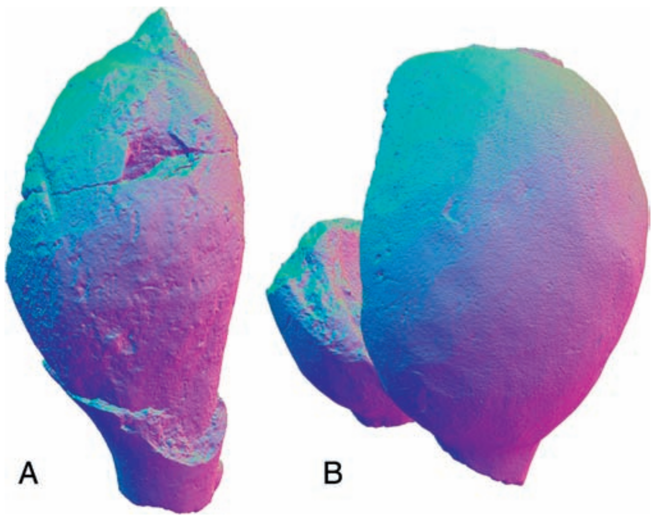

Fig. 20. 3D traces. A – coarsing (fragment TK007), B – fingerprints (fragment TK005). For scale see fig. 2.
Obr. 20. 3D příznaky. A – zdrsňování (fragment TK007), B – otisky prstů (fragment TK005). Měřítko je uvedeno na obr. 2.

of all figurines. We also considered the contribution of high magnification optical methods, i.e., microscopy, use-wear and 3D analysis, to be significant, as they provided a wealth of data needed to study the formation, manufacture and fragmentation processes.

6. Conclusion

All analyses carried out showed significant variability in the majority of observed parameters. These findings showed how uncertain or even misleading it would be to construct a wider social interpretation of the figurine's role based on individual analysed samples from several sites scattered in a large area. The analysis of large collections is required to clarify if the processes during their production, use, discard and deposition were arbitrary or if they were performed in a stable pattern. How stable and repetitive the processes were reflects how organised and socially important the figurine's role was. Although all samples were from the same site, and had the same chronology and typology, their variability was not only seen in the mass composition, but also in shaping (forming, number of layers, number and type of parts compounded together), and surface treatment. Unnecessary technology, composition and shaping would be related to narrative information, which would involve only the object per se in the visual sense. However, identified traces of use and manipulation varied in a similar way. Patterned or arbitrary manipulation was closely related to the individual or social role of the figurines. Use-wear analysis of a much larger collection is a key task in further research of this phenomenon. This will deepen our knowledge of Neolithic anthropomorphic figurines and their involvement in the life of society.

We would like to express our gratitude to Jan Petřík and Karel Slavíček who provided helpful consulting of our research goals and methods.
Lab-XRF values of our samples were measured on Department of Geological Sciences, Faculty of Science, Masaryk University in Brno. Polished sections were manufactured on Department of Archaeology and Museology, Faculty of Arts, Masaryk University Brno, Experimental centre Panská Lhota.

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Neolitické keramické plastiky
Několik možností analytického studia památkově cenných keramických artefaktů

Cílem příspěvku je poukázat na přínosy a dopady vybraných, šířeji dostupných, nedestruktivních a semidestruktivních metod analytického studia keramických plastik a rozšířit tak spektrum relevantních metod pro analýzu těchto cenných artefaktů. Informace o složení keramické hmoty, provenienci inkluzí, způsobu tváření, výpalu a skartace jsou zcela klíčové pro posun diskuse o interpretačním potenciálu neolitických keramických antropomorfních plastik. Masivnímu nasazení metod, obvykle používaných při studiu keramiky ke zjištění těchto dat, dosud brání dva závažné faktory – destruktivnost vypovídacích analýz, která naráží na památkovou ochranu a obecné povědomí o hodnotě a vzácnosti takových nálezů, a horší cenová dostupnost analýz při aplikaci na statisticky robustní počet vzorků (stovky vzorků). Bez plošného zmapování měřitelných dat zůstáváme odkázáni pouze na jednotlivě publikované analýzy izolovaných vzorků, obvykle z jiné kultury, období nebo geografické oblasti. Na souboru osmi keramických plastik stupně Ia lengyelské kultury, ze situací v těsné blízkosti rondelu v lokalitě Těšetice-Kyjovice – Sutny (*obr. 1–3*; *tab. 1*), jsme aplikovali místo výbrusu posouzení nábrusu v místě fraktury. Odtud jsme také odebrali malé množství práškového vzorku pro XRF analýzu. Tato data jsme porovnali s výsledky měření na povrchu plastik běžněji dostupným p-XRF. Původní topografie fraktury byla před nábrusem a odběrem vzorku detailně dokumentována 3D fotogrammetrií s vysokým rozlišením. Kromě těchto metod, které jsou zaměřené především na počáteční fáze operačního řetězce, jsme využili možností optické mikroskopie a 3D analýzy ve vysokých rozlišeních k získání dat zejména k fázím používání, vyřazení a skartace.

