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EDITORIAL

Like any other discipline, archaeology generates vast amounts of research data. Over time, this has led us to develop procedures for preserving and disseminating primary information obtained through excavations and surveys. Codified reports and other forms of 'grey literature' have become a well-established genre that archaeologists both produce and consult. Yet, data creation does not end once we put down our shovels and trowels. In particular, the scientific methods employed in archaeology are capable of yielding large datasets, but not all make it to the final publications. Some are simply too extensive for print, while others are considered merely auxiliary by researchers. Our laptops and external drives thus overflow with tables, lists, images, and code. Left in this state, such data are effectively wasted. When made available for other researchers, they can be revisited, rendered, and expanded upon by future research.

New repositories and research infrastructures are currently emerging to address this challenge and to make archaeological data more accessible. Another effective way, however, is to link such data directly to published papers as supplementary material. *Archeologické rozhledy* has supported this approach for over two years, thanks to a new website on which supplementary materials are directly available on the paper's landing page. Authors most often provide data tables or text documents, but supplementary materials need not be limited to these data types. We encourage contributors to include, for example, R and OxCal scripts, videos documenting key excavation contexts, and georeferenced datasets compatible with GIS programmes. Links to external repositories can also be embedded in the supplementary material. This means that the data itself remains primarily stored on trusted platforms while seamlessly connected to the article via a URL link. For instance, you may wish to attach a 3D model hosted on Sketchfab or datasets deposited on Zenodo.

The opening paper in this issue by Martin Moník and colleagues illustrates this approach well: the primary analytical data are stored on GitHub and simultaneously linked to the article as online supplementary material. By analysing the dimensions, techno-typology, appearance, and chemical fingerprint of various samples, the authors investigate the provenance of radiolarites from the Gravettian site of Milovice I in Moravia. Their results suggest that most of the radiolarites were brought to this site from more distant sources, probably the White Carpathian Mountains. Local gravels, despite their availability, were used only rarely. These findings made it possible to address the mobility of Gravettian hunters, whose movements were shaped by the demand for raw materials but constrained by the harsh conditions of the Glacial environment.

The second article, by Jaroslav Peška and colleagues, also applies the archaeometric approach to track the provenance of objects. The study deals with an Early Eneolithic copper hammer-axe fragment recently found near Krhov in Moravia. Compared to lithics analysis in the previous case, tracing the origin of metal objects appears to be a greater challenge. The complex metallurgical *chaîne opératoire* and repeated recasting can obscure the signatures of the original raw materials. The authors thus combine palaeometallurgical analysis with typological assessment, which allows them to conclude that the hammer axe was most likely produced in Western Slovakia.

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The following two papers belong to the category of topical reviews and take the reader to the later medieval and post-medieval periods. Jagoda Mizerka-Urbaniak presents a review of early medieval strongholds in Western Greater Poland, a region that has long remained on the periphery of scholarly attention, as most previous studies have focused on the Gniezno Lakeland, where the Piast dynasty originated. Her paper, a truly comprehensive study, therefore represents the first systematic attempt in many years to reassess and update the record of local sites. Mizerka-Urbaniak combines field verification of sites previously known only from archival research with revisions based on the Polish Archaeological Record documentation. This allows her to provide a list (available as online supplementary material) of strongholds in Western Greater Poland, offering an important correction and starting point for further research on the formation of the Polish state.

Magdalena Bis contributes a review focused on pottery production and distribution during the Modern period within the territory of present-day Poland. Distinctive pottery types can be understood as proxies to track connectivity and cultural transfer—not only within Europe, but also reflecting influences that emerged through exploration beyond the Old World. Bis examines the channels through which pottery changes were transmitted and describes the three key phases of the process: the time of imitation, the time of individuality, and the time of simplification. Her paper thus deals with questions of broad relevance to archaeologists across regions and time periods. As the articles in this issue collectively demonstrate, connectivity is not a phenomenon unique to the modern world, but a persistent feature throughout human history, manifested with varying intensity since the earliest times.

Václav Vondrovský

RESEARCH ARTICLE – VÝZKUMNÝ ČLÁNEK

Exploitation of radiolarites at the Milovice I Gravettian site

Využití radiolaritů na gravettienské lokalitě Milovice I

Martin Moník – Martin Kováček – Petr Hamrozi – Zdeňka Nerudová

The lithic assemblage from the Gravettian site at Milovice I was predominantly composed of radiolarite. To reconstruct the mobility patterns of the Gravettian population, we addressed the question of whether the radiolarites were imported from the Pieniny Klippen Belt (PKB) of the Western Carpathians or elsewhere. Another plausible source was the gravels from under the Pavlovské vrchy Hills. These are known to have been exploited in the Upper Palaeolithic, most notably at the Milovice I site during the Aurignacian. Our research revealed that local gravels were not the primary source of the Gravettian radiolarite artefacts, as the two differ macroscopically. Some flakes, and possibly microgravettes, are an exception, as their material is sometimes similar to gravel radiolarites. The occasional exploitation of local gravels, along with the small dimensions of the Gravettian industry, possibly reflects a shortage of material at a certain point of the site's occupation and the necessity to adopt curated lithic technology when trips for new material were unfeasible. Moreover, the curated lithic technology observed in the Milovice I assemblage is dissimilar to large Pavlovian sites, suggesting more economic behaviour and influence from radiolarite-supplied sites along the Váh River in the Late Gravettian.

Gravettian – radiolarite – chemical fingerprint – LA-ICP-MS – microscopy – mobility

Kamenná štípaná industrie z gravettienské lokality Milovice I byla přednostně vyrobena z radiolaritu. Pro rekonstrukci mobility gravettienské populace jsme řešili otázku, zda byly tyto radiolarity donášeny z pieninského bradlového pásma (PKB) Západních Karpat nebo z jiných zdrojů. Dalším možným zdrojem byly štěrky uložené pod Pavlovskými vrchy, které byly v mladém paleolitu rovněž využívané, typicky na lokalitě Milovice I v období aurignacienu. Náš výzkum odhalil, že místní štěrky nebyly primárním zdrojem gravettienských radiolaritových artefaktů, protože jsou makroskopicky odlišné. Výjimkou jsou některé úštěpy a snad i mikrogravetty, jejichž materiál je v několika případech podobný štěrkovým radiolaritům. Příležitostné využívání místních radiolaritů spolu s malými rozměry gravettienské industrie pravděpodobně odráží nedostatek suroviny v určité fázi osídlení lokality a nutnost aplikovat úspornou (curated) technologii štípání, když nebylo možné realizovat výpravy za novou surovinou. Kromě toho se úsporná technologie zpracování kamenné industrie, pozorovaná v gravettienském souboru z Milovic I, liší od technologie pozorované na velkých lokalitách pavlovienu a naznačuje ekonomičtější chování a vliv pozdně gravettských lokalit z Povážií, rovněž zásobovaných radiolaritem.

gravettien – radiolarit – chemický otisk – LA-ICP-MS – mikroskopie – mobilita

Introduction

One of the defining characteristics of Gravettian sites located beneath the Pavlovské vrchy Hills in Moravia, Czech Republic, is their non-economic management of fine-grained chert and flint materials. There is evidence of the stockpiling of nodules of erratic flints (EFs) and Cracow cherts without their subsequent exploitation. Debris from the first stages of core exploitation and processing was produced excessively (*Oliva 2002 and 2007*; *Polanská*

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2020). This high-cost strategy was, however, accompanied by a more economically efficient pattern of raw material exploitation in certain parts of some Gravettian locations. The same applies to the lithic assemblage from the Milovice I, sector G (hereafter Milovice I) Late Gravettian site (*Oliva et al. 2009*). The excavation between 1986 and 1991 yielded a lithic assemblage composed, unlike other Gravettian collections from the area, predominantly of radiolarite (*Oliva 2009a*, 162; *Moník et al. 2025a*, supplementary material). The original dimensions of raw material blocks reached up to 8–10 cm in length and approximately 6 cm in width, but most cores were smaller, reflecting a desire for maximum exploitation of the used raw material (*Neruda – Nerudová 2009*, fig. 3: 2; *Oliva 2009a*, graf 2). The larger core remnants were split lengthwise employing the bipolar technique and then used as chipping tools (for either bone splitting or the acquisition of tiny blanks (typological determination based on *Demars – Laurent 1989*, 94–95 and *Floss 2012*, 444), while tool fragments were also reutilised (*Neruda – Nerudová 2009*).

The study aims to explain the causes of the specific pattern of raw material exploitation at the Milovice I site. Two possible hypotheses of intense raw material exploitation and small core/tool dimensions have so far been suggested:

– Radiolarite material from local Tertiary/Quaternary gravels was primarily used. This material was already small-sized when collected (*Moník et al. 2025a*).
– The small dimensions of local radiolarite industry were driven by the functional specificity of the site (cf. *Polanská 2020*).

Interestingly, the presence of knappable materials in gravels beneath the Pavlovské vrchy Hills has long been recognised (*Soták 1990*; *Mrázek 1996*, 25; *Přichystal 2013*; *Vít 2014*; *Important Geological Localities of the Czech Republic*, Milovice–ID 4232), yet it was rarely applied to archaeological reconstructions of Upper Palaeolithic mobility patterns (*Moník et al. 2025a*; *2025b*). Radiolarites from local Gravettian sites were always considered to be long-distance imports from the White Carpathians, i.e. the Slovak part of the Pieniny Klippen Belt (PKB; *Svoboda 1994*, 72; *Wilzyński et al. 2019*, 5). This suggests either the movement of individual Gravettian hunters or social interaction with the PKB territory (cf. *Maier et al. 2022*).

Methods

To test the postulated hypotheses, we measured the dimensions of radiolarite samples from their natural occurrences under the Pavlovské vrchy Hills and selected Gravettian radiolarite artefacts and used macroscopic and stereomicroscopic observations of radiolarites from Central European outcrops (*Přichystal 2013*), their chemical fingerprints (*Moník et al. 2025b*), and techno-typological characteristics of the Milovice I and Dolní Věstonice I (excavated by B. Klíma 1966–1968) Gravettian assemblages (those held at in the Moravian Museum in Brno). Techno-typology was adopted from the original research by *Oliva* (*2007*; *2009a*). Metrics of the radiolarite gravel and artefacts were taken using a sliding gauge and later processed with the PAST programme. Thin section microscopy was applied to 15 selected radiolarite outcrop samples, providing insight into the composition of radiolarian and other microfossils that may aid in provenance estimation. It is unlikely that Hungarian radiolarites were transported by Miocene Ocean or fluvial currents to the

gravel deposits under the Pavlovské vrchy Hills. Therefore, we only prepared one thin section of Hungarian (Gerecse Mts.) radiolarite.

The chemical fingerprints from 151 Central European radiolarite samples and 8 selected artefacts from the Milovice I site (see all data under *Online Supplementary Material 1*; Milovice I Gravettian artefacts are marked MI01–MI08 in the database) were analysed using laser ablation induced coupled plasma mass spectroscopy (LA-ICP-MS). Outcrop samples were cut, abraded and fine-polished (artefacts only slightly abraded) prior to the analysis to get rid of the weathering rind. A total of 48 elements were quantified using an Analyte G2 193 nm excimer laser ablation unit (Photon Machines, USA). Samples were analysed using line scans 5–8 mm in length and data quantified using SRM NIST 610, for which a pre-made Excel spreadsheet was used. We employed the analysis of SRM NIST 612 and SRM NIST 614 trace elements in glass to control the reliability of the quantitative results (see *Gregar et al. 2025* and *Moník et al. 2025b* for further details).

LA-ICP-MS produced a raw dataset of compositional measurements (parts-of-a-whole proportions) describing the chemical composition of radiolarites, rather than absolute quantities. Considering this particular data type, in order to apply traditional statistical techniques such as PCA and LDA, we first had to transform our data using the centred log-ratio (clr) transformation (*Grunsky et al. 2017*). After applying this transformation, we identified outliers that distorted the results. In total, 10% of the original sample set was removed to offer a more representative subset for further analysis. Subsequently, feature selection techniques, including brute force approach or recursive feature elimination (*Guyon et al. 2002*), were applied to set aside a subset of elements. This step was important to improve generalisation of our model even for latent data, which has the biggest practical implications. We used an LDA algorithm to differentiate geographically-specific radiolarite groups based on their chemical elements (*James et al. 2013*). The methodology builds on the prior work by *Gregar et al.* (*2025*) or *Hamrozi et al.* (*2025*). However, rather than limiting ourselves to the original six groups – 1. Northern Calcareous Alps /NCA/, 2. St. Veit Klippen Belt, 3. Gerecse Mts., 4. PKB of west Slovakia, 5. PKB of southern Poland, and 6. Bakony Mts. – we introduced a seventh group representing natural occurrences of gravels beneath the Pavlovské vrchy Hills. We supposed that by comparing the eight artefacts selected from the Milovice I assemblage with these groups we would be able to estimate their provenance.

In comparison with our previous studies on the same problem (*Moník et al. 2025a*; *2025b*), we have also collected more radiolarite samples from different deposits around Pavlovské vrchy Hills for macro- and microscopic observation and size measurements (*Fig. 1*; *Tab. 1*). Local Tertiary (Miocene) gravels may lie at a considerable elevation above the current water level of the Nové Mlýny Reservoir. The location between the villages of Brod nad Dyjí and Dolní Dunajovice, for example, lies in the vineyard on the NE slope of Dunajovický kopec Hill, 210–260 m asl. and up to 90 m higher than the former floodplain of the Thaya River. Geologically, the Miocene marine sediments belong to the Carpathian Foredeep (*Geological Map of the Czech Republic 1:50 000*) of the Outer Western Carpathians. The radiolarite samples from Pasohlávky-Mušov and Dolní Dunajovice were subject to metric and chemical analysis (see below). In this way, we complemented our background sample collected around the Mušov Roman fort in 2023 (today in the Pasohlávky cadastre; *Moník et al. 2025b*), producing a total of 24 Miocene pebble-radiolarite samples. Radiolarites from the other sampling spots, from Miocene and Pleistocene gravels,

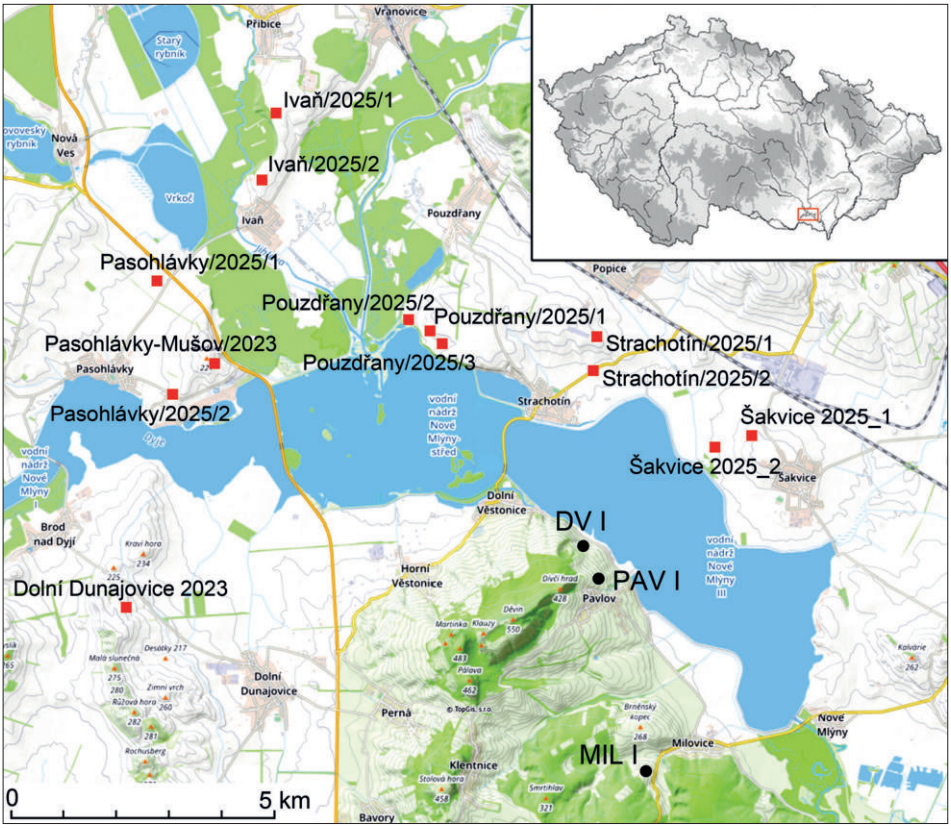

Fig. 1. Overview of locations around the Pavlovské vrchy Hills, where gravel samples were collected for comparative analysis and the position of the Dolní Věstonice I (DV I), Pavlov I (PAV I) and Milovice I (MIL I) Gravettian sites (data ČÚZK 2025). Red square – gravel samples collection sites.

were collected later and only assessed qualitatively, along with other knappable materials from the same context (see Discussion).

Results

Metrics

A comparative analysis of the principal tool categories and cores from the Milovice I and Dolní Věstonice I sites—both produced from radiolarites and erratic flints (EFs)—indicates that most artefacts from Milovice I are smaller in length (*Tab. 2*). Statistically significant differences between the two assemblages were observed for radiolarite cores (Mann–Whitney *U* test, Monte Carlo permutation, p = 0.005), EF burins (p = 0.001), and microgravettes (p = 0.005). Within the Milovice I assemblage, radiolarite cores are also smaller than EF cores, although this difference is not statistically significant (p = 0.054). Some categories, such as endscrapers, were too few in number due to long-term external loan, making reliable testing impossible. Eight microgravettes (six made from radiolarite/

N	Sampling spot	Lat	Long	Dating (epoch)
1	Ivaň/2025/1	48.946825N	16.578025E	Pleistocene
2	Ivaň/2025/2	48.93588N	16.577133E	Pleistocene
3	Pasohlávky/2025/1	48.917608N	16.554702E	Pleistocene
4	Pasohlávky/2025/2	48.8998N	16.561812E	Miocene
5	Pouzdřany/2025/1	48.91566N	16.615927E	Pleistocene
6	Pouzdřany/2025/2	48.915258N	16.620468E	Miocene
7	Pouzdřany/2025/3	48.91474N	16.622749E	Pleistocene
8	Strachotín/2025/1	48.916297N	16.66253E	Pleistocene
9	Strachotín/2025/2	48.910782N	16.662148E	Pleistocene
10	Šakvice 2025_1	48.9031922N	16.7052739E	Pleistocene
11	Šakvice 2025_2	48.9005547N	16.6955319E	Pleistocene
12	Dolní Dunajovice 2023	48.8636408N	16.5563147E	Miocene
13	Pasohlánky-Mušov 2023	48.9059850N	16.5699833E	Miocene

Tab. 1. Overview of locations around the Pavlovské vrchy Hills, where gravel samples were collected for comparative analysis.

Length [mm]																
Site	Milovice I	DV I	Milovice I	DV I	Milovice I	DV I	Milovice I	DV I	Milovice I	DV I	Milovice I	DV I	Milovice I	DV I	Milovice I	DV I
Tool type	Burins				Endscrapers				Microgravettes				Cores			
Raw material	Erratic flint		Radiolarite		Erratic flint		Radiolarite		Erratic flint		Radiolarite		Erratic flint		Radiolarite	
N_samples	19	22	25	1	0	9	1	1	17	10	61	1	4	19	3	20
Min	16	28	15	18	-	30	34	45	9	17	7	32	34	32	14	30
Max	80	107	65	18	-	55	34	45	34	58	37	32	75	60	33	61
Mean	35.6	57.0	30.6	18	-	41.3	34	45	20.1	34.7	16.4	32	46.5	39.4	22.7	44.8
SD	15.9	25.5	10.7	-	-	7.9	-	-	7.6	13.6	6.5	-	19.3	9.4	9.6	8.3
Mann-Whitney p-value	0.001		-		-		-		0.005		-		0.373		0.005	

Tab. 2. Length of the principal tool categories (burins, endscrapers and (micro)gravettes) and cores from Milovice I and Dolní Věstonice I (DV I) lithic assemblages. Tools/cores made of radiolarite and erratic flint (EF) are compared with Mann-Whitney *U* non-parametric test and the p-values shown. Radiolarite cores, and EF burins and micrograveттes are significantly smaller in Milovice I than in the Dolní Věstonice I assemblage.

two made of EF) and seven cores (4R/3EF) from Milovice I site could not be measured as there are on exposition in the Anthropos Pavilion. It is unlikely, though, that the size radiolarite artefacts resulted from preferential use of local gravels at either of the two sites. Local radiolarite pebbles from Miocene sediments commonly reach up to 8 cm on their longest axis (mean value = 6.6 cm from 24 measured pebbles; SD = 5.7), and in some cases as much as 14.5 cm (*Fig. 2*; see Discussion).

Macro- and stereomicroscopic observation

Macroscopic and stereomicroscopic observations of outcrop samples have revealed differences between radiolarites found in outcrops and those found in gravels (summarised

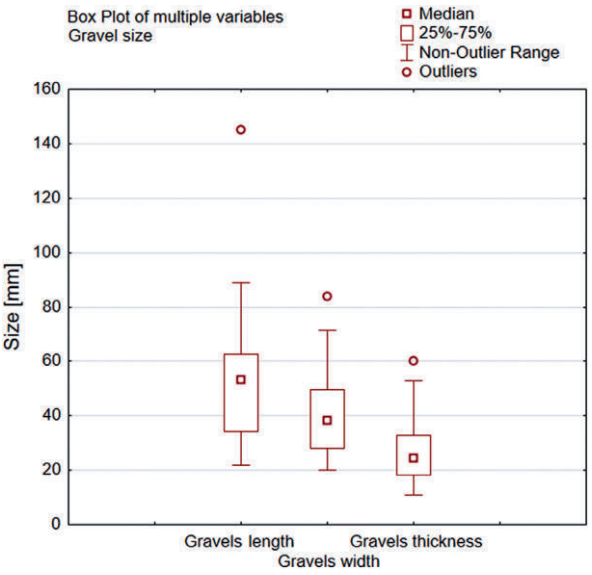

Fig. 2. Size of radiolarite pebbles from under the Pavlovské vrchy Hills. Pebbles of up to 14.5 cm can be encountered in local Miocene gravels.

in *Tab. 3* and *Fig. 3*). Iron or manganese oxides and thick cortex are relatively more present in radiolarites from gravels (*Fig. 3*: f; *Verpoorte 1997*). Fossils are usually poorly preserved in gravel radiolarites, but there are exceptions to this rule, even within our moderate sample. We often observed opaque dots in gravel radiolarites. These are not as frequent in radiolarites from the outcrops that we sampled. This feature might be characteristic of one specific area or outcrop. Finally, tectonic fissures are characteristic of both types of radiolarites, but selection of raw material free of such inhomogeneities is understandably easier on primary outcrops where the material is more abundant. The radiolarite artefacts from Milovice I are mostly macroscopically similar to the samples from the White Carpathian outcrops, particularly the banded ones (*Fig. 4*: a–c). Thus far, banding has only been observed by us on samples from White Carpathian outcrops. However, Alpine radiolarites are sometimes also banded (*Binsteiner 2011*, Abb. 4). Some of the microgravettes are dull and may also originate from local gravels (*Fig. 4*: d), as is most likely the case for the flakes with a gravel cortex (*Fig. 4*: e).

Features	Radiolarites from outcrops	Radiolarites from gravels under Pavlovské vrchy Hills
Banding	(+/-)	(--)
Good fossil preservation	(+)	(-)
Stains of Fe/Mn oxides	(+/-)	(+)
Tectonic fissures	(+)	(+)
Opaque matter	(-)	(+/-)
Thick cortex	(+/-)	(++)

Tab. 3. Differences and similarities between radiolarites from primary outcrops and from secondary occurrences in gravels: -- – not observed; - – usually absent; +/- – sometimes present; + – usually present; ++ – frequently present.

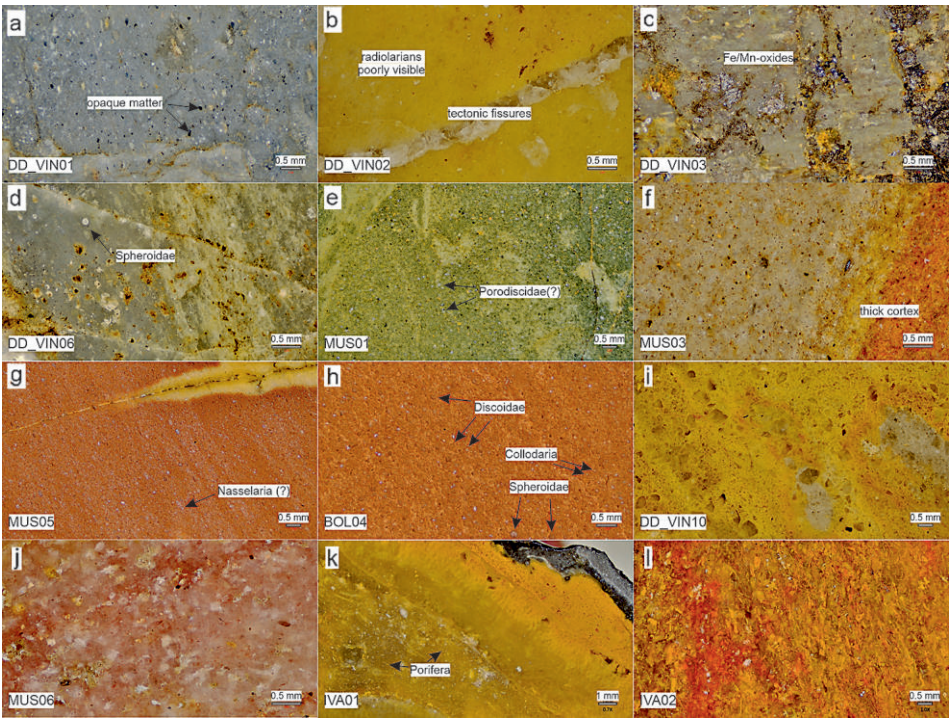

Fig. 3. Stereomicroscopy of radiolarites and other materials from Pleistocene and Miocene gravels from under the Pavlovské vrchy Hills (a-g; i-j) and a PKB (White Carpathian) outcrop (h). Materials: a–h – radiolarites; i – 'sun-boulder' silcrete; j – Alpine (?) chert; k, l – Cretaceous spongolites (also *Fig. 6*: e, h). Sampled sites: DD_VIN – Dolní Dunajovice-vineyard; MUS – Pasohlávky-Mušov; BOL – Bolešov-Kráľov vrch; IVA – Ivaň.

Thin section microscopy

The study of thin sections of radiolarites employed the method of *Andrejeva-Grigorovič et al.* (*2004*), with respect to the traditional systematics of *Haeckel* (*1887*). Apart from radiolarians, spicules of siliceous sponges were also observed in the radiolarites, including the following: Hexactinellida: monoaxons and triaxons; Demospongiae: Tetractinellida monoaxons and the suborder of Megamorina?; and Monactinellidae: monactin spicules with only one ray and one axis. Thin section microscopy enables most taxa to be identified at the family level and some at the genus level. A total of 21 taxa were identified from the 15 thin sections.

All identified species belong to the Polycystina order, with two dominant suborders. The first, Spumellaria, forms basic concentric and radial structures with numerous fine pores. They are further divided into the families of Sphaeroidea, Prunoidae, Discoidae, Porodiscidae, Hexastylidae, Orbiculiformidae, Actinommidae, Xiphostylidae, Heliodiscidae, and Spongodiscidae. Spumellarians are mostly colonial and played a significant role in the rock-forming processes of cherts. The second suborder, Nassellaria, is mostly solitary and first appeared in the Triassic period. Unlike Spumellarians, Nassellarian species could usually be identified at the genus level (e.g. *Ristola sp.*, *Bathropyramis sp.*, *Dictyomitra sp.*,

	Group														
	I: Northern Calcareous Alps; St. Veit Klippen Belt					II: Gerecse Mts.	III: Pieniny Klippen Belt (PKB)						IV: Miocene gravels (Pavlovské vrchy Hills)		
Country	AUT	AUT	AUT	AUT	AUT	HUN	SVK	SVK	POL	SVK	POL	POL	CZE	CZE	CZE
Taxon	ELS 01	ELS 10	ELS 32	BAU 01	WMA 04	GER 05	BOL 08	CEK 10	CZA 11	KRIR 05	SZA 04	ZDZ 03	DDI 02	DDI 03	MUS_VIN 05
Porifera spicules	Hexactinellida		Hexactinellida; Tetractinellidae (monoaxons)	Hexactinellida; Monoaxons, triaxons		?	Hexactinellidae		Megamorina?		Hexactinellida		Spicules ?	Hexactinellida-; Monactinellidae	
Orbiculiforma												+++			+++
Sphaeroidae															
Collodaria				+++		?					+++			+++	
Ristola sp.				*								+++			
Discoidae			*												
Porodiscidae					+++										
Prunoidae	+++										+++				+++
Hexastylus sp.					+++										
Nassellaria					+++							+++			
Bathropyramis sp.							*		*						
Xiphosphaera sp.									+++					*	
Dictyomitra sp.												*			
Xiphostylidae						?					*				
Cenosphaera sp.															+++
Heliodiscidae		*													
Lophocyrtis sp.		*													
Stylodictya sp.		*													
Sethoconus sp.															
Tripospyris sp.										*					
Cenodiscus sp.															
Lithocampida															

Tab. 4. Radiolarian and other microfossil content in radiolarites from Central European outcrops and secondary occurrences in Miocene gravels: black – abundant, more than 7 specimens; +++ – common, 3–7 specimens; grey – rare, ≤ 3 specimens; * – sporadic occurrence; white – absent; ? – uncertain. Sites: ELS – Elsbethen-Glasenbachklamm; BAU – Baunzen; WMA – Wien-Mauer; GER – Gerecse Mts.; BOL – Bolešov-Kráľov vrch; CEK – Červený kameň; CZA – Jaworki-Czajakowa skała; KRIR – Krivoklát-rozhľadňa; SZA – Szaflary; ZDZ – Maruszyna-Zdżar; DDI – Dolní Dunajovice I; MUS_VIN – Pasohlávky-Mušov-vineyard.

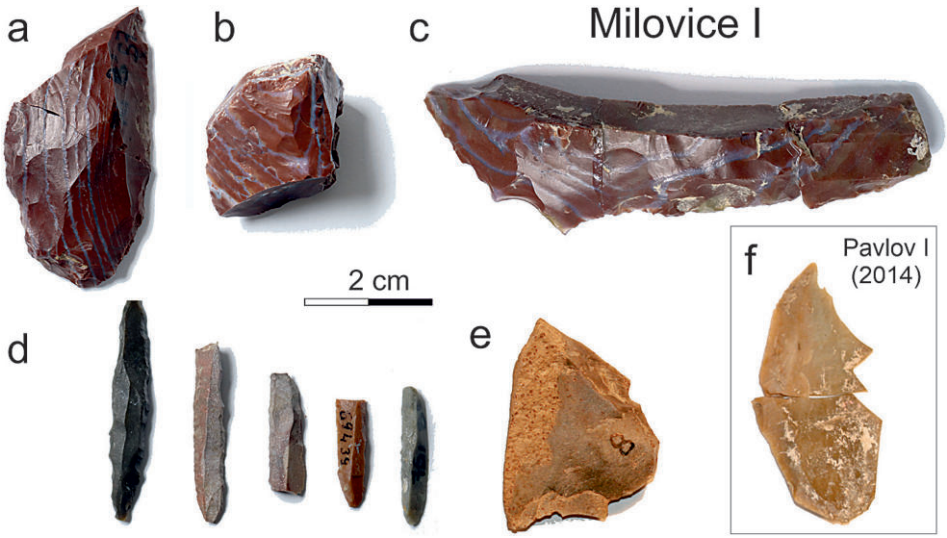

Fig. 4. Selected radiolarite artefacts from the Gravettian sites of Milovice I and Pavlov I (excavated in 2014): a – burin; b – core remnant; c – burin; d – (micro)gravettes; e, f – flakes. The pieces made from banded radiolarites (a, b, c) most likely originate from the White Carpathians. The origin of the radiolarites used for microgravettes (d) is more ambiguous, and the two flakes (e, f) were probably made from gravel radiolarites.

Lophocyrtis sp., *Sethoconus sp.*, *Tripospyris sp.*). Two specimens were identified as belonging to the family Lithocampidae and the suborder Nassellaria. In addition to the two dominant suborders, the third suborder, Collodaria, represents a solitary or colonial polycystine group with a simple skeleton containing simple or branched spicules. These spicules could also be misinterpreted as Porifera axons. It is not possible to determine these spicules more closely, and there is currently no valid classification system for them.

Overall, the composition of the analysed radiolarian fauna favours Spumellarian species, which form 66% of all identified specimens. Nasselarian species make up 26%, and Collodaria can be found in 9%. Generally, most cherts comprise Spumellarians, which are evolutionarily older and therefore more prevalent due to their colonial life strategy. On the other hand, the solitary Nassellarians formed more complicated skeletons, which could be observed when they were well-preserved. Spumellarian Sphaeroidae were present in all samples except DDI 02. Specimens containing more Spumellarians and Porifera are usually affected by dissolution and recrystallisation. The microfossil composition indicates relatively poorer preservation in gravel radiolarites, particularly in samples DDI 02 (where only sponge spicules were preserved) and DDI 03 (where only three taxa were observed; see *Tab. 4*). Sample GER 05 also has few radiolarians and shows heavy recrystallisation. However, the MUS VIN 05 sample shows good preservation of radiolarians.

Ožvoldová et al. (*2000*) presented the quantitative composition of radiolarians from the Pieniny Klippen Belt radiolarites, which is consistent with our findings and highlights the dominant Spumellarian species alongside the accessory Nasselarian fauna. The richest sample, ELS 10, shows seven species (three Nassellarians and four Spumellarians). Sphaeroidae are the most prevalent type of radiolarian throughout Central European outcrops and are frequently found alongside sponge spicules. In general, the microfossil content

of gravel materials overlaps between geographical groups. This means that the provenance of radiolarite gravel, or artefacts, cannot be determined based purely on microfossil content. For this reason, we did not conduct a more detailed microfossil analysis of the radiolarite artefacts from the Milovice I site.

Chemical fingerprinting

Plotting the seven radiolarite Groups on the LDA graph (*Fig. 5*), it transpires that the radiolarites from gravels beneath the Pavlovské vrchy Hills (labelled 'Moravia') overlap somewhat with the Austrian- (more those from St. Veit Klippen Belt than from NCA), PKB- (west Slovakia and southern Poland), and even Hungarian (Gerecse Mts.) sources. The chemical analysis by itself is not suitable to clearly distinguish between the gravel radiolarites and those acquired on the outcrops. However, most analysed artefacts are closest to the cluster formed by either the gravel- or White Carpathian radiolarites. Even the two artefacts in the top right of the LDA graph cluster somewhere between the PKB and Hungarian sources when LDA 3 is plotted. The acquisition of Milovice I radiolarites, based on their chemical fingerprint, thus probably occurred either in local Miocene/Quaternary gravels or in PKB.

Discussion

Chemical fingerprinting of Gravettian radiolarite artefacts from the Milovice I site did not yield clear results, but most of the radiolarites resemble samples from the White Carpathian (PKB) outcrops in terms of macroscopic characteristics. A few artefacts were most likely acquired from local gravels, but it is generally unlikely that locally sourced gravel radiolarites predominated over those transported from primary outcrops in any of the Gravettian assemblages from the settlement cluster under the Pavlovské vrchy Hills (except for the small Pavlov I/2014 assemblage; see *Fig. 4*: f; *Svoboda et al. 2016a*; *2016b*; *Moník et al. 2025a*). Radiolarite pebbles from local Miocene (or even Oligocene — see the Milovice sand pit *in Important Geological Localities of the Czech Republic* database) and Quaternary gravels under the Pavlovské vrchy Hills were rarely used not because of their size but due to frequent tectonic fracturing (the poor *quality* mentioned by *Polanská 2020*, 431). On primary outcrops, where such fractures also occur, Palaeolithic flint-knappers had a much wider material spectrum to choose from and selected blocks free of inhomogeneities (*Fig. 3*: h; *cf. Verpoorte 1997*, 221). Gravel radiolarites appear to have been used more frequently for dull-coloured flakes and (micro)gravettes, which could be produced from relatively small cores (*Fig. 4*: d). This is consistent with the previous observation in the Dolní Věstonice II Gravettian assemblage made by *Polanská* (*2016*). In different sectors, she observed and re-assembled radiolarite nodules and river pebbles used preferentially for the production of blades and bladelets (*Polanská 2016*, 193). Interestingly, she did not document such pebbles in either of the Pavlov site lithic assemblages.

Based on techno-typological grounds, radiolarites were imported *directly* to the sites under the Pavlovské vrchy Hills (*Oliva 1998a*; *1998b*; *2007*, 149; *Polanská 2020*; *Moník et al. 2025b*, 14), i.e. not acquired through social exchange with neighbouring Gravettian groups. This is supported by the fact that, apart from EFs, radiolarites are the only raw

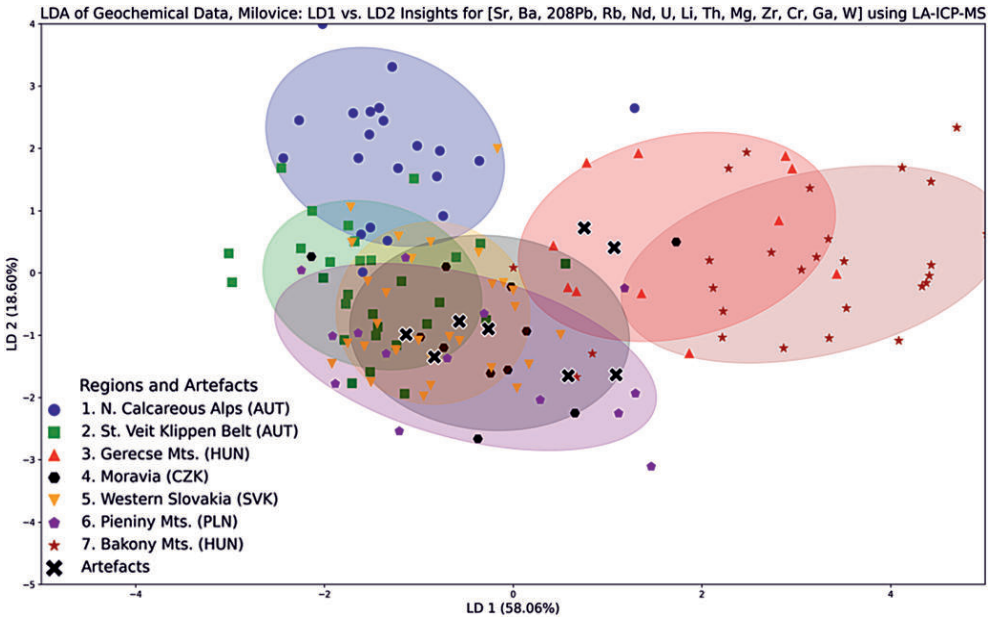

Fig. 5. Chemical fingerprint of Central European radiolarites. Those encountered in gravels from under Pavlovské vrchy Hills ('Moravia') overlap with PKB (nos. 6 and 7) and St. Veit Klippen Belt radiolarites.

material frequently present in the form of cores. Their complete reduction sequences have been refitted by archaeologists (*Škrdla 1997*; *2001*) at the Milovice I, Dolní Věstonice I, Dolní Věstonice II and Pavlov I–NW sites. In contrast, other exotic materials (obsidian, limnic chert, jasper, etc.) were brought to the sites as final products, e.g. as blades or bladelets. The treatment of radiolarite raw material varied. Sometimes, the further away we get from the sources, the more curated the treatment becomes (*Oliva 2007*, 149). However, the assemblages from the Pavlov I–NW and Dolní Věstonice I sites also comprise unused or unretouched radiolarite blanks, which may depend on the presence or absence of inhomogeneities (*Škrdla 1997*, 316; *Oliva 2007*, 146; *Oliva 2012*, 7). Cretaceous spongolites, predominant at the Milovice I and Pavlov I sites during the Aurignacian culture (*Svoboda et al. 2016a*, 104; *Moník et al. 2025b*, table 2), were almost ignored in the Gravettian period, while other rocks washed down from the Bohemian Massif, the Carpathian Flysch Belt or the Alpine region were only occasionally exploited. These rocks include Krumlovský les cherts, chert breccias, and 'sun-boulder' silcretes (*Fig. 6*). Furthermore, local gravels probably also provided the thermal metamorphite and graphite observed in the Milovice I assemblage, different cherts in the Pavlov I–SE assemblage (where marlstones acquired from nearby outcrops were also favoured), and the reddish pebble limestones used for manufacturing retouchers in the Pavlov I–NW assemblage (*Mrázek 1996*, 24; *Oliva 1997*, 417; *Škrdla 1999*, 66; *Svoboda – Přichystal 2005*, 148–149; *Moník et al. 2025a*, supplementary material). There is a clear difference here compared to some Gravettian sites along the Danube, such as Krems-Wachtberg and Willendorf II-AH5 (*Brandl et al. 2014*, 160; *Moreau et al. 2016*, table 1). Both radiolarites from the Danube gravels and other local materials were favoured at these sites, and long-distance imports were rare (*Brandl et al. 2014*, 147).

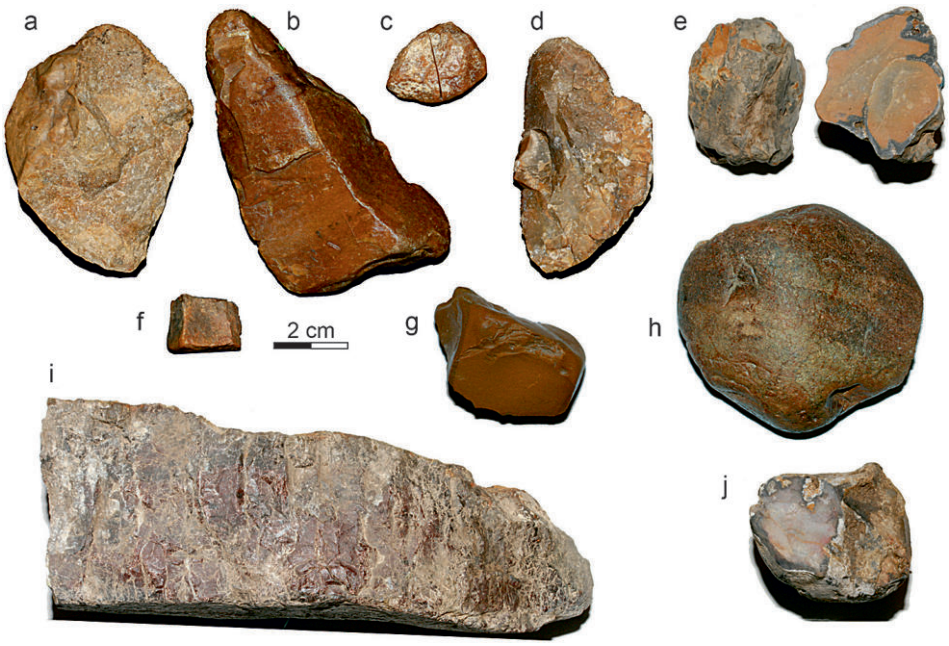

Fig. 6. Knappable raw materials encountered on Pleistocene (Riss- and older) terraces on the cadastres of Šakvice (a-d, f), Ivaň (e, h), Pouzdřany (g), Strachotín (j), and in Miocene marine sediments east of Dolní Dunajovice (i), under the Pavlovské vrchy Hills. Materials: a – 'sun-boulder' silcrete; b, c, e, h – Cretaceous spongolites; d – chert breccia from Krumlovský les; f, i – radiolarites; g – silicified claystone; j – chert of the Krumlovský les type, variety I.

The small size of the radiolarite artefacts at the Milovice I site is therefore more likely to be determined by their function than their origin. In the case of microgravettes, there is an obvious influence from west Slovak Late Gravettian assemblages, which are also dominated by radiolarites (*Kozłowski 2013*; *Polanská 2016*, 193). This is not the case of the somewhat older (classical Gravettian/Pavlovian) assemblage from Dolní Věstonice I, where just one radiolarite microgravette was identified (as regards Klíma's 1966–1968 excavation).

Curated behaviour (*Binford 1979*), apart from function, may explain the small size of some artefact categories at Milovice I, possibly linked to the high share of tools (*Tab. 5*; *Oliva 2009c*, 161; *Moník et al. 2025a*; supplementary material). When necessary, the Gravettian groups used even the smallest flint and radiolarite tools and fragments until new supplies became available (*Chlachula et al. 2025*). Such patterns occur during material shortages, which may have arisen in winter when chert and flint were difficult to obtain. Snow cover, low density, and limited daylight restricted the mobility of both game and hunter-gatherers (*Guthrie 1968*, 361; *1982*, 325; *Burch 1972*, 345; *Coady 1974*, 432; *Winterhalder 1981*, 72; *Lundmark – Ball 2008*, 116; *Pedersen et al. 2021*, 17; *Melin et al. 2023*, 21). While lowlands may have had little snow (*Coady 1974*, 428), mountainous zones such as the White Carpathians were likely snowbound, hampering access to radiolarite outcrops. At such times, gravel radiolarites served as a backup, and both radiolarite- and EF cores were maximally reduced (*Tab. 2*). Small cores and artefacts also suggest year-round

Site	% tools	% end-scrapers	% burins	% backed elements	% microlithic elements	Source
Milovice I G	25.7	5.6	9	46	0.3	*Oliva 2007*
Milovice I – north	30.4	13.9	18.9	11.5	-	*Oliva 2007*
DV I – bone heap	24.2	7.1	51.8	14.5	-	*Oliva 2007*
Dol. Věstonice I/central part	**	25.1	32.2	15.1	-	*Oliva 2007*
Dol. Věstonice I/feature 1	**	10.5	25.7	39.5	-	*Oliva 2007*
Dol. Věstonice I/feature 2	**	10.9	33.2	21	-	*Oliva 2007*
Dol. Věstonice II/lower etage	**	6.1	41.7	33.7	-	*Oliva 2007*
Dol. Věst. II/upper etage, 1986	3.5	18.1	30	43.7	-	*Oliva 2007; Klíma 1995*
Dol. Věst. II/upper etage, 1987	3.2	0	7.5	51.4	-	*Oliva 2007; Klíma 1995*
Pavlov I SE	9.2	9.2	31.8	28.1	10.4	*Verpoorte 2005*
Pavlov I Middle	9	9	28.5	13	15.7	*Verpoorte 2005*
Pavlov I NW	7.8	7.8	24.3	13.9	13.6	*Verpoorte 2005*
Pavlov I South-central	4.1	6.8	21.7	21.2	24.3	*Verpoorte 2005*
Pavlov II	12	11.7	49.4	12	-	*Oliva 2007*
Pavlov VI	6.8*	9.4	16	9.4	-	*Polanská 2011; Novák 2011**

Tab. 5. Proportions of tools in the cluster of Gravettian sites under the Pavlovské vrchy Hills. Note the high incidence of tools (and backed pieces) within the Milovice I G assemblage. * – information from *Novák 2011*; ** – not calculated.

occupation at Milovice I. Similarly, frequent use of local cherts from gravel deposits at nearby Gravettian sites (e.g. Dolní Věstonice II–III; Pavlov VI; *Klíma 1971*; *1995*; *Škrdla et al. 1996*; *Svoboda et al. 2015*) suggests mobility restrictions during certain seasons, especially winter.

The implication for the Gravettian lifestyle

Armed with information on the procurement of lithic material, we can tentatively reconstruct the year-round movements of hunter-gatherer groups to and from the Milovice I Gravettian site. Present-day herd animals often migrate north in spring and early summer (*Fischer 2007*; *Nicholson et al. 2016*), although this can vary depending on geography (*The World of Deer*). Accordingly, we can suppose that some Moravian Gravettian groups moved to present-day Silesia (southern Poland) or some hilly area free of mosquitoes during that season (*Fig. 7*). Although large residential camps, such as those evidenced under Pavlovské vrchy Hills, normally imply logistic forays (*Clark – Barton 2017*, 139), these are often hard to distinguish from residential movements based on lithic material (*Oliva 2007*, 149; *Mears – Wilson 2023*, 14). Both strategies were likely practised in certain periods of the Moravian Gravettian. Movements in a south-westerly direction towards the Alps seem less probable due to the barrier posed by the Danube River (cf. *Oliva 2009e*, 270; *Moník et al. 2025a*). Additionally, the geochemical signature of the radiolarites found at sites under the Pavlovské vrchy Hills does not usually indicate that they were imported from the Alps or the St. Veit Klippen Belt around present-day Vienna (*Moník et al. 2025a*, fig. 1).

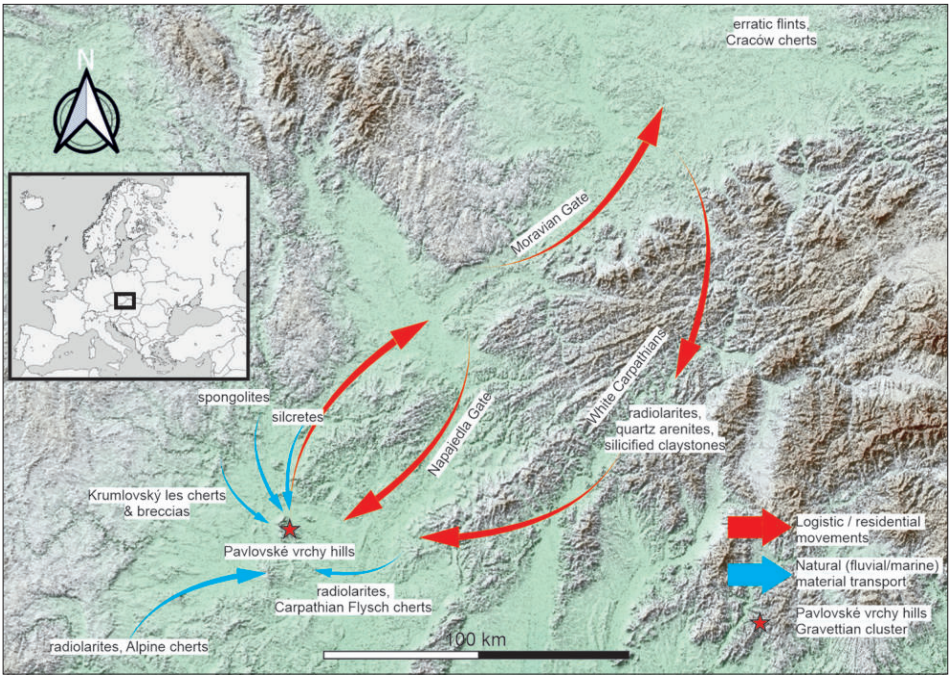

Fig. 7. The main directions of logistical and/or residential movements to and from the Gravettian sites under the Pavlovské vrchy Hills, as well as the directions of the natural marine and fluvial transport of knappable materials to the gravels deposited during the Tertiary and Quaternary periods. It is evident that some materials that were previously believed to have been imported from distant locations could have been sourced locally (based on our analysis and *Soták 1990*; *Oliva (ed.) et al. 2009*; *Přichystal 2013*; *Vít 2014*; *Moník et al. 2025a*; *2025b*).

After obtaining EFs and Cracow cherts from Silesian sources—or along the way—the Gravettians would have continued to the White Carpathians in the PKB area to procure additional lithic raw materials, including radiolarite blocks and, nearby, Carpathian Flysch Belt lithologies such as quartz arenites and silicified claystones (*Moník et al. 2025*b, 22). They would then have returned to the Pavlovské vrchy Hills. Hunting might have taken place in late summer/early autumn when the herds returned to their winter ranges. Apart from hares, lions, and bears, a variety of large mammals, including mammoths, elk, red deer, reindeer, and horses, were hunted at Milovice I (*Oliva 2009b*; *Brugère – Fontana 2009*, fig. 8). However, the hunting seasons for these species likely varied, reflecting differences in the feeding behaviours and ecological preferences of proboscideans and ungulates (*Musil 2014*, 124, 135). The floodplain below the Pavlovské vrchy Hills offered a significant environmental advantage, as it could have supported a wide range of plant, fish, and bird species—some of which were available throughout the year—as evidenced by faunal and botanical records from nearby sites Pavlov I and VI, Dolní Věstonice I, and Milovice IV (*Bocheński et al. 2009*; *Svoboda et al. 2011*; *Revedin et al. 2015*; *Svoboda 2022*).

The late summer hunt is a common practice among hunter-gatherers in northern latitudes, as the bulls are fat and their furs are of good quality. A hunting technique known as ‘head-em-off-at-the-pass’ is common during the seasonal migration of herd animals. It

involves waiting at selected spots, such as narrow valleys and fords (*Burch 1972*). This would apply to Gravettian sites within or at the mouth of the Moravian Gate (e.g. Předmostí and Ostrava-Petřkovice: *Klíma 1990*; *Svoboda et al. 1999*, 177; *Svoboda 2008*), along the middle course of the Morava River at the Napajedla Gate (e.g. the Jarošov II and Napajedla I sites: *Škrdla 2005*; *Škrdla et al. 2008*), and the cluster of sites in the Pavlovské vrchy Hills (*Svoboda – Sedláčková 2004*; *Oliva 2007*; *Svoboda 2020*; *2022*). In the latter case, north-facing Gravettian sites would also have allowed local hunters to monitor the arrival of herds from their summer pastures (cf. *Oliva 1997*; *2009d*, 136; *2016*).

Given the approximately 8,000-year duration of the Gravettian occupation of the Pavlovské vrchy Hills, this scenario may reflect the use of lithics and the landscape over the *longue durée* time frame, but it is probably one of many that occurred as conditions changed over time. The annual paths of herd animals, for example, must have changed for various reasons (*Ingstad 1971*; *Owen-Smith 1988*; *Hoppe et al. 1999*; *Fischer 2007*; *Joly et al. 2021*). The hunting and gathering strategies adopted at the Milovice I site must have varied accordingly, relying on diversified sources mentioned above. However, both direct and indirect evidence support the seasonal migration and hunting of reindeer, horses, and mammoths (*Wooller et al. 2021*, fig. 2; *Kowalik et al. 2023*, fig. 1; *Waters et al. 2023*). The relatively limited faunal record from the Milovice I site suggests that mammoths were hunted, and possibly also scavenged, during the autumn season (*Oliva 1997*, 426; *Brugère – Fontana 2009*; *Nývltová-Fišáková 2009*, table 1; *Bosch 2012*; *Nývltová-Fišáková 2013*), likely in connection with the procurement of winter supplies (*Binford 1978*; *Kelly 1983*, 278; *Burch 1998*). In contrast, evidence for fox hunting at Milovice I indicates activities carried out during the spring or summer months (*Nývltová-Fišáková 2009*, table 1). This seasonal variability supports the interpretation that the site was occupied for more than a brief period—although this view is not universally accepted (*Halámková 2009*, 117; *Oliva 2009d*, 269)—and is further corroborated by the presence of multiple hearths, albeit not analysed micromorphologically (*Oliva et al. 2009*, 135–153; *Oliva 2016*, 159). Analogues in the evidence for year-round occupation can be observed at other major Moravian Gravettian sites, such as Dolní Věstonice II (western slope), Pavlov I, Předmostí, and Jarošov-Podvršťa (*Svoboda et al. 1999*, 210–211; *Nývltová-Fišáková 2013*).

Conclusion

The fluvial and marine gravels beneath the Pavlovské vrchy Hills contain a wide range of materials (radiolarites, spongolites, Krumlovský les cherts, silcretes, and others) deposited in their present location during the Tertiary and Quaternary, having been transported from the Bohemian Massif, the Alps, and the Carpathians. The radiolarites used at the Milovice I Gravettian site for artefact manufacture, though, were predominantly acquired from primary outcrops in PKB (probably within White Carpathian Mts.); local gravels containing radiolarites were only occasionally exploited. This contrasts with the procurement pattern observed during the Aurignacian period, when local spongolites were favoured, and with the Gravettian pattern of procurement on some Danube River sites, which focused on radiolarite gravel. Despite this preference for exotic materials (radiolarites and EFs) over local ones at the Milovice I Gravettian site, several smaller sites under the Pavlovské vrchy Hills (Dolní Věstonice II – northern slope, Dolní Věstonice IIa and IIIa, and Pavlov VI) relied

more heavily on local Moravian cherts, some of which might have comprised gravel material. As previously suggested, these sites may represent the remains of small, seasonally occupied camps established during periods when forays to procure flint nodules were difficult to realise. The possible winter occupation of the Milovice I site is indirectly indicated by faunal remains, which reflect autumn hunting of mammoths. This scenario may apply particularly to areas of the settlement where small radiolarite flakes and Gravettian points manufactured from dull, gravel-like radiolarite were recovered, suggesting activities associated with a winter occupation phase. However, the predominance of small artefacts in these contexts is more likely related to the technological trends of the Late Gravettian period, characterised by a preference for smaller tool types, such as microgravettes, and a more economical use of lithic raw materials. During this time, Gravettian sites situated along the Váh River in present-day Slovakia gained significance, coinciding with the increased exploitation of radiolarites from the Pieniny Klippen Belt (PKB).

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RESEARCH ARTICLE – VÝZKUMNÝ ČLÁNEK

Fragment měděného sekeromlatu z počátku eneolitu z Krhova na Moravě jako příklad materiálové skupiny Hrádok

Fragment of an Early Eneolithic copper hammer-axe from Krhov in Moravia as a representative of the Hrádok material group

Jaroslav Peška – Zuzana Jarůšková – Filip Ondrkál – Michael Kamarád

The article discusses an intriguing find of a fragment of a copper axe-hammer from the Boskovice Furrow area in Moravia. This is a new detector discovery of a fragment of the rear section of an axe-hammer, found at the site of Krhov-Písečný, Blansko district, in the central part of the Boskovice Furrow. It belongs to the broader group of so-called heavy copper industry, genetically linked to similar types such as Szendrő, Székely-Nádudvar, Handlová, etc. Typologically, it does not represent a completely distinct type, showing the greatest similarity to the Székely-Nádudvar and Handlová types. For the latter type of axe-hammers, their dating is reassessed, based on associated inventories in hoards (including the eponymous Handlová), shifting from the Early/Middle Eneolithic to the Early Eneolithic and the cultural environments of the Ludanice culture (Slovakia) and the Jordanów culture (Moravia). Paleometallurgical analysis of the Krhov artefact provides an interesting finding, showing a difference from the traditional material, represented by Handlová-type copper, and similarity to the newly defined material group of Hrádok-type copper. The typical so-called Axtmarks are interpreted as a certain indicator of prestige (social, symbolic?) or the trade value of the artefact. The artefact itself is interpreted as a symbol of power, wealth, and the social status of its owner.

Székely-Nádudvar type hammer-axe – Handlová-type hammer-axe – Early Eneolithic – copper material group – paleometallurgy – use-wear analysis

Příspěvek se zabývá zajímavým nálezem fragmentu měděného sekeromlatu z Boskovické brázdy na Moravě. Jedná se o nový detektorový nález fragmentu týlní části sekeromlatu, který pochází z lokality Krhov-Písečný (okr. Blansko) ve střední části Boskovické brázdy. Náleží do širší skupiny tzv. těžké měděné industrie geneticky svázané s podobnými typy Szendrő, Székely-Nádudvar či Handlová a přestože nejde o typologicky zcela vyhraněný typ, nejvyšší podobnost vykazuje vůči typu Székely-Nádudvar a Handlová. U posledně uvedeného typu sekeromlatů přehodnocujeme na základě doprovodného inventáře v depotech (včetně eponymní Handlové) jejich datování z přelomu staršího a středního eneolitu (3900/3800–3100/3000 BC) do eneolitu časného (4300/4200–3900/3800 BC) a prostředí kultur ludanické (Slovensko) a jordanovské (Morava). Paleometalurgická analýza artefaktu z Krhova zaznamenala zajímavý rozdíl oproti tradiční surovině v podobě mědi typu Handlová a podobnost s nově definovanou materiálovou skupinou mědi typu Hrádok. Typické tzv. Axtmarky jsou hodnoceny jako jistá míra prestiže (společenské, symbolické?) nebo obchodovatelnosti artefaktu. Sám artefakt je pak interpretován jako symbol moci, bohatství a společenského postavení majitele.

sekeromlat typu Székely-Nádudvar – sekeromlat typu Handlová – časný eneolit – materiálová skupina mědi – paleometalurgie – traseologická analýza

Úvod

Počátky eneolitu jsou v celoevropském měřítku bezprostředně spjaty s nejstaršími projevy metalurgie. Jejich nejvýraznější formou je objevení se vcelku intenzivní vlny masivních

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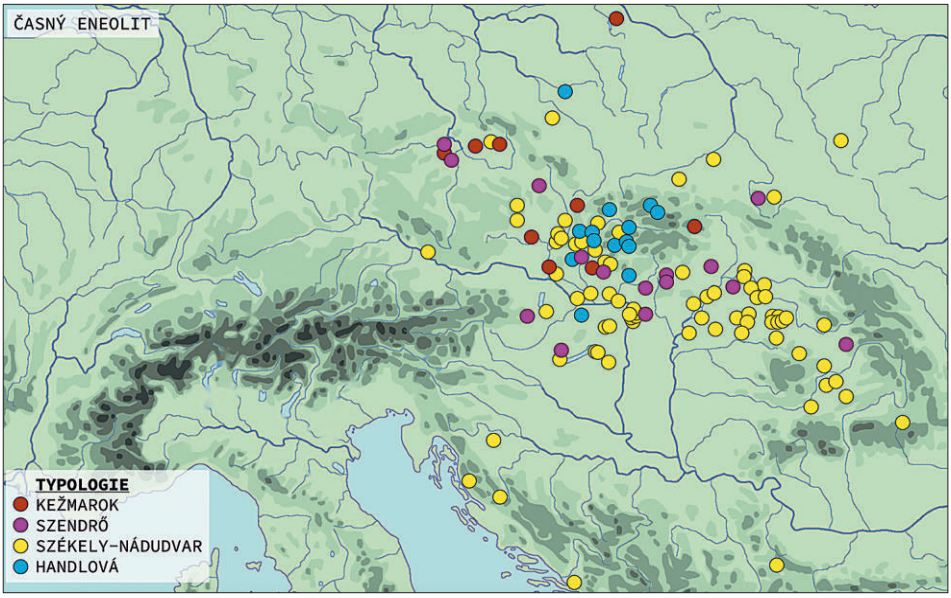
měděných nástrojů, tzv. těžké industrie v podobě sekeromlatů, seker s křížovým ostřím a plochých seker několika typů. Ze sekeromlatů sem jednoznačně patří typ Crestur, Kežmarok, Holíč, Szendrő, Székely-Nádudvar, Handlová a Mezőkeresztes, které do literatury uvedl *Schubert* (*1965*, 275–280, Abb. 1) jako skupinu pokročilých, resp. vyvinutých artefaktů s jednostrannou nebo oboustrannou tulejí (skupina II). Pozdější třídění se soustředilo jen na vyčlenění variant, čemuž se věnovalo několik dalších badatelů (*Novotná 1970*; *Vulpe 1975*; *Mayer 1977*; *Todorova 1981*; *Patay 1984*; *Říhovský 1992*; *Žeravica 1993*; *Schubert – Schubert 1999*; *Heeb 2011*; *Antonović 2014*). Za oblast vzniku a prvotního rozšíření této industrie lze považovat širší severní a severovýchodní část Karpatské kotliny (*Obr. 1*), odkud docházelo k menším infiltracím směrem na sever a severozápad, výjimečně také na jih a jihozápad (Székely-Nádudvar). Největší zastoupení a územní rozsah vykazuje právě typ Székely-Nádudvar, k němuž nově řadíme nálezy sekeromlatů z moravsko-slovenského pomezí (Slavkov-Kolo, Beckov – Zbojnícky vrch, Chocholná-Velčice – Kykula: *Peška 2022a*), které jsme původně přisuzovali typu Handlová (*Farkaš et al. 2023*). V případě posledně jmenovaného typu se mělo vždy za to, že jeho rozšíření pokrývalo především širší oblast středního Slovenska se dvěma výjimkami, a to sekeromlat z ojedinělého nálezu na lokalitě Bakonyoszlop (Oszlop) poblíž Bakoňského lesa v severní části Zadunajska (*Patay 1958*, 303, tab. II:5) a exemplář snad z depotu společně se sekerou s nízkými postranními lištami (?) z lokality Sucha Wielka severně od Wrocławi v Dolním Slezsku (*Seger 1904*, 51 ad., Abb. 1). Ten byl již dříve považovaný za variantu typu Handlová, dnes však za sekeromlat tohoto typu sekundárně upravený na motyku typu Hortobágy. Nové slovenské exempláře z depotů (Diviaky nad Nitricou, Žitná-Radiša I a Mníchova Lehota II) nebo ojedinělého nálezu (Horná Ves, okr. Prievidza) z oblasti Považského Inovce a Strážovských vrchů posunují hranici rozšíření západním směrem (*Peška – Ondrkál v tisku*).

V období časného eneolitu, kdy se na území Moravy rozvíjela první metalurgie, pocházela měď pro výrobu nástrojů a ozdob především z karpatských zdrojů (*Dobeš et al. 2019*). Tyto suroviny se lišily obsahem stopových prvků a díky tomu je dnes můžeme pomocí chemických analýz rozpoznat a přiřadit k určitému zdroji. V archeologickém výzkumu rané metalurgie se proto setkáváme s tím, že měděné artefakty nejsou vyrobeny z chemicky totožného kovu, ale z různých surovinových skupin, které se od sebe liší složením a lze je jednoznačně odlišit. Tyto tzv. materiálové skupiny dostávají v odborné literatuře ustálené názvy a kódová označení (SAM systém podle *Junghans et al. 1960*; *1968*) a jejich identifikace nám umožňuje sledovat původ kovu, technologie zpracování a regionální výrobní tradice. V této studii se zaměřujeme na dvě z nich. Měď typu Handlová představuje surovinu s výrazným geochemickým podpisem, typicky tvořeným zvýšeným obsahem arsenu (As > Sb > Bi) a původem v tennantitových rudách těžených v oblasti horního toku řeky Nitry; v systému *SAM* odpovídá zejména skupině C6A a je úzce spojena s výrobou charakteristických sekeromlatů z depotu Handlová – „Na Pstruhároch“. Naproti tomu nově vyčleněná materiálová skupina Hrádok má odlišný chemický profil, s dominancí antimonu (Sb>As) a původem v tetraedritových rudách západokarpatské subzóny; v systému *SAM* se nejčastěji klasifikuje do skupin C4/E10/G. Její využití se váže převážně na artefakty ludanické skupiny, zejména spirály a drátěné šperky z depotů západního Slovenska a jihovýchodní Moravy (*Peška – Ondrkál v tisku*). Vymezení a porovnání obou skupin je pro naši studii zásadní, protože jejich odlišení na základě geochemických znaků a kontextu výskytu nám umožňuje sledovat jak technologické, tak distribuční vzorce rané metalurgie v Karpatské kotlině.



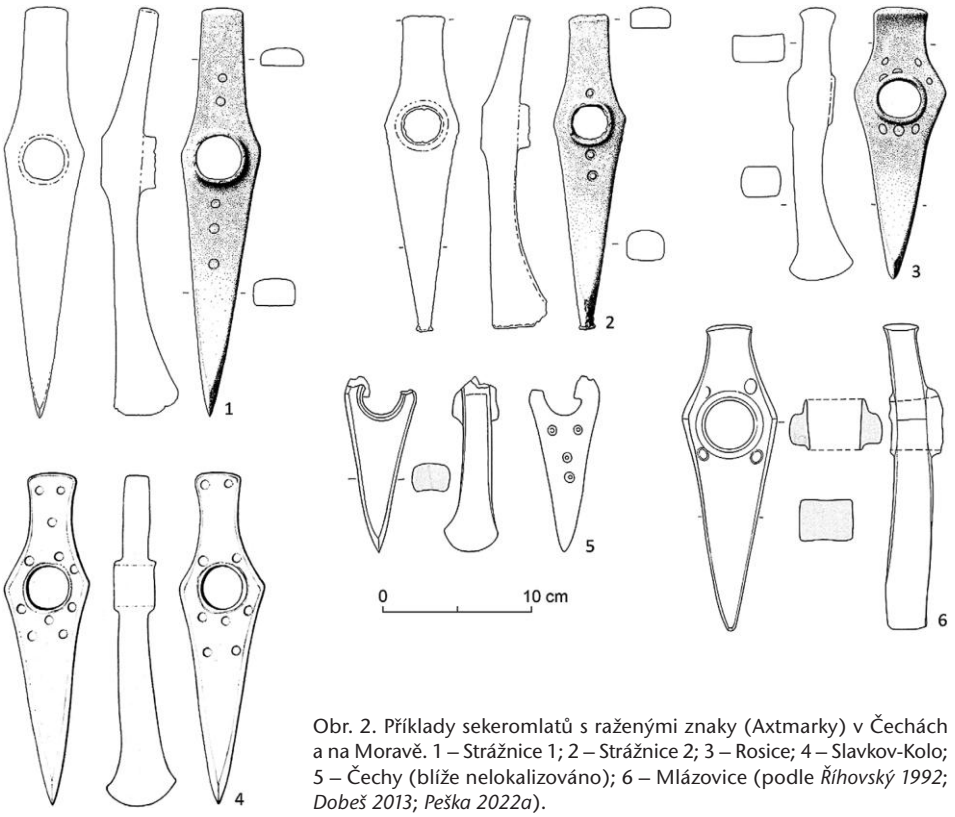
Obr. 1. Prostorová distribuce měděných sekeromlatů z počátku eneolitu ve střední Evropě (mapa P. Grenar).

Tento článek přináší komplexní analýzu nového detektorového nálezu fragmentu týlní části měděného sekeromlatu z lokality Krhov-Písečný (okr. Blansko) ve střední části Boskovické brázdy, jenž podle morfologických znaků náleží k širší skupině těžké měděné industrie a vykazuje největší podobnost s typy Székely-Nádudvar a Handlová. Nález z Krhova rozšiřuje nejen geografický rámec výskytu těchto typů, ale otevírá i otázky spojené s jejich funkčním a sociálním významem, surovinovým zázemím a časovým zařazením. Zvláštní pozornost bude věnována paleometalurgické analýze, která v případě krhovského artefaktu prokázala složení blízké nově definované materiálové skupině mědi typu Hrádok, a nikoli tradičně spojované mědi typu Handlová. To vyvolává výzkumnou otázku, zda odlišnosti v materiálových skupinách odrážejí pouze regionální dostupnost surovin, nebo zda jsou projevem specifických technologických tradic či směnných a redistribučních sítí v raném eneolitu. Jelikož náš zlomek z Krhova vykazuje největší podobnosti s typem Székely-Nádudvar a Handlová, budeme se podrobněji zabývat právě jimi s typologickým srovnáním ostatních typů sekeromlatů Schubertovy druhé skupiny.

Typologická základna

Sekeromlaty typu Székely-Nádudvar

Původně byly tyto sekeromlaty vyčleněny jako dva typy velice podobné konfigurace se společnými znaky ve formě více či méně konkávního profilu bočnic, oboustranné tuleje a přímé nebo lehce prohnuté boční osy. Identifikací mnoha přechodných (smíšených) forem se dospělo k dvouslovnému označení spojující původně ostřeji profilovaný typ Székely a měkčeji profilovaný typ Nádudvar s výraznou horní tulejí připomínající poněkud sekery



Obr. 2. Příklady sekeromlatů s raženými znaky (Axtmarky) v Čechách a na Moravě. 1 – Strážnice 1; 2 – Strážnice 2; 3 – Rosice; 4 – Slavkov-Kolo; 5 – Čechy (blíže nelokalizováno); 6 – Mlázovice (podle *Říhovský 1992*; *Dobeš 2013*; *Peška 2022a*).

s křížovým ostřím typu Jászladány (*Schubert 1965*, 278). Široká tvarová škála vedla (mimo zvláštní formy) k vyčlenění několika variant: Székely, Apagy, Dorog a Monostorpályi (*Patay 1984*, 47–56), z nichž se mnohé svými znaky opět prolínají. Četný společný výskyt jasně ukazuje na jejich současnost, takže není nezbytné se vždy tak podrobného třídění držet.

Tento typ sekeromlatu je zastoupen vcelku hojně, největší koncentraci pozorujeme v severní části Karpatské kotliny se dvěma enklávami v Potisí a kolem středního Dunaje, kde na slovenská naleziště plynule navazují ta moravská (*Obr. 1*). Početný je také výskyt na území Rumunska s ubýváním nálezů směrem na Balkán, kde se kromě Bulharska (2x) objevuje ještě na území Bosny a Hercegoviny (1x) a Černé Hory (1x). Mimo Moravu (5x) jej lze zaznamenat také v Čechách (2x) a zhruba stejný výskyt registrujeme v Polsku (6x) a v Rakousku (6x; z toho 4x neznámá lokalita).

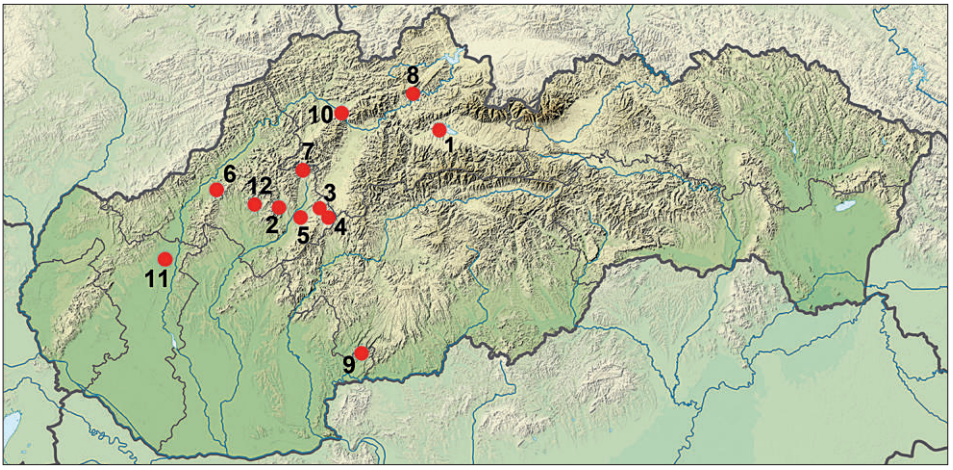
Mimo zatím nepublikovaný depot z Moravského Krumlova – Krumlovského lesa (publikace v přípravě) jej na Moravě známe z depotu ve Strážnici (2 ks) a z ojedinělých nálezů z Rosic a Sušice-Traplic (*Obr. 2*; *Říhovský 1992*, 26, 28, Taf. 1: 8; 2: 9, 10, 12; *Vaškových 2004*, 162–163, obr. 2; *Dobeš et al. 2019*, tab. 1; *Peška 2021*). V Čechách pochází jeden celý kus z depotu z Mlázovic, jehož nálezové okolnosti však neznáme, a dále je znám jeden fragment z neznámé lokality (*Dobeš 2013*, 14, 18, obr. 1: 3, 3: 2). Jako u jiných typů dominují ojedinělé nálezy, výjimečný je nález na sídlišti (Apagy, Púchov-Skalka).

V depotech mimo naše území vystupuje jednotlivě (Székely, Cluj), nebo v doprovodu ploché sekery blízké typu Szakálhát (depot Linz–St. Peter: *Mayer 1977*, Taf. 1: 9; 10: 111) a v depotech ve Stabanj a Nevest v Chorvatsku spolu se sekerou typu Szakálhát a sekerami s křížovým ostřím typu Jászladány (*Žeravica 1993*, Taf. 1: 8, 9). Nejistý je celek z Dorog (depot nebo hrob?), kde sekeromlat typu Székely-Nádudvar vystupuje spolu s dlátem a plochou sekerou typu Felsőgalla (čili vlastně Jordanów). Stejně je tomu ve známém depotu Szeged-Szillér, který tvoří stejný typ dláta, sekera typu Szakálhát, ale také sekera s křížovým ostřím typu Jászladány. Jmenované příklady společného výskytu s typem Jászladány podporují datování do období bodrogkeresztúrské kultury v karpatském prostředí, do jordanovské kultury u nás a do ludanické na Slovensku. Oba sídlištní exempláře v Apagy bývají spojovány ještě s tiszapolgárskou kulturou a mohly by tak naznačovat časnější nástup těchto sekeromlatů (právě varianta Apagy?), jejichž doba rozkvětu a největšího rozšíření však spadá do námi jmenovaného období.

Sekeromlaty typu Handlová

Shrnutí všech dnes známých nálezů sekeromlatů typu Handlová se nedávno stalo předmětem poměrně rozsáhlé studie (*Peška – Ondrkál v tisku*), takže se zde omezíme pouze na nové poznatky a pozorování. V poslední době je zajímavý relativně vysoký nárůst nálezů z prostředí Strážovských vrchů, resp. Považského Inovce: Diviaky nad Nitricou, Žitná-Radiša, Mníchova Lehota II (celkem 7 kusů). Tyto nálezy podtrhují krystalizační jádro výskytu sekeromlatů typu Handlová s lehkým posunem na západ, neboť dosavadní exempláře se nejčastěji objevují na území středního Slovenska s kumulací v oblasti Kremnických vrchů a pohoří Vtáčnik na širším území mezi Banskou Bystricí a Bánovci nad Bebravou. Jde o území západně od Slovenského rudohoří a Starohorských hor. Na této ose je nejvíce k západu situován depot z Mníchovy Lehoty II ležící na pomezí Strážovských vrchů a Považského Inovce. Menší skupina nálezů pochází z území více na sever z Oravy a horního Pováží (Bešeňová, Strečno). Mimo hlavní koncentraci jsou známé sekeromlaty z Veľkých Kostoľan na dolním Pováží a z Plášťovců z Krupinské planiny nad Iplem na jižním Slovensku. Ten by mohl mít souvislost s jediným maďarským exemplářem ze Zadunajska (Bakonyoszlop). Mimo teritorium Slovenska je znám pouze již zmíněný panonský nález z Bakonyoszlop a exemplář ze Sucha Wielka ve Slezsku se specifickou úpravou. Nejvyšší koncentrace tak zůstává na pomezí západního a středního Slovenska (*Obr. 3*).

Sekeromlaty dostaly svůj název podle eponymního depotu (*Obr. 4*), který kromě sekeromlatu obsahoval plochou sekeru typu Jordanów a tři surovinové koláče (*Budaváry 1930*; *Novotná 1970*; *Schubert – Schubert 1999*). Svým složením se blíží depotům z Nedakonic nebo Szeged-Szillér (*Schubert – Schubert 1999*). První z nich obsahoval kromě pyramidového koláče také měděné šídlo a dvojici plochých seker typu Stollhof (*Říhovský 1992*, 60, Taf. 8: 74–75; *Schubert – Schubert 1999*, Abb. 9). Dvojí metalurgická analýza potvrdila shodné složení kovu jak u artefaktů, tak u suroviny (*Peška 2020*, 164). Časově příbuzný depot ze Szeged-Szillér, původně větší, poskytl kromě stejně formovaného koláče sekeru s křížovým ostřím typu Jászladány, dva fragmenty seker totožného typu upravené na palice a kladivo, plochou sekeru typu Szakálhát, dláto a dlouhé štíhlé šídlo (*Pulszky 1881*, 1 ad., Taf. 1; *Schubert – Schubert 1999*, 670, Abb. 10). Díky přítomnosti upraveného metalurgického náčiní a suroviny je depot někdy vykládán jako dílna metalurga mědi (*Schubert – Schubert 1999*, 670). Dvě ploché sekery (nejspíše typ Stollhof a snad Rödigen s prvky



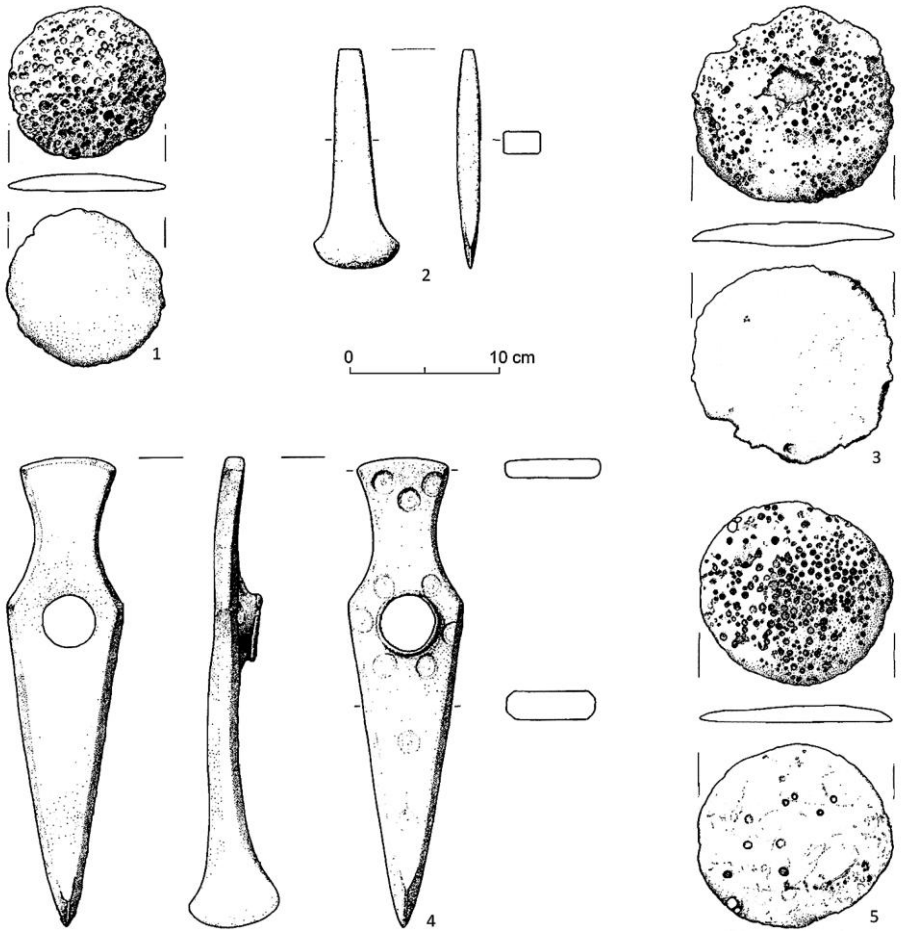
Obr. 3. Prostorová distribuce sekeromlatů typu Handlová v Evropě (mapa P. Grenar).

typu Jordanów) a surovinu v počtu dvou kusů obsahoval depot z Hradce (okr. Prievidza) (*Novotná 1955*, 90, Tab. 2: 6, 7; *1970*, 14–15, Taf. 1: 14; 2: 21; *Remiášová 1971*, 5), nacházející se přímo v centru rozšíření sekeromlatů typu Handlová (severní cíp pohoří Vtáčnik mezi Handlovou a Prievidzou), kde starobylé ploché sekery první nálezové skupiny datují depot do časného eneolitu (*Dobeš 2013*, 40).[1] Podobné datování depotu Handlová – Na Pstruhároch potvrzuje přítomnost ploché sekery typu Jordanów (*Obr. 4: 2*; *Schubert – Schubert 1999*, Abb. 1: 2). Ne zcela jasné nálezové okolnosti společného výskytu s badenskou keramikou na sídlišti (?) ve Veľkých Kostoľanech (*Schubert 1965*, 284 s poznámkou 43, 295; *Novotná 1970*, 24, č. 104) se zdají být neopodstatněné. V případě exempláře ze Slezska (Sucha Wielka) se nejspíše jedná, jak již bylo uvedeno, o sekeromlat typu Handlová sekundárně upravený na motyku typu Hortobágy (*Schubert – Schubert 1999*, 663).

Mimo další ne zcela jasný sídlištní nález z Bešeňové (*Volko 1923*, 127, obr. 2; *Novotná 1970*, 24, č. 102; *Schubert – Schubert 1999*, 659)[2] představují všechny exempláře sekeromlatů typu Handlová jen ojedinělé nálezy. Nejnovější objevy z oblasti Strážovských vrchů pocházejí z depotů, navazují na eponymní kontext. Rozšiřují a posunují ohnisko výskytu směrem na západ a ukazují daleko výraznější koncentraci a zastoupení tohoto typu těžké industrie v počátcích eneolitu. Depot z lokality Diviaky nad Nitricou obsahoval celkem pět kusů „zdobených" sekeromlatů (k dokumentaci se podařilo získat pouze tři). V depotu z Mníchovy Lehoty II doprovázela sekeromlat dvojice plochých seker typu Jordanów, menší brýlovitý závěsek s očkem a pár spirálovitých závěsků s háčkem typu Hrádok. Hromadný nález z lokality Žitná-Radiša přinesl kromě exempláře typu Handlová sekeromlat typu Şiria,

[1] Plochá sekera z Hradce (*Novotná 1970*, 14, Taf. 1: 14) může být spojena až s typem Stollhof a tím též s pozdně-ludanickým obdobím, tj. 4000–3750 BC (*detto* depot Handlová, příp. jeskyně Cigánka II, jejíž osídlení bylo radiokarbonově datováno 3941–3661 cal. BC na hladině pravděpodobnosti 95,4 %; *Horňák et al. 2020*).

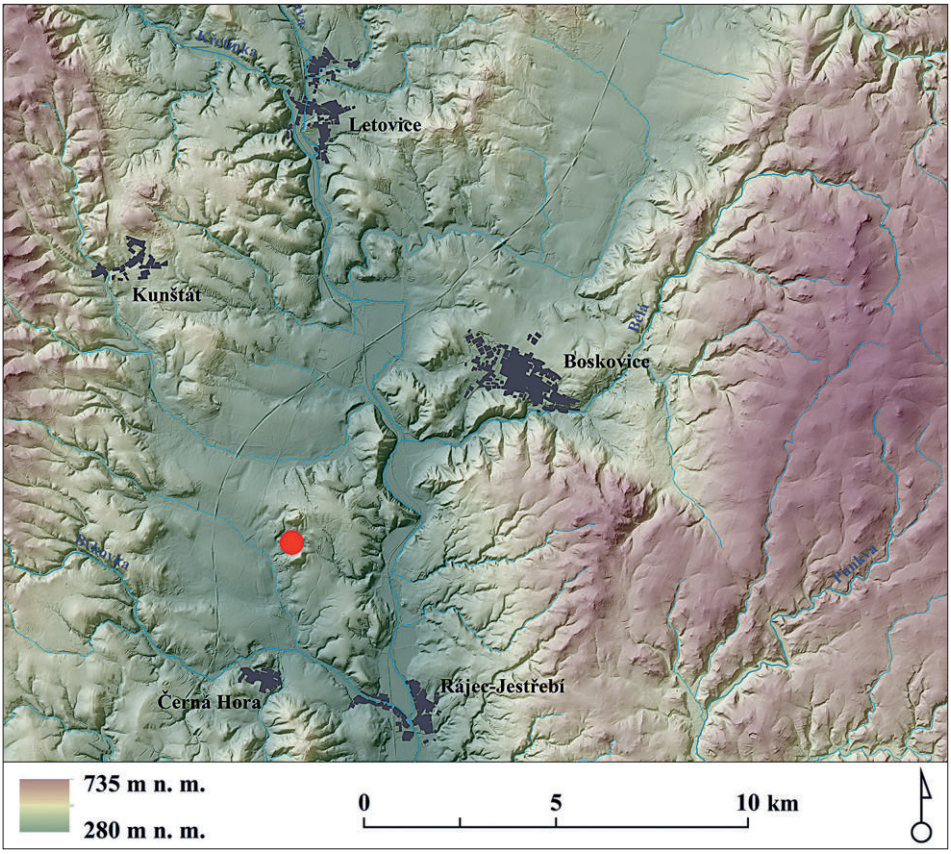
[2] J. Volko v článku zmiňuje za nejasných nálezových okolností společný nález dvou kopytovitých klínů a „*bronzovej sekerky*", takže lze nález sekeromlatu typu Handlová klidně hodnotit také jako ojedinělý (cf. *Volko 1923*, 125–127, obr. 2).



Obr. 4. Složení eponymního depotu z lokality Handlová – Na Pstruhároch (podle *Schubert – Schubert 1999*).

sekeru typu Jordanów a masivní dláto (vše *Peška – Ondrkál v tisku*). Doprovodné vystupování typických časně eneolitických typů artefaktů (Şiria, Jordanów) pak jasně hovoří pro dataci všech kontextů do časného eneolitu, tedy shodně s typem Székely-Nádudvar.

Detailnější vhled do delšího přežívání sekeromlatů typu Handlová je nezbytné, neboť důkazy ze Slovenského Pravna a Horné Mičiné jasně naznačují metalurgickou činnost spojenou s tetraedritovou mědí i po roce 4000 BC, s těžištěm v 38. století BC (*Nevizánsky et al. 2017*; *Zachar et al. 2023*). Vzhledem ke kontinuitě měděné metalurgie v tomto období považujeme za pravděpodobné, že nejen sekeromlaty typu Handlová, ale i další měděná industrie mohla přetrvávat déle, než se původně předpokládalo. Tento pohled podporuje i analogická situace v nálezovém kontextu sekeromlatu typu Şiria z Überlingen am Bodensee, který se sice nachází mimo původní oblast rozšíření, ale jeho absolutní datování do období 3950–3850 cal BC (95,4 % pravděpodobnost) naznačuje dlouhodobé využívání podobných nástrojů (*Matuschik 1997*). Představa, že sekeromlaty typu Handlová vyrobené z tetraedritové mědi by nepokračovaly do období po roce 4000 BC, se tak jeví jako



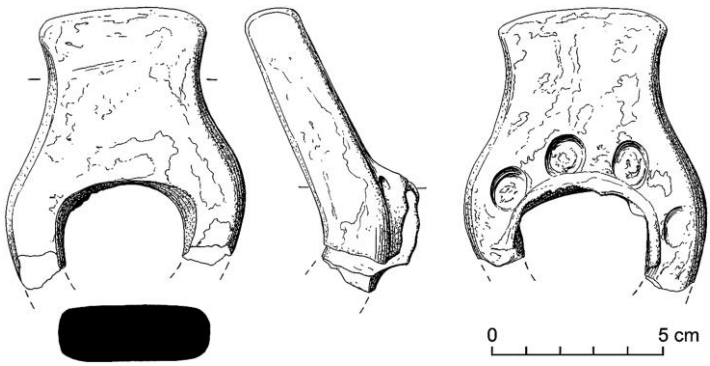
Obr. 5. Krhov-Písečný 2023. Mapa s vyznačením místa nálezu fragmentu sekeromlatu (mapa Z. Jarůšková).

neudržitelná. Spíše můžeme uvažovat o komplexnějším vývojovém scénáři, kdy metalurgie tetraedritové mědi začíná již v ludanické kultuře, ale plynule přecházela i do mladších fází. Absence dosud doložených sídlišť ludanické kultury ve středním Slovensku proto nemusí odrážet skutečný stav osídlení, ale spíše současný stav výzkumu, což jen podtrhuje potřebu dalšího bádání v této oblasti.

Fragment z Krhova

Místo nálezu

Fragment týlní části sekeromlatu byl nalezen za pomoci detektoru kovů v roce 2023 dlouholetým spolupracovníkem muzea v Boskovicích Miroslavem Francem. Nález pochází z pole v katastru obce Krhov, v trati Písečný na severozápadním svahu kopce Velký Chlum, přičemž v nedaleké, avšak samostatné vyvýšenině zvané „Malý Chlum“ bylo prokázáno pravěké hradiště, jež je významnou archeologickou lokalitou oblasti (*Novák 2015*). Pole v těchto místech vytváří menší hřbet o nadmořské výšce 370 m, který je situován nad



Obr. 6. Krhov-Písečný 2023. Kresebná dokumentace fragmentu sekeromlatu typu Handlová (kresba O. Nagláková).

levým břehem levostranného bezejmenného přítoku Lysického potoka (*Obr. 5*). Sekeromlat byl nalezen asi 15 cm pod povrchem. Nálezce se v této souvislosti domnívá, že sekeromlat mohl být v minulosti již vyzvednut a znovu odhozen, přičemž patina lomové plochy odpovídající zbytku artefaktu naznačuje, že poškození je staršího data.

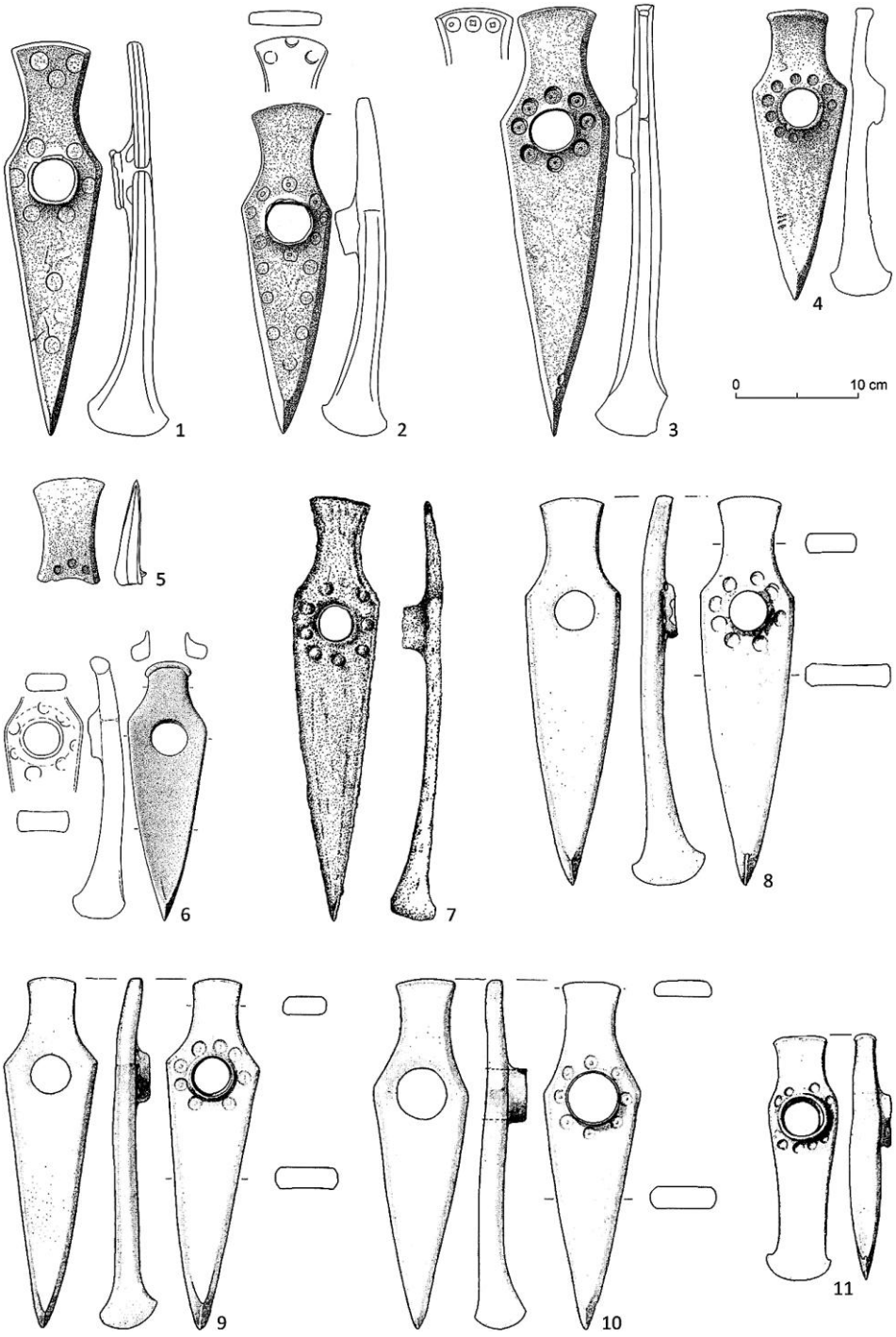
Popis předmětu

Fragment představuje týlní část sekeromlatu typu Székely-Nádudvar, která nese znaky série Handlová. Artefakt byl přeražen v místě násadního otvoru. Zachovala se pouze týlní část, která má lehce kónický a mírně roztepaný týl. V bokorysu je patrná původní lomená osa těla artefaktu. Násadní otvor je opatřen krátkou, poškozenou tulejkou, která se nachází pouze na vnější straně. Okolo násadního otvoru se dochovaly ražené značky, z nichž čtyři jsou zachovalé. Původně tyto značky pravděpodobně obíhaly celý obvod násadního otvoru. Povrch artefaktu pokrývá světle zelená patina. Zachovaná délka činí 85,63 mm, šířka týlu 47,74 mm a maximální šířka 69,89 mm. Maximální tloušťka dosahuje 25,61 mm. Zachovaný průměr násadního otvoru činí 36,54 mm. Hmotnost fragmentu je 531 g. Předmět je uložen v Muzeu regionu Boskovicka pod inventárním číslem A 51293, AMČR PAS https://doi.org/10.71928/M-202400061-N00462 (*Obr. 6*; *Obr. 7*).

Obr. 7. Krhov-Písečný 2023. Fotodokumentace fragmentu sekeromlatu typu Handlová (foto M. Kršková).

Typologie

Při stanovení typologické příslušnosti zkoumaného fragmentu z Krhova je nutné hned na úvod zdůraznit, že jeho morfologické znaky jej mohou řadit buď k typu Handlová, nebo k typu Székely-Nádudvar. Určení naráží na řadu problémů, především proto, že u nejstarších eneolitických sekeromlatů jde *de facto* o individuální výrobky, odlévané pravděpodobně do ztracených forem.



Obr. 8. Přehled dosud publikovaných sekeromlatů typu Handlová (podle *Schubert – Schubert 1999*).

Z toho plyne jejich originalita na jedné straně, ale na druhé straně také neostrá hranice mezi jednotlivými typy či variantami s četnými přechodnými znaky, resp. kombinací znaků několika typů současně.

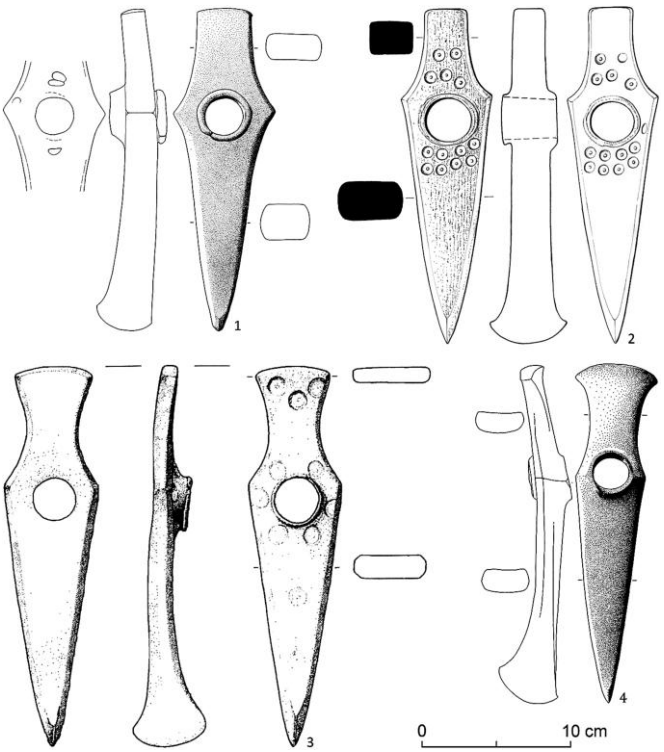
Typ Handlová je charakteristický deskovitým tvarem těla, tulejkou na vnitřní (zadní) straně, raženými značkami nejčastěji okolo tulejky, ale také na vnitřní straně, a přímou boční osou sekeromlatu bez zahnutí (lomení) týlové části (nyní nebereme v úvahu surovinové složení, které by „tradičně" mělo vykazovat tetraedritovou měď typu Handlová). Získáním nových nálezů sekeromlatů typu Handlová na západě Slovenska (*Peška – Ondrkál v tisku*) se však ukazuje, že takto přísně postavená charakteristika neplatí beze zbytku, jelikož u nových exemplářů evidujeme oboustrannou tulej, lomení týlu, absenci zdobení a ražené značky na vnější (přední) straně tulejky nebo i jinde na těle. Oba typy sekeromlatů mají k sobě velice blízko, což podporuje hypotézu o jejich genetické i časové příbuznosti (*naposledy Peška – Ondrkál v tisku*). Rozdíly mezi nimi spočívají především v tom, že typ Székely–Nádudvar (všechny varianty) vykazuje měkčí profilaci těla s méně ostrými hranami, obdélný týl je rozšířen jen náznakově nebo vůbec a osa těla je většinou přímá, někdy obloukovitě prohnutá. Známe však i exempláře s lomeným týlem (var. Dorog, Apagy). Ostří je buď rovné, jednostranně rozšířené, méně vějířovité. Sekeromlaty jsou vždy opatřeny oboustrannou tulejí, byť někdy sotva znatelnou, přičemž u vnitřní strany bývá nasazena plynule, zatímco vnější je ostřejší.

Sekeromlaty typu Handlová jsou naproti tomu ostřeji profilované s výraznými hranami, značně vykrojené boční strany kolem násadního otvoru přecházejí ve výrazně rozevřený a obloukovitě zakončený týl. Osa těla je většinou rovná nebo lehce esovitě prohnutá, méně lomená (týl), ostří je zásadně výrazně vějířovitě oboustranně rozšířené. Tulej bývá pouze jednostranná, na vnitřní straně a je dost výrazná až přehrnutá, jak jsme si však uvedli, existují výjimky (*Obr. 8*).

Společným znakem jsou ražené kruhové značky, tzv. Axtmarky (*Schubert 1965*, 286–295). U typu Handlová se nacházejí převážně na vnější straně artefaktu (kolem násadního otvoru), blízko týlu, ale známy jsou i případy oboustranné aplikace s převahou značek na vnitřní partii těla – například u eponymního nálezu z Handlové. Naproti tomu u typu Székely–Nádudvar převažuje jiné schéma v podobě dvou řad nad a pod násadním otvorem, doplněné často záseky nebo půlměsícovitými značkami uvnitř nebo oboustranně na předmětu (*Patay 1984*, Taf. 14: 199–201; 15: 204; 16: 212; 17: 219 aj.).

Fragment z Krhova je blízký typu Székely-Nádudvar oblou profilací kolem násadního otvoru, nízkým a nepříliš výrazně prohnutým týlem, lomením týlu, ojedinělá je jednostranná vnější tulej. Naopak netypický je prstenec značek okolo tulejky na vnější straně. U zástupců tohoto typu převažují oboustranné tuleje a ražené značky jsou ponejvíce na vnitřní straně artefaktů. K ostatním typům uvedené skupiny má náš zlomek ještě dále. Na základě nových poznatků by pro zařazení k typu Handlová byla příznačná jednostranná tulej (byť vnější), prstenec ražených značek (byť vnější), prohnutí týlu (i když lehké) a koneckonců i lomený týl, který se objevuje, jak uvedeno dále, u obou typů. Typomorfologické shody a rozdíly jsou shrnuty do přehledové tabulky (*Tab. 1*) a jsou viditelné i na vyobrazení vybraných typů sekeromlatů (*Obr. 9*; *Tab. 1*).

Na základě výše uvedených skutečností jsme nakloněni exemplář z Krhova považovat za hybridní variantu obou sledovaných typů (Székely-Nádudvar/Handlová) bez toho, abychom jednoznačně rozhodli, ke kterému typu má blíže. Dosavadní absence čistého typu Handlová a naopak přítomnost zástupců typu Székely-Nádudvar na Moravě a v Čechách,



Obr. 9. Porovnání typomorfologických znaků základních znaků typických časně eneolitických sekeromlatů: 1 – Székely (typ Székely-Nádudvar); 2 – Beckov – Zbojnícky vrch (typ Székely-Nádudvar se znaky typu Handlová); 3 – Handlová – Na Pstruhároch (typ Handlová); 4 – Békésszentandrás (typ Mezőkeresztes) (podle *Patay 1984*; *Schubert – Schubert 1999*; *Farkaš et al. 2023* sestavila K. Pluskalová).

včetně suroviny ve formě mědi jiného typu než je tetraedritový typ Handlová, by sice svědčily více pro typ Székely-Nádudvar, avšak zatím svým způsobem neutrální pozice nové skupiny mědi typu Hrádok, v níž je Krhov prvním zástupcem svého druhu (viz níže a *Peška – Ondrkál v tisku*), nám jednoznačný závěr neumožňuje.

Lomený týl

U sekeromlatů typu Handlová se lomení týlu neobjevuje, maximálně je doloženo jeho mírné zahnutí spolu s jemným prohnutím celého těla sekeromlatu (*Obr. 8*). Přímou analogii ke Krhovu tak spatřujeme zatím pouze v nově zveřejněném exempláři z depotu Mníchova Lehota II (*Peška – Ondrkál v tisku*). Naopak je charakteristický pro typ Kežmarok (*Novotná 1970*, Taf. 4: 86; *Patay 1984*, Taf. 11: 185; *Dobeš et al. 2019*, Tab. 2: 1, 2) a objevuje se u typů Szendrő (*Vulpe 1975*, Taf. 2: 22–25; 3: 26; *Patay 1984*, Taf. 10: 171, 173, 11: 181, 182), Codor (*Vulpe 1975*, Taf. 3: 28–30) a u sekeromlatu z Aţel (*Vulpe 1975*, Taf. 3: 22). Zvláště typický je pro typ Vidra (*Todorova 1981*, Taf. 6: 100, 102, 103; 7: 106–108, 111, 116; 8: 127 a další; *Patay 1984*, Taf. 9: 156; *Antonović 2014*, Taf. 10: 131). Velice signifikantní i s prohnutím celého těla je pro typ Mezőkeresztes (*Novotná 1970*, Taf. 6: 105; *Vulpe 1975*, Taf. 7: 59, 8: 59–61, 9; 10: 67, 68, 71; *Todorova 1981*, Taf. 10: 151; *Patay 1984*, Taf. 21: 255, 256; 22: 258–260; *Antonović 2014*, Taf. 11: 141, 143; *Dobeš et al. 2019*, obr. 2: 1). Opakovaně je tento prvek zastoupen také u sekeromlatů typu Székely-Nádudvar (*Novotná 1970*, Taf. 4: 91, 94; *Vulpe 1975*, Taf. 4: 41, 43, 5: 48A, 6: 50; *Mayer*

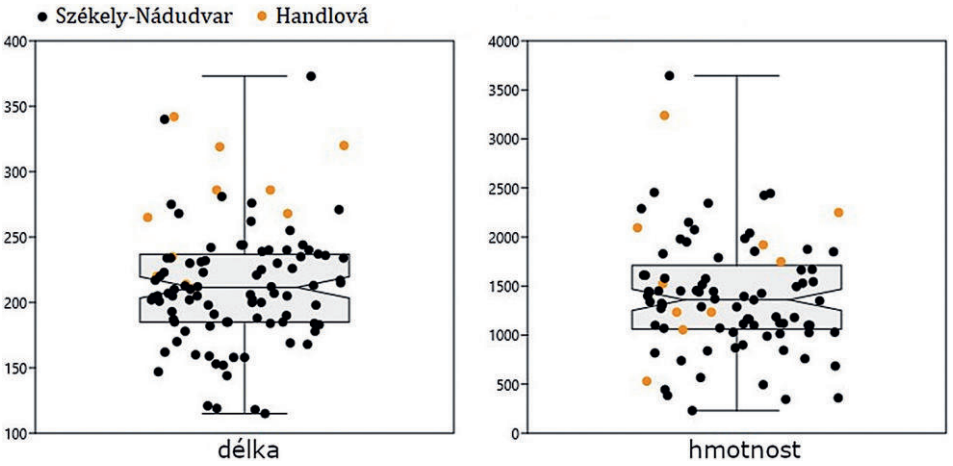
Porovnání typologických znaků		
TYP SEKEROMLATU	**ANO**	**NE**
CRESTUR	• jednostranná vnější tulej (řídce)	• trapézovitý týl (prohnutí) • oboustranná tulej • lomení týlu žádné • jiné schéma značek
SZÉKELY – NÁDUDVAR	• oblé boky • nízký týl • jednostranná vnější tulej (řídce) • lomený týl • prstenec značek (řídce) • surovina	• prohnutí týlu • převaha oboustranné tuleje • ražené značky vnitřní (převaha)
SZENDRŐ	• nízký týl • prstenec značek (výjimečně)	• trapézovitý týl • ostře lomenné boky • lomený týl
KEŽMAROK	• jednostranná vnější tulej • lomený týl (typické)	• trapézovitý týl • minimum značek – odlišné schéma
HANDLOVÁ	• prohnutí týlu • jednostranná tulej vnější (výjimečně) • lomení týlu (výjimečně) • prstenec značek	• ostře lomenné boky • jednostranná vnitřní tulej (převaha) • prstenec značek vnitřní (jasná převaha)
MEZŐKERESZTES	• prohnutí týlu • lomení týlu	• vysoký prohnutý týl • vějířovitá úprava • ostré boky • oboustranná tulej • minimum značek – jiné schéma

Tab. 1. Srovnání základních typologických znaků sekeromlatů typu Crestur, Székely-Nádudvar, Szendrő, Kežmarok, Handlová a Mezőkeresztes (sestavila K. Pluskalová).

1977, Taf. 1: 10, 11, *Patay 1984*, Taf. 12: 187; 13: 191, 195; 15: 204, 207 etc.; *Dobeš et al. 2019*, Obr. 2: 2, 3). Teritoriální rozdíly nejsou podstatné a se zalomením týlu se setkáváme na celém území rozšíření jednotlivých typů. Nasazením dřevěného toporu do takto tvarovaného nástroje získáme jiný úhel než u přímé osy artefaktu. To by z praktického hlediska mohlo usnadňovat manipulaci s nástrojem, přichází-li, díky velké hmotnosti některých kusů, v úvahu. V případě čistě ceremoniální nebo podobné funkce předmětu by se mohlo jednat čistě o dekorativní záležitost.

Metrika

Je zřejmé, že pro artefakty dochované ve fragmentárním stavu, jako je nález z Krhova, nelze smysluplně vyvozovat kompletní metrickou charakteristiku. Proto vycházíme z dosavadních shromážděných dat u celých exemplářů, a to s cílem ukázat obecné rozměrové rozpětí jednotlivých typů a posoudit, zda se jejich metrické odlišnosti mohou stát podpůrným argumentem pro typologické zařazení krhovského nálezu. Data ukazují, že i u tak vyhraněného typu, jako je Handlová, je patrný značný rozptyl jak v délce (214–342 mm; medián 269,63 mm), tak v hmotnosti (1234–3240 g; medián 1683,5 g). Ve srovnání s podobně konstruovaným a nejvíce rozšířeným typem Székely–Nádudvar jsou patrné rozdíly (*Obr. 10*) v délce (118–373 mm; medián 211,36 mm) i v hmotnosti (385–3645 g; medián 1367,1 g). Lze tedy konstatovat, že sekeromlaty typu Handlová jsou v průměru o něco delší a robustnější než exempláře shrnuté pod typ Székely–Nádudvar. Raženými znaky (Axtmarky) jsou bohatě opatřeny všechny exempláře a tento „dekor“ se u typu Handlová



Obr. 10. Krabicový graf srovnání délky a hmotnosti sekeromlatů typu Handlová a Székely-Nádudvar (graf K. Pluskalová).

vyskytuje jednoznačně častěji než u Székely–Nádudvar, čímž *de facto* patří k jeho určujícím charakteristikám (*Obr. 2*; *9*; *11*). Jejich možná interpretace již byla v literatuře zmíněna (*Peška – Salaš 2020*, 87–90; *Peška 2022a*, 321–322, Fig. 7; *2022b*, 230; *Farkaš et al. 2023*, 6–8; *Peška – Ondrkál v tisku*).

Spektrální složení

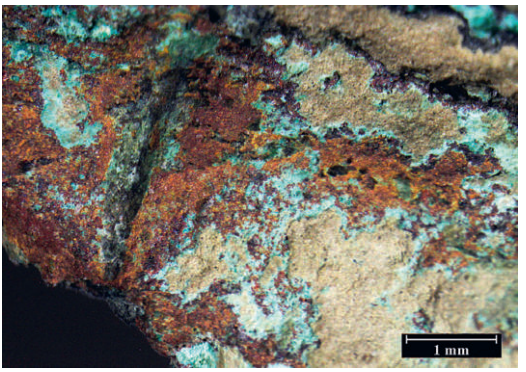
Analýza elementárního složení byla provedena a následně replikována pomocí ED-XRF spektrometrů ElvaX (AC Olomouc, ARÚ Brno) na vzorku odvrtaném z kovového jádra sekeromlatu (aco_rfa_2498). Časy akvizice byly nastaveny na 200/300 s a kvantitativní hodnoty byly vypočteny z kalibrace ověřené certifikovanými modely. Průměrné hodnoty získané dvěma laboratořemi na stejném vzorku se zdají být poměrně konzistentní, vezmeme-li v úvahu nepravidelné rozložení sloučenin v kovu (*Tab. 2*).

Objekt	Předmět	Laboratoř	Číslo vzorku	Obsah stanovených prvků [%]											
				Cu	Sn	As	Sb	Ag	Ni	Bi	Pb	Co	Au	Zn	Fe
Krhov	sekeromlat	AC Olomouc	aco_rfa_2498	99,67	0,06	0,05	0,05	0,01	0,03	0,03	LOD	0,01	LOD	0,05	0,07
Krhov	sekeromlat	ARÚ Brno	aco_rfa_2498	99,88	0,03	0,04	0,03	LOD	0,01	0,02	LOD	LOD	LOD	LOD	LOD

Tab. 2. Krhov-Písečný 2023. Výsledky analýzy elementárního složení zlomku sekeromlatu pomocí ED-XRF (AC Olomouc – F. Ondrkál; ARÚ Brno – M. Kmošek).

Výsledky ED-XRF nápadně připomínají přirozené log-normální rozdělení minoritních a stopových prvků v minerálech, což naznačuje, že pocházejí z tavených rud a nemohly být přímo kontrolovány. Tento model předpokládá, že surovinou použitou k výrobě měděného sekeromlatu není čistá měď (N/E00), jelikož hodnota As a Sb v obou případech překračuje úroveň 0,025 %. Kov s popsanými parametry následně spadá pod dva datové body (SAM C1A, C6A; *Junghans et al. 1960*, Tab. 1), jasněji definované systematickým

Obr. 11. Krhov-Písečný 2023. Detail ražených znaků kolem násadního otvoru sekeromlatu (foto M. Kršková).

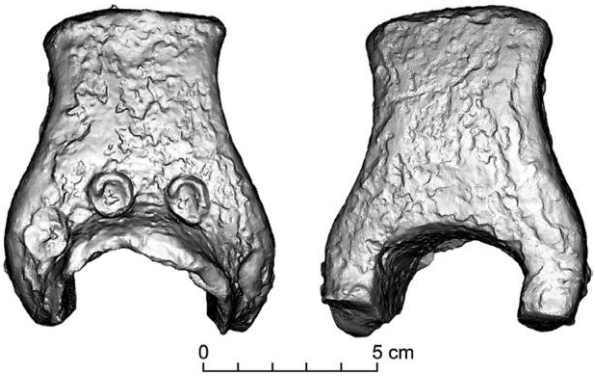


Obr. 12. Krhov-Písečný 2023. Mikrofotografie traseologické analýzy značky se středovým výstupkem (foto M. Kamarád).

rozptylem ostatních prvků (Sn, Ag, Ni, Bi, Co), jejichž kumulativní podíl však nepřevyšuje 0,14 %. Přestože archeologická konfigurace nedokáže takové extrémně nízké odlehlé hodnoty korelovat jako definující klastry mědi typu Handlová (SAM C6A), izotopové pole olova předpokládá její zdroj v mineralizacích Západních Karpat (*Schreiner 2007*; *Novotná et al. 2021b*, 88–90). Vzhledem k rozptylu koncentrací prvků v analytických skupinách L. Klassena (*Klassen 2000*, 222) se klastr této nízkokoncentrační mědi prolíná se skupinou mědi typu Nógrádmarcal a Handlová (SAM C1A/B, C6A). Je sporné, zda rozdíly ve spektrech těchto typů lze přičíst různému původu mědi, různým metodám zpracování nebo kombinaci obou příčin (*Schmitz 2004*, 532). Je však velmi obtížné si představit, že vysoké oxidační podmínky nebo časté přetavování mědi by způsobilo tak výraznou ztrátu těkavých prvků (As). Jak poznamenala H. Lechtman, je komplikované odstranit veškerý arzén z rudy oxidací (*Lechtman 1996*, 481).

Traseologie

V dubnu 2024 byla realizována traseologická analýza týlové části sekeromlatu typu Handlová z lokality Krhov-Písečný na stereomikroskopu Nikon SMZ18 s maximálním zvětšením 100x světlé pole s jednoduchou polarizací a se šikmým osvětlením. Je nutné přiznat metodologická omezení traseologického zkoumání předmětného sekeromlatu, přičemž plně reflektujeme fakt, že rozsah interpretací je nevyhnutelně podmíněn stavem dochování artefaktu (*Peška et al. 2006*). Konkrétně znečištění povrchu sedimenty a korozními vrstvami představuje zásadní faktor ovlivňující možnost jednoznačného určení mikrotrhlin a sekundárních modifikací funkčních zón. S ohledem na uvedené skutečnosti je nutné přistupovat k traseologickým závěrům s přiměřenou opatrností. V rámci studie proto důsledněji zvažujeme formu prezentace hypotéz a posilujeme metodologickou diskusi o vlivu diagenetických procesů na zachování mikroskopických stop (*Obr. 12*). Naším záměrem je poskytnout vyvážený pohled, který respektuje vědeckou opatrnost při interpretaci traseologických dat, přičemž však ponechává prostor pro relevantní úvahy o potenciálním funkčním využití sekeromlatu v širším kontextu měděné metalurgie.

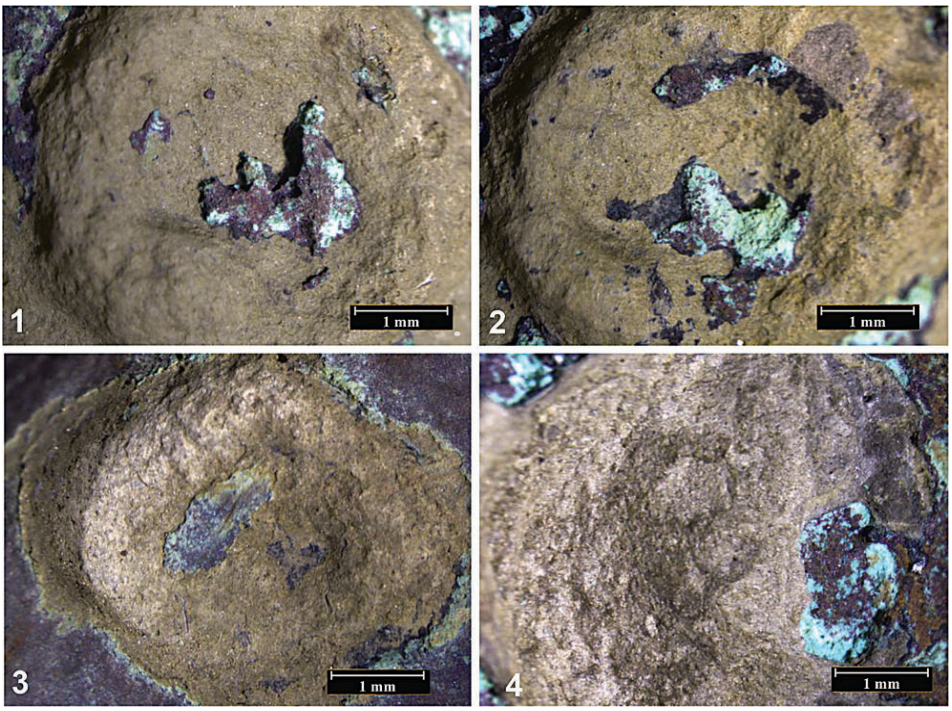


Obr. 13. Krhov-Písečný 2023. 3D modelace přední a zadní strany zkoumaného sekeromlatu.

Kvůli ztíženému pozorování povrchových stop bylo nutné zaměřit se na stopy, které zasahují do samotné struktury artefaktu, a nelze je tak zaměnit s recentními stopami. Pozornost byla proto zaměřena na ty části, kde již makroskopickým zkoumáním bylo možné objevit určité anomálie – oblast ulomené části násadního otvoru a výzdoby. Oblast zlomu je původního charakteru a nejedná se o recentní záležitost. V rámci návaznosti na makroskopická i mikroskopická pozorování, která jsou podpořena 3D modelací artefaktu (*Obr. 13*), lze pozorovat známky intencionální fragmentace, jež by mohly potvrzovat záměrné rozlomení artefaktu. Důkaz pro toto tvrzení přináší celková tvarová variabilita sekeromlatu, která je od oblasti ulomené části násadního otvoru s největší pravděpodobností záměrně plasticky zdeformovaná. Pro tento typ deformace je typické, že vzniká teplotním účinkem, díky němuž se materiál stává měkčím a snáze se plasticky deformuje (*Schubert – Schubert 1999*, 666; *Heeb 2011*, 214, 271–278; *2014*, 88–94).

Násadní část sekeromlatu již makroskopicky zaujme svou nepravidelností a hrubým povrchem bez stop po broušení. Traseologickou analýzou bylo zjištěno, že úprava povrchu byla pravděpodobně realizována stlačováním ze čtyř stran pomocí zaobleného a ostrého nástroje. Neupravené hrany na ventrální straně u eneolitických sekeromlatů či seker s křížovým ostřím jsou běžnou záležitostí a přinášejí doklady o úpravách během výroby (*Dobeš et al. 2015*, obr. 4–6; *Dobeš et al. 2019*, obr. 2: 1–3; 10: 1–3; *Peška – Salaš 2020*, obr. 4–6; 8; *Peška 2022b*, obr. 1; 3; 5–7). Totožné mikrostopy jsou známé u sekeromlatů typu Handlová z lokalit Mníchova Lehota II a Diviaky nad Nitricou (*Peška – Ondrkál v tisku*) a přinášejí doklady o opotřebení násadního otvoru vzniklé jejich praktickým využíváním, kdy vlivem působení dřevěné násady topůrka na kov docházelo k opotřebení a lámavosti hran. Nepravidelné až částečně zdeformované násadní části se rovněž vyskytují u dalších eneolitických sekeromlatů. Jako příklad lze zmínit sekeromlaty typu Szendrő z lokality Hlohovec-Šulekovo a Vepřek nebo také opotřebené hrany u sekeromlatu typu Mezőkeresztes z lokality Moravičany a sekeromlatu typu Székely-Nádudvar z lokality Strážnice (*Dobeš et al. 2015*, 168–172; *2019*, 8–22; *Farkaš et al. 2024*, 35–47).

Poslední částí, která má určitý výpovědní charakter, jsou značky. Ty se hojně vyskytují u eneolitických sekeromlatů a seker s křížovým ostřím, nejčastěji v okolí násadního otvoru. Jsou interpretovány jako výzdobný prvek, nebo jako označení specifických výrobních dílen (*Schubert – Schubert 1999*, 666; *Heeb 2011*, 214, 271–278; *2014*, 88–94; *Peška – Salaš 2020*, 87–92). Rozlišují se celkem tři druhy značek: 1) vtlačené kolečko, 2) kolečko se zesíleným okrajem a 3) kolečko se středovým výstupkem. Hlavním rozdílem mezi těmito



Obr. 14. Krhov-Písečný 2023. Mikrofotografie půlkruhové značky (foto M. Kamarád).

třemi typy je síla ražby, která může nabývat intenzity od méně výrazné až po velmi výraznou. Jejich výskyt na eneolitických sekerách či sekeromlatech je často kombinovaný a jedná se pravděpodobně o úmyslně zvolenou sílu ražby (*Peška – Salaš 2020*, 87–92).

Na zachovalé zadní části sekeromlatu z Krhova jsou zřetelné celkem čtyři kruhové značky vyskytující se kolem násadního otvoru (*Obr. 14*). Dvě z nich, nacházející se uprostřed, patří k tzv. typu se středovým výstupkem (*Obr. 12*; *Obr. 14*: 1–2). Třetí značka na pravém boku, patří k výše zmíněnému prvnímu typu značek a od dvou předchozích se liší menší intenzitou ražby (*Obr. 14*: 3; *Schubert – Schubert 1999*, 666). Čtvrtá značka (*Obr. 14*: 4), vyskytující se na levé boční straně, má půlkruhový tvar a pravděpodobně se jedná o záměrný tzv. půlměsícový či podkovovitý znak, což je méně častý typ, který se vyskytuje na eneolitických sekeromlatech. Dále se také nabízí hypotéza, že se může jednat o kruhovou značku, ovšem špatně stlačenou (*Patay 1984*, Taf. 14: 200; *Peška – Salaš 2020*, 88). Podle výsledků traseologické analýzy lze stanovit, že s nejvyšší pravděpodobností všechny značky vznikly čerstvě po odlití sekeromlatu stlačením razidla (*Patay 1984*, Taf. 14: 200; *Peška – Salaš 2020*, 87–91). Tuto hypotézu potvrzuje i síla ražby na tomto artefaktu, která se pohybuje od méně výrazné (jedna značka) až po hodně výraznou (tři značky).

Co se týká analogií v počtu značek u dalších exemplářů sekeromlatů typu Handlová (Mníchova Lehota II, Diviaky nad Nitricou, Diviaky – Nová ves, Handlová) jejich počet a síla ražby v blízkosti násadního otvoru je různorodá. Určitou podobnost lze spatřit pouze v jejich celkovém počtu, který tvoří ve výše zmíněné části rozmezí šesti až osmi znaků.

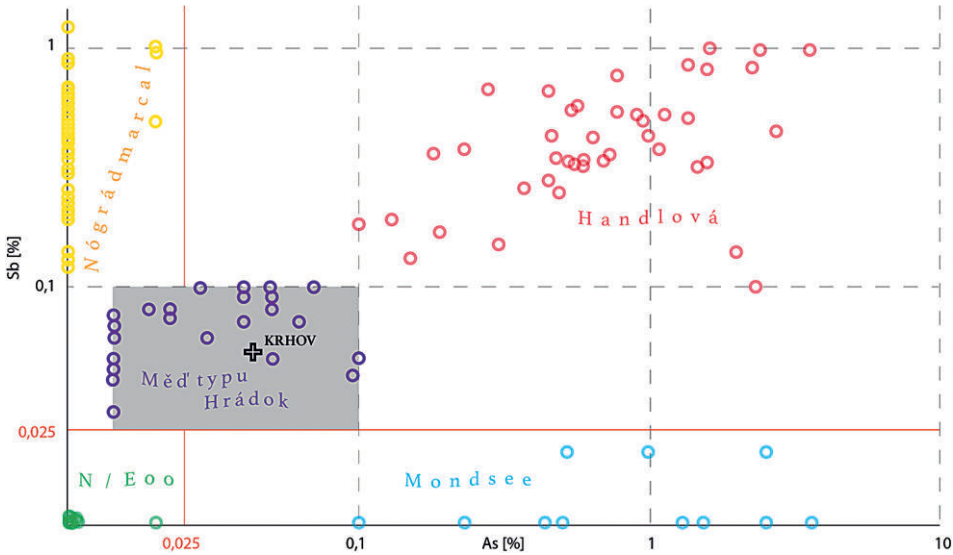
Proto se u zdeformovaného sekeromlatu z Krhova dá stanovit, že se u nezachovalé přední části vyskytovaly celkem dvě až čtyři značky. Z důvodu mírně převažujícího počtu sedmi prvků u sekeromlatů typu Handlová (Mníchova Lehota II, Diviaky nad Nitricou) lze hypoteticky uvažovat, že artefakt z Krhova mohl obsahovat v kruhovém obvodu sedm značek.

Výše zmíněné pozorované poznatky bylo možné porovnat s celkovou 3D modelací sekeromlatu, která potvrdila správnost traseologicky pozorovaných skutečností (*Obr. 13*). Na modelu byly rovněž identifikovatelné stopy po zaoblení a vybroušení hran. Z tohoto hlediska lze tudíž vyloučit, že by se mohlo jednat o polotovar (*Remondino – El-Hakim 2006*, 269–291). V návaznosti na všechny zjištěné skutečnosti se domníváme, že artefakt mohl být funkčně používán, ale kvůli zachování pouze jedné, navíc zdeformované části nelze toto tvrzení bezpečně potvrdit. Tento artefakt rovněž nese mikrostopy po vybroušení a také stopy po zaoblení u bočních stran, které svědčí o úpravách předmětu. Je tudíž vyloučeno, že se jedná o polotovar.

Diskuze

Problém s datací (ano či ne)?

V rámci studia rané metalurgie se pro lepší orientaci v chronologii používá členění do tzv. horizontů vývoje kovové industrie, které vymezují postupné fáze rozšíření a užívání kovových artefaktů v eneolitu (*Peška 2020*). Dosavadní tendence datovat sekeromlaty typu Handlová do horizontu Balaton II/II – Bajč-Retz-Křepice – Mondsee – Baalberg – mladší Michelsberg, tedy do staršího eneolitu (3900/3800–3600/3500 BC), nebo dokonce eneolitu středního (3600/3500–3100/3000 BC; nově horizont 3 a 4: *Peška 2020*, 184), byla postavena na údajném nálezu na sídlišti badenské kultury ve Veľkých Kostoľanech a na použití tetraedritového typu mědi s příměsí stříbra a antimonu, tj. mědi typu Handlová (*Schubert 1965*, 284; *1982*; *Novotná 1970*, 24; *1974*, 13–14; *Schubert – Schubert 1999*, 666–668). Již samotný eponymní depot (přítomnost sekery typu Jordanów) i skladba nově nalézaných depotů s artefakty časně eneolitického prostředí ukazují na větší stáří používání sekeromlatů typu Handlová již od časného eneolitu (4300/4200–3900/3800 BC). Tomu odpovídají také nejstarší projevy metalurgie (zatím) na jihozápadním Slovensku v horizontu ludanické kultury, eventuálně později (brázděný vpich), kdy je používání mědi typu Handlová jasně prokázáno (*Dobeš et al. 2019*, 40). To nakonec platí například i pro menší sekeru typu Stollhof z depotu Mníchova Lehota I, která je podle autorů vyrobena právě z tetraedritové měděné suroviny typu Handlová z místních špaňodolinských zdrojů (*Novotná et al. 2021b*, 89, obr. 4: 2, tab. 1). Tetraedritová ruda byla objevena rovněž v sídlištním kontextu ze Slovenského Pravna v bezprostřední blízkosti regionu nejvyšší koncentrace sekeromlatů typu Handlová (*Šalkovský 1977*; *Nevizánsky et al. 2017*; *Novotná et al. 2021b*, 89). Ze shodného geografického prostředí pochází nový objev metalurgického zařízení (jámová pec) ludanické kultury (3968–3708 BC při 95,4% pravděpodobnosti) z lokality Horná Mičiná (okr. Banská Bystrica). Publikované výsledky analýzy měděné rudy, strusky a vytavené mědi odhalují také tetraedritovou měď lokálního původu označenou jako měď tetraedritového typu Handlová (*Zachar et al. 2023*). Odpovídajícím (o něco mladším) nálezem z Moravy by mohl být objekt baalberské fáze kultury nálevkovitých pohárů s tyglíkem se zbytky mědi. Povrchová prvková analýza tyglíku sice prokázala přítomnost mědi, nikoliv „s významnou příměsí As, Ag a Sb“ (cf. *Novotná et al. 2021b*, 92;



Obr. 15. Podíl As a Sb v měděných artefaktech z počátku eneolitu na Moravě a v Karpatské kotlině (dataset SAM, *Schreiner 2007*).

Rožnovský – Šmíd 2015, 46, pozn. 2, tab. 1; *Šmíd 2017*, 209). Zmiňována je sice měď typu Mondsee, ale výsledky, jakkoliv díky povrchovému měření zkreslené, tomu neodpovídají. Situování minimálně tří přímých dokladů metalurgie (Slovenské Pravno, Banská Bystrica, Horná Mičiná) do bezprostředního okolí ložisek měděné suroviny jistě není náhodné a dokresluje doklady celého metalurgického procesu v této části středního Slovenska (*Kvietok 2013*; *2017*).

V otázce datování tak musíme počítat s nástupem sekeromlatů typu Handlová (a tím také využívání mědi typu Handlová) již v době epilengyelské ludanické kultury na Slovensku v období časného eneolitu, což by mělo odpovídat nástupu zástupců tzv. těžké industrie a horizontu 2 (Balaton I – Ludanice – Jordanów – Bisamberg/Oberpullendorf – Brześć Kujawski) výskytu kovové industrie (*Peška 2020*, 183). Sem je ostatně zařazováno i použití sekeromlatů typu Székely-Nádudvar. Naopak zatím nic neukazuje na delší dobu používání těchto sekeromlatů, což mohou potvrdit nebo vyvrátit jen nové nálezy.

Měď typu Hrádok

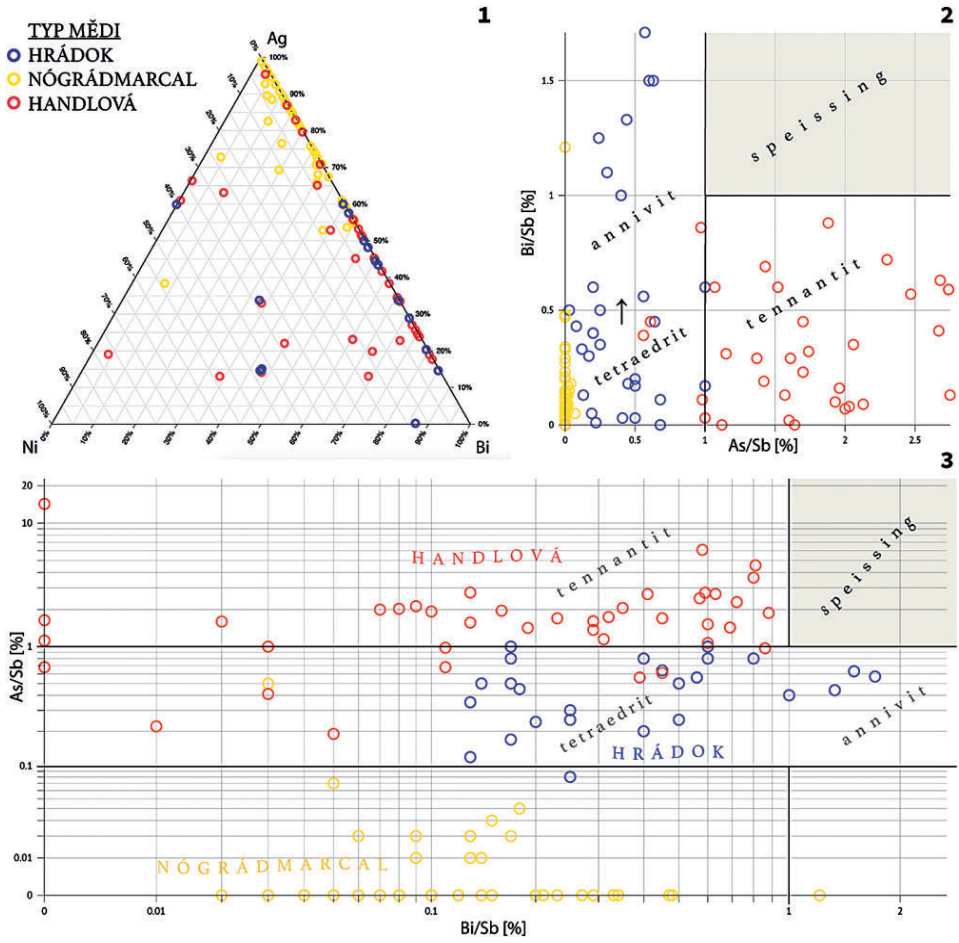
Argumenty k prozkoumání složení sekeromlatu nabízí graf vynášející podíl As a Sb v měděných artefaktech na počátku eneolitu v České a Karpatské kotlině (*Obr. 15*). Jak je zřejmé, mračno bodů, vyznačující se přítomností As a Sb v hodnotách mezi 0,25–0,1 %, nezapadá do známého rozsahu bipolární klasifikace Handlová – Nógrádmarcal. Geologická charakteristika těchto vzorků, která jasně ukazuje na odlišný typ mědi (typ Hrádok), původně nebyla zahrnuta mezi eneolitické skupiny (SAM C4, E10, G), což lze v procesu vymezení považovat za první náznak její jedinečnosti. Aby se zdůraznila důležitost materiálové skupiny Hrádok na jedné straně a její těsné propojení s materiálovou skupinou Handlová na straně druhé, text níže se primárně zaměřuje na odkazy na artefakty, které se

v podobě série depotů vyskytují celkem sedmkrát (Beckov, Diviaky nad Nitricou, Hrádok, Lopeník, Mníchova Lehota II, Slavkov a Žitná-Radiša I; *Novotná et al. 2021a*; *2021b*; *Peška 2021*; *2022a*; *Farkaš et al. 2023*; *Peška – Ondrkál v tisku*). Navrhovaná materiálová skupina typu Hrádok proto popisuje měď, která se vyznačuje specifickým chemickým spektrem (As, Sb v rozmezí 0,25–0,1 %) a téměř výlučným použitím v konkrétním chronokulturním kontextu (ludanická skupina). Bez ohledu na přesný původ suroviny je klíčovým bodem, že taková měď a dílenská výroba byla místní, spočívající v produkci nestandardních typů artefaktů (spirály, čelenky, drátěné šperky).

Depot z eponymní lokality Hrádok (okr. Nové Mesto nad Váhom; *Novotná et al. 2021a*) vícenásobně obsahoval spirály se zpětnou kličkou typu Hrádok (6x) a úzké válcovité trubičky (19x), které byly nalezeny společně s keramikou jordanovské kultury. Autoři původně přiřadili ICP-MS/OES spektrum exempláře H4 k materiálové skupině C1B (antimonová měď typu Nógrádmarcal) a zvýšené hodnoty arzénu interpretovali jako lehkou kontaminaci primárního rudného tělesa (tetraedrit). Zmiňují též možný původ této mědi v sekundárních minerálech obsahujících arzén (*Novotná et al. 2021a*, 521). Toto spektrum mědi bylo zaznamenáno i v depotu Lopeník, kde bylo klasifikováno jako „blízké“ mědi Nógrádmarcal (*Peška 2021*, 75). V další studii je depot Beckov I a Hrádok zařazen do jednoho klastru a obsah As v „nízkokoncentrační“ Sb-Ag mědi typu Nógrádmarcal vysvětlen příbuzností s typem Handlová, kde při použití stejného druhu rudy a zavedením jiné metalurgické techniky došlo k sublimaci části As a Sb (*Farkaš et al. 2023*, 18, obr. 17).

S rozšířením analytické databáze a revizí karpatské metalurgie se objevily nové nálezy, které naznačily potřebu přehodnocení původní kategorizace. Laboratorní analýzy v naší studii (ternární diagram Ag:Ni:Bi; *Obr. 16*: 1) tuto hypotézu potvrzují a místo spojení se sérií Nógrádmarcal navrhují zařazení podle tříd SAM C4/E10/G v systému E. Sangmeistera (*Junghans et al. 1968*, Diagram 1). Na první pohled by se sice mohlo zdát, že měď typu Hrádok je výsledkem tavení prekurzoru (rudy) mědi typu Handlová, při kterém došlo k sublimaci arzénu (As) a antimonu (Sb). Podrobné analýzy však odhalují výrazné rozdíly mezi těmito dvěma typy mědi. Z hlediska archeologických materiálových skupin (*Obr. 16*: 3) je „hrádocká“ měď klasifikována jako tetraedritová (*Schreiner 2007*, 151) s indikací úzké vazby na západokarpatskou subzónu, která se potvrzuje narůstajícím počtem analyzovaných vzorků (31x) (*Peška 2021*; *2022a*; *Farkaš et al. 2023* a tato studie). Dochází zde též k určitému klasifikačnímu paradoxu – SAM skupiny C4 a E10 představují antimonovou měď, skupina G „Fahlerzmetall mit Ni“. Tento klasifikační posun vyvolává řadu otázek o konzistenci samotného modelu SAM a jeho schopnosti adekvátně popsat metalurgické reálie. Problém spočívá v nejednoznačnosti aplikace systému SAM, protože zařazení určitých skupin do stejného kontextu může být výsledkem nesprávné interpretace geochemických údajů.

Tetraedritová měď typu Hrádok (reprezentativní dataset v *Tab. 3*) se vyznačuje nízkým, ale dominantním obsahem antimonu ($0{,}025 < Sb < 0{,}1$ %) ve srovnání s arzénem ($As < 0{,}1$ %), přičemž jejich poměr bývá zpravidla 2 : 1 nebo 1 : 1. Tento základní profil doplňují nižší koncentrace stopových prvků, jako je stříbro ($Ag < 0{,}04$ %), nikl ($Ni < 0{,}025$ %) a dvě varianty bismutu: a) $Bi < 0{,}008$ %; b) $Bi \geq 0{,}008$ %. Nejvíce konzistentní chemickou signaturu – zahrnující 26 vzorků – tvoří předměty bez obsahu niklu, ale s vyšším množstvím bismutu ($Bi \geq 0{,}008$ %), což jednoznačně vylučuje možnost, že by šlo o směs různých zdrojů nebo recyklaci soudobých archeologických artefaktů. Proto na ternárním diagramu (*Obr. 16*: 1) hrají klíčovou roli prvky Ag, Ni a Bi, jejichž koncentrace a poměry



Obr. 16. Binární a ternární srovnání poměrů As, Sb, Ag, Ni a Bi u materiálových skupin Hrádok, Handlová a Nógrádmarcal (dataset SAM, *Schreiner 2007*).

zůstávají při pyrometalurgickém zpracování nejstabilnější (*Wedepohl 1978*). I když pole mědi typu Hrádok zahrnuje vzorky skupiny Handlová, podobnosti mezi nimi nejsou překvapivé, neboť oba typy mají společný původ (tetraedrit-tennantit). Oblast bodů odpovídajících typu Hrádok je lépe vymezena poměrovým biplotem (As/Sb)/(Bi/Sb) (*Obr. 16*: 2), který se navíc systematicky nachází pod rozptylem „handlovských" artefaktů. Zatímco vstupním minerálem mědi typu Handlová byl tennantit (As > Sb > Bi; *Obr. 16*: 2), u mědi typu Hrádok (A) šlo o tetraedrit (Sb > As a Bi, obvykle As > Bi), a vstupním minerálem mědi typu Hrádok (B) bohaté na bismut byl annivit (Bi > Sb > As; *Siklósi et al. 2022*).

Myšlenka hledání metalurgických dílen – jako regionálních fenoménů založených na typech artefaktů, nikoli na technologii – byla základem typologického přístupu, který dominoval ve výzkumu artefaktů celá desetiletí (*Jockenhövel 2003*). Definici materiálové skupiny Handlová popsal E. Schubert již v roce 1982 pomocí sekeromlatu a doprovodných artefaktů z eponymního depotu Handlová – Na Pstruhároch a lokalizoval místo produkce

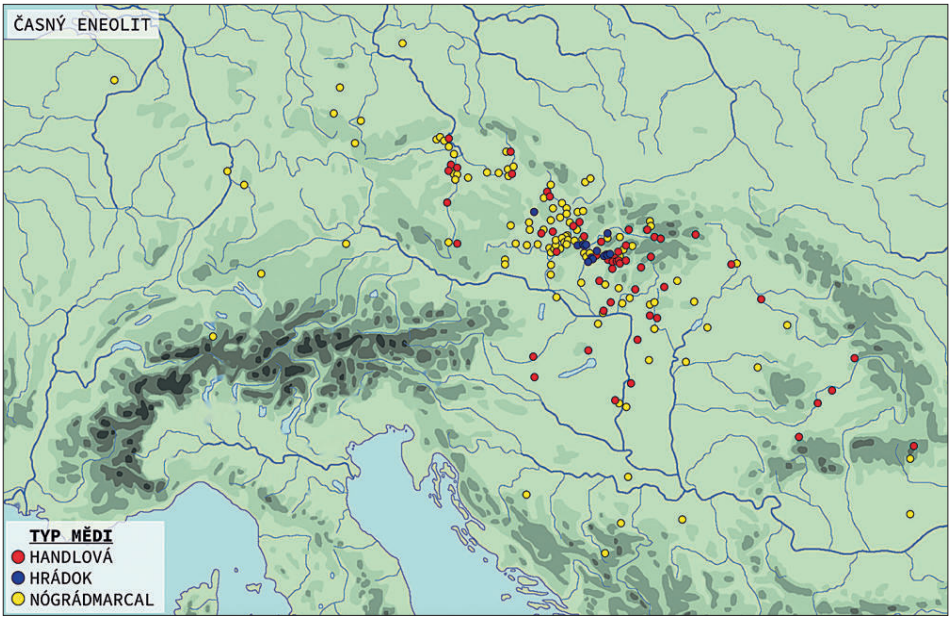
Lokalita	Předmět	Reference	Obsah stanovených prvků [%]											
			Cu	Sn	As	Sb	Ag	Ni	Bi	Pb	Co	Au	Zn	Fe
Beckov (SK)	náramenice	aco_rfa_2259	99,72	LOD	0,04	0,09	0,03	LOD	0,12	LOD	LOD	LOD	LOD	LOD
Beckov (SK)	náramek	aco_rfa_2255	99,73	LOD	0,05	0,08	0,02	LOD	0,12	LOD	LOD	LOD	LOD	LOD
Beckov (SK)	sekeromlat t. Szé-Nád.	aco_rfa_2253	98,65	LOD	LOD	0,05	0,01	LOD	0,02	LOD	LOD	LOD	LOD	LOD
Hrádok (SK)	spirála typu Hrádok	Novotná et al. 2021, H4	99,71	0,02	0,05	0,11	0,02	0,02	0,02	0,01	0,002	LOD	0,01	0,03
Krhov (CZ)	sekeromlat t. Handlová	aco_rfa_2498	99,67	0,06	0,05	0,05	0,01	0,03	0,03	LOD	0,01	LOD	0,05	0,07
Lopeník (CZ)	spirálovitý kotouč	LOP5 (5843)	99,86	LOD	0,019	0,08	0,04	LOD	LOD	LOD	LOD	LOD	LOD	LOD
Mníchova Lehota II (SK)	spirála t. Hrádok	aco_rfa_2482	99,23	0,21	0,03	0,06	LOD	0,02	LOD	LOD	LOD	LOD	LOD	0,35
Mníchova Lehota II (SK)	brýlovitý závěsek	aco_rfa_2484	99,56	0,12	0,01	0,04	LOD	0,01	LOD	LOD	LOD	LOD	0,08	0,08
Mníchova Lehota II (SK)	sekera t. Jordanów	aco_rfa_2486	99,57	0,1	0,01	0,06	0,03	0,02	LOD	LOD	LOD	LOD	0,07	0,05
Slavkov (CZ)	sekeromlat typu Szé-Nád.	Peška 2022	99,77	LOD	0,05	0,09	0,04	LOD	0,05	LOD	LOD	LOD	LOD	LOD
„Ungarn“	sekeromlat typu Szé-Nád.	SAM 12480	99,85	LOD	0,06	0,06	0,01	0,01	0,01	LOD	LOD	LOD	LOD	LOD
Žitná-Radiša I (SK)	sekeromlat t. Şiria	aco_rfa_2443	99,70	LOD	0,07	0,11	0,04	LOD	0,05	LOD	LOD	0,01	LOD	0,02
Žitná-Radiša I (SK)	sekera t. Jordanów	aco_rfa_2444	99,89	LOD	0,01	0,05	0,03	LOD	0,02	LOD	0,01	0,01	LOD	LOD

Tab. 3. Prvkové složení reprezentativních vzorků mědi typu Hrádok.

do oblasti horního toku řeky Nitra (*Schubert 1982*). Jeho argumentace byla založena na hodnocení složení chronologicky významných typů artefaktů. Z přísně metalurgického hlediska však lze podotknout, že z celkového počtu 249 studovaných měděných předmětů ze středního Podunají bylo z handlovské mědi vyrobeno jen 20 (přibližně 8 %) – což naznačuje, že tento místní výskyt tetraedritu nesehrál klíčovou roli při získávání mědi v Karpatské kotlině a zůstal jen lokálního významu.

Pohled na mapu rozšíření (*Obr. 17*) mědi typu Nógrádmarcal a Hrádok – západně od hlavní koncentrace mědi typu Handlová (střední Slovensko) – evokuje odlišný geografický původ suroviny a typů se sériovým charakterem (brýlovité závěsky / dýky typu Malé Leváre), zaznamenaných v souvislosti s hromadným výskytem těžkých měděných nástrojů v závěru 5. tisíciletí BC (*Peška – Ondrkál v tisku*). Absence artefaktů z mědi typu Handlová na Považí spíše poukazuje na jiné lokální zdroje. Výskyt měděných předmětů z Sb-dominantní mědi typu Nógrádmarcal (*Zachar et al. 2019*) se nápadně koncentruje v oblasti mezi řekou Váh a Morava, proto původ rudy vykazuje nejlepší korelaci s rudnou oblastí Malých Karpat, bohatou také na antimonit (*Bergfest 1953*). Je však důležité poznamenat, že projekce tohoto seskupeného výskytu může být přehnaná: region Moravy byl zkoumán mnohem intenzivněji než západní část Slovenska (*Dobeš et al. 2019*). Vzhledem k nesrovnalostem je nutné toto poznání prohloubit pomocí údajů z izotopových analýz. Ty by měly umožnit i lepší zasazení nových objevů do kontextu první středoevropské metalurgie.

Spektrální analýzy získané metodou ED-XRF potvrzují, že sekeromlat z Krhova má nižší obsah arzénu a antimonu, než by se očekávalo ve skupině Handlová. Naopak některé hodnoty pro skupinu Székely-Nádudvar, známé zastoupením arzénu (0–0,15 %) a antimonu



Obr. 17. Mapa distribuce mědi typu Nógrádmarcal, Handlová a Hrádok během časného eneolitu (dataset SAM, *Schreiner 2007*).

(0–0,18 %), přesně odpovídají analyzovanému vzorku. Z geologického (surovinového) hlediska to poukazuje na využití rud s tetraedritovým podpisem, pravděpodobně těžených v severní nebo západní části Karpatské kotliny, kde se tyto prvky přirozeně vyskytovaly v nižších koncentracích (*Krause 2003*). Porovnání chemického složení sekeromlatu z Krhova s analyzovanými vzorky skupiny Székely-Nádudvar tedy odhalilo vysokou míru podobnosti. Vzdálenosti vypočítané metodou euklidovské metriky ukazují, že Krhov nejvíce odpovídá exemplářům ze západokarpatských lokalit Beckov (SK) a Slavkov (CZ). Tyto vzorky mají podobný podíl minoritních prvků, přičemž poměr As/Sb se pohybuje v rozmezí 1 : 1. Tento artefakt proto není pouze importem, ale odrazem místní adaptace metalurgických standardů typu Székely-Nádudvar. Odlišná vzdálenost od vzorků z čisté mědi ze středního Maďarska (např. Budapest-Csepel) naznačuje menší pravděpodobnost, že by Krhov využíval stejné rudy, což vyvrací hypotézu o centralizovaném zpracování surovin této skupiny. Krhov tak představuje křižovatku dvou významných tradic: globálního šíření skupiny Székely-Nádudvar a lokální specializace výroby na západním Slovensku. Tato adaptace mohla být podpořena přítomností metalurgických dílen, které byly schopny zpracovat regionální suroviny v souladu s technologickými normami skupiny Székely-Nádudvar.

Význam

Zlomek týlní části sekeromlatu typu Székely-Nádudvar/Handlová z lokality Krhov-Písečný v severní části Boskovické brázdy je svým způsobem výjimečným nálezem, jelikož se jedná o hybrid dvou spřízněných typů časně eneolitických sekeromlatů. Z pohledu

typu Handlová by se jednalo o první náznak přítomnosti tohoto typu (ne v čisté formě) na Moravě. Současně by šlo o nejzápadnější distribuci, která se postupně posunuje směrem na západ (očekávat lze budoucí nálezy z východní, resp. střední Moravy), neboť i nejnovější objevy tohoto typu se koncentrují na pomezí západního a středního Slovenska (*Obr. 1*). Sekeromlat z Krhova náleží do skupiny tzv. těžké měděné industrie z počátku eneolitu (společně s dalšími typy sekeromlatů, seker s křížovým ostřím a první nálezovou skupinou plochých seker), jež má genezi nejspíše z typu Szendrő nebo Székely-Nádudvar, soudě podle řady společných znaků a přechodných tvarů. Díky tvarové i výzdobné specifikaci a konec konců i skladbě suroviny (viz výše) nemusíme být daleko úvahám o samostatném typu, pro něj však chybí více srovnávacích exemplářů. Zůstáváme proto u interpretace hybridní formy obou výrazných typů sekeromlatů (Székely-Nádudvar a Handlová). Ve srovnání s ostatními soudobými typy půjde snad jen o více lokálně orientovanou formu sekeromlatu. Jeho datování do období časného eneolitu (2. horizont měděné industrie podle *Peška 2020*), do prostředí ludanické kultury na Slovensku a jordanovské kultury na Moravě (ca 4300/4200–3900/3800 BC) se zdá být i novými nálezy (zejména depoty) a jejich doprovodnými artefakty, potvrzeno.

Traseologických pozorování je minimum (od analýzy fragmentu týlu nelze očekávat výrazný posun), a tak lze o jejich významu a využití pouze spekulovat. Značná velikost, ale zejména hmotnost celých kusů (2–3 kg) odrazuje od praktického využití jako nástroje (k čemu vlastně?) a posouvá nás spíše do roviny úvah o ceremoniálním předmětu coby insignie moci nebo určité úrovně společenské prestiže a postavení. S tím může dobře korespondovat častá „výzdoba" v podobě ražených značek, charakteristický znak zmíněných typů, ve smyslu honosných zdobených broušených kamenných sekeromlatů salzmündské kultury (*Jarecki – Moser 2014*; *Schunke 2013*), zdůrazňující obecně společenskou hodnotu artefaktu. Na tom nic nemění ani zvolna se objevující zalomení týlu (Krhov, Diviaky nad Nitricou), působící spíše dekorativně (nikoliv ve smyslu změny praktického využití předmětu). Díky početnému vystupování v depotech a absenci v hrobových kontextech sice nelze pominout možnost formy obchodovatelné komodity nebo ekvivalentu (nebo dokonce suroviny?), avšak relativně vysoce sofistikovaná technologie vyhotovení hovoří ve prospěch společenské insignie.

Závěr

Detektorový nález fragmentu měděného sekeromlatu hybridní společné formy Székely-Nádudvar/Handlová z lokality Krhov-Písečný v severní části Boskovické brázdy představuje týlovou část za násadním otvorem a jisté novum ve spektru časně eneolitické těžké industrie. Geneticky lze tuto spíše lokální formu odvozovat ze sekeromlatů typu Szendrő nebo Székely-Nádudvar, s nimiž sdílí řadu společných znaků, včetně typu Handlová. Dosavadní tendence datovat sekeromlaty typu Handlová až do horizontu Balaton II/II – Bajč-Retz-Křepice – Mondsee – Baalberg – mladší Michelsberg, tedy do staršího či dokonce středního eneolitu, je třeba korigovat. Většina nálezových kontextů, například eponymní depot Handlová, doprovázená plochými sekerami typu Jordanów, sekeromlaty typu Şiria, závěsky typu Hrádok či malými brýlovitými závěsky typu Malé Leváre, jednoznačně spadá do časného eneolitu (ludanická a jordanovská kultura) a prokazuje časnější nástup jak sekeromlatů typu Handlová, tak i tetraedritové mědi stejného typu (*Peška – Ondrkál v tisku*).

V datování sekeromlatů typu Székely-Nádudvar do téhož časového období rozpory nejsou. V souvislosti s proveniencí suroviny zaujme podobnost chemického složení zlomku z Krhova s nově definovanou materiálovou skupinou mědi typu Hrádok (*Peška – Ondrkál v tisku*) se zvýšeným obsahem arzénu a antimonu, kterou bude nutno ve srovnání s dalšími analýzami sekeromlatů typu Handlová ještě zkoumat. V jistém smyslu tak představuje Krhov křižovatku dvou významných tradic ve spojení globálního šíření skupiny Székely-Nádudvar s místní specializací výroby na západním Slovensku, kde bude mít použitá surovina nejspíše svůj původ. Nevylučujeme však možnost delšího přežívání sekeromlatů v rámci regionálních technologických tradic a sociálních kontextů. Vzhledem k variabilitě depozičních strategií a jejich vztahu k dlouhodobému využívání metalických artefaktů je možné, že některé exempláře mohly cirkulovat v rámci intergeneračního přenosu nebo sekundárního využití i po svém primárním výrobním horizontu. Tato otázka si vyžaduje další výzkum, zejména v souvislosti s funkční analýzou a identifikací opětovných úprav povrchu, které by mohly indikovat prodloužené používání sekeromlatů i v pozdějších fázích vývoje metalurgie.

Ražené znaky kolem násadního otvoru, tak signifikantní pro typ Handlová, nechybí ani v Krhově. Interpretace osciluje mezi označením výrobce nebo spíše jisté míry prestiže (společenské, symbolické), či obchodovatelnosti artefaktu rostoucí úměrně s počtem znaků. V kombinaci s vysoce technologicky vyspělou podobou výroby to může doplňovat společenskou roli artefaktu ve smyslu symbolu moci, bohatství a společenského postavení majitele.

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Fragment of an Early Eneolithic copper hammer-axe from Krhov in Moravia as a representative of the Hrádok material group

In 2023, a detector find consisting of a fragment (occipital part up to the hafting hole) of a copper hammer-axe of the Székely-Nádudvar/Handlová hybrid form from the Krhov-Písečný site, located near the prehistoric hillfort Malý Chlum in the central part of the Boskovice Furrow, was handed over to the museum in Boskovice. Genetically, this form of hammer-axe is derived from the Szendrő or Székely-Nádudvar types, with which it shares many features. A number of transitional forms exist, especially with the latter type. A noteworthy novelty is the presence of a broken occiput in the Handlová type, with a direct analogy in the hoard from Mníchova Lehota II (*Peška – Ondrkál in print*). The phenomenon of a broken lateral axis also appears in the Kežmarok, Szendrő, Codor, and Vidra types, with bending of the entire body in the Mezőkeresztes type, and is strongly represented in the Székely-Nádudvar type. Due to its fragmentary nature, the Krhov specimen is difficult to evaluate metrically; however, it corresponds to the general observation that the axe-arms of the Handlová type are slightly longer and more robust than those of the Székely-Nádudvar type (*Fig. 6*; *Fig. 7*). The commonly accepted dating of Handlová-type hammer-axes to the Balaton II/II – Bajč–Retz–Křepice – Mondsee – Baalberg – Late Michelsberg horizon requires revision. On the basis of the majority of find contexts, including the eponymous Handlová hoard, where these artefacts occur alongside Jordanów-type flat axes, Şiria-type hammer-axes, Hrádok-type pendants, or Malé Leváre-type miniature spectacle pendants, they clearly belong to the Early Eneolithic (Ludanice and Jordanów cultures). The presence of Handlová-type copper, characterised by arsenic with silver and antimony admixture, further supports an earlier dating, possibly already to the Early Eneolithic or even the Middle Eneolithic (e.g., Baden culture settlement at Veľké Kostoľany). There is virtually no evidence for a prolonged survival of this type. The dating of the Székely-Nádudvar type is similar and generally unquestioned. From the perspective of raw material provenance, it is noteworthy that the chemical composition of the Krhov fragment corresponds to the newly defined Hrádok-type material group (*Peška – Ondrkál in print*), characterised by elevated arsenic and antimony content. Further comparative analyses with other Handlová-type hammer-axes will be necessary. Use wear analysis did not yield fundamentally new results, yet it confirmed that the damage (breakage) to the hammer-axe is of prehistoric origin. The differing thickness of the impressions around the hafting hole appears to be intentional. Significant ‘decoration’ in the form of embossed marks is also present on the Krhov specimen. The interpretation of these signs oscillates between being a maker’s mark and a symbol of prestige, whether social or symbolic. It is also possible that the number of such marks increased the market value of the artefact. In combination with the highly advanced manufacturing technique, these elements suggest that such hammer-axes may have served as symbols of power, wealth, and social status.

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TOPICAL REVIEW – TEMATICKÁ SYNTÉZA

State of research on early medieval strongholds in Western Greater Poland

Stav výzkumu raně středověkých hradišť v západním Velkopolsku

Jagoda Mizerka-Urbaniak

The study reviews the current state of research on early medieval strongholds in Western Greater Poland, a region in which roughly 30 such sites are known. Built in the older phases of the Early Middle Ages, they precede the formation of the state of the first Piasts, which took place from the second half of the 10th century. The strongholds display considerable diversity in terms of physical features and probably also in their chronology and function. The northwestern part of Greater Poland, however, has been studied to a limited and rather selective degree. The preliminary analysis of local strongholds presented in this paper indicates significant research potential, particularly given their good state of preservation. Key questions concern the chronological variability of the sites, their functions, and the role they played within micro-regional settlement networks. Ultimately, these investigations may shed light on the social and political dynamics underlying the origin, functioning, and decline of the strongholds.

strongholds – Early Middle Ages – Greater Poland – pre-state period – tribal period – Tornow-Klenica

Tato studie přináší přehled současného stavu výzkumu raně středověkých hradišť v západním Velkopolsku. V této oblasti je známo asi 30 takových lokalit. Byly postaveny ve starších fázích raného středověku a předcházejí tak vznik státu prvních Piastovců, k němuž došlo v druhé polovině 10. století. Hradiště se vyznačují značnou rozmanitostí, pokud jde o jejich fyzické atributy a pravděpodobně také chronologii i funkci. Severozápadní část Velkopolska však byla studována pouze v omezené míře a spíše selektivně. Předběžná analýza místních hradišť prezentovaná v tomto článku naznačuje významný výzkumný potenciál, zejména vzhledem k jejich dobrému stavu zachování. Klíčové otázky se týkají chronologické variability lokalit, jejich funkcí a role, kterou hrály v mikroregionálních sídelních sítích. Tyto výzkumy mohou nakonec osvětlit sociální a politickou dynamiku, která stála za vznikem, fungováním a úpadkem hradišť.

hradiště – raný středověk – Velkopolsko – předstátní období – kmenové období – Tornow-Klenica

Introduction

The territory of Western Greater Poland, where the fortified settlements described in this article are located, is bounded by the Warta River to the north and east, and the Obra River to the west and south. Through its centre run smaller tributaries: the Sama, the Samica, the Mogilnica, the Ostroroga, the Wirynka, the Czarna Woda, and the Kamionka rivers, which outlined movement arteries in the Early Middle Ages facilitating the flow of ideas, people, and products of material culture (*Pawlak 2021*, 115). During phase B (c. 600/650–850/900 AD), C (c. 850/900–950 AD), and D_0 (c. 900–950/960 AD) of the Polish chronology of the Early Middle Ages (after *Dzieduszycki 1990*), numerous fortified settlements were built in this area, varying in terms of the morphology of the terrain on which they were erected, as well as in their dimensions, the fortification construction

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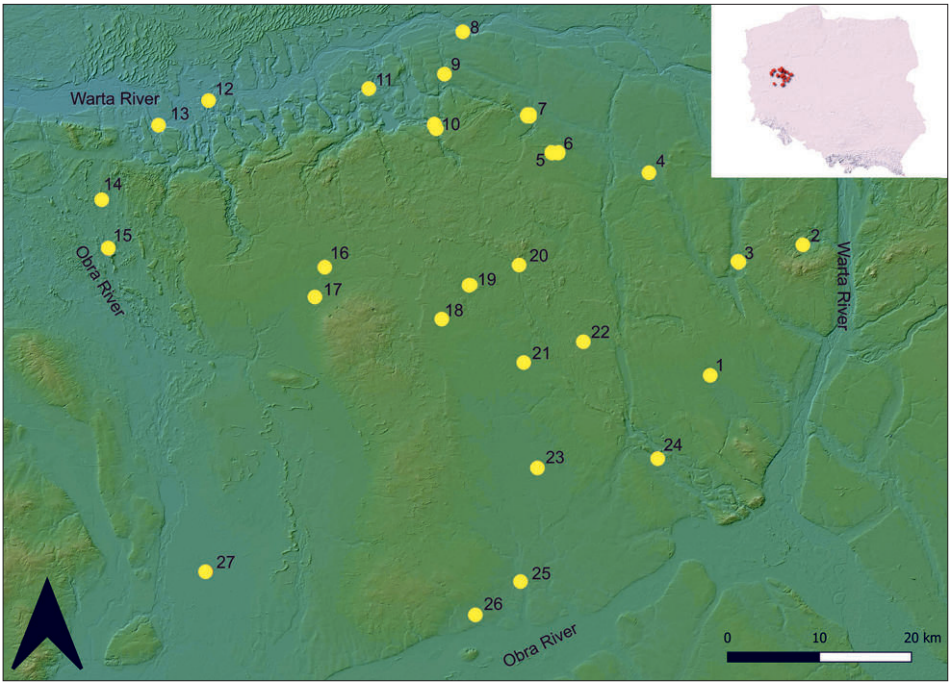

Fig. 1. Location of strongholds from the earlier phases of the Early Middle Ages in Western Greater Poland. 1 – Dąbrówka; 2 – Glinno; 3 – Pawłowice; 4 – Kąsinowo-Baborówko; 5 – Rudki; 6 – Jastrowo-Ostrolesie; 7 – Ostroróg; 8 – Pierwoszewo; 9 – Wróblewo; 10 – Nojewo; 11 – Ryżyn; 12 – Aleksandrowo; 13 – Muchocin; 14 – Pszczew; 15 – Pszczew, Katherine Peninsul; 16 – Linie-Wymyślanka; 17 – Grońsko-Komorowo; 18 – Bródki; 19 – Niewierz, dis. Szamotuły; 20 – Wilczyna-Młynkowo, dis. Szamotuły; 21 – Sędzinko-Zalesie; 22 – Brzoza; 23 – Dakowy Mokre; 24 – Nowa Wieś-Krąplewo; 25 – Kamieniec; 26 – Trzcinica; 27 – Karna (data from geoportal.gov.pl, based on *Pawlak 2021*; *Michalski et al. 2016*)

techniques and, finally, the very way in which they were used. It can be said with a high degree of certainty that they are also differentiated by the presumed reasons for their downfall. Both chronological and geographical aspects were of great importance. They determined the development and affiliation to specific communities in the pre-state period (until the end of the first half of the 10th century),[1] and then their position within the newly forming Piast state (from the second half of the 10th century). In total, Western Greater Poland has 27 fortified settlements dating to the older phases of the Early Middle Ages and several sites that are known only from archival records, but their chronology or stronghold character are sufficiently established (*Fig. 1*; *Tab. 1*).

This text aims to describe the history of research at the fortified settlements located in Western Greater Poland. It focuses on excavations carried out to date along with inventories and other results obtained during these campaigns. The text is supplemented by a dataset

[1] The tribal period in Poland is defined as the earlier phases of the Early Middle Ages. The twilight of the tribal period in Greater Poland was associated with the formation of the Piast state.

Number on the map	Name of site	Chronology (phase)
1	Dąbrówka, dis. Poznań	B/C
2	Glinno, dis. Poznań	
3	Pawłowice, dis. Poznań	C
4	Kąsinowo-Baborówko, dis. Szamotuły	B/C
5	Rudki, dis. Szamotuły	B/C
6	Jastrowo-Ostrolesie, dis. Szamotuły	C
7	Ostroróg, dis. Szamotuły	C
8	Pierwoszewo, dis. Szamotuły	C
9	Wróblewo, dis. Szamotuły	C/D
10	Nojewo, dis. Szamotuły	B/C?
11	Ryżyn, dis. Międzychód	B/C
12	Aleksandrowo, Bielsko, dis.Międzychód	B/C
13	Muchocin, dis. Międzychód	B/C
14	Pszczew, dis. Międzyrzecz	B/C-D
15	Pszczew, Penisula Katarzyna, dis. Międzyrzecz	C-E
16	Wymyślanka (Linie 3), dis. Nowy Tomyśl	Early Middle Ages
17	Grońsko-Komorowo, dis. Nowy Tomyśl	B/C
18	Bródki, dis. Nowy Tomyśl	B/C
19	Niewierz, dis. Szamotuły	B/C-D
20	Wilczyna-Młynkowo, dis. Szamotuły	B/C
21	Sędzinko-Zalesie, dis. Szamotuły	B/C
22	Brzoza, dis. Szamotuły	B/C
23	Dakowy Mokre, dis. Nowy Tomyśl	B/C
24	Wielka Wieś-Kraplewo, dis. Poznań	B/C
25	Kamieniec, dis. Grodzisk	B
26	Trzcinica, dis. Kępno	B/C
27	Karna, dis. Wolsztyn	C-E

Tab. 1. List of early medieval strongholds in Western Greater Poland.

overviewing the most important information about the strongholds, as well as figures with excerpts from archival maps, LiDAR imagery, and aerial photographs (*Online Supplementary Material 1*).

History and methods of research

The distinctive form of the strongholds, rising prominently from the lowland landscape, has meant that they have attracted scholarly interest for more than 150 years. The first inventories and descriptions date back to the 19th century. The first archaeological association to engage in their research was the Society of Collectors of National Antiquities (Towarzystwo Zbieraczów Starożytności Krajowych) in 1841, whose statutory aims included the inventory and care of ‘strongholds, mounds, ramparts, pre-Christian cemeteries,

Fig. 2. Destruction at selected strongholds. A – Dakowy Mokre (October 2018); B – Grońsko-Komorowo (August 2020); C – Niewierz (August 2020); D – Linie-Wymyślanka (September 2012); E – Kąsinowo-Baborówko (October 2024) (data from Google Earth).

graves, and ruined old castles'. Among the sites visited and described were the fortified settlements in Niewierz, Sędzinko-Zalesie, Wilczyna-Młynkowo, Brzoza, Kąsinowo-Baborówko, Rudki, and Jastowo-Ostrolesie (Szamotuły County) (*Kierski 1867*, 221–224). About three decades later, the sites were visited by two German researchers, Wilhelm Schwartz and Rudolf Virchow, who made quite thorough descriptions that are at present

archived in the Archaeological Museum in Poznań. In addition, Schwartz and Virchow collected archaeological material from the surface of the fortified settlements, mainly ceramics, animal bones, and other artefacts such as knives or spindle whorls, which are now stored in the same museum.

Parallel to the professional activities described above, amateur examinations were carried out, consisting of digging within the area of strongholds either to satisfy curiosity and collect artefacts or to obtain building material. For these reasons, earth and stones were taken from the rampart flanking the stronghold in Dakowy Mokre (Nowy Tomyśl County) to be used in the construction of a road to nearby Uścięcice. The fortified settlement at Dakowy was particularly unlucky. In addition to levelling the ramparts (*Fig. 2*: A; *Fig. 4*: A), quite regular earthworks have been carried out there for several years – both on the ramparts and inside the enclosed area, during which numerous artefacts were excavated. The archaeological material deposited at the Archaeological Museum in Poznań testifies to the fact that the so-called 'bulk finds', i.e. unornamented or fragmented pottery and animal bones, were not collected, as only specific and the 'most valuable' artefacts such as bone awls, spindle whorls, a barbed bead, and iron knives were selected (*Kaczmarek et al. 2013*, 199–245). In turn, the ramparts of the Grońsko-Komorowo stronghold (Nowy Tomyśl County) had probably been used at the end of the 19th century to fill in the ditches in a nearby field, as a result of which half of their original perimeter was destroyed (*Fig. 2*: B; *Fig. 4*: B). Soil from part of the ramparts at Kamieniec (Grodzisk County) served a similar purpose and was most likely used to fill in the rather deep ponds established in the early 19th century outside of the stronghold (*Mizerka – Krasnodębski 2025*, 150–151). The heavy devastation of the site had already begun in the Middle Ages when the northern part of the ramparts, which had basically been a pile of accumulated building material requiring relatively little work, were re-used for the erection of a motte-type stronghold (*Fig. 3*: D; *Fig. 4*: B). For a different reason, part of the embankment at Niewierz (Szamotuły County) was ploughed away. There was no demand for earth or stones here; instead, it had been caused by the desire to enlarge the arable area (*Kowalenko 1938*, 1). As a result, the well-preserved rampart with a visible gate entrance in the southeastern part was widened and destroyed, creating an entrance with a width of about 25[2] (*Fig. 2*: C; *Fig. 4*: C). Probably for similar reasons, the fortified settlements in Linie-Wymyślanka (Nowy Tomyśl County), Dąbrówka (Poznań County), and Kąsinowo-Baborówko (Szamotuły County) disappeared from the landscape.

In such cases, archival descriptions or cartographic sources become invaluable and made it possible to search for the exact location or learn about the physical features of the strongholds. Some of the older cartographic sources date back to the 19th century and provide valuable data, especially because the Greater Poland area was subjected to intensive economic and industrial works, including land reclamation, which implied significant landscape transformation, contributing to the destruction of archaeological sites (*Hildebrandt-Radke – Przybycin 2011*, 324; *Mizerka 2021*, 173–176). An excellent example is the aforementioned fortified settlement at Linie-Wymyślanka, shown on the Meßtichblatt

[2] This is evidenced by the descriptions from Virchow and Schwartz as well as the results of geophysical prospecting (*Mizerka – Ryndziewicz in press*).

Fig. 3. Strongholds on historical maps. A – Linie-Wymyślanka (Messtichblatt map 3562 from 1893); B – Grońsko-Komorowo (Messtichblatt map 3563 from 1893); C – Grońsko-Komorowo (KDR map from 1898); D – Kamieniec (Messtichblatt map 2129 from 1890); E – Rudki (Messtichblatt map 3464 from 1892); F – Kąsinowo-Baborówko (Messtichblatt map 3465 from 1892) (Data from https://igrek.amzp.pl/).

map of 1892, which at the time appeared to have been preserved in excellent condition (*Fig. 3*: A). Interestingly, the stronghold at Grońsko-Komorowo, about 4.5 km away, already had visible damage to the rampart, yet it was the one that managed to preserve its terrain form to the present day. The fortified settlement at Linie-Wymyślanka must have

suffered fairly rapid or systematic devastation, as it has been levelled to the ground. In the late 1970s, it proved difficult to locate in the field[3] (*Kurnatowska – Łosińska 1985*, 84). Identification occurred based on the small amount of archaeological material discovered in two test trenches (*Minta-Tworzowska 1985*, 120). Final confirmation of its location was provided by vegetation features visible in contemporary aerial photographs (*Fig. 2*: D).

Maps are also a valuable source of information on the progress and chronological sequence of destruction at a given site. This was the case with the aforementioned fortified settlement at Grońsko-Komorowo. On the Meßtichblatt map 1:25 000 drawn in 1891 and published in 1893 (*Archiwum Map Wojskowego Institutu Geograficznego 1919–1939*, 'Neustadt' sheet, map emblem 3563), it is depicted as an oval structure with completely preserved ramparts (*Fig. 3*: B). At that time, the stronghold was located in an area overgrown by a mixed forest, which covered c. 6 km^2 and was bounded on the south by the Mogilnica River and on the east by a road leading from Jakubowo to Turowo. The nearest buildings were located about 650 m north of the site and a kilometre south, in the vicinity of the Buchberg Grange. The stronghold was therefore protected from being converted into arable land. This situation changed rapidly a few years later, as shown on the 1898 Karte des Deutschen Reiches 1:100 000 (*David Rumsey Map Collection*, sheet 299.1. 'Tirschtiegel', Karte des Deutschen Reiches; *Fig. 3*: C), where the site appears on a deforested meadow and the woodland area resembles its present state, with only a small patch to the south-west of the stronghold covered by trees. The distance to the nearest buildings remains similar, but the density of houses changed, which is particularly evident on the south side, where the Grońsko Grange is located, and on the north side, where the village of Komorowo was developing at that time. On this map, the fortified settlement had already had its ramparts breached from the south-east, but the entire northern and north-eastern sections are still preserved. The initial phase of its degradation appears to have been captured.

More complicated processes shaped the remnants of a stronghold from the older phases of the Early Middle Ages at Dąbrówka, which was also accompanied by a younger ring stronghold from the 13th to 14th century. Even though the early medieval stronghold had been levelled, most likely in the second half of the 19th or early 20th century, both fortified sites were marked on maps published until 1940 (*Pawlak – Pawlak 2019a*, 21–24). As a result of discrepancies in identification and descriptions between the mentioned sites, archaeological literature ceased to feature the former tribal-period stronghold, despite a solid information basis (cartographic sources, accurate descriptions, inventories). This state of affairs has been changed by a contemporary aerial photograph, which re-introduced the site to the scholarly discourse.

However, not all fortified settlements were displayed on the Meßtichblatt maps.[4] There were probably various reasons behind this, such as the earlier degradation of stronghold

[3] Linie, site 3. '*Between Linie and Wymyślanka, 1.5 km from Linie, 40 m north of Wymyślanka, on the right bank of the river flowing through the adjacent meadows – a round, concave stronghold with a rampart destroyed from the south, from the side of the meadow and the river. 50 m in diameter*'.

[4] I refer to the Meßtichblatt maps because they show most of the known strongholds. For example, the map by G. D. Reymann from 1846 shows a small number of them, including those at Dąbrówka, Rudki, Jastrowie-Ostrolesie, and Brzoza. Available at: www.wbc.poznan.pl/dlibra/doccontent?id=433176 [accessed 07-02-2023].

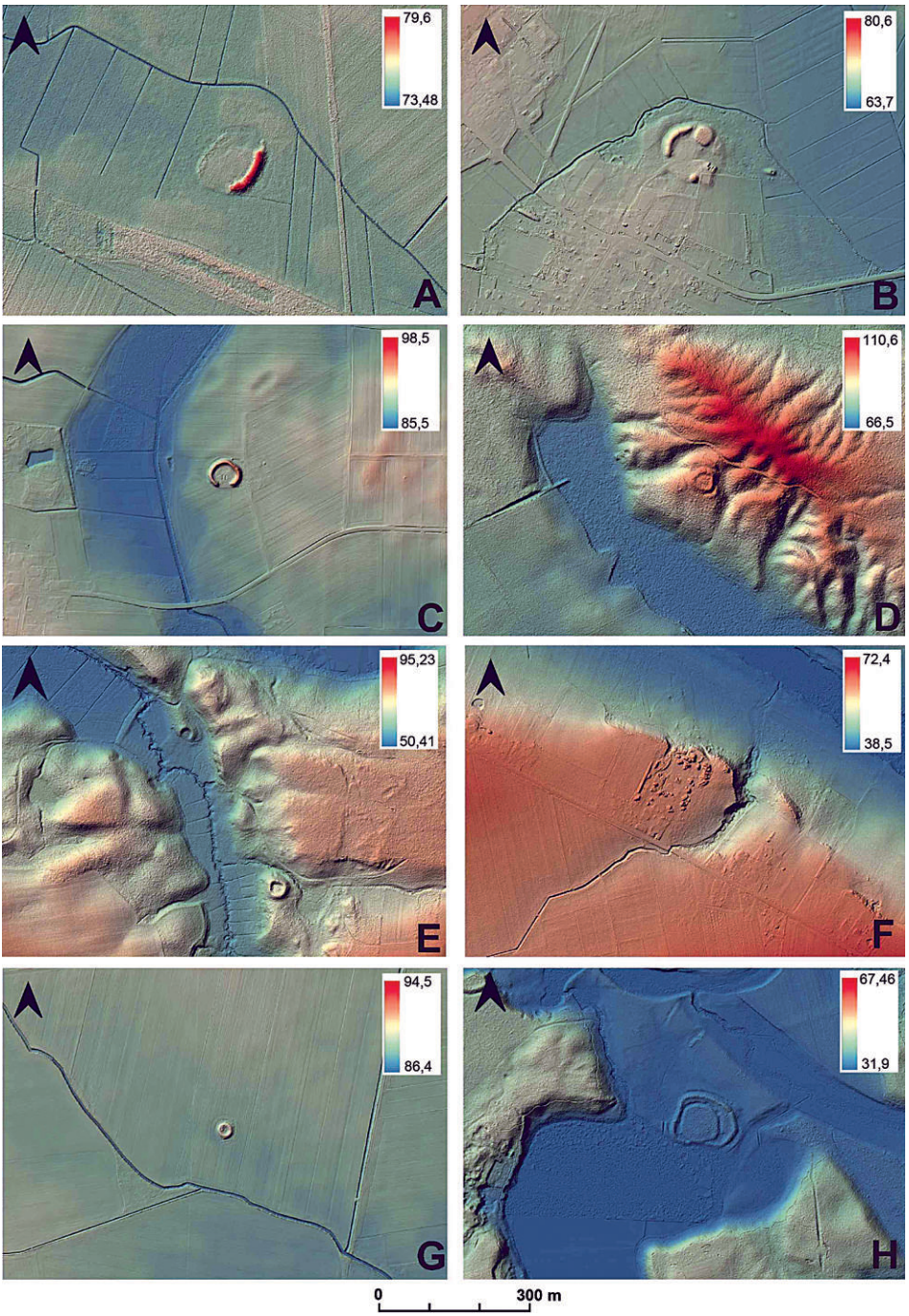

Fig. 4. Visualisations of Digital Terrain Model data. A – Dakowy Mokre; B – Kamieniec; C – Niewierz; D – Wielka Wieś-Krąplewo; E – Nojewo; F – Pierwoszewo; G – Bródki; H – Aleksandrowo/Bielsko (data from geoportal.gov.pl).

remains or the accessibility of the sites, which may have kept them outside the awareness of local inhabitants or amateur archaeologists. Thus, old maps do not show strongholds from Pawłowice (Poznań County), Krąplewo-Wielka Wieś (Poznań County; *Fig. 4*: D), or Nojewo (Szamotuły County; *Fig. 4*: E). While the identification in the field is not a problem for the latter two sites, the existence of a map would verify the presumed location in the case of the completely levelled fortified settlement at Pawłowice. Such verification would also have implications for the chronology. The existing dating is based on the ceramic material collected from the surface, which may, however, originate mostly from settlement located near the stronghold (*Pawlak – Pawlak 2019c*, 662).

The issue of strongholds was eagerly taken up by researchers. Western Greater Poland sites were included by Jan Nepomucen Sadowski in his work 'Wykaz zabytków prehistorycznych na ziemiach polskich I: Porzecza Warty i Baryczy' (*Sadowski 1877*), Robert Behl in 'Die vorgeschichtlichen Rundwälle im östlischen Deutschland' (*Behla 1889*), Gregor Snowadzki in his article 'Die vorgeschichtlichen Burgwälle der Provinz Posen' (*Snowadzki 1909*), and finally by Oscar Schummacher, synthesising previous inventories of fortified settlements in 'Die Burgwälle in der früheren preussischen Provinz Posen' (*Schummacher 1924*). The first half of the 20th century also saw the publication of two works, still occupying an important place in archaeological literature, by *Dylik* (*1936*) and *Kowalenko* (*1938*), which were of a synthesising character and collected all the strongholds known at the time. The difficult task of collecting, publishing, and initially establishing the chronology of all known sites, including early medieval strongholds from Greater Poland was undertaken by Witold Hensel with co-authors Zofia Kurnatowska and Alina Łosińska in seven volumes of 'Studia i Materiały do osadnictwa Wielkopolski wczesnohistorycznej' (*Hensel 1950*; *1953*; *1959*; *Hensel – Hilczer-Kurnatowska 1972*; *1980*; *1987*; *Hensel et al. 1995*). Subsequently, in the process of the verification campaign carried out in 1970–1980 and 1990, Kurnatowska and Łosińska, together with other researchers, subjected all the strongholds known at that time to test-trench research (*Kurnatowska – Łosińska 1985*, 56, 82–83). The so-called micro trenching method usually involved the excavation of several small trenches with an area of approximately 0.3 m^2 to identify the stratigraphy and obtain dating materials (*Kirschke – Prinke 1995*, 9), often making use of existing exposed areas at the strongholds, such as tree uproots, animal pits, slopes, etc. Information obtained in this way supplemented the Studies and Materials for Early Medieval Settlement, representing a catalogue unique in Poland (*Hensel et al. 1995*).

The described period around the turn of the third millennium was full of numerous archaeological initiatives, including excavations.[5] One such project was an extensive verification of the Lusatian culture settlement that the stronghold at Dakowy Mokre was then considered to be. The excavation season in 1974 allowed for the verification of the earlier hypothesis and the establishment of its new early medieval chronology (*Śmigielski 1974*; *1975*). As a result of the uncovering of quite a large area – about 140 m^2 in the circumference of the levelled rampart, the area adjacent to the rampart, and the central part of the bailey – this stronghold was for a long time one of the best examined in the western zone.

[5] The text does not include information on the verification-test trench research conducted by Z. Kurnatowska and A. Łosińska. This information can be found in *Online Supplementary Material 1*.

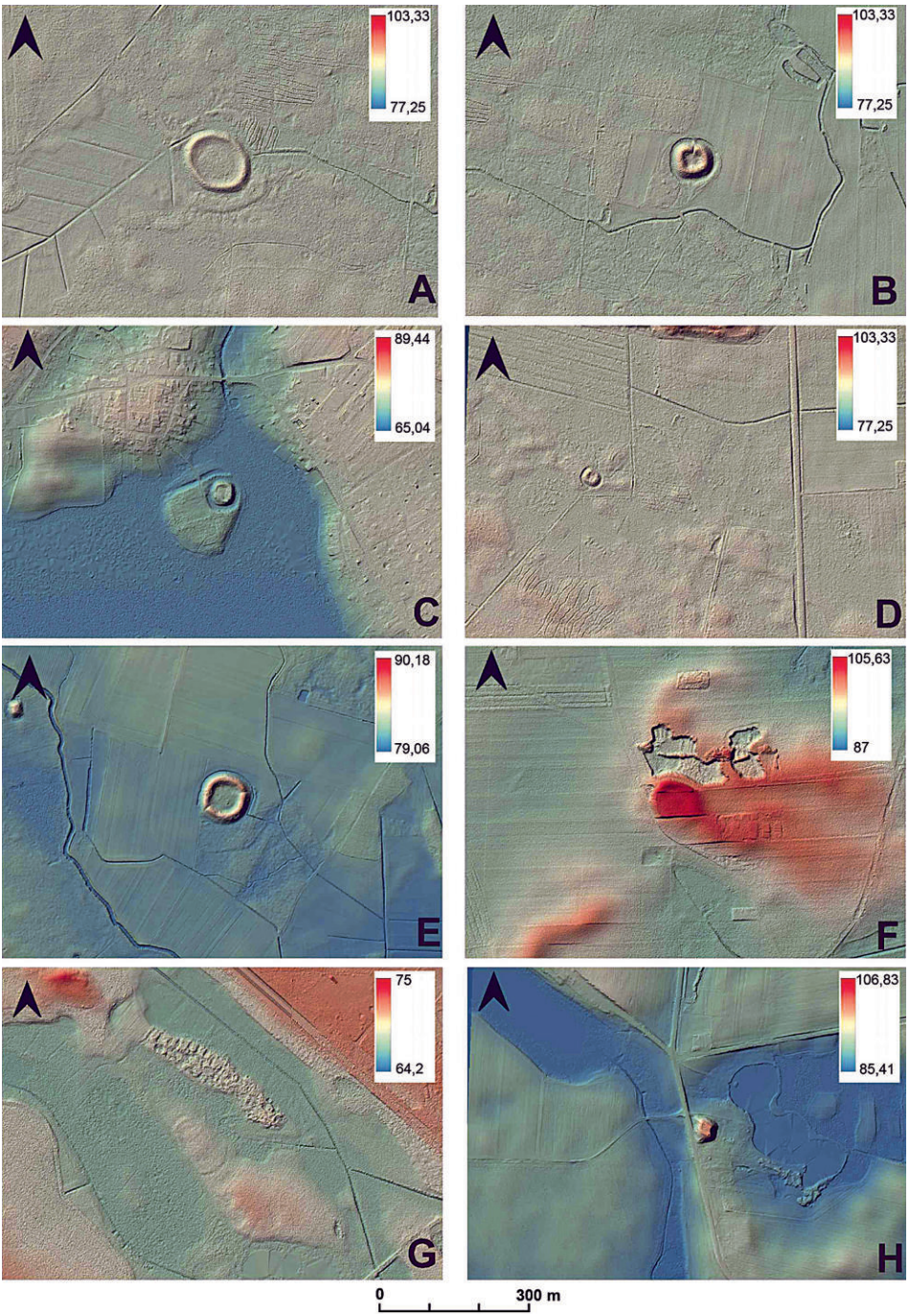

Fig. 5. Visualisations of Digital Terrain Model data. A – Rudki; B – Jastrowo-Ostrolesie; C – Ostroróg; D – Rudki-Lipnica; E – Sędzinko-Zalesie; F – Brzoza; G – Kąsinowo-Baborówko; H – Wilczyna-Młynkowo (data from geoportal.gov.pl).

Regrettably, the results of this research have not yet been published. Destroyed elements of the rampart construction, such as wooden beams, stone cobbles, a fascine base, as well as the road adjacent to the rampart, hearths, and a sunken feature of a presumed dwelling and storage function, were discovered (*Mizerka 2024*). The excavation revealed an assemblage of about two thousand fragments of pottery and animal bones, as well as objects of daily use (knives, spindle whorls, bone objects, nails), indicating intensive use of the settlement from the late 8th to the late 9th century (*Mizerka 2024*, 203–204).

Using the method of borehole drilling and small test trenches in the baileys, two heavily damaged areas were recognised in 1982 at Pierwoszewo (*Fig. 4*: F) and Wróblewo (Szamotuły County). Information was obtained on the structure and layer thickness along and an assemblage of archaeological material was retrieved: a small amount of pottery from Pierwoszewo and large amounts of ceramics and burnt clay finds from Wróblewo (*Cnotliwy 1990*, 188–193, 229–236). In 1985, a team from the Adam Mickiewicz University established one test trench in the northern part of the bailey of the Bródki stronghold (Nowy Tomyśl County; *Fig. 4*: G). At the time, three hearths with stone cobbles and burnt material were discovered, two of which contained sparse early medieval ceramic finds. That same year, the fortified settlement at Kąsinowo-Baborówko (Szamotuły County), which had already been heavily devastated (*Fig. 2*: E), was also investigated. Borehole drilling was used to identify its location and to estimate its original size (*Kurnatowska – Łosińska 1985*, 78–85).

About a dozen years later, a project was launched to learn more about early medieval strongholds in the Szamotuły area (*Pietrzak 2003*). It surveyed four sites: Rudki (*Fig. 5*: A) – 6 m^2 trench in the eastern part of the bailey; Jastrowo-Ostrolesie (*Fig. 5*: B) – 65 m^2 in total excavated including the southern and northern parts of the bailey and the area along the whole length of the entrance; Ostroróg (*Fig. 5*: C) – 20 m^2 trench within the ramparts; and Kąsinowo-Baborówko, where, as it later turned out, the excavation did not cover the area of the stronghold but only the adjacent settlement. Rich assemblages of artefacts were retrieved from the first two of the aforementioned sites, allowing the previous chronology and relationship between them to be sustained. Namely, the site in Rudki was founded earlier, as evidenced by the greater quantity of entirely hand-made pottery. In Jastrowo, the remains of a wooden feature (dwelling?) were identified, as was a pit thought to be the remains of a sunken-floor house (*Pietrzak 2003*, 56). On the other hand, the plan to survey the stronghold at Kąsinowo-Baborówko failed. Only an early medieval settlement from phase C was identified at the site, while recognition of the stronghold was hampered by heavy damage and accumulations visible in the field that gave a false impression of the existence of destroyed ramparts. Alina Łosińska recognised the aforementioned accumulations as remains of embankments on the basis of her own research carried out in 1986. A series of boreholes on the elevation showed the existence of cultural layers with early medieval material. The stronghold at Ostroróg had also been heavily damaged and transformed. It was first explored in the 1960s by Janusz Łopata while excavating a medieval castle at the same location. During the subsequent research in 1997, a trench on the south-eastern slope revealed, at a depth of 2.5 m from the top of the hill, a one-metre-thick sequence of layers associated with an early medieval rampart. The ceramic material collected during both excavations indicates the use of the stronghold in phase C (*Łopata 1962*, 333–337; *Pietrzak 2003*, 65–66).

In recent years, the research has followed the new conservation doctrine that severely restricts excavating, and thus there has been virtually no field research on strongholds in Western Greater Poland, with a single exception. The stronghold, or rather the entire settlement complex at Dąbrówka, remains unique in terms of its scale of archaeological research. It consists of a stronghold with a fortified craft settlement and numerous adjacent hamlets. Geophysical surveys and excavations on part of the bailey, the fortifications, and parts of the settlements around the stronghold provided a great number of finds and information (*Pawlak – Pawlak 2019b*; *Pawlak et al. 2024*). Research became possible due to the unfavourable circumstances of finding the stronghold related to the progressing modern development of the neighbouring area. As a result of research of a different character, a total area of 20 ares was subjected to study, leading to the identification of structures in the bailey, vestiges of the ramparts, the moat, and the northern forefield of the stronghold (*Pawlak – Pawlak 2019b*, 59–60). The information obtained is an invaluable source of knowledge regarding, among other issues, how the stronghold was constructed, its two-phase use, and interregional contacts reflected in the archaeological material. The assemblage of artefacts, including almost 11,000 vessels, has become a comparative basis for the material from Western Greater Poland.

The current state of research

At present, there are 27 sites in Western Greater Poland whose stronghold character and early medieval chronology are beyond doubt (*Tab. 1*; *Online Supplementary Material 1*). They vary mainly in terms of size. The assemblage includes strongholds with very little usable space, where the area of the 'acropolis' (maidan) is up to 0.05 ha (e.g. Bródki, Wilczyna-Młynkowo), small ones with standardised dimensions fitting the definition of a Tornow-Klenica type stronghold,[6] the area of the maidan up to 0.25 ha (e.g. Grońsko-Komorowo, Niewierz, Jastrowo-Ostrolesie), and fortified settlements covering large areas, the maidan from 0.25 ha to 0.7 ha (Dakowy Mokre, Dąbrówka, Brzoza, and Rudki, Pawłowice). In addition, they are differentiated by other attributes, such as location in relation to the morphology of the terrain (the vast majority were founded in valleys) or construction, such as the height of the ramparts or the presence of additional structures (e.g. supplementary ditches and ramparts around the strongholds or their baileys).[7] he excavation confirmed that a ditch, probably accompanied by a rampart, surrounded the settlement at Dąbrówka. A similar ditch surrounds a circular stronghold in Niewierz. Also, in the forested south-eastern section surrounding the site at Sędzinko-Zalesie, a ditch accompanied by a low rampart is visible. Ditches surrounding settlements preceding the establishment of the stronghold or associated with strongholds were discovered in the Chełmno-Dobrzyń Land

[6] Strongholds of the Tornow-Klenica type are small structures not exceeding 0.5 hectares, located mainly in river valleys, which were used in the late 9th and early 10th century (*Dulinicz 1994*; *Tietz 2017*, 101)

[7] This verification would also have an impact on the chronology of the stronghold in Pawłowice. The current chronology was established on the basis of pottery collected from the surface, with Ewa and Paweł Pawlak indicating that it came mainly from the settlement near the stronghold (*Pawlak – Pawlak 2019c*, 662).

(*Chudziak 1990*; *Kowalewski 1997*), as well as in Grzybowo in Wielopolska, which is already associated with the period of the Piast dynasty (*Bogacki 2021*). A ditch surrounding the settlement is also known from Lubrza (Świebodzin County), where it is dated to the period from the end of the 9th to the mid-10th century (*Tabaka – Zamelska-Monczak 2011*).

Strongholds of questionable character or chronology

In addition to the sites with well-established chronological and functional bases, there is a group which, with the current state of research, cannot be classified as strongholds either because of the uncertainty of their factual occurrence or uncertain dating. Among others, we are discussing the site at Chorzemin (Wolsztyn County), which has been included in the early medieval network of strongholds by *Pawlak* (*2021*, fig. 1). The site is now levelled, while archival information indicates that it was a motte-type stronghold that should be associated with the later phases of the Early Middle Ages. The KEZA record card[8] refers to a nearby stronghold in Powodowo (Wolsztyn County). Here, we are also confronted with uncertainty and possibly a conical stronghold construction. The existence of a stronghold in Konojad (Grodzisk County) remains enigmatic as well. Information that it was to have existed between the Mogilnica River and the railway tracks was found in the work of W. Kowalenko, who, in turn, referred to the verification carried out by Zygmunt Zakrzewski. The latter stated the presence of a ring-shaped stronghold, which had certainly not existed in the landscape in 1938. It was not depicted on the Meßtichblatt maps, but the sketches of the destroyed stronghold that exist in the collection indicate its presence. Surface surveys and test trenches carried out in the area in 1983 yielded negative results. An aerial photograph published in 2021 provided a new impetus to address this issue. The vegetation markers visible approximately 200 m to the north of the original location of the former stronghold were arranged in a fairly regular circle (*Pawlak 2021*, fig. 4). A field verification was carried out in 2024, but it did not reveal archaeological material on the surface and the analysis of archival aerial photographs did not highlight a circular structure. The presence of the presumed stronghold requires further verification, as well as the consideration of other hypotheses: perhaps it is a paleochannel of the Mogilnica River, which flows nearby. The last stronghold, Zielona Chojna (Międzychód County), is located less than 600 m north-west of the stronghold in Aleksandrowo/Bielsko (Międzychód County) and occupies a natural elevation just above the Warta River. It is only partially preserved because, among other things, it was cut through by a military trench. The preserved fragment does not allow reconstruction of its original shape. Ceramic and flint artefacts recovered during test trenching and borehole drilling indicate that it is likely associated with the Lusatian culture.

The second sub-group of the dataset consists of fortified settlements with an uncertain dating. Based on the current state of research, including them in the network of early medieval strongholds would be a mistake (*Michalski et al. 2016*, tab. 1; *Pawlak 2021*, fig. 1). The first of these is located at the north-western part of the studied area, in Kolno

[8] Record Card of the Archaeological Monument (Karta ewidencyjna zabytku archeologicznego or KEZA), which should cover every known archaeological site in Poland.

(Międzychód County). Although it is considered an early medieval site (*Michalski et al. 2016*, 220), the KEZA card states otherwise, presuming a late medieval chronology. The lack of ceramic material from the surface (only charcoal and daub fragments have been uncovered) does not provide the basis for determining the early medieval chronology of the stronghold and instead indicates a younger dating. The shape, dimensions, and location of the Kolno stronghold should be left out of the discussion for now, as the state of research in Western Greater Poland does not allow for an unequivocal categorisation based on these determinants. Due to its small dimensions and upland location, the stronghold in Kolno could be regarded as a motte-type stronghold. At the same time, the strongholds in Glinno or Wilczyna-Młynkowo with a fairly certain early medieval chronology may be analogous.

Two valley strongholds by the Samica River in Objezierze (Oborniki County) and Obrzycko (Szamotuły County) face a similar problem. The existence of the first – albeit heavily damaged – is beyond doubt, while its chronology is highly questionable. The artefacts found during surface surveys permitted the conclusion that it is a Lusatian culture stronghold that was reused in the Late Middle Ages. The site at Obrzycko, on the other hand, offers a more complicated situation, as its presence is established based on an archival but rather enigmatic reference. It does not contain a precise description regarding, among other things, the ramparts. What is known is that vessel fragments, dated to phases B/C, have been found on one of the hills above the Warta River, while a motte-type stronghold exists nearby. In conclusion, there is currently no evidence of a fortified settlement from the older phases of the Early Middle Ages.

The Rudki/Lipnica site is another stronghold neither listed in the Register of Archaeological Sites nor included in the catalogues to date and is still waiting for its chronology to be verified. It is located near the strongholds in Rudki and Jastrowo-Ostrolesie and was mentioned in the oldest inventory sources, but it was later forgotten and not encountered during subsequent verifications. It appears as a rather distinct small rectangular structure of 38 × 31 m with ramparts that are approximately 2.5 m high (*Fig. 5*: D). Although the size as well as the visibility of the site on LiDAR imaging may indicate its later chronology, it should not be forgotten that the phase C stronghold in Jastrowo-Ostrolesie is characterised by similar features. The Rudki/Lipnica site requires field verification and, regardless of the adopted chronology, also needs to be placed under conservation protection.

A separate problem is the location of the stronghold in Kąsinowo-Baborówko. Previous research showed the existence of early medieval layers with numerous artefacts in a place resembling a devastated rampart. Still, the research concluded that the stronghold must be located on the neighbouring western acclivity (*Pietrzak 2003*, 64). LiDAR visualisation, however, indicates the existence of a circular ditch, approximately 70 m south of the surveyed elevation (*Fig. 5*: G). The feature mentioned above is about 6–7 m wide and marks out a space about 110 m in diameter. It is not preserved along its entire perimeter but only in the northwestern and eastern parts. The anthropogenic character of the ditch is mostly unquestioned due to its regular shape, while the potential fortification at Kąsinowo requires further research.

Strongholds in enclaves

Strongholds that occur in enclaves with a chronological distinction are also noteworthy and the sites in Sędzinko-Zalesie, Niewierz, Brzoza, Bródki, and Wilczyna-Młynkowo

should now be regarded as such (*Fig. 1*: 21, 19, 22, 18, 20; *Tab. 1*). Ceramics collected from the surface or derived from verification excavations have made it possible to assign them to a single chronological horizon within phases B–C. It should be noted that this is a rather long period of about 200 years, and the current possibilities of dating ceramic material do not permit a narrowing of this range.

A cursory look at the group of listed strongholds shows that they have varied physical characteristics. The sites at Brzoza and Sędzinko-Zalesie are the largest, distinguished by their diameter of about 100 m. Moreover, the latter stands out for its still impressive ramparts that are around 4 m in height and are surrounded by a deep moat (*Fig. 5*: E, F). Topographically speaking, completely different locations were chosen for the foundation of sites similar in terms of size. The stronghold in Brzoza was located on a high natural elevation, away from the river or wetlands, while Sędzinko was built in a wetland area; it was connected with the Mogilnica River, which flows approximately 500 m to the west. The stronghold at Niewierz is similar in that it is located in a valley near watercourses. However, it has lower ramparts and a smaller interior diameter, bringing it closer to the definition of so-called Tornow-Klenica-type fortified settlements. On the other hand, the very small stronghold in Bródki with a diameter of 40 m resembles a later site, although a few potsherds recovered from two hearths with no signs of damage (*Minta-Tworzowska 1985*, 110–113), seem to date the site to the earlier phases of the Early Middle Ages. The stronghold at Wilczyna-Młynkowo (*Fig. 5*: H), on the other hand, has a unique location. It was founded on a natural elevation of about 100 m above sea level, which had probably been levelled at the top and surrounded by low ramparts (*Schummacher 1924*, 51). The small space of the 'bailey' now has limited accessibility, as it is located on private property, fenced, and overgrown with dense coniferous forest, but the cobblestones visible during the visit by Schwartz and Virchow, together with the traces of heavy burning and the unusual location, led them to describe the site as a cult stronghold (*Schwartz 1880*, 3). With its upland location and relatively small size, this site resembles two other strongholds in Glinno (Poznań County) and Krąplewo-Nowa Wieś (Poznań County; *Fig. 4*: D). They all differ in shape, but perhaps the pentagonal outline of Krąplewo-Nowa Wieś is the result of the better state of preservation compared to the others. The different shapes may also be due to the way in which the individual morphological features of the elevations were used.

In their study of the stronghold at Dąbrówka, Ewa and Paweł Pawlak separated a group including the sites in Glinno, Krąplewo-Nowa Wieś, Pawłowice, and Brzoza, which, due to its location, fit into the two described enclaves (*Pawlak – Pawlak 2019c*, 663–664). They pointed to the large strongholds at Pawłowice, Brzoza, and Dąbrówka located inside the enclave and two more analogous upland strongholds flanking them. The authors explain that these sites might have had a type of cooperation at some stage, perhaps to achieve common political and economic goals.

Strongholds in pairs

Studies conducted on the stronghold network in Western Pomerania have revealed the phenomenon of strongholds in pairs. They have been recorded, e.g. in Żółte (Drawsko County), Radacz (Szczecin County), and Bobięcino (Bytów County). Archaeological finds prove that they functioned, at least for a certain period, simultaneously. The occurrence

of pairs of strongholds on a small area is an important premise for considering their function and role (*Chudziak et al. 2009*, 122–126; *Chudziak 2014*, 27–28). This phenomenon is also clear in Western Greater Poland, where two almost identical sites are located in the Sieraków Landscape Park west of the village of Nojewo. Despite being omitted from the registry of archaeological sites and not having a KEZA card, both can be clearly described as ring-shaped strongholds with a diameter of about 37–38 m and ramparts of a similar, two-meter height. They are separated by a short distance of 350 m, but the height of the terrain on which they are located is significantly different. The first stronghold occupies part of a natural elevation, while the second is located more than 12 m below, directly on the bottom of the Osiecznica River valley. Only the first site, preserved in excellent condition, with a presumed entrance on the eastern side, is listed in the Register of Monuments (*Fig. 4*: E). The second, with a destroyed rampart along a distance of about 20 m in the south-western part, is not included (*Fig. 4*: E).

The second example of paired sites gives the aforementioned strongholds in Rudki, measuring 120 × 150 m, and in Jastrowo-Ostrolesie, which is a much smaller site, about 80 m in diameter. In a straight line, they are separated by a distance of about 500 m. The ceramic material from small test trenches that were unearthed in the baileys of both strongholds indicates that they were in use during phases B–C. Nevertheless, as the research in Rudki provided a greater amount of hand-made pottery, it is considered to be older than Jastrowo-Ostrolesie (*Pietrzak 2003*, 71). Another pair, albeit with a different dynamic, is formed by the strongholds in Grońsko-Komorowo and Linie-Wymyślanka. Their location and the distance of approximately 5 km (in a straight line) between them do not directly suggest a symbiotic relationship. In order to identify these objects, which are quite similar in shape and size, it would be necessary to determine their chronology and function. This would allow us to determine whether they functioned simultaneously, but served different purposes, or were differentiated by the chronology and temporal sequence of both sites.

Chronology

The chronology of almost all of the described sites is based on the ceramic material, for which we are forced to operate with rather wide time ranges. Only a few of the strongholds have been dated using scientific methods. The site in Pszczew, with more than ten radiocarbon and dendrochronological measurements (*Kara – Banach 2012*), and the one in Dąbrówka, dated by nine radiocarbon and dendrochronological measurements (*Goslar – Szmyt 2019*, 473–477; *Pawlak et al. 2024*, 81–82), rank best in this respect. Of the others, only the stronghold in Dakowy Mokre has one radiocarbon dating (*Mizerka 2024*, 203–204). At the present stage of research, phases B and C predominate among the established chronologies of the sites; later phases have been recognised only sporadically. To some extent, this may reflect how these chronologies are determined: in most cases, they are based on surface materials, where the probability of discovering either diagnostic pottery fragments or a representative assemblage is rather low. Strongholds established in the B/C phase and lasting into the later phases should be considered exceptionally rare, which has given rise to further hypotheses attempting to explain this state of affairs. The chronology of the stronghold in Pszczew stands out among the described sites. Located on the Katarzyna Peninsula on Lake Kochle, it functioned from the end of the 9th/early 10th century until

the middle of the 12th century, with a break of several decades in the 11th century (*Kara – Banach 2012*). The stronghold in Pszczew is considered a tribal structure taken over peacefully by the Piasts in the middle of the 10th century, as the lack of signs of destruction suggests.

The upper boundary of the functioning of the strongholds in Niewierz and Wróblewo has been set at phase D, which is probably the result of finding fragments of fully wheel-thrown pottery. In this context, it should be mentioned that the lower boundary of the occurrence of such pottery has been recently shifted from the first half of the 10th century to the end of the 9th century (*Biermann 2006*, 117–125; *Trzeciecki 2018*, 42–67; *Kara 2021*, footnote 45; *Kolenda – Zamelska-Monczak 2021*, 444). In practice, this means that the aforementioned strongholds may be associated with the tribal period, preceding the crystallisation of the Piast state. The chronologies of most sites were established solely on ceramic material excavated during the verification research by Z. Kurnatowska and A. Łosińska, carried out in 1970–1980. Although formal and stylistic analysis of ceramic vessels still plays an important role in chronological frameworks, its accuracy is far from satisfactory. Due to the significant dynamics of settlement, political, and cultural changes that took place between the 8th and 10th century, such low precision in determining the time of use of individual sites is now difficult to accept. It should be emphasised that there are sites that, apart from the aforementioned verification research in the 1980s, have not been examined by larger surveys (*Pawlak – Pawlak 2019c*, 672). A project undertaken at the Institute of Archaeology and Ethnology of the Polish Academy of Sciences in Poznań and financed by the National Science Centre and carried out since 2022, aims to continue the study of strongholds in this area. Within the framework of the grant, five sites are being researched by geophysical and excavation methods: Niewierz, Sędzinko-Zalesie, Grońsko-Komorowo, Dakowy Mokre, and Kamieniec. The research results to date have yielded important information. The geophysical survey has provided information about the activities in the baileys and the intensity of their use. In the case of Dakowy Mokre, it brought a new quality of information, revealing a hitherto unknown structure within the bailey, which is of major importance and potential; this discovery may shed new light not only on a more complete understanding of the character of the researched site but also on the genesis, character, and development of fortification centres from the older as well as the turn of the older and younger phases of the Early Middle Ages in Greater Poland. The discovered structure, i.e. a ditch with a circular outline about 50 m in diameter with two entrances and numerous features inside, was described in an article (*Mizerka – Ryndziewicz in press*).

Excavations have been carried out thus far at three strongholds – Sędzinko-Zalesie, Niewierz and Grońsko-Komorowo – and archaeological material has been obtained, including samples for scientific dating.

Conclusion

Research on early medieval strongholds has had a long tradition in Greater Poland, as evidenced by numerous publications and archaeological material stored in museums (*Hilczerówna 1967*; *Zamelska 1995*; *Teske 2003*; *Brzostowicz 2002*; *2016*; *Kara et al. 2006*; *Kaczmarek et al. 2013*). The western part of Greater Poland, however, has been studied in a limited, rather selective manner. The preliminary analysis of the strongholds in this

region presented in this paper points to its high research potential, not least because of the good state of preservation of the monuments. There is a number of issues that loom on the horizon, starting with the most important ones, i.e. the chronological distinction of the sites, through their functional analysis and the research of the micro-regional networks, to the understanding of the social and political aspects of the formation, functioning, and, finally, the demise of strongholds. The strongholds occurring in pairs or enclaves, which are preserved particularly in the northern part of the Szamotuły County, seem to be extremely intriguing in this context.

In summary, in the area of Western Greater Poland, we are confronted with interesting strongholds, diverse among themselves in terms of size and topography. The previous research has mostly consisted of establishing the chronology, but the ongoing investigation can bring us closer to finding answers to important questions about the origins of the settlement network, its transformation, and the reasons for its decline. The hypothesis presented in the article by Andrzej Wędzki assumes that in the area of Western Greater Poland, 'there was no formation of a larger, compact settlement complex', but only 'a few small territorial communities in the form of collections of settlements emerged' (*Wędzki 1996*, 70), the collapse of which was to have taken place under the influence of the formation of the state organisation and 'liquidation …, often by force, of inconvenient former territorial centres as well as deliberate changes introduced in the settlement structure of larger areas of the country' (*Wędzki 1996*, 71). The question of the reasons for the disappearance of the stronghold network in Western Greater Poland is still open, although there is clearly a dominant belief in their military conquest and destruction. This hypothesis was based, among other things, on the research of strongholds from the middle and upper Obra and Ląd land, where there are clear traces of armed attacks in the form of heavy burning at the strongholds, the discovery of numerous (abandoned) objects of daily use, as well as elements of warfare. Did the fortified settlements in Western Great Poland suffer a similar fate as, for example, Bruszczewo and Spałwie Bonikowo (*Kurnatowska – Kara 2008*, 161)? Certainly, the approach of the Piast rulers differentiated these regions, as some of the settlements in Southern Greater Poland were taken over and rebuilt, while those in the western part of the region show no evidence of occupation after the middle of the 10th century. The literature supports the hypothesis of armed conquest, as well as the resettlement of part of the population in the territory of the newly forming state in order to explicitly eliminate competitors (*Brzostowicz 2009*, 25–26). In the 30 years that have passed since Andrzej Wędzki wrote his article, no significant breakthrough has been made that could unequivocally confirm or refute the hypotheses put forward at the time. It seems that only further archaeological research of the fortified settlements and their hinterland can bring us closer.

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TOPICAL REVIEW – TEMATICKÁ SYNTÉZA

From foreign prototype to local production: Finds of post-medieval ceramic vessels from Poland as evidence of the continuity of influence networks

Od zahraničního prototypu k místní výrobě: Nálezy postmedieválních keramických nádob z Polska jako důkaz kontinuity sítí vlivů

Magdalena Bis

The aim of this article is to identify the multi-directional networks of influence that shaped ceramic production in the Modern period within the territory of present-day Poland, and to examine the factors that led to the development of local characteristics. The discussion emphasises the phenomenon of connectivity, understood as the evolving relationships between foreign producers, external sources of inspiration, and indigenous artisans. The analysis focuses on selected groups of vessels – namely slipware, so-called Pomeranian faience, and Stettinware. These types of earthenware became popular for both table use and display during the 16th to 19th century. Drawing on examples of archaeological finds, I aim to demonstrate that while these productions emerged from a shared tradition, they developed distinctive characteristics shaped by a range of local factors.

post-medieval pottery – slipware – Pomeranian faience – Stettinware – ceramics – historical archaeology

Cílem tohoto článku je identifikovat vícesměrné sítě vlivů, které formovaly keramickou výrobu v novověku na území dnešního Polska a prozkoumat faktory, které vedly k rozvoji místních specifik. V diskusi bude zdůrazněn fenomén konektivity, chápaný jako vyvíjející se vztahy mezi zahraničními výrobci, vnějšími zdroji inspirace a místními řemeslníky. Analýza se zaměří na vybrané skupiny nádob – konkrétně na polévanou keramiku, tzv. pomořanskou fajáns a štětínské zboží. Tyto typy keramiky se v průběhu 16. až 19. století staly oblíbenými jak při stolování, tak pro výstavní účely. Na příkladech archeologických nálezů se snažím ukázat, že ačkoli tyto výrobky vzešly ze společné tradice, vyvinuly se u nich odlišné vlastnosti, které byly formovány řadou místních faktorů.

postmedievální keramika – polévaná keramika – pomořanská fajáns – štětínské zboží – keramika – historická archeologie

Introduction

Archaeological finds are the remains of tangible objects and therefore represent a material reality. As such, they serve as direct sources of information about what was actually created, used, and circulated during a given period (see *Gawronski 2012*, 11). In this context, ceramic sherds recovered during excavations at historical sites are particularly significant. They can provide insights into a wide range of general and specific aspects of past life, including changes in practices related to food and beverage consumption, indicators of consumption habits, patterns of international and regional trade, and production technologies (see *Barker – Majewski 2006*, 205; *Gaimster 2006*, 136). Thus, the role of ceramics

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can be seen as complex and multifaceted – both material and non-verbal – encompassing symbolic meanings, behavioural processes, social identity, emotional values, and utilitarian functions (e.g. *Gaimster 2006*, 136–144; *Wilson 2006*, 11–12; *Mullins 2011*, 134–135).

In this paper, I use examples of artefacts belonging to this category to illustrate the issue raised in the title – namely, the continuity of influence networks. To this end, the article shifts focus from the traditional examination of ceramic production and trade in the Early Modern period to the evolution of the networks through which these goods, and the ideas associated with their manufacture, were disseminated. The aim is to demonstrate how such transformations of networks can be identified. The primary source for this study consists of three groups of earthenware produced, used, and popular within the territory of present-day Poland between the 16th and 19th century, i.e. slipware, Pomeranian faience, and Stettinware (*Stettinerware* in German). The analysis is based on archaeological finds and seeks to trace how various foreign models and influences provided the impetus for the differentiation and further development of these wares, which represent an eclectic and innovative style emerging on native soil. The discussion centres on decorative schemes, combined with the technological aspects of production, within the broader context of consumption practices. These issues are presented in a European context, with particular reference to major traditions that shaped Early Modern ceramic production: Italian maiolica and Dutch faience. This paper aims to highlight the potential of such an approach and to encourage further research.

The starting point for this study is relevant Polish and foreign literature, published analyses of archaeological assemblages – including the vessels discussed here – as well as the author's own research and examined finds. Art historical research and literature are particularly valuable in the case of maiolica and faience, as these objects constitute a significant part of many museum collections and are recognised as important examples of historical craftsmanship.

This article constitutes an attempt to approach these products from a perspective different to that traditionally adopted in Polish scholarship – namely, by considering them collectively as examples of related phenomena within Early Modern European and domestic ceramic production, as well as within the broader context of contemporary artistic and cultural transformations. The ceramic groups under consideration have already attracted the attention of researchers, though typically in isolation and to varying degrees. Most publications have focused on identifying vessel forms and describing their appearance.[1] Analytical studies offering broader interpretations are relatively scarce (e.g. *Szetela 1969a*; *1969b*; *Fryś-Pietraszkowa 1970*; *Supryn 1975*; *Meyza 1991*; *1997*; *2017*; *Szetela-Zauchowa 1994*; *Marcinkowski 2009a*; *2011*; *Oniszczuk 2013a*; *Trzeciecki 2016*; *Majewski 2019*; *Szajt 2021*; *Bis 2021*; *2025*). The lack of comprehensive studies and the inconsistent presentation of material hinder comparative research. The least well-studied group to date is Stettinware, for which no comprehensive analysis has yet been conducted (e.g. *Kwiatkowski 2010*; *2011*; *Majewski 2019*; *Szeremeta 2022*; *2025*). The situation is somewhat better in the case of slipware (e.g. *Szetela 1969a*; *1969b*; *Fryś-Pietraszkowa 1970*; *Meyza 1991*;

[1] The number of such publications is considerable. I do not list them all here, referring only to those most relevant to the analysed issues.

1997; *Szetela-Zauchowa 1994*; *Marcinkowski 2009a*) and Pomeranian faience (e.g. *Marcinkowski 2007*; *2009b*; *2011*), although many fundamental issues concerning their production and use remain unresolved – particularly on a broader geographical scale, as current knowledge is largely based on finds from individual centres.

New trends in ceramic production: European and domestic background

In European cultural history, the Early Modern period is generally regarded as a time of transition. Many of the trends traditionally associated with this concept occurred at slightly different times and with varying intensity across different parts of Europe (e.g. *McCabe 2015*, 188). In general, the period was marked by profound socio-economic change and the emergence of a 'consumption society' – understood as the development of more diversified consumer patterns (e.g. *Blondé 2002*, 296; *van Oosten 2009*, 8). This concept rests on the assumption that increasing numbers of people were able to acquire non-essential goods, leading to a growing share of national income being generated through commerce (*Jervis 2017*, 3). This development contributed to the accumulation of personal wealth across various segments of society, improved living standards, and heightened demand for a wide range of material goods (see *Finn 2014*, 3). As a result, many manufacturing sectors flourished, giving rise to a richly material world. The growth of consumerism was also linked to expanding international trade and the influx of new colonial commodities (e.g. *McCabe 2015*, 188–201). These shifts brought about significant changes in dietary habits: new modes of eating reshaped culinary practices, social activities, and everyday lifestyles. Such transformations were reflected in certain types of essential items (e.g. *Gaimster 2006*, 138–141). Thus, the period between the 16th and 18th century in Europe witnessed a radical redefinition of taste, understood as prevailing notions of what was considered correct, attractive, and desirable. By embracing new materials and fashions, consumers expressed emerging preferences that, in turn, influenced their purchasing behaviours (e.g. *McCabe 2015*). These shifts were closely connected to the broader transformation of customs, including table manners.

The most radical shift was the transition from communal dining and the shared use of vessels to individual consumption and the introduction of specialised utensils designed for that purpose. This change led to the development of dedicated tableware and the proliferation of items comprising meal sets, i.e. table services (e.g. *Finn 2014*, 245–246). At the same time, the gradual diversification of diets necessitated the use of specialised equipment for food preparation, resulting in a broader range of cookware. The vessels used for these purposes appeared in increasingly varied forms and qualities. As a result, the Modern period witnessed a significant expansion in the variety of ceramics, accompanied by growing functional specialisation and decorative sophistication. This phenomenon is often referred to as the 'ceramic revolution' (e.g. *Cumberpatch 2003*; *Barker – Majewski 2006*, 20; *Gaimster 2006*, 136–137; *van Oosten 2009*, 9). It was paralleled by the transformation of pottery from a purely utilitarian commodity into a social object. Consequently, these items began to serve not only practical but also symbolic functions within the household (*Gaimster 2006*, 136). The wide range of item standards made ceramics accessible to middle- and lower-class households. Consumers from various social strata could pur-

chase individual pieces based on their tastes and financial means, or acquire complete sets tailored to their needs (see *Courtney 1997*; *Finn 2014*, 3). This civilisational process, often explained through 'trickle-down' or social emulation theory, refers to the imitation of elite lifestyles by broader segments of society. It played a key role in the formation of the modern consumer society (e.g. *Courtney 1997*, 95; *Linaa 2021*, 74). This mechanism manifested in multifaceted changes initiated by the upper classes, which, over time, were gradually adopted and imitated by less affluent groups.

The aforementioned pan-European processes also affected domestic kitchens, larders, and dining tables. In the territory of Poland, the transformations initiated in the Late Middle Ages and continued into the Early Modern period brought increasing diversification in kitchen- and tableware. A key innovation was the gradual emergence and use of vessels specifically designed to accompany food and beverage consumption – particularly for individual use (e.g. *Kruppé 1981*, 51–82; *Marciniak-Kajzer 2020*, 207–217, 248–279; *Szajt 2021*, 21–85). This shift was driven by changing views on hygiene, cleanliness, and propriety. By the 17th century, dining tables had acquired a more formalised array of crockery, with each diner provided with a personal set of utensils. In the 18th century, tableware continued to evolve and diversify. From the 16th century onward, there was a growing distinction between everyday meals – simpler and less ceremonious – and festive occasions marked by elaborate, carefully orchestrated feasts. In the 17th and 18th centuries, exquisite dining became an important social ritual (see *Bogucka 1994*, 119–129; *Bockenheim 1999*, 29–93; *Gajewska 1999*, 77–82; *Oniszczuk 2013a*, 204–210). A well-set table and its accompanying accessories elevated meals to special events and enhanced the sensory and intellectual enjoyment of dining ('tasting with the mind'). The proliferation of coffee and tea also played a significant role in this evolution, particularly toward the end of the period under discussion. The increasing popularity of these colonial beverages was accompanied by the production and use of specialised paraphernalia for their preparation and consumption (see e.g. *Wendland 2008*, 153–187; *Marcinkowski – Pospieszna 2016*, 69–79; *Ceynowa ed. 2020*; *Trzeciecki 2021*). The adoption of new dining habits gradually spread across social groups, beginning with the royal court and its magnate entourage – who set the trends – and eventually reaching the nobility and urban burghers (*Gaimster – Nenk 1997*, 171; *Gajewska 1999*, 82). At the same time, tableware served as a means to express the lifestyle and status of its owner, functioning as a visible indicator of socio-economic position and cultural identity (e.g. *Gajewska 1999*, 77–78; *Dumanowski 2005*, 19, 21; *Oniszczuk 2013a*, 210–213; *Roćko 2013*, 21). Decorative ceramics, beyond their immediate utilitarian role and material value, became objects of communication – conveying messages based on distinctiveness and uniqueness (see *Jervis 2017*, 7).

From innovation to diffusion: examples of foreign maiolica, faience, and slipware

For the issues discussed here, it is also essential to highlight the broader processes unfolding between the 16th and 18th century, which may be described under the concept of the 'circle of ceramics'. This term refers to the circulation – that is, the multifaceted interaction, exchange, and adaptation of ideas, traditions, and innovations in ceramic production across Europe over the course of these centuries. These phenomena were the result of com-

plex processes involving the mutual permeation of Eastern and Western cultures, and the blending of native and foreign, progressive and anachronistic elements in pottery-making, with varying pace and intensity. These processes consisted in the appropriation, transformation, and adaptation of know-how, forms, and decorative schemes to local raw material resources, the level of craft development and its traditions, market demands, aesthetic preferences of consumers, etc. The outcome of these complex interactions was an eclecticism, yet also a distinct individualism characteristic of ceramics produced in different regions and countries. In this new form, they in turn influenced subsequent makers and users, local workshops, tastes, and expectations. Thus, certain characteristic elements – such as shapes, motifs, colour schemes, and compositional strategies – were imitated and reworked across various types of ceramics, persisting within a broader productional, social, and cultural circulation. The vessels that bore these traits became not only commodities and material goods, but also agents of change and media for non-verbal communication. This chain of cause and effect is essential for understanding the evolution of networks of influence and cultural transfer.

Maiolica

One of the ceramic types that came into use in the period and gradually transformed the European pottery landscape was Italian maiolica, i.e. Italian faience. Within its regionally and qualitatively diverse production between the 15th and 17th century, the processes that occurred in the development of other ceramic groups are reflected and exemplified – like in a lens focusing the sequence and dynamics of broader change. For this reason, I outline them briefly below. These processes have been the subject of study by art historians (e.g. *Melegati 1997*, 20–49; *Benini et al. 1998*, 4–44, 56–86; *Wilson 2016*; *Glaser 2000*).

From a technological perspective, maiolica is earthenware with a porous body, made from clay with the addition of calcium or levigated chalk, and fired to a light colour (ranging from white to yellowish or pinkish). It features a tin glaze on the front and usually a transparent lead glaze in the exterior, underglaze-painted decoration, and spur marks on the surface. It was possibly derived from Mallorca, the Spanish island through which these wares were traded (e.g. *Rada 1993*, 27–28; *Hume 2001*, 367–368). Its distinctive character lay in an innovative approach to decoration and modelling, using high-quality glaze and elaborate relief and painted ornamentation in a vibrant colour palette (blue, green, brown, yellow, and red) (*Fig. 1–2*). Its production was complex and demanded significant technical and artistic skill on the part of its makers. In many respects, maiolica was the quintessential Renaissance art form (*Campbell 2021*, 11).

These wares bear numerous traces of external influences, to which individual production centres were subject in varied and evolving ways over time. To their local Renaissance and later Baroque traditions, and to the stylistic features characteristic of their respective regions, potters incorporated new techno-stylistic elements drawn from imported ceramics – such as themes, colours, painting techniques, and vessel forms. These were adopted through cultural and commercial contacts, particularly with the Iberian Peninsula (e.g. lusterwares), as well as with the Middle East, and later the Far East (e.g. porcelain). Neighbouring production centres also served as sources of inspiration. Artisans drew primarily from contemporary painting and printmaking, but also from other branches of applied arts, and architecture. Selected features of ceramic prototypes were appropriated,

Fig. 1A. Italian maiolica from Deruta (5–6, 8–9, 10?), Florence or vicinity (12), Gubbio (7, 11), Montelupo (2), Naples (3), Tuscany? (1), and Italy (4) from c. 1470–1540. Selected vessels from the collection of The Metropolitan Museum of Art in New York, the J. P. Getty Museum in Los Angeles, and the National Museum in Krakow (Public domain, *The MET 2025*: Object Nos. 1975.1.1113 (1), 46.85.34 (2), 46.85.27 (3), 32.100.364 (5), 04.9.26 (8), 46.85.41 (9), 1975.1.1056 (12); *Getty 2025*: Object Nos. 84.DE.110 (6), 84.DE.103 (10), 84.DE.111 (11); *MNK 2025*: Inv. Nos. MNK XIII-1771 (4), MNK XIII-1646 (7); computer processing M. Bis and W. Bis).

Fig. 1B. Italian maiolica from Deruta (5–6, 8–9, 10?), Florence or vicinity (12), Gubbio (7, 11), Montelupo (2), Naples (3), Tuscany? (1), and Italy (4) from c. 1470–1540. Selected vessels from the collection of The Metropolitan Museum of Art in New York, the J. P. Getty Museum in Los Angeles, and the National Museum in Krakow (Public domain, *The MET 2025*: Object Nos. 1975.1.1113 (1), 46.85.34 (2), 46.85.27 (3), 32.100.364 (5), 04.9.26 (8), 46.85.41 (9), 1975.1.1056 (12); *Getty 2025*: Object Nos. 84.DE.110 (6), 84.DE.103 (10), 84.DE.111 (11); *MNK 2025*: Inv. Nos. MNK XIII-1771 (4), MNK XIII-1646 (7); computer processing M. Bis and W. Bis).

Fig. 2A. Italian maiolica from Cafaggiolo (8), Deruta (1), Faenza (10, 12), Naples? (6), Urbino (3, 5?, 11), Venice (4, 7, 9), and Viterbo (2) from the 16th–17th century. Selected vessels from the collection of The Metropolitan Museum of Art in New York, the J. P. Getty Museum in Los Angeles, and the National Museum in Krakow (Public domain; *The MET 2025*: Object Nos. 27.97.36 (3), 65.6.7 (5), 20.93.1 (6), 08.59 (10), 46.85.35 (12); *Getty 2025*: Object Nos. 84.DE.120 (4), 84.DE.109 (8); *MNK 2025*: Inv. Nos MNK XIII-1774 (1), MNK XIII-2927 (11); after: *Benini et al. 1998*, 42, 67 (2, 9); *Melegati 1997*, 40 (7); computer processing M. Bis and W. Bis).

Fig. 2B. Italian maiolica from Cafaggiolo (8), Deruta (1), Faenza (10, 12), Naples? (6), Urbino (3, 5?, 11), Venice (4, 7, 9), and Viterbo (2) from the 16th–17th century. Selected vessels from the collection of The Metropolitan Museum of Art in New York, the J. P. Getty Museum in Los Angeles, and the National Museum in Krakow (Public domain; *The MET 2025*: Object Nos. 27.97.36 (3), 65.6.7 (5), 20.93.1 (6), 08.59 (10), 46.85.35 (12); *Getty 2025*: Object Nos. 84.DE.120 (4), 84.DE.109 (8); *MNK 2025*: Inv. Nos MNK XIII-1774 (1), MNK XIII-2927 (11); after: *Benini et al. 1998*, 42, 67 (2, 9); *Melegati 1997*, 40 (7); computer processing M. Bis and W. Bis).

resulting in products that were fusion forms – combinations of local and foreign motifs. These, in turn, influenced further stylistic developments (*Melegati 1997*, 20–49; *Benini et al. 1998*, 4–44, 56–86; *Sani 2012*, 45–111).

During the period in question, maiolica was produced in numerous centres across the Italian Peninsula, including Casteldurante, Deruta, Faenza, Florence, Genoa, Gubbio, Montelupo, Siena, Urbino, and Venice. Depending on their intended use, objects were made in various stylistic modes. In the workshops of leading masters, signed pieces were created on commission and for specific occasions. The refined objects were tailored to the needs of courts and affluent clients. The range of such products was wide, including plates, bowls, serving utensils, and jugs of varying shapes and sizes. Their distinguishing features included painted motifs of a geometric (*Fig. 1*: 3, 8, 12; *Fig. 2*: 6), plant (*Fig. 1*: 1, 3, 10; *Fig. 2*: 9, 11), biblical (*Fig. 1*: 7, 9; *Fig. 2*: 3), mythological (*Fig. 2*: 1), grotesque (*Fig. 2*: 4, 12), heraldic (*Fig. 1*: 11; *Fig. 2*: 7), or portrait nature (*Fig. 1*: 4–6; *Fig. 2*: 5), along with inscriptions (*Fig. 1*: 5–6, 8; *Fig. 2*: 5). Maiolica wares were often named after their dominant decorative style, for example: *istoratio* – 'narrative' pieces, depicting historical, religious, or genre scenes (*Fig. 2*: 1–3); *alla porcellana* – inspired by Chinese porcelain (*Fig. 2*: 7–8); *candiane* – resembling ceramics from Iznik (*Fig. 2*: 9) (*Melegati 1997*, 20–49; *Benini et al. 1998*, 21–45, 60–68; *Sani 2012*, 43–111; *Wilson 2016*, 71–317, 361). These vessels were not only aesthetically appealing, but also didactic, conveying edifying or moralising narratives (*Sani 2012*, 115–151). They became an integral element of elite culture (*Campbell 2021*, 21–23). At the same time, numerous maiolica vessels in vernacular styles were also produced – simpler, primarily utilitarian items, such as apothecary jars (*albarelli*) (*Fig. 2*: 6).

Over time (from the first half of the 17th century), under the influence of imports from the Far East, alongside the characteristic polychrome and often overly ornate decoration, a more restrained colour palette and simpler forms began to appear. Among these were wares known as *bianchi* (with white glaze developed in Faenza in the mid-16th century), featuring decorations in the *compendiario* (sketch-like) style, executed in blue and yellow (e.g. *Benini et al. 1998*, 294–295; *Sani 2012*, 73) (*Fig. 2*: 10–11). These compositions reflect efforts, particularly in regions that had recently led in ceramic production, to respond to shifting aesthetic trends and consumer expectations by adapting workshop practices and product ranges accordingly. It can be seen as a pattern of innovation and diffusion (see *Orton 1985*). During this period, however, the overall quality of maiolica production declined: decorative motifs were increasingly repeated in a formulaic manner, and creative inspiration diminished (e.g. *Szetela 1969a*, 23).

Vessels of the analysed types, originally produced in Mediterranean countries, were also manufactured from the 16th century onwards in the Netherlands – including in Antwerp, and later in Amsterdam, Haarlem, Middelburg, and Utrecht – as well as in other regions such as England and France. This production was initiated by immigrant artisans from Italy or Spain and was continued by subsequent generations of skilled craftsmen (e.g. *Hume 2001*, 367–368; *Kowalski 2018*, 12–13). The earliest objects made in Central Europe using techniques modelled on maiolica originate from German-speaking regions and date to the 1520s (*Glaser 2021*, 74–76). Ceramic workshops established north of the Alps in the 17th century also operated initially under strong Italian influence, with their wares closely imitating the Mediterranean prototypes. Over time, however, the quality of production declined, and the products lost much of the creativity characteristic of earlier phases. As

traditional maiolica came to be seen as outdated, producers began to refresh their offer by modifying and simplifying decorative schemes, adapting them to contemporary national tastes. These adaptations included the incorporation of motifs drawn from local painting traditions, popular literature, contemporary printed landscapes, family coats of arms, medallions, and emblems. This transformation coincided with the growing influence of Oriental styles, particularly after the mid-17th century (e.g. *Benini et al. 1998*, 88–99; *Lahaussois 2008*, 18–21, 30–37).

Faience

In ceramic production, the Netherlands played a role in the period from the first half of the 17th century to the early 18th century comparable to that of Italy in the 16th century. The Delft centre achieved particular renown, with its faience representing a refined and technically improved continuation of the maiolica tradition. The peak of technical and artistic development in these workshops occurred between 1680 and 1700. A distinctive hallmark of Delftware was its rich ornamentation imitating Chinese and Japanese porcelain[2] – particularly motifs from the Ming dynasty, including the Wanli (1573–1619) and Kangxi (1662–1722) periods (e.g. *Piątkiewicz-Dereniowa 1996*, 16–17; *Kilarska 2003*, 10–12; *van Dam 2004*; *Kowalski 2018*, 19). Such wares were even referred to as Dutch porcelain (e.g. *Chrościcki 1989*, 158; *van Dam 2004*, 18–21, 30–31; *Frontczak 2009*, 70; see also *Lahaussois 2008*, 13–15, 46–49) (*Fig. 3*).

The development of local ceramic production was stimulated by competition from these fragile, high-quality imports that began arriving in large quantities in the United Provinces aboard Dutch East India Company ships from the early 17th century (e.g. *Piątkiewicz-Dereniowa 1996*, 10; *Kilarska 2003*, 11, 13; *van Dam 2004*, 11). As a result, Chinese porcelain had a major impact on European material culture and products of the burgeoning European ceramics industry, which replicated porcelain forms and decorations, and attempted to produce porcelain bodies (e.g. *Barker – Majewski 2006*, 223). This influx prompted changes in both manufacturing techniques and the quality of products crafted in local (here: Dutch) pottery workshops. New types of wares appeared, characterised by thinner walls, tin-glazed surfaces on both sides, new vessel forms, and the introduction of innovative decorative styles. These were often based on monochrome designs – most notably cobalt blue painting on a white background (*van Dam 2004*, 11–17; *Kowalski 2018*, 15–17).

Oriental patterns were both imitated and reinterpreted, and when combined with local decorative traditions, they achieved an excellent synthesis in Delftware. Most of the motifs aimed to replicate Chinese designs, which carried specific meanings and symbolic value. European potters drew inspiration from these originals, but their limited understanding of the underlying symbolism often led to inaccurate reproductions – some motifs were altered or transformed into entirely different designs (see *Casimiro 2006*, 116; *Bartels 2016*, 402). Foreign elements were blended with European aesthetic preferences and details drawn from familiar, local contexts, resulting in a hybrid set of motifs that merged two distinct cultural

[2] Portuguese faience also followed this trend (e.g. *Casimiro 2006*).

Fig. 3A. Delft faience from the 17th – first half of the 18th century. Selected vessels from the collection of The Metropolitan Museum of Art in New York, the Rijksmuseum in Amsterdam, and the National Museum in Krakow (Public domain; *The MET 2025*: Object Nos. 30.86.3 (1), 1994.218a-c (9), 2014.712.3 (12); *Rijks 2025*: Object Nos. BK-1972-78 (8), BK-NM-8242 (11); *MNK 2025*: Inv. Nos. MNK IV-C-3721 (2), MNK IV-C-1208 (3), MNK IV-C-3734/1-2 (4), MNK IV-C-3738/a-b (5), MNK IV-C-3726 (6), MNK IV-C-1216 (7), MNK IV-C-1218 (10); computer processing M. Bis and W. Bis).

Fig. 3B. Delft faience from the 17th – first half of the 18th century. Selected vessels from the collection of The Metropolitan Museum of Art in New York, the Rijksmuseum in Amsterdam, and the National Museum in Krakow (Public domain; *The MET 2025*: Object Nos. 30.86.3 (1), 1994.218a-c (9), 2014.712.3 (12); *Rijks 2025*: Object Nos. BK-1972-78 (8), BK-NM-8242 (11); *MNK 2025*: Inv. Nos. MNK IV-C-3721 (2), MNK IV-C-1208 (3), MNK IV-C-3734/1-2 (4), MNK IV-C-3738/a-b (5), MNK IV-C-3726 (6), MNK IV-C-1216 (7), MNK IV-C-1218 (10); computer processing M. Bis and W. Bis).

Fig. 4. Delftware from England (3–6), France (2), and Germany (1) from c. 1650–1750. Selected vessels from the collection of The Metropolitan Museum of Art in New York (Public domain; *The MET 2025*: Object Nos. 1995.268.6 (1), 17.190.1779 (2), 38.73.5 (3), 45.12.10 (4), 37.13.3 (5), 41.194.15 (6); computer processing M. Bis and W. Bis).

worlds (*Melegati 1997*, 65; *van Dam 2004*). The Delft product range consisted primarily of tableware, including plates (*Fig. 3*: 1–3, 8, 10–12), bowls, and jugs (*Fig. 3*: 7). Vases (*Fig. 3*: 4–6) and flower holders (*Fig. 3*: 9) were also a notable feature of the Delftware assortment. This was further expanded by the production of apothecary jars and ceramic accessories (e.g. *Chrościcki 1989*, 159–160; *Benini et al. 1998*, 107; *van Dam 2004*, 77–101, figs. 35–55). The variety of forms and decorative schemes, combined with strong craftsmanship, consistent quality, and a lower price compared to Far Eastern porcelain, enabled Delftware to flood the European market after 1650 (e.g. *Melegati 1997*, 78–79; *Benini et al. 1998*, 96–97; *Kowalski 2013*). At its peak, the production of Delft manufactories was widely imitated by almost every European pottery centre operating from the second half of the 17th to the first half of the 18th century (cf. *Frontczak 2009*, 146–153; *Dawson 2010*; *Glaser 2021*) (*Fig. 4*). In Poland, their stylistic influence is evident in the output of two 18th-century *farfurnie* (faience manufactories): Belweder and the Bielino workshop, founded by Bernardi and Wolff (e.g. *Chojnacka 1981*, 26–44; *Chrościcki 1989*, 162). In the Netherlands, in addition to Delft, faience production – including wall tiles (fleis) – also took place in other centres such as Haarlem, Harlingen, Makkum, and Rotterdam (e.g. *Fries Aardewerk 2007*; *Frontczak 2009*, 70; *Ostkamp 2013*).

The popularity of Dutch wares throughout the 17th century was part of a broader cultural shift toward simplicity. As a neutral colour, blue complemented the sober fashions of the time (*van Dam 2004*, 17). These blue-and-white objects became both a reflection and a vehicle of the fashion for *chinoiserie*, which dominated the decorative arts well into the following century (e.g. *Benini et al. 1998*, 97). This phenomenon illustrates a marked change in taste and a growing appreciation for exotic tableware during that period. Another significant shift occurred in the 18th century, when potters resumed working with a broader palette of colours, including red, yellow, and green. This development responded to a new phase in ceramic production, influenced by the emergence and popularity of coloured porcelain.

The decline in the demand for faience and the eventual collapse of the Delft centre were driven by the invention and widespread production of European porcelain beginning in the first half of the 18th century. This development, along with the emergence of numerous faience and porcelain manufactories – including English factories supplying affordable products – created strong competition for Delftware. Another significant factor was the transformation in the applied arts influenced by the rise of Neoclassicism. This stylistic shift began in the second half of the 18th century and continued into the 19th century (see *Chrościcki 1989*, 161–162; *van Dam 2004*).

Slipware

The production of slipware is recorded in Europe between the second half of the 16th century and the 18th century, with the regional continuation in the folk pottery occurring until the 20th century. It peaked at the end of the 16th century and in the first half of the 17th century (*Stephan 1987*). This type of pottery represents a distinctive phenomenon due to its widespread presence across the continent during that period. Compared to the maiolica and faience discussed above, slipware was generally of lower quality.

Slipware is defined as slip-decorated, lead-glazed earthenware (*Fig. 5–7*). The use of slip (engobe) – a refined clay suspension – is fundamental to this ceramic type. Slip can

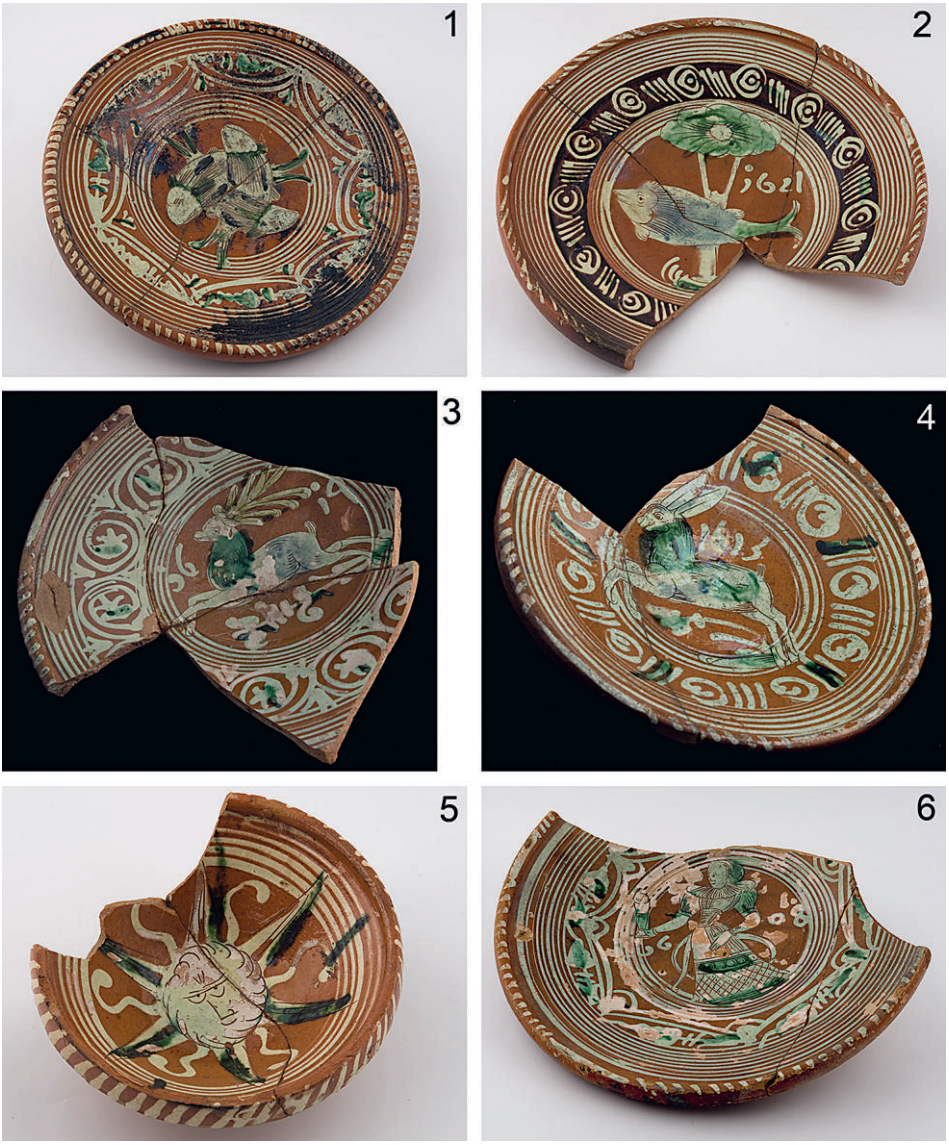

Fig. 5A. Werra- (1–6) and Weser-type (7–12) slipware from the second half of the 16th–17th century. Selected vessels from the collection of the Museum Rotterdam (Public domain; *MR 2025*: Inv. Nos. 19272 (1), 19274 (2), 19220 (3), 19241 (4), 19262 (5), 19302 (6), 6873 (7), 6659 (8), 23676 (9), 14005-47 (10), 23677 (11), 7865 (12); computer processing M. Bis and W. Bis).

serve both as a surface coating and as a material for decorative painting. It is typically composed of fine clay that fires to a different colour than the vessel's fabric. Slip varies in consistency and methods of application. While designs were most often painted, decoration could also be created by cutting through an overlying slip layer to reveal the colour of the clay body beneath – a technique known as sgraffito – or by using methods such as

Fig. 5B. Werra- (1–6) and Weser-type (7–12) slipware from the second half of the 16th–17th century. Selected vessels from the collection of the Museum Rotterdam (Public domain; *MR 2025*: Inv. Nos. 19272 (1), 19274 (2), 19220 (3), 19241 (4), 19262 (5), 19302 (6), 6873 (7), 6659 (8), 23676 (9), 14005-47 (10), 23677 (11), 7865 (12); computer processing M. Bis and W. Bis).

chattering. The glaze applied to the vessel surface is colourless, transparent, glossy, and composed primarily of lead oxide (*Stephan 1987*; *MPRG 1998*, chapters 12.5–12.6; *Hume 2001*, 371; *Orton – Hughes 2013*, 86–88; *de Groot 2018*, 3–4). It forms a thin layer, usually applied only to the decorated side of the vessel. Production relied on local (usually

ferruginous) clays and natural pigments. The analysed pottery was predominantly wheel-thrown. The range of forms is diverse but primarily includes tableware such as bowls and plates in various sizes – open forms chosen to display the decoration – alongside cups, tankards, jugs, small pots, and lids (e.g. *Stephan 1987*, 268–304; *Gaimster 2006*, 85–87).

Slipware is primarily distinguished by its ornamentation, arranged in various compositions on the vessel walls. The basic repertoire of motifs includes floral designs – typically highly stylised flowers and leaves – arranged individually, in threads, or as bouquets, alongside geometric patterns such as straight, wavy, or zigzag lines, circles, semicircles, dots, rays, lattices, etc. Occasionally, figurative elements also appear, including animals of various species, fantastic creatures, and human figures, as well as, less frequently, dates, inscriptions, or symbols placed in the centre of the composition. Additional decorative techniques included irregularly splashed dots and marbled effects, which formed distinct pattern types. The common colour palette was relatively limited, featuring white, yellow, orange, red, green, and brown, supplemented by a variety of tonal nuances. Slipware decoration relied on contrasting the pattern with the vessel surface–typically light slip (either a full coating or painted design) set against a dark background, such as a bisque-fired reddish-brown body or coloured slip washes (see e.g. *Stephan 1987*, 268–304; *Bis 2025*, 52).

Some of the most important regions in Europe for slipware production were located in present-day Germany, with the best-known examples being Werraware (*Fig. 5*: 1–6) and Weserware (*Fig. 5*: 7–12). The production of these vessels in larger quantities spanned several decades, starting in the 1560s and coming to a halt with the outbreak of the Thirty Years' War. Weserware was manufactured in the area between the Weser and Leine rivers, while Werraware was produced in Hesse, across several centres of manufacture – such as Dörpe, Höxter, and Völksen for Weserware, and Grossalmerode, Hannoversch Münden, and Wanfried for Werraware. The two groups of vessels are distinguishable by the type of slip used for covering and decoration, as well as by their iconography. Werraware is notable for its elaborate figurative sgraffito designs, whereas Weserware is characterised by more restrained, geometric ornamentation (*Stephan 1987*, 85–110, 274–280, 304; *Bartels 1999*, 171–178; *Demuth 2001*, 75–78; *Gaimster 2006*, 84–88; *Dąbal 2013*, 124–133; *de Groot 2018*, 3–6).

The production of these centres was, in many respects, revolutionary. It made maximum use of the potential inherent in commonly available raw materials, well-established manufacturing techniques, basic vessel forms, and simple decorative motifs – elements which were creatively modified and refined. The value of these ceramics lay in their functionality and visual appeal. This effect was achieved through the skilful preparation of ceramic bodies and forming techniques, careful surface finishing, decoration adapted to the shape and structure of each vessel, and the inventive composition of ornamentation using modest elements combined into striking colour schemes. As a result, their attractive appearance and high quality inspired manufacturers in other regions and production centres, serving as influential models of know-how (see *Hurst – Gaimster 2005*, 270–279; *Gaimster 2006*, 84–87; *de Groot 2018*, 9–14). Both ceramic groups were produced in large quantities and widely distributed across northern and north-western Europe (e.g. *de Groot 2018*, 15–20), including present-day Poland (see *Bis 2021*, 53, with further references).

Through archaeological discoveries, many other slipware production sites have been identified across northern and central Europe, including in the Czech Republic (e.g. *Blažková 2019*; *Matějková 2019*), Denmark (e.g. *Knudsen et al. 2023*), France and the Nether-

lands (e.g. *Gaimster 1991*), northern Germany (e.g. *Gaimster 2006*, 84–88; *Schäfer 2007*; *Kröll 2012*; *Witte 2014*), Sweden (e.g. *Johansson 2007*), and Switzerland (e.g. *Heege 2019*, 96). The spread of these techniques in Scandinavia and generally along the Baltic coast was largely the result of German influence and the migration of German potters (*Stephan 1987*, 304–305).

These products share a number of distinguishing features, notably ornamental techniques based on the use of slip, and a similar colour palette. Among other unifying traits are the homogeneous range of raw materials, comparable production quality, and a standardised basic assortment. Nevertheless, as evidenced by published archaeological finds and museum collections, significant differences also exist – particularly in the frequency of specific vessel forms and the layout and execution of decorative schemes. These variations are generally associated with particular workshops or regional production centres (see *Stephan 1987*).

The influence of these ceramic traditions on pottery production in Europe was long-lasting, and their impact can be seen in the types of earthenware discussed below.

The case of slipware, Pomeranian faience, and Stettinware from Poland

Three notable groups of ceramics that emerged during the Early Modern period in the territory of present-day Poland are slipware, so-called Pomeranian faience, and Stettinware. In my opinion, these wares serve as illustrative examples of the continuation process within regional pottery production.

Slipware

Beginning with this type of earthenware – representing the category of earlier origin. A detailed analysis of the quality of slipware production within the territory of present-day Poland, based on archaeological finds, remains difficult due to the limited state of research and publication, as well as the fragmentary condition of most surviving vessels. Nevertheless, a review of the available literature suggests that these wares display the manufacturing standards outlined above. Their chronology also corresponds to the pan-European time framework, with production taking place from the second half of the 16th century through the 18th century. The tradition continued locally in folk pottery until the 20th century (e.g. *Fryś-Pietraszkowa 1970*).

Based on archaeological remains, it can be estimated that there were at least a dozen slipware production sites in the lands of present-day Poland in the 16th–18th century: Brzeg, Bydgoszcz, Gdańsk, Jarosław, Kraków, Lublin, Łańcut, Miechocin, Myślibórz, Nysa, Poznań, Recz, Rzeszów, Śmigiel, Warsaw, and Wrocław (*Fig. 6–7*). This is evidenced by the relics of pottery kilns and/or pottery waste discovered at these locations, or is considered likely based on numerous finds of this type of earthenware in their vicinity (*Bis 2021*, 53–55; *2025*, 52, with further references). In several cases – specifically in the workshops operating in Bydgoszcz, Kraków, Myślibórz, Poznań, Recz, Śmigiel, and Warsaw – it is clearly documented that slipware constituted a secondary branch of broader ceramic production (*Bis 2025*, 55). Given the evident craftsmanship of these vessels, it

Fig. 6A. Slipware from Miechocin from the 17th–18th century: 1 – on the exhibition at the Historical Museum of the City of Tarnobrzeg (photo by M. Bis); 2–4 – reconstruction of selected decoration; 5–6 – dishes found in Miechocin; 7 – dish found in Łańcut (after *Szetela-Zauchowa 1994*, fig. 86: 2–4; fig. 87: 1, 3–4; computer processing M. Bis and W. Bis).

appears that there were no material or technological constraints that would have precluded their production in other workshops as well. The primary impetus was likely market demand, with the potters' ingenuity and manual skill serving as key enabling factors.

Most of the confirmed or potential production centres were concentrated along the course of the Vistula River – the principal conduit for the transmission of goods and ideas in the former Polish-Lithuanian Commonwealth – primarily in the southern and central parts of the country. It is worth noting that these regions had long maintained distinct traditions,

Fig. 6B. Slipware from Miechocin from the 17th–18th century: 1 – on the exhibition at the Historical Museum of the City of Tarnobrzeg (photo by M. Bis); 2–4 – reconstruction of selected decoration; 5–6 – dishes found in Miechocin; 7 – dish found in Łańcut (after *Szetela-Zauchowa 1994*, fig. 86: 2–4; fig. 87: 1, 3–4; computer processing M. Bis and W. Bis).

differing from those of towns in the north and west. During this period, workshops in Western Pomerania and Silesia were located within the borders of neighbouring states and were primarily influenced by German cultural traditions (cf. *Stephan 1987*, 303).

Among the known production centres, the one in Miechocin (Lesser Poland) stands out (*Fig. 6*). Products from its twelve excavated workshops – including both finished vessels and post-production waste – exhibit a range of ornamental compositions and levels of craftsmanship over the course of the centre's activity, which spanned from the late 16th century to the end of the 18th century. The decoration evolved from highly precise, multi-threaded polychrome patterns on a white slip background to simpler, typically two-colour designs. The motifs reflect a regional adaptation that combined local ceramic traditions with Western influences (*Szetela 1969a*; *1969b*, 95–100; *Stephan 1987*, 304; *Szetela-Zauchowa 1994*).

Fig. 7A. Miechocin-type slipware from the 17th–18th century: 1–6 – dishes found in Gdańsk (after *Oniszczuk 2013b*: 93–95, Catalogue Nos. 443 (1), 442 (2), 438 (3), 431 (4), 430 (5), 425 (6)); 7–13 – dishes found in Warsaw (drawing by U. Skwara-Niecuła; after *Meyza 2017*, 20–23, pl. 1:1 (7); 2:3 (8); 2:7 (9); 4:4 (10); 3:7 (11); 3:4 (12); 4:2 (13); computer processing M. Bis and W. Bis).

The Miechocin material is documented best among Polish slipware finds, and knowledge about it is already well established within the scholarly community. As such, it serves as a key reference point for identifying and analysing similar finds from other sites across Poland (see *Fig. 7*).

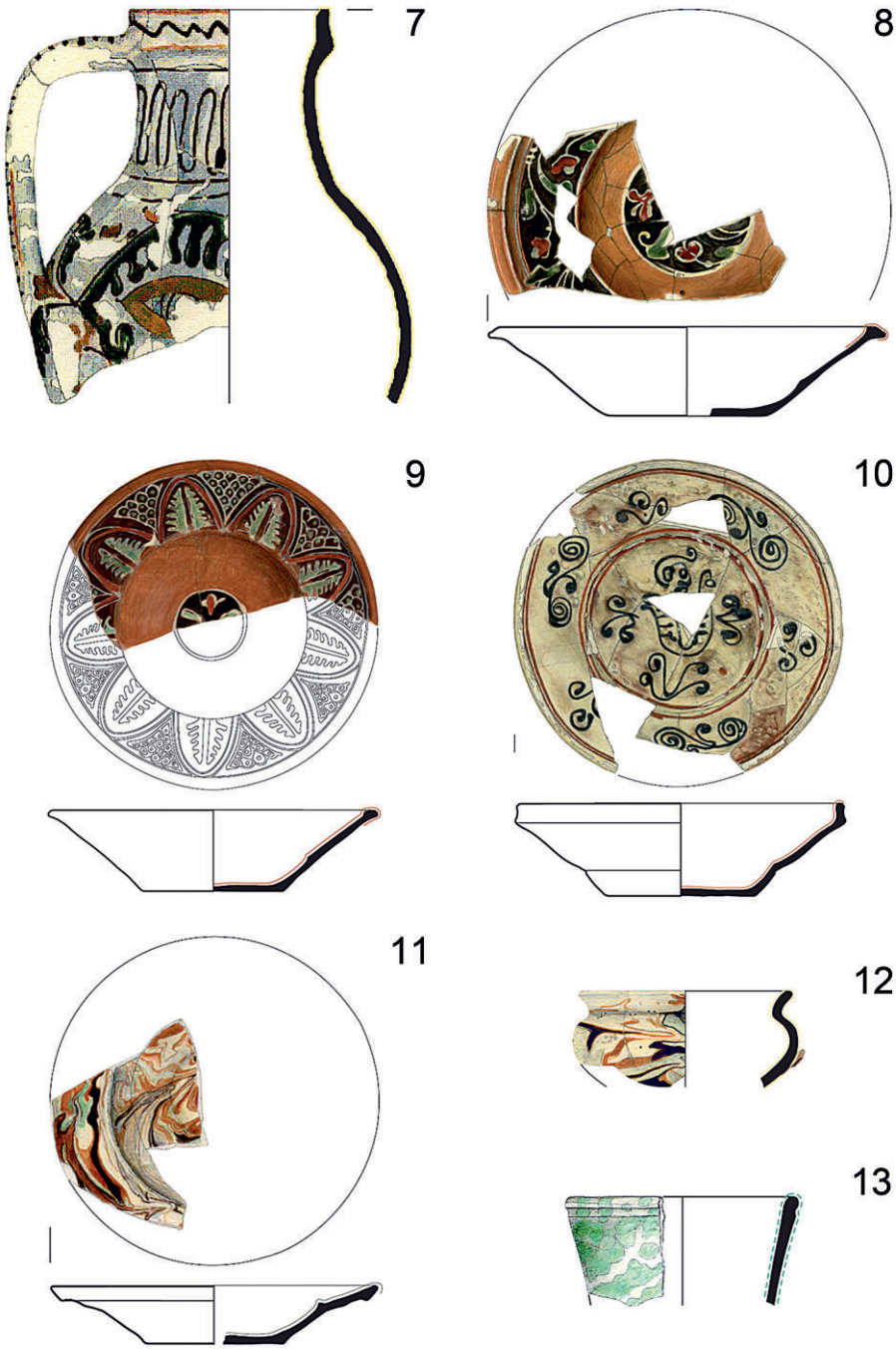

Fig. 7B. Miechocin-type slipware from the 17th–18th century: 1–6 – dishes found in Gdańsk (after *Oniszczuk 2013b*: 93–95, Catalogue Nos. 443 (1), 442 (2), 438 (3), 431 (4), 430 (5), 425 (6)); 7–13 – dishes found in Warsaw (drawing by U. Skwara-Niecuła; after *Meyza 2017*, 20–23, pl. 1:1 (7); 2:3 (8); 2:7 (9); 4:4 (10); 3:7 (11); 3:4 (12); 4:2 (13); computer processing M. Bis and W. Bis).

Equally important is the discovery of the workshop in Myślibórz (in Western Pomerania, in former Brandenburg), which operated from the late 16th to the early 18th century. Its products are distinguished by the originality of their ornamentation, including the use of the chattering technique, vibrant colours, and a wide variety of forms (e.g. *Kałagate – Kościukiewicz 2004*; *Majewski 2019*, 206–209). These finds have not yet been thoroughly investigated or fully published. This observation also applies to the other workshops mentioned above, as well as to many existing collections of artefacts.

It can be observed that the features of vessels discovered at each of the recorded sites – particularly in terms of colour schemes and decorative motifs – exhibit general, and at times even striking, similarities. This suggests that some of the production centres may have functioned as regional leaders, exerting considerable influence on the development of slipware production in smaller neighbouring towns. For instance, Miechocin likely influenced pottery production in other centres of Lesser Poland, such as Jarosław, Łańcut, and Rzeszów (*Bis 2021*, 54). Poznań may have played a similar role for Śmigiel and broadly for the whole of Greater Poland, while Myślibórz appears to have affected centres in Western Pomerania and beyond. Verification of this hypothesis appears feasible through further comparative studies. In this context, archaeometric methods now offer significant potential for accurately determining the provenance of ceramic finds. The implementation of a comprehensive programme of such analyses for slipware discovered in Poland is an urgent research priority, as such studies have so far been conducted only sporadically (*Trąbska et al. 2019*).

The decline of slipware production was driven by its loss of status in the face of the growing availability of factory-made faience from the 17th century onwards, and, from the 18th century, of European porcelain. In domestic contexts, such ceramics were increasingly replaced in kitchens by metal utensils (*Fryś-Pietraszkowa 1970*, 77).

Pomeranian faience

Similar observations and conclusions may be drawn in relation to another type of post-medieval earthenware – so-called Pomeranian faience (*Fig. 8–9*). Its production began approximately a century later than that of slipware, most likely in the late 17th century, and continued into the early 19th century. It was concentrated in centres located in northern Poland, specifically in Gdańsk Pomerania (formerly Royal Prussia). In addition to Gdańsk, the region included Elbląg, Malbork, and smaller nearby localities such as Chełm (Stara Wieś), Frombork, Młynary, Pasłęk, and Tolkmicko (*Marcinkowski 2007*; *2009b*; *2011*). Within this category of ceramics, the output from the Elbląg region stands out for its better quality and value. Products from this centre are also the best documented and most thoroughly studied. However, earthenware similar in terms of technology and ornamentation is found in various parts of Poland (conclusion based on the review of literature). It does not necessarily originate exclusively from the coast of the Baltic Sea. The average quality of these vessels does not preclude their production in other regions (e.g. in Mazovia), in numerous pottery workshops. Nonetheless, in Polish publications, pottery of this tape is universally described as ‘Pomeranian faience’. This ceramic tradition was continued by folk potters in the 19th and 20th centuries in the other centres (*Kwaśniewska 2006*, 63–97).

This group of Early Modern ceramics is characterised by a reddish body, resulting from the use of ferruginous clays, and a surface coated with lead-tin glaze – typically applied

only to the decorated side. The vessels are adorned with schematic ornaments painted in shades of blue, green, yellow, and purple-brown on a light background, most often white with a slightly bluish or greenish tint. Although the patterns were polychrome, the prominence of specific colours varied over time (*Marcinkowski 2009b*, 44–45). These vessels were intended primarily as decorative items for interior display, as indicated by a pierced base for suspension and the absence of glaze on the reverse side (*Kilarska 2003*, 147).

The established range of forms is dominated by plates and bowls of varying depth. Also produced were jugs of different heights and capacities – with or without tubular spouts – as well as vases, small bowls, and tankards (*Marcinkowski 2009b*, 44; *2011*, 39–52). A distinguishing feature of Pomeranian faience was the presence of a ring at the base and painted decoration depicting stylised plants (*Fig. 8*: 1–7, 9–10; *Fig. 9*: 3, 4, 12) and geometric patterns (*Fig. 9*: 9), sometimes accompanied by human figures (*Fig. 9*: 7–11), birds (*Fig. 8*: 8–9, 11–12), dates (*Fig. 9*: 5), architecture (*Fig. 9*: 1–2) or landscapes (*Fig. 9*: 3, 6), heraldic motifs, or inscriptions (*Marcinkowski 2011*, 53–96). The similar arrangement and colour scheme of the ornamentation found on various examples may suggest a common provenance (*Marcinkowski 2009b*, 45). The quality of craftsmanship varied over time (see below), but was generally average, as evidenced by production flaws visible on many pieces, such as cracked glaze, uneven application, spilled pigment, as well as chipping and craquelure in the painted decoration (*Marcinkowski 2011*, 102–105).

Stettinware

Stettinware (German: *Stettiner Ware*) is the conventional term used to describe a type of pottery characteristic of the broader region of Western Pomerania, which was exported via the port of Szczecin. These wares were also produced in Denmark, southern Sweden, Mecklenburg, and Schleswig-Holstein from the early 18th century until the end of the 19th century. As such, they represent the most recent development among the ceramic groups discussed here – particularly as production in the Szczecin area likely began only in the second half of the 18th century and continued into the early 19th century. The periodisation of this pottery tradition, despite more than a century having passed since the foundational study on the subject, remains largely valid (*Kwiatkowski 2010*, 40, footnote 5; 43; *Szeremeta 2022*, 100; after *Secker 1915*). Known production centres along the southern Baltic coast include Greiffenberg, Greifswald, Lübeck, and Stralsund, as well as sites within the borders of present-day Poland, such as Chociwle, Czaplinek, Gryfino, Koszalin, Krosno Odrzańskie, Police, Słupsk, and Trzebiatów (e.g. *Karwowska 2010*, 17, 20; *Kwiatkowski 2010*, 42; *Szeremeta 2022*, 99–100; see also *Möller 1999*, 4–12).

This was a distinctive and individual type of Pomeranian ware combining simple, utilitarian forms with a limited range of decorative motifs. Technologically, it belonged to the category of faience, featuring a porous body typically in shades of yellow-brown or yellow-grey. It can be thought that, compared with the faience from Gdańsk Pomerania, Stettinware was of comparable quality, i.e. made of similar ceramic fabrics, but with slightly different colours, equally fairly well fired. A characteristic feature of these vessels was the absence of a foot ring. The plain ceramic core was concealed beneath a coating of white lead-tin glaze. The decoration was dominated by compositions of stylised plant motifs (*Fig. 10*: 1–8) – either as single elements or arranged in tendrils, branches, or bouquets – often combined with other elements such as linear, architectural (*Fig. 10*: 10, 12), or

Fig. 8A. Pomeranian faience from Elbląg from the 18th century. Selected vessels from the collection of the Archaeological and Historical Museum in Elbląg (photo by A. Czuba, M. Marcinkowski, and L. Okoński; after *Marcinkowski 2011*, Catalogue Nos. 29 (1), 119 (2), 21 (3), 133 (4), 211 (5), 250 (6), 68 (7), 81 (8), 32 (9), 22 (10), 41 (11), 189 (12); computer processing M. Bis and W. Bis).

Fig. 8B. Pomeranian faience from Elbląg from the 18th century. Selected vessels from the collection of the Archaeological and Historical Museum in Elbląg (photo by A. Czuba, M. Marcinkowski, and L. Okoński; after *Marcinkowski 2011*, Catalogue Nos. 29 (1), 119 (2), 21 (3), 133 (4), 211 (5), 250 (6), 68 (7), 81 (8), 32 (9), 22 (10), 41 (11), 189 (12); computer processing M. Bis and W. Bis).

Fig. 9A. Pomeranian faience from Elbląg from the 18th century. Selected vessels from the collection of the Archaeological and Historical Museum in Elbląg (photo by A. Czuba, M. Marcinkowski, and L. Okoński; after *Marcinkowski 2011*, Catalogue Nos. 213 (1), 79 (2), 62 (3), 223 (4), 33 (5), 66 (6), 166 (7), 95 (8), 20 (9), 252 (10), 138 (11), 209 (12); computer processing M. Bis and W. Bis).

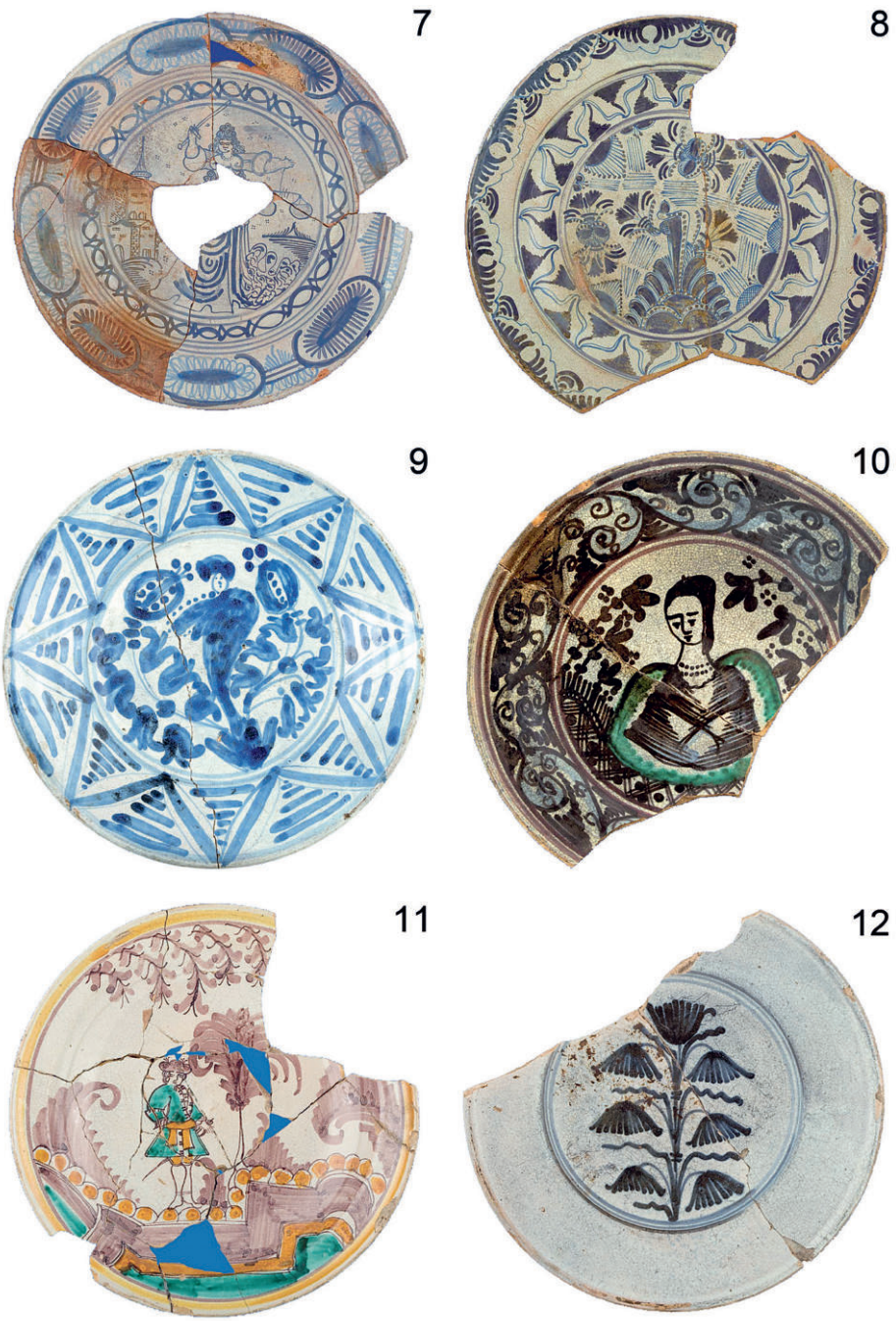

Fig. 9B. Pomeranian faience from Elbląg from the 18th century. Selected vessels from the collection of the Archaeological and Historical Museum in Elbląg (photo by A. Czuba, M. Marcinkowski, and L. Okoński; after *Marcinkowski 2011*, Catalogue Nos. 213 (1), 79 (2), 62 (3), 223 (4), 33 (5), 66 (6), 166 (7), 95 (8), 20 (9), 252 (10), 138 (11), 209 (12); computer processing M. Bis and W. Bis).

Fig. 10A. Stettinware (*Stettiner Ware*) from the 18th – beginning of the 19th century. Selected vessels from the collection of the Archaeological and Historical Museum in Stargard (2–6, 8) (photo by M. Szeremeta; after *Szeremeta 2022*, 106, fig 6: 1; 108–109, figs. 8: 1, 9:1–2; 116, fig. 14: 1) and the National Museum in Stettin (Public domain; *MNS 2025*: Inv. Nos. MNS/E/5970 (1), MNS/E/606 (7), MNS/E/6348 (9), MNS/E/6350 (10), MNS/E/568 (11), MNS/E/6349 (12); computer processing M. Bis and W. Bis).

Fig. 10B. Stettinware (*Stettiner Ware*) from the 18th – beginning of the 19th century. Selected vessels from the collection of the Archaeological and Historical Museum in Stargard (2–6, 8) (photo by M. Szeremeta; after *Szeremeta 2022*, 106, fig 6: 1; 108–109, figs. 8: 1, 9:1–2; 116, fig. 14: 1) and the National Museum in Stettin (Public domain; *MNS 2025*: Inv. Nos. MNS/E/5970 (1), MNS/E/606 (7), MNS/E/6348 (9), MNS/E/6350 (10), MNS/E/568 (11), MNS/E/6349 (12); computer processing M. Bis and W. Bis).

cartouche-like designs. The ceramic repertoire consisted primarily of plates and bowls in various sizes and depths, slender handled pots, lids, and tankards. In terms of ornamentation, the commonly used blue dye was gradually supplemented by turquoise, green, yellow, and purple-brown (*Möller 1999*, 4–8, 14, fig. 1; *Karwowska 2010*, 19–20; *Kwiatkowski 2010*, 38–40; *Szeremeta 2022*, 104–115). Archaeological finds from Stargard show that most of these vessels were carelessly made: they are crooked, have a thick body, and the quality of paint and decoration is poor (*Kwiatkowski 2010*, 41).

The decline of this pottery tradition was driven by the growing demand for cheaper porcelain (from the mid-18th century), the narrowing of the market to a primarily rural clientele, and eventually by the advent of industrial production in the early 20th century (*Karwowska 2010*, 18).

Discussion: from determinants and influences to their dissemination in domestic ceramic production

Influences and adaptations

The origins of the discussed ceramic groups within the territory of present-day Poland remain uncertain and have yet to be definitively explained. Based on technological features and decorative elements, various factors have been identified as potential influences shaping their production. It appears that these developments resulted from the convergence of multiple impulses, emerging through simultaneous, multidirectional interactions triggered by the broader socio-economic conditions and cultural transformations occurring between the 16th and 19th centuries (as outlined above). These changes were driven in part by technological advancements, which enabled the creation of wares with previously unattainable forms and ornamentation. A key stimulus came from the influence of foreign ceramics – originating both from distant Asia and nearby European regions – which were of higher quality and often introduced stylistic features unfamiliar to local production. Their visual appeal created consumer demand, which in turn influenced patterns of trade and local manufacturing practices.

In the case of slipware, two principal directions of influence can be identified – one originating from the south, the other from the west (*Bis 2025*). For vessels featuring a white background and richly polychrome decoration, close analogies have been drawn with 16th-century Italian maiolica, particularly from centres such as Deruta, Gubbio, and Faenza. This connection has been confirmed for certain finds from Łańcut, Rzeszów, and Miechocin (see *Szetela 1969a*, 24–33, figs. 90–96, 112–121; *Fryś-Pietraszkowa 1970*, 76), in the latter case specifically for vessels produced during the initial and peak phases of the workshop's activity, i.e. from the late 16th to the mid-17th century. The affinity lies in the range, types, and compositional layout of decorative motifs, while the differences are evident in their modification and schematisation. The designs tend to be graphic and restrained – still representational, but lacking the refinement of their Italian prototypes (*Szetela 1969a*, 25, 28). Typical maiolica motifs such as heraldic emblems, grotesques, and *istoratio* scenes were not adopted. Human figures appear only occasionally (see *Fig. 6*: 7). Animals (e.g. birds or deer) and fantastical creatures are likewise rare. Instead, the ornamental schemes incorporated indigenous elements (*Szetela 1969a*, 24, 30–31). Designs

inspired by the plant world came to dominate, particularly on light slip coatings (see *Fig. 6*: 1, 4–6; *Fig. 7*: 1, 2, 4, 7). These included rosettes, petals, and leaves of various forms and species (e.g. oak, vine), either arranged individually, in bouquets, or as floral bunches, along with palmettes, bulbs, acanthus, and laurel wreaths. These were frequently accompanied by geometric ornaments (see *Fig. 6*: 2–3) – typically set against dark backgrounds – such as dots, spirals, zigzags, concentric circles, rays, knots, and wavy bands (*Szetela-Zauchowa 1994*, 48–65, figs. 4–81). The motifs were arranged in a variety of compositions: radially, in segments, in loose compositions, or in the form of so-called fish scale or floral spray patterns (*Szetela 1969a*, 13–19).

This gave rise to speculation that production may have been initiated by migrants from the aforementioned Italian centres, possibly arriving directly from the Apennine Peninsula (cf. *Szetela 1969b*, 80; *Fryś-Pietraszkowa 1970*, 76). Alternatively, the transmission of decorative models could have occurred via potters of Italian descent who migrated from neighbouring Moravia, where such traditions were already established. One such group may have been the Haban community. Although no written sources confirm this hypothesis, similarities between Haban pottery – in terms of ornamental layout and motif selection – and the decorative schemes found on slipware from Miechocin have been recognised and demonstrated (*Szetela 1969a*, 24–28; *Szetela-Zauchowa 1994*, 56). This type of ceramic was produced by Anabaptists (Protestant immigrants), who probably originated in the northern part of the Italian Peninsula or in Switzerland, South Germany, and Tyrol. They settled in the region of present-day southern Moravia (from 1526; the heyday of the Anabaptist community spans between 1565 and 1592). Due to re-Catholicisation, after 1620 most of them moved to Hungary, to neighbouring west Slovakia. Anabaptists brought to these territories progressive procedures, advanced technologies and production methods, which they continued to improve. They mastered all the important crafts, including ceramic production. Their wares developed based on the model of Italian maiolica, especially *bianchi di Faenza*, characterised by painted, polychrome decoration – albeit in a limited colour palette (typically blue, yellow, purple, and green) – applied over a white tin glaze, often outlined in a dark contour (as seen in maiolica and Miechocin products). In most cases, decoration was applied only on the front side of a vessel. Stylised floral motifs predominated, occasionally accompanied by initials, dates, craft emblems, monograms, or coats of arms. Over time, the range of motifs expanded (e.g. *Kalesný 1994*; *Pajer 2006*; *2011*; *Kalinová 2017*, 59–66; *Bis 2025*, 58, 59, fig. 7).

In Polish slipware, stylistic references to Italian originals are also evident in other decorative techniques. One such method is marbling, which was a standard decorative practice in Tuscan slipware production between 1550 and 1650. It was certainly employed in Pisa and in other towns along the Arno River, such as Montelupo and Pontorme (*Moore Valeri 2012*; see also *Meyza 2017*, 127–128). This ornamental effect was achieved by mixing liquid slip on the vessel's surface, resulting in flowing, smooth lines, as well as in spots and irregular blotches (*Rada 1993*, 151–153; *MPRG 1998*, chapter 13.2). Two marbling variants have been noted on red-bodied sherds: a monochrome version (in white) and a polychrome version combining white, red, black, and green (*Moore Valeri 2012*, 20–21, 25–26). The use of marbling has also been confirmed in Lombard pottery in the second half of the 16th century (*Stephan 1987*, 301). A similar decorative effect, executed in a comparable colour palette, appears on wares from Miechocin dated to the late 16th to mid-17th century (*Szetela 1969a*, 18; *Szetela-Zauchowa 1994*, 64). Marbling was used

either as the sole ornament on the vessel's surface or in combination with geometric patterns (see *Fig. 7*: 6, 11, 12).

Its version was splashing. This effect was created by splashing the liquid on the surface of a vessel and took the form of irregular spots, splashes or streaks (*MPRG 1998*, chapter 13.2). Typically, one pigment (green or brown) was applied over a light slip coating. This primitive method was used on the vessels from Miechocin from the 18th century (*Szetela-Zauchowa 1994*, 67) (see *Fig. 7*: 3, 13).

Another ornamental technique – sgraffito – may also trace its origins to Italy in an earlier period. This decorative tradition was developed in various Italian centres, notably in Tuscan workshops, including Pisa, from the 15th to the 17th century. The most common types were *a punta* and *a stecca* (in addition to *a fondo ribassato*). Incised patterns were filled with paints in several colours and then covered with a lead glaze. The underlying body remained yellowish or brown (e.g. *Giorgio 2019*, 15, 18–19, figs. 6–7). Other Italian centres known for sgraffito ware included Bologna, Cremona, Ferrara, Lodi, Padua, and Venice (*Stephan 1987*, 301). However, the dissemination of this technique in Early Modern ceramics across Central and Western Europe did not occur through maiolica, but rather through Werra-type slipware (cf. *Gaimster 1991*; *2006*, 36, 87; *Hurst – Gaimster 2005*; *de Groot 2018*). On the surfaces of these vessels, selected design elements were outlined through incision and then filled with colouring agents (see *Fig. 5*: 1–6). This method enhanced the three-dimensional effect of the motifs and increased their decorative impact. These wares introduced both technical and aesthetic innovations, making them attractive models for imitation. In the territory of present-day Poland, this style of decoration may have first appeared in pottery workshops in Silesia (see *Szajt 2021*, 76–77, 236–242, pls. 113–119; *Duma 2025*).

A similar function was served by the use of contour lines (outlines) around painted motifs across all of the discussed ceramic groups. This feature often resulted from transferring the design onto the vessel surface using a stencil (e.g. *van Dam 2004*, 44). It reflects both an attention to detail in the depiction of motifs and a deliberate effort to achieve a controlled and planned visual effect. On Italian maiolica, contour lines were typically brown or blue (e.g. *Sani 2012*; *Wilson 2016*), while on Dutch faience, they were usually blue or black – referred to as 'trek' (e.g. *Piątkiewicz-Dereniowa 1996*; *Kilarska 2003*; *van Dam 2004*; *Kowalski 2013*). Outlining was also a characteristic feature of slipware from Miechocin dating to the period up to the mid-17th century: brown contours were used for motifs painted on light backgrounds (see *Fig. 6*: 1, 4–7), while bright outlines were applied to elements painted on dark slip grounds (see *Fig. 6*: 2, 3) (*Szetela-Zauchowa 1994*, 63–66). Contour lines are also found around certain ornaments on Pomeranian faience from Elbląg produced in the first half of the 18th century (*Marcinkowski 2011*, 55–69) (*Fig. 8*: 1, 4; *Fig. 9*: 4, 7, 10–11). However, this feature disappears in wares with more schematic and carelessly executed motifs, such as Elbląg faience from the second half of the 18th to the mid-19th century (*Marcinkowski 2011*, 69–96), and in Stettinware from the latter half of the 19th century (*Karwowska 2010*, 28–37).

In the case of Miechocin, as well as of Jarosław and Rzeszów wares, influences from Eastern cultural traditions – particularly those associated with the Ottoman Empire (Turkey) – have also been noted in connection with İznik ceramics. This influence is believed to have been transmitted through the Armenian diaspora (*Supryn 1975*, 260–262; *Szetela-Zauchowa 1994*, 53). İznik pottery was produced from the last quarter of the 15th century

until the end of the 17th century, with the main output consisting of tableware and decorative tile wall panels. The defining features of this ceramic group include a white body and glaze, which provided an ideal base for vibrant designs in red, blue, and green. The decorative repertoire represented a creative synthesis of traditional Turkish motifs, especially arabesques, combined with stylistic elements derived from Chinese art. Floral motifs predominated, often covering the entire surface of the vessel, and were frequently accompanied by zoomorphic elements (mainly peacocks), as well as the 'dollar' pattern (e.g. *Iznik Pottery 2025*; *Kralj 2016*; *Bis 2025*, 58).

Another technique introduced in Early Modern times and documented in Polish slipware finds is chattering, although it originated from the opposite geographical direction. It was likely invented in Mecklenburg–Western Pomerania – possibly in Myślibórz – or in Sweden before 1600. The technique was subsequently adopted in various pottery traditions across the continent, including in the Lower Rhine region (c. 1660), the Probstei region in Schleswig-Holstein (c. 1706), and the German-speaking part of Switzerland (shortly before 1700). Chattering was achieved using a chattering tool or a roulette to incise concentric patterns – typically rows of small hollows – into the slip layer. It usually appeared on the interior surfaces of vessels and was often combined with slip-trailed colour designs, as well as incised or combed decoration (*MPRG 1998*, chapter 12.6; *Gaimster 2006*, 56; *Heege 2019*, 95–108).

Based on costume analysis and the depictions of men and women painted on vessels from Miechocin, additional possible sources of inspiration for these images have been identified – namely local visual culture, including contemporary woodcuts and painting. Certain details may have been drawn from the decorative arts, such as carving, embroidery, or manuscript illumination, including illustrated prints that gained popularity in Poland from the late 16th and early 17th century onwards (*Szetela 1969a*, 32–33; *1969b*, 82–86). A distinctive example of the inventiveness of local potters – likely influenced by the picaresque literature – can be seen in the inscriptions found on Miechocin vessels. In addition to male and female names, these include explanatory captions related to illustrations, as well as fragments of proverbs, sayings, and moral maxims (*Szetela 1969a*, 32–34, 40–41, figs. 145–149). To the author's knowledge, such inscriptions have not been identified on slipware from other sites in Poland. The most common inscriptions on similar wares are dates, which appear infrequently – for instance, on vessels produced in Silesian centres (see *Szajt 2021*, 76; *Duma 2025*, 42). Given the cultural connections of these regions, such practices may be regarded as imitative of Werra-type wares.

While slipware production was largely shaped by adoptions from Mediterranean pottery traditions, the other two ceramic groups – Pomeranian faience and Stettinware – belong to the broader phenomenon of Dutch faience production and its consumption across the Baltic Sea countries. They represent a regional repercussion of the popularity of this ware in Early Modern Europe, albeit produced far from its place of origin in the Low Countries and typically in localised, often lower-quality variants (see *Fig. 8–10*). The tonality – as well as the content and compositional layout of key motifs – clearly resonates with the Dutch prototypes, though these were frequently simplified or rearranged (e.g. *Przeździecka 1954*, 220–222; *Marcinkowski 2009b*, 42, 46–47; *Szeremeta 2025*). Such designs may also be interpreted as echoes of the fashionable *chinoiserie*. It is also possible that the transmission of decorative models occurred through faience produced in German-speaking countries, which themselves imitated Dutch wares (e.g. *Glaser 2021*) (see *Fig. 9*: 6, 11). These

ceramics evoked the exoticism of the Orient while in practice representing a hybrid amalgamation of disparate stylistic elements. The tendency to 'Europeanise' the decoration of Pomeranian faience became more pronounced around the mid-18th century (*Marcinkowski 2011*, 55–69).

Archaeological evidence indicates that certain motifs from Delftware were frequently copied and reinterpreted in Pomeranian faience. These likely included the elements most strongly associated – by both producers and consumers – with Far Eastern culture and with the prestigious Delft tradition. Among them were plates decorated with so-called 'Chinese motifs' (symbols of good fortune), vases of flowers, bouquets, figures of Chinese people in landscape settings, floral sprays, and stylised architectural elements (see *Fig. 8–9*). These central motifs were often accompanied by lambrequins and decorative floral or linear designs (cf. *Kilarska 2003*, 147–152; *Marcinkowski 2011*; *Kwiatkowski 2011*; *Szeremeta 2025*). Some of the decorative features and vivid colour combinations found on specific vessels also evoke associations with late 16th- and early 17th-century Dutch maiolica (cf. *Kowalski 2018*). The ceramic output of that region thus found in Pomerania both imitators (among local potters) and admirers (among the clientele).

Routes of transition

Ceramic wares from Mediterranean countries, Western and Northern Europe reached the territory of present-day Poland primarily by sea, entering through the ports of Gdańsk (e.g. *Kilarska 2003*, 18–24; *Marcinkowski – Pospieszna 2016*, 60–69) and Stettin (e.g. *Karwowska 2010*, 18) and were subsequently distributed inland – mainly via river routes.

In addition to the direct influx of imported goods, another important stimulus for the dissemination of stylistic and technological influences in Early Modern Polish pottery was the mobility of journeymen. Techniques, vessel forms, and decorative patterns observed during their travels or acquired in foreign workshops were gradually integrated into local craft traditions by returning native apprentices (*Kwapieniowa 1966*, 104–108; *Fryś-Pietraszkowa 1970*, 77).

At this stage of research, it is also possible to mark the participation of foreign pottery makers in shaping local manufacture. It seems that the crafting was started by newcomers, accommodating their needs, quality standards and designs. Nevertheless, local pottery tradition – raw materials, techniques, etc. – was at least partly incorporated into the new production (cf. *Hume 2001*; *van Oosten 2009*, 14). The involvement of non-local artisans (innovators) resulted in the manufacturing of higher-quality goods with eclectic features. It can be assumed that during the transition period, several following generations of potters worked to meet the changing expectations of the local market. As a result, foreign decorative elements tended to fade over time, giving way to simpler, more restrained forms. Richly decorated wares were progressively supplanted by plain dishes with modest ornamentation. This was related to the gradual economic decline of pottery (see below).

What motivated people to purchase and use these goods? In this context, the varied constraints and motivations of individuals are particularly significant (*Blake 1980*, 5–9; *Courtney 1997*, 104). The concept of the desire to acquire things may help explain such behaviour (*Jervis 2017*, 13–14). There was likely a widespread aspiration to emulate the lifestyle of the better-off by acquiring similar possessions – provided they were financially attainable (*Blake 1980*, 6). This was accompanied by a desire for distinction and for

owning aesthetically pleasing objects – a sentiment shared not only by elites but also by members of other social strata. Among the lower classes, consumption was shaped by the transformation of luxury items into everyday goods (*McCabe 2015*, 212). This process unfolded through the gradual replacement of expensive, high-quality, and sophisticated originals with more affordable and simpler versions (*Blondé 2002*, 299; *Cumberpatch 2003*). The production of the ceramic types discussed here fulfilled this specific functional and social niche within the regional market (cf. *Gaimster 2006*, 85), offering more accessible forms of tableware. These wares were intended for consumers with refined tastes but of only moderate means (e.g. *Marcinkowski 2009b*, 50–51).

According to a preliminary evaluation of Polish finds, it can be assumed that the quality and status of slipware, Pomeranian faience, and Stettinware were broadly comparable to one another – albeit significantly lower than those of more luxurious, and typically less frequently recovered, ceramic categories such as faience (whether imported or produced in domestic manufactories), as well as maiolica, stoneware, and porcelain (cf. *Gaimster 2006*, 145, Diagram 7).

Phases of transition

Across all the ceramic groups under consideration, similar developmental trajectories can be observed – though differing in intensity and timing – including a phase of flourishing, followed by stagnation, and ultimately a decline in production. These processes led to a two-pronged evolution of production and a wide range of wares, from attractive, well-crafted vessels to those characterised by simplified forms and the most schematic decoration. This gradual decline in quality unfolded over the course of approximately two centuries.

One of the discussed categories comprises meticulously and precisely crafted items, presumably produced by skilled artisans (ceramicists and painters) – often with a notable degree of creativity. These vessels were probably intended for more demanding customers. They were produced at a time when the centres had reached the peak of their development. During this period (which we can call ‘time of imitation’), there was a discernible effort to replicate motifs with fidelity and to preserve the colour schemes of the ceramic prototypes.

In the case of the Miechocin workshops, this top phase occurred between the late 16th and the mid-17th century. Characteristic features of this period included expressive and precise painting with contour lines, adherence to zonal decoration and specific ornamental layouts, e.g. the use of figural compositions, the flower-in-vase motif, and the marbling technique (*Szetela-Zauchowa 1994*, 63–66) (see *Fig. 6*).

Pomeranian wares from Elbląg reached a comparable level of development in the first half of the 18th century, when decorations in several stylistic variants imitated Dutch and Frisian faience. Chinese figural motifs combined with floral patterns (mainly flower baskets) dominated. These vessels retained a monochromatic palette – primarily blue, occasionally supplemented with yellow – along with careful execution and a generally acceptable level of quality (*Marcinkowski 2009b*, 46–47; *2011*, 55–58) (*Fig. 8*: 1, 8, 10; *Fig. 9*: 1, 7, 9).

Early-phase Stettinware (c. 1695–1750, after *Marcinkowski 2009b*, 42) also exhibits skilled craftsmanship, with decoration comprising a greater number of individual elements, executed with a confident hand (*Karwowska 2010*, 19) (*Fig. 10*: 1, 9).

By contrast, a second category consists of more rudimentary wares, which merely reference certain stylistic tendencies seen in earlier production phases. These vessels were produced in a simplified manner by potters of average skill and reflect a gradual impoverishment of the decorative repertoire, and the simplification of motifs. They were intended for sale to a less affluent clientele. The ceramics contained more indigenous elements ('time of individuality'). An appreciable decline in craftsmanship is evident in this group, marking a regressive stage in production. This final phase ('time of simplification') is particularly characterised by a reduction in the colour palette, the progressive primitivisation of vessels and their transformation into folk pottery.

In the slipware from Miechocin, this decline becomes apparent as early as the second half of the 17th century. Italian maiolica patterns were no longer replicated; instead, single, enlarged motifs – often occupying the entire surface of the vessel – came into use, including highly stylised floral sprays. The colour scheme of the designs changed; green and blue dominate instead of red and brown. Throughout the 18th century, the decoration grew increasingly modest, for example, employing spotted patterns, while the use of contour lines was gradually abandoned (*Szetela 1969b*, 98–101; *Szetela-Zauchowa 1994*, 66–67).

In the case of faience production in Gdańsk Pomerania, changes included a shift in compositional structure and the disappearance of Chinese motifs arranged in reserves, around the mid-18th century (*Fig. 8*: 3, 5, 12; *Fig. 9*: 5, 8). From the second half of the 18th century onwards, decoration often covered the entire surface of vessels, motifs were frequently applied using stencils, native floral designs were introduced, cartouches surrounded by a laurel wreath, a lambrequin ornament and a running wave pattern were used, and the colour palette included green and brown hues (*Marcinkowski 2009b*, 47; *2011*, 58–78) (*Fig. 8*: 2, 4, 6, 9, 11; *Fig. 9*: 2–4, 6, 10–11). By the late 18th and early 19th century, continuing into the mid-19th century, decoration became increasingly limited and simplified, with additional motifs eliminated in favour of a central element (*Marcinkowski 2011*, 78–92) (*Fig. 9*: 12).

The decline of Stettinware, initiated c. 1790–1820 (*Fig. 10*: 2–8, 10–12), occurred during the second half of the 19th century and continued into the early 20th century. Over time, the decoration became smaller in scale, more delicate, and more schematic, with a noticeable increase in the use of geometric motifs. In later phases, when decoration was still applied, it was often executed with stamps or stencils, and many vessels were left undecorated (*Karwowska 2010*, 19–20).

Conclusion

The manufacturing of slipware, Pomeranian faience, and Stettinware was initiated as a number of the discussed factors occurred, particularly the combination of various dynamic, multidirectional cultural influences, technological advancements, and Renaissance and Baroque stylistics. These ceramics were shaped by inspirations drawn from pottery of diverse origins. Imports from the Far East, such as Chinese porcelain, played a pivotal role in transforming European pottery production. Simultaneously, different models were provided by products from Italian maiolica. Additionally, Dutch faience and regional manufacturing traditions also had a significant impact on the development of new ceramic styles, and they were an integral part of these complex processes.

Thus, using their examples, we can explore how ceramic styles were juxtaposed, repeated or transformed over time. This circulation ('circle') of ceramics and ideas is key to understanding their development (see *Barker – Majewski 2006*, 226). In these categories of products, the described influences, primarily in decorations, are more or less evident, as indicated above. However, their subsequent development significantly diverged from the mainstream of ceramic evolution. It was fixed at a regional or even local level and determined by available resources as well as the abilities and artistic sensibility of pottery makers. It proceeded in three phases: from the time of imitation, through the time of individuality, to the time of simplification.

The presented evolution of pottery production was a result of the growing demand for more sophisticated goods serving as substitutes for their expensive counterparts. This process was fuelled by the aspirations of the lower classes to imitate the lifestyle of the well-off. As a result, local craftsmen were encouraged to produce a range of relatively cheap and lower quality vessels, which were inspired by luxury goods (including the most impactful Italian maiolica, Dutch faience, as well as foreign slipware).

From the 16th to the early 19th century, the analysed ceramics formed an integral part of table culture. They embodied and reflected contemporary notions of what was fashionable and desirable from the perspective of the user – with distant origins, continually reinterpreted and adapted by local producers. This process unfolded as a journey from foreign, refined, and elite prototypes to modest, locally produced wares of average quality, tailored to the means and expectations of consumers in the remote Polish countryside.

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