SPRAWOZDANIA ARCHEOLOGICZNE 77/2, 2025
PL ISSN 0081-3834
DOI: 10.23858/SA/77.2025.2.4185

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NEW DATA ON METAL ARTEFACTS OF THE CORDED WARE CULTURE IN LITTLE POLAND (MAŁOPOLSKA)

ABSTRACT

Kowalewska-Marszałek H. 2025. New data on metal artefacts of the Corded Ware Culture in Little Poland (Małopolska). *Sprawozdania Archeologiczne* 77/2, 285-328.

During archaeological excavations at Kichary Nowe, Site 2, near Sandomierz, five graves belonging to the Kraków-Sandomierz group of the Corded Ware culture were unearthed, three of which contained metal artefacts, including ornaments and tools made of gold and copper. The presentation of these finds in the context of other metal specimens belonging to this culture is the subject of this article. The results of their chemical composition analyses will also be discussed.

Keywords: Corded Ware Culture, Late Neolithic, Little Poland, gold, copper, ornaments, tools
Received: 04.07.2025; Revised: 22.07.2025; Accepted: 29.08.2025

INTRODUCTION

Metal objects are still relatively rare in the assemblages of the Corded Ware Culture, both in the Little Poland (Małopolska) region and in neighbouring areas as well. This is why every new discovery of this kind deserves consideration. The existing list of metal finds related to the Kraków-Sandomierz group of this culture (Machnik 1966, 55; Włodarczak 2006, 40) may be completed now with a few more items originating from Kichary

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Nowe (the current name of the village: Nowe Kichary, Dwikozy commune, Sandomierz district, Świętokrzyskie voivodeship) in south-eastern Poland discovered there during recent archaeological excavations. The aim of this article is to present these finds in the context of other previously known metal objects belonging to this cultural circle (Fig. 1; Table 1). The results of analyses of their chemical composition will also be taken into account.

Site 2 (AZP: 99-74/18) at Kichary Nowe (the former name of the village has been left in this article according to the field documentation) is situated in the Little Poland (Małopolska) region, in the eastern part of the Sandomierz Upland. It is located on a prominent loess promontory on the left bank of the Opatówka River valley. Archaeological excavations conducted there in 1987-2020 revealed remains of a Neolithic and Early Bronze Age cemetery (see *e.g.*, Kowalewska-Marszałek 2000a; 2007; 2013; Kowalewska-Marszałek