Petrografický popis na základě optické mikroskopie plochy nábrusu ukázal výraznou heterogennost ve všech sledovaných parametrech (*tab. 2*; *obr. 4–7*) – tedy v charakteru matrix, poměru matrix a inkluzí, ve frakci, ostrohrannosti, tvaru, vytřídění i orientaci inkluzí, i tvaru a orientaci pórů. Několik vzorků vykázalo výrazné odlišnosti v obsahu chemických prvků (*tab. 3, 4*; *obr. 8–13*). Tyto rozdíly mohou naznačovat nelokální původ buď celých plastik, nebo jen přinesené složky hmoty (inkluzí). K potvrzení nebo vyvrácení této hypotézy je nezbytné statistické vyhodnocení řádově většího množství vzorků a verifikace některou z destrukčních metod na vytipovaných jedincích. Právě aplikace mikroskopie nábrusů a p-XRF měření by umožnila roztřídění libovolně velkého souboru plastik do technologických skupin. Z nich je pak možné vybrat pro další analýzu již pouze zástupce. To by zásadně eliminovalo nejen poškození těchto cenných nálezů, ale i finanční náklady. Při malém počtu dobře vybraných vzorků by bylo možné aplikovat jak μ-CT, tak některou z nedestruktivních metod analýzy chemického nebo minerálního složení (XRD, IR aj.). Měření p-XRF porovnané s dostatečným počtem lokálních vzorků sedimentů v různých stupních výpalu, stejně jako s větším množstvím měření soudobé jemné a hrubé keramiky, by přinejmenším bylo schopno poskytnout objektivní informaci o tom, které vzorky jsou místního původu a které jsou cizorodé. Již to je zcela zásadní informace. Identifikované nelokální vzorky by poté mohly být dále analyzovány s cílem identifikovat původ inkluze, případně matrix. Optické metody – mikroskopie, traseologie a 3D analýza dosud nebyly ve studiu keramických plastik uplatňovány. Výsledky však přinesly řadu zcela nových zjištění. Byly identifikovány traseologické příznaky finálních úprav povrchu (leštění – vzorky TK001, TK008A), opakovaného kontaktu s měkkými organickými materiály (vzorky TK001, TK004, TK005, TK007, TK008A), postdepozičních procesů (TK008A) i technologických nedostatků výroby (*obr. 14*). Nejnápadnější otěrový impakt byl identifikován v rozsáhlé, jasně ohraničené zóně šíjové oblasti plastiky

TK008 (*obr. 15*). Typickým dokladem postdepozičních náhodných kontaktů jsou izolované striace (vzorky TK001, TK004, TK008). Častým jevem byla přítomnost termických mikroprasklin (šíře do 50 μm), které při makroskopickém studiu zůstávají neodhaleny (vzorky TK001, TK002, TK008A). Tyto praskliny skrytě omezují trvanlivost plastik. Z ohledání prasklin nicméně nevyplývá, že by se u sledovaných vzorků jednalo o doklad záměrné skartace přepálením. Jak je vidět na situaci bodu 02 vzorku TK005 (*obr. 16*), mikroprasklina probíhá mezi velkými inkluzemi (frakce 0,6 mm). Ty mohly být slabým místem homogenity hmoty již při výpalu. Při 3D analýze byly analyzovány 3D fotogrammetrické modely se submilimetrovým rozlišením (na fotografii 6000×4000 pixelů odpovídal 1 pixel vzdálenosti 0,1 mm na povrchu plastiky). Sledování v digitálním záznamu, s možností filtrů, renderů, nebo odstranění textur je výrazně efektivnější než vizuální posouzení. Byly identifikovány stopy po zahlazování napojení mezi jednotlivými částmi plastik (*obr. 17*), rozdíly v topografii fraktur jednotlivých vrstev keramické hmoty plastik (*obr. 19*), stopy hlazení (*obr. 18*), drsnění povrchů před spojováním částí a dalšího formování povrchu (*obr. 20a*), i otisky prstů (*obr. 20b*).

Domníváme se, že využití otestovaných nedestruktivních a semidestruktivních metod má vysoký potenciál zisku analytických dat. Za významný považujeme také přínos optických metod pracujících ve vysokém zvětšení, tedy mikroskopie a 3D analýzy. Navíc využívání souboru těchto metod umožní analyzovat stovky plastik, což dosud při důrazu na destruktivní metody nebylo přípustné. Jenom tak může být zjištěno, zda jednotlivá data dosud provedených destruktivních analýz jsou relevantní pro ostatní keramické plastiky v regionu, kultuře, období, nebo i jen téhož sídliště. Počet analyzovaných vzorků je prozatím příliš malý, abychom mohli níže uvedené výsledky obecněji interpretačně uchopit. To bude možné až po zpracování analýz desítek či stovek vzorků. Předložená studie však nabízí cestu, jak prohloubit naše poznání neolitických antropomorfních plastik a jejich zapojení do života společnosti.

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