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Project Gallery

Halberds of power: an Early Bronze Age hoard from Muszkowo in Poland

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Analysis of use-wear and chemical composition of five early Bronze Age halberds from Muszkowo reveals that they were crafted over several casting events and meticulously finished, then subjected to use before their final deposition.

Keywords: Eastern Europe, Early Bronze Age, ICP-MS, pXRF, halberds, hoards

Introduction

In 2021, a farmer from Muszkowo, a village in western Poland, reported to local authorities that he had unearthed metal objects in a field. These may originally have been covered by a stone structure but both the structure and the objects had been removed before the authorities were notified. Following this report, a survey and excavations were carried out at the find spot on a promontory surrounded by the Muszyna River (Figure 1), leading to the discovery of rivets and a piece of a dagger. The hoard comprises 15 objects: five halberds, a fragmented dagger, a chisel, an axe, a battle axe, a tubular shaft and five rivets (Figure 2b). Radiocarbon dating on a wood sample from the socket of object no. 2 indicates a date in the later stages of the Early Bronze Age (Poz-164203: 1886–1694 BC at probability 95.4%; Figure 2a).

This article focuses on the five halberds, iconic artefacts of the European Bronze Age. Manufacturing techniques and traces of use are examined through use-wear analysis, computer tomography (CT; only halberds 1–3) and x-ray imaging. Microscopic observations were made under a digital microscope (Nikon ShuttlePix P-MFSC) at the Institute of Archaeology, University of Wrocław, while CT and x-ray images were taken at Wrocław Technology Park. Chemical composition was tested with portable x-ray fluorescence (pXRF) at the Institute of Archaeology, University of Wrocław, and inductively coupled plasma mass spectrometry (ICP-MS) at HUN-REN Institute for Nuclear Research in Debrecen, Hungary.

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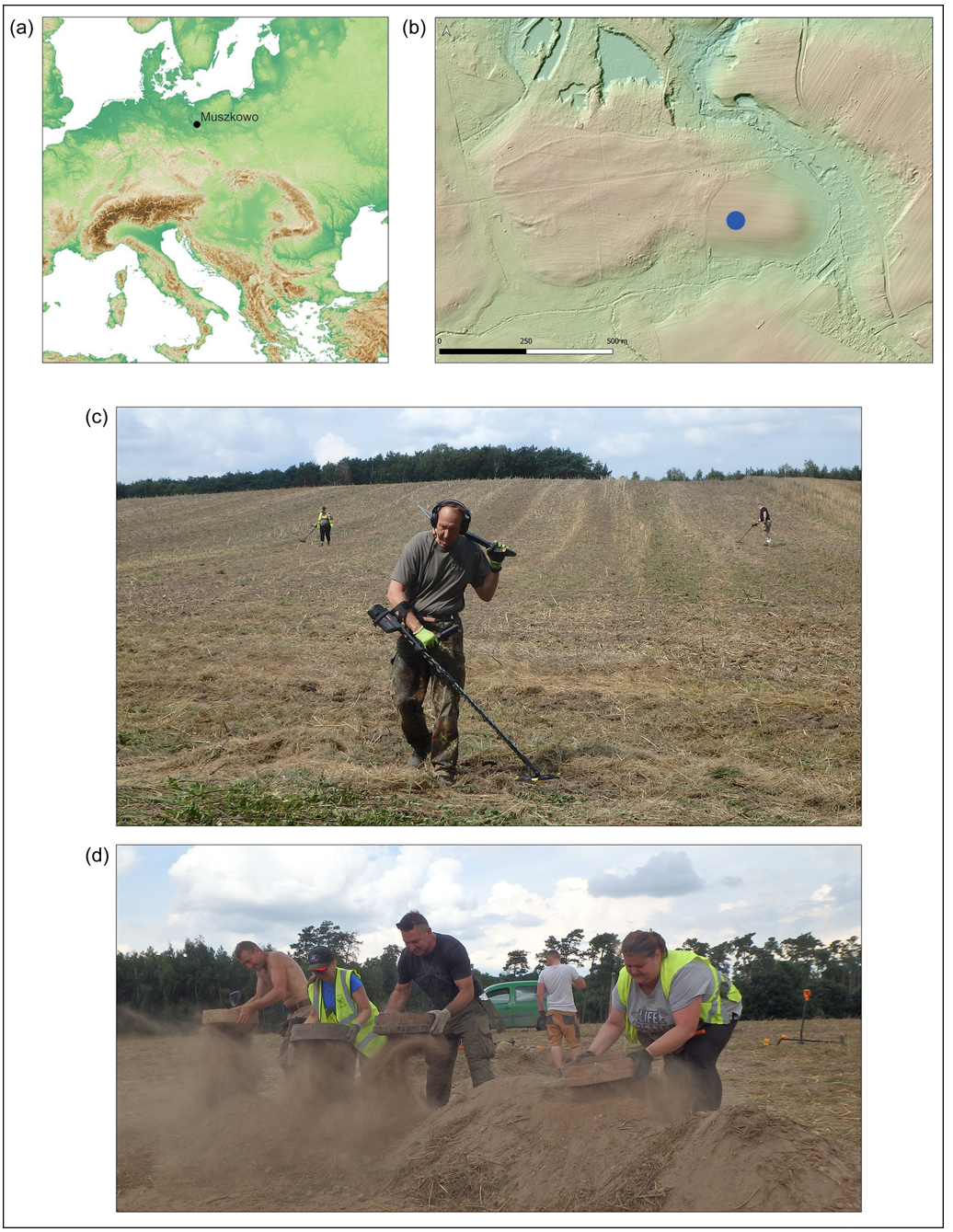

Figure 1. Location of the find spot (a & b) and fieldwork at the site (c & d) (maps by Marek Grześkowiak & Radek Kuźbik; source: mapsforeurope.org & dane.gov.pl; photographs by Stanisław Sinkowski).

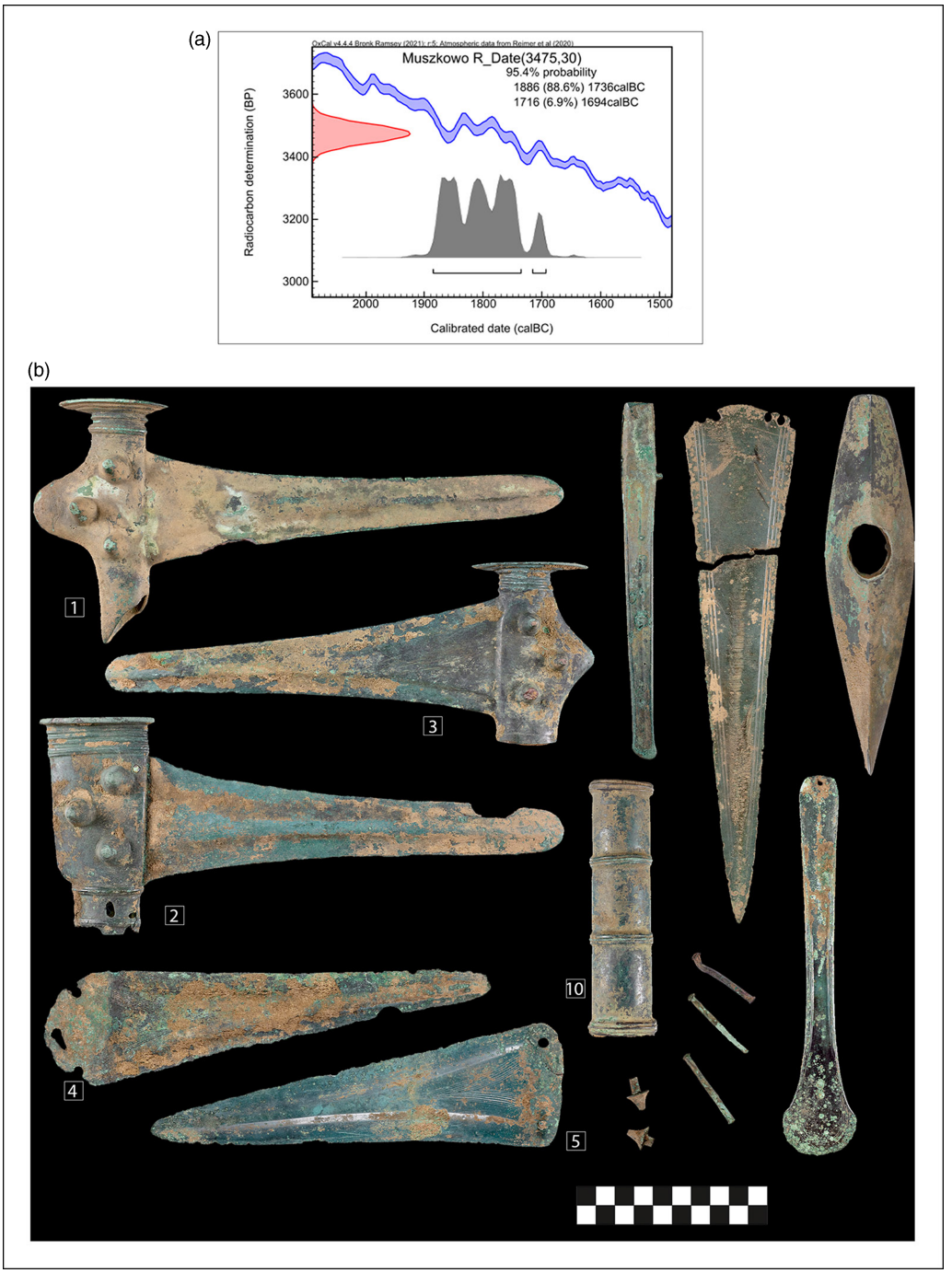

Figure 2. a) Calibrated radiocarbon date for object no. 2; b) complete collection of metal artefacts from the hoard; the numbers in squares identify the objects discussed in the text (photograph by Marek Grześkowiak).

Table 1. Summary information for the weapons from the hoard.

Item no.	Description	Weight (g)	Length (mm)	Height (mm)	Width (mm)	Socket diameter (mm)	Pommel (mm)
1	Socketed halberd	465.9	275	127		31 × 25	61 × 20
2	Two-piece socketed halberd	427.1	267	115		35 × 15	59 × 20
3	Socketed halberd	330.4	255	96		30 × 17	58 × 21
4	Blade	203.1	237		59		
5	Blade	200.6	214		64		
10	Shaft	169.5		127		32 × 22	

Table 2. Results of compositional analysis.

Item		Chemical composition of sample (wt%) sum	Cu	Sn	As	Ni	Ag	Sb	Pb
Halberd 1	ICP-MS blade	93.20	88.39	0.16	1.44	0.14	1.22	1.58	0.06
	pXRF	99.68	90.56	2.18	1.41	0.11	2.07	3.16	0.09
Halberd 2	ICP-MS blade	100.6	90.43	2.78	0.90	1.78	1.43	3.01	0.01
	pXRF blade	99.85	76.20	17.21	0.83	0.86	1.52	3.03	<DL*
	pXRF socket	99.86	81.79	7.43	1.00	1.05	2.55	5.92	<DL
Halberd 3	ICP-MS blade	111.1	100.8	5.24	1.33	0.30	0.98	2.08	0.02
	pXRF	99.79	82.13	11.18	1.53	0.20	1.70	2.93	0.02
Blade 4	ICP-MS	96.1	83.63	10.32	0.41	0.02	0.81	0.61	0.00
	pXRF	99.70	74.20	22.70	0.54	0.04	1.10	1.02	<DL
Blade 5	ICP-MS	96.70	85.93	9.12	0.42	0.04	0.69	0.38	0.01
	pXRF	99.78	76.60	20.80	0.48	0.05	0.96	0.62	<DL
Shaft 10	pXRF	99.81	84.78	9.25	1.35	0.25	1.80	2.31	<DL

* Below Detectable Level.

The collection

Although all are called halberds, the collection comprises different morphological types (Table 1): three objects (1–3) have sockets, the other two are only halberd blades (4–5) (Figure 2b). Halberds 1 and 3 are one-piece objects, while halberd 2 consists of two pieces. The patina range on blades 4 and 5 indicates that they were initially hafted as halberds. The shape of blade 4 resembles a right-angled triangle with a semi-circular base. Blade 5 has a similar shape and grooved decoration, and was probably hafted parallel to one edge.

Manufacturing and use

Chemical composition was tested using two methods (Table 2). The initial analysis was performed in 10mm spots, with the patina removed, using pXRF. To compensate for the

limitations of this method (Wrobel Nørgaard 2017), we also conducted sensitive ICP-MS analyses for samples drilled from the patina-free spots. The results indicate differences in the proportion of copper (Cu) and tin (Sn), and to a lesser degree in silver (Ag) and antimony (Sb). High Sn content can probably be related to the accidental analysis of the outer corrosion layer by pXRF. The ICP-MS results should be considered representative of the casting alloy used.

The chemical composition of the halberds varies substantially. Low-, medium- and high-tin bronzes are similar to those in other, also diverse, collections of halberds from across Europe (Krause 2003: 185–87; Horn 2014: 151–52). Impurities (As, Ag, Sb, Ni) are detectable in bronze at various levels (Table 2). High compositional diversity in impurities and also of the tin content in the Muszkowo halberds suggests that the objects were not cast during a single event. The implications of these results will be explored in a future publication.

The surfaces of the halberds were meticulously finished, as a result data on manufacturing techniques are limited. Imaging reveals that halberds 1 and 3 are single-piece items (Figure 3), made either using the lost wax technique or in a bivalve mould with a core. In contrast, halberd 2 consists of two pieces; the oval-based blade fits into a socket in the pommel and is secured by two small rivets (Figures 3 & 4e). The socket base shows signs of abrasion, likely applied to level the surface (Figure 4c).

Blade 5 was attached to a handle using two evenly spaced rivets, similar to the method observed in halberd 2. The surfaces at both rivet holes show traces of intense grinding and the edges of the holes are worked (Figure 4g). Blade 4 has three holes, suggesting a different way of hafting in which the distribution of holes resembles the three decorative rivets observed on halberds 1–3. It is possible that the loose rivets also recovered from the findspot were used for that purpose. Any other traces related to manufacturing have been carefully removed by polishing (Figure 4h) or have worn off during use.

The halberds exhibit almost perfect casting quality, with only minor defects. These include misruns, such as a keyhole-shaped rivet hole and the uneven surface of blade 4 (Figure 4f). U-shaped notches and blunt or slightly serrated edges indicate that the halberd blades were used prior to their deposition (Figure 4a, b & d). At the socket opening of halberd 2, there are two holes on opposite sides; one is irregular due to a misrun, while the other appears to have been damaged, likely by a broken-off shaft (Figure 3, middle row). Traces of such an impact align with recent studies showing that blades, sockets and shafts were all actively involved in halberd combat techniques (Horn 2017).

Conclusions

The hoard from Muszkowo represents a remarkable collection that showcases metallurgical expertise extending beyond the casting of everyday items. Each of the five halberds exhibits distinct differences in alloy composition, design and manufacturing techniques, indicating their production over multiple casting events or else a prolonged period of collection before the deposition. Variety in construction, including hafting angles, the number of rivets and the shapes of the blades, is also observed. Although halberds have previously been regarded as primarily ceremonial objects, the halberds from Muszkowo exhibit clear signs of use, such

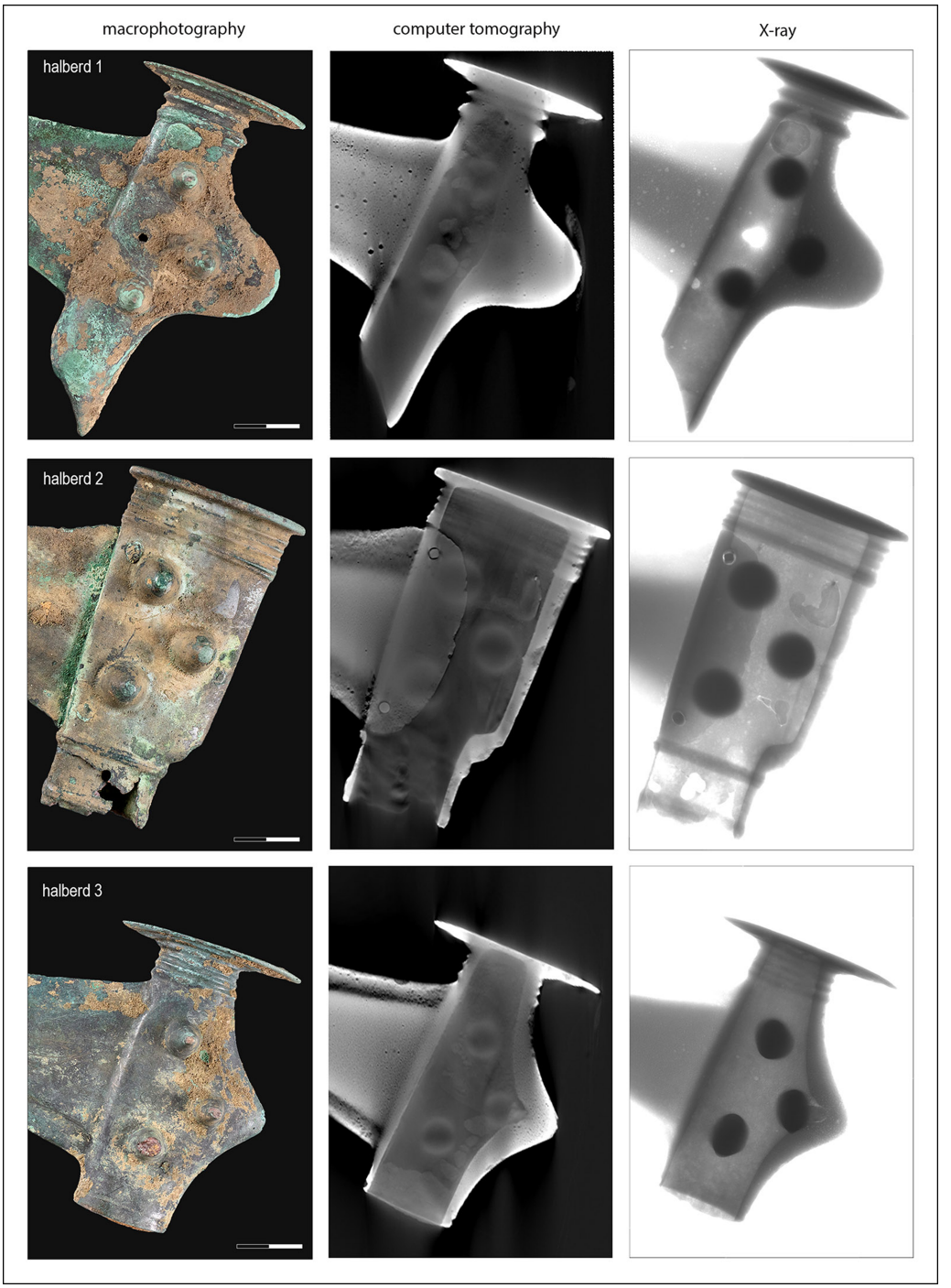

Figure 3. The halberd sockets under various imaging techniques (photographs by Marek Grześkowiak).

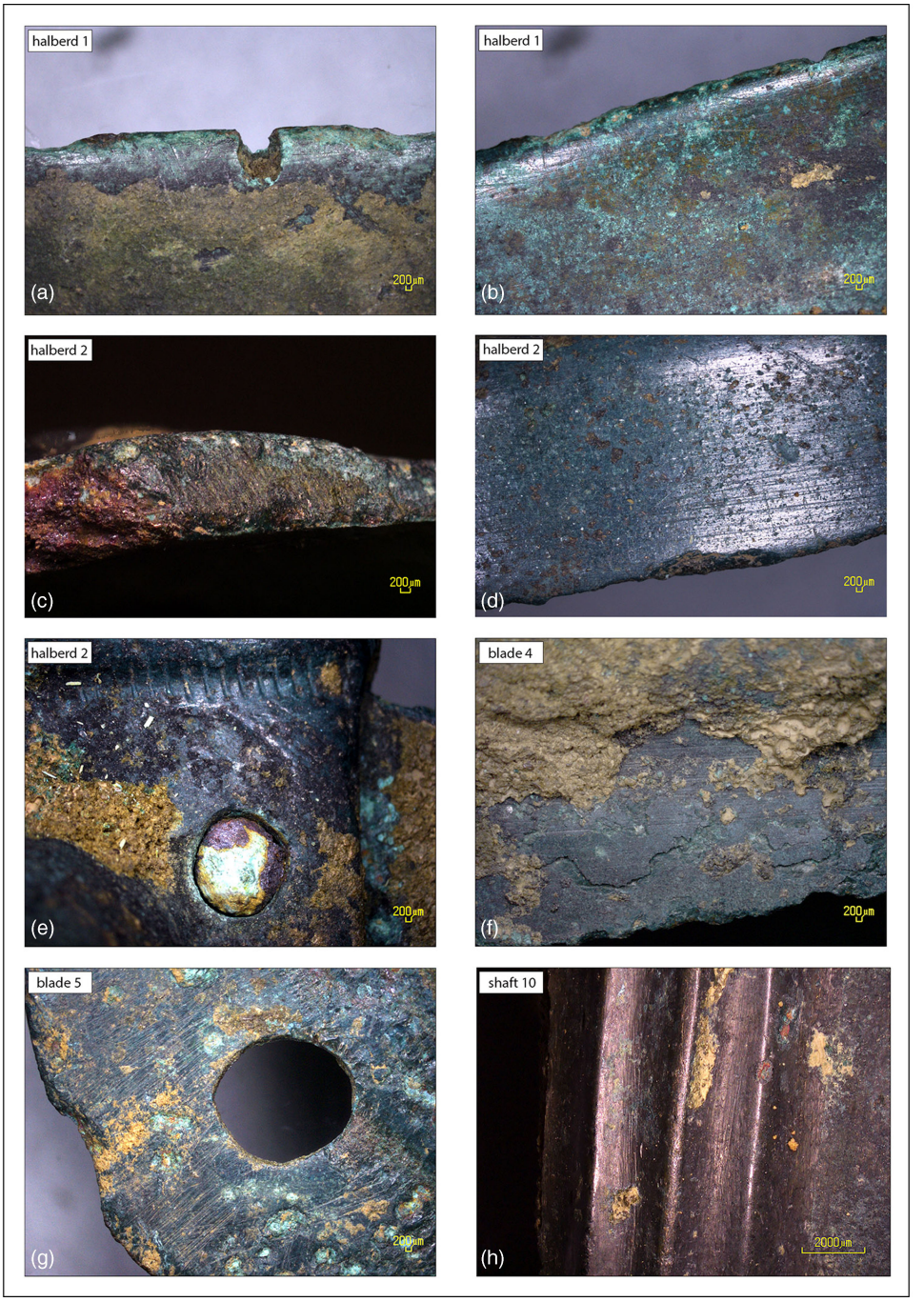

Figure 4. Manufacturing and use traces (photographs by Justyna Baron).

as damage to the blades and sockets, indicating that they were crafted for both ceremonial and combat purposes.

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