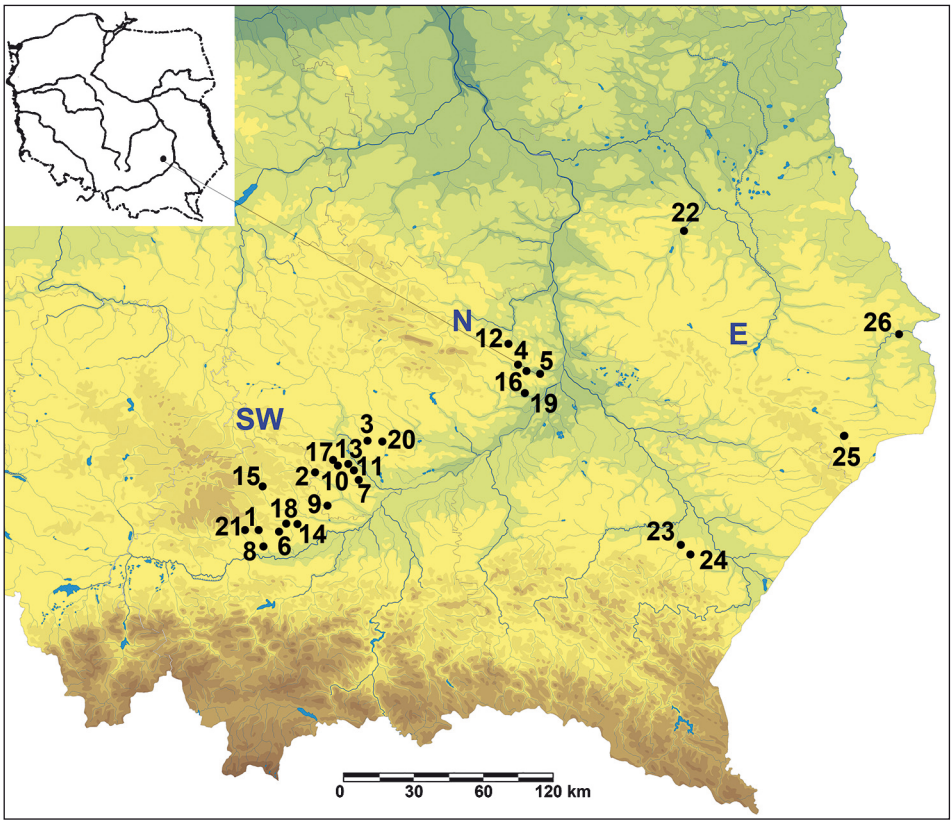


Fig. 1. Sites of the Corded Ware culture with metal finds, SE Poland: 1 – Bosutów, 2 – Bronocice, 3 – Chotelek Zielony (=Siesławice), 4 – Daromin (=Nowy Daromin), 5 – Kichary Nowe, 6 – Kocmyrzów, 7 – Kolosy, 8 – Kraków-Mogiła and Kraków-Mistrzejowice, 9 – Łękawa, 10 – Malżyce, 11 – Miernów, 12 – Mierzanowice, 13 – Pełczyska, 14 – Proszowice, 15 – Smroków, 16 – Wilczyce, 17 – Zagaje Stradowskie, 18 – Zielona, 19 – Złota Grodzisko II, 20 – Żerniki Górne, 21 – Modlnica, 22 – Lublin, 23 – Mirocin, 24 – Szczytna, 25 – Klekacz, 26 – Strzyżów. Processing: D. Wyczółkowski

Table 1. Sites with metal artefacts of the Corded Ware culture in the western part of the Little Poland

No	Site	Features with metal artefacts (and with traces of copper)	Type of finds							Total number of metal artefacts	Traces of copper	Notes
			Ornaments				Tools		Indeterminate			
			Ring	Spiral	Necklace	Other	Intermediate-retoucher	Awl				
1	Bosutów	1		1*						1		Spiral (1″ coils) or ring (*cf.* Krauss 1960, 63; Kempisty 1982, 68)
2	Bronocice	1							1(?)	1		After Włodarczak 2006, 180
3	Chotelek Zielony (= Siesławice)	1 (+2)				1*				1	2	*Remnant of indetermine ornament (Pyzik 1982 [1983], 63)
4	Daromin (= Nowy Daromin)	3		2	1	1*				4		*Fragment of ornament of copper wire (Antoniewicz 1925, 252)
5	Kichary Nowe 2	2 (+1)		3*	1		2			6	1	*copper - 1 item; gold – 2 items
6	Kocmyrzów 17	2		4		1*				5		*Diadem
7	Kolosy	1						1		1		
8	Kraków-Mistrzejowice	1		1						1		
9	Kraków-Mogiła	1		1						1		
10	Łękawa	1 (+1)		1						1	1	
11	Malżyce 30	2		2			1			3		
12	Miernów 2	(1)									1	
13	Mierzanowice 1	3	2	4	1					7	1	
14	Pełczyska	1	1*			1**				2		*Ring or spiral fragment ; **fragment of ornament (?)
15	Proszowice	1		1 (?)						1		„Earring" (*cf.* Włodarczak 2006, 182)
16	Smroków 17	1?							1	1		Uncertain relationship to the feature
17	Wilczyce 10	1					1		1*	2		*fragment of metal plate

Table 1.

No	Site	Features with metal artefacts (and with traces of copper)	Type of finds							Total number of metal artefacts	Traces of copper	Notes
			Ornaments				Tools		Indeterminate			
			Ring	Spiral	Necklace	Other	Intermediate-retoucher	Awl				
18	Zagaje Stradowskie	1							1 (?)	1		After Włodarczak 2006, 183
19	Zielona	1						1*		1		*awl or retoucher
20	Złota-Grodzisko II	2	2							2		
21	Żerniki Górne	5 (+2)	2	4		3*				9	3	*1 fragment of pin and 2 fragments of pendants (?)
22	Modlnica 5	(1)									1	
Total:		31+1? (+7)	7	23 +1?	3	7	4	2	2+2?	51*	9	*Cu: 49, Au: 2

Table 2. Kichary Nowe, Site 2. Graves with metal artefacts belonging to the Kraków-Sandomierz group of the Corded Ware culture

Grave No.					Grave goods								
	Sex	Age	Position	Orientation	Vessels	Battle-axe	Flint axe	Arrowheads	Small flint tools	Flint blanks	Tools of animal bones	Whetstone	Metal
23	F?	adultus	Left side	NE – SW	1		1		1			1	1?
26	M?	juvenis/ adultus	Right side	SE – NW	3	1	2	9*)	1	18	2		1
29	M?	adultus	Right side	SSE- NNW	2		2	13	4	26	1		5**)

Age and sex determination according to M. Pyżuk (Pyżuk 2006): *) Isolated arrowheads (9) and consolidated cluster of specimens, **) Copper artefacts (3) and gold spirals (2)

and Duday 2014). Five graves belonging to the Kraków-Sandomierz group of the Corded Ware culture were unearthed there, except for several human burials related to the Funnel Beaker culture (Duday and Kowalewska-Marszałek 2003; Kowalewska-Marszałek *et al.* 2006) and to the Mierzanowice culture of the Early Bronze Age. Two of those connected with the Corded Ware culture (Graves No. 26 and No. 29) contained metal artefacts made of gold and of copper; in another one (Grave No. 23), traces of a decomposed copper object have been detected. A detailed study of the golden ornaments has already been published (Kowalewska-Marszałek 2000b; 2000c); the presentation of the copper objects is the subject of this article.

The author of the anthropological analyses is Dr Mira Pyżuk (Department of Applied Sciences, Institute of Archaeology and Ethnology, Polish Academy of Sciences, Warsaw). The chemical analyses were carried out by Mrs Elżbieta Pawlicka and Dr ing. Zdzisław Hensel in the Central Laboratory of the Institute of Archaeology and Ethnology, Polish Academy of Sciences, Warsaw, using the EDAX spectrometer (Philips).

MATERIALS

Grave No. 23 contained a human burial placed on the left side, head to NE, face directed to SE, and legs strongly drawn up (Fig. 2, Table 2). These skeletal remains belonged to a gracially built adult, presumably female, approximately 20-25 years of age (Pyżuk

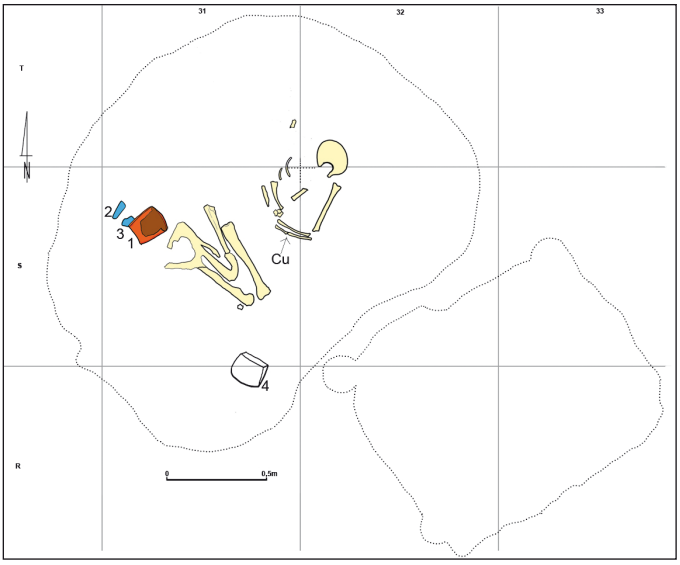


Fig. 2. Kichary Nowe, Site 2, Grave No. 23. Layout of burial and location of grave goods:
1 – vessel, 2 – flint axe, 3 – partially retouched flint flake, 4 – whetstone, Cu – traces of copper.
Drawing: E. Gumińska (after original field documentation by M. Krakowiak)

2006). A green-tinted area of the left ulna was visible for a few centimetres in the distal part of the diaphysis (Fig. 3). This is undoubtedly a trace of a copper object, probably an ornament, perhaps a bracelet or a metal appliqué of small thickness that has completely decayed.

Fig. 3. Kichary Nowe, Site 2, Grave No. 23. Human burial with traces of copper (probably of a copper object decayed) on the left ulna (x), and the grave goods at the bottom of the burial chamber (seen from the SW). Photo: H. Kowalewska-Marszałek

Grave No. 26 contained a burial of an individual in late adolescence or young adult (iuvenis/adultus), presumably male (Pyżuk 2006), lying on his right side, along the SE-NW axis, head to SE. A small copper spiral ornament was situated directly by the skull, near the left temporal lobe (Fig. 4: 12); it was completely covered with a greenish patina and slightly damaged. This is a small spiral (No. H27-286; Fig. 5, Table 3) made of narrow and rather thin copper strip, approximately rectangular in cross-section, and formed by 2¼ coils, with the left side twisted and cylindrical in shape. One end is slightly flat, hammered, and trapezoidal; the other one (defective) was probably straight. Analysis of the chemical composition (Laboratory reference: CL 11761) reveals that this artefact was made of copper (96.94%) with a relatively high content of Pb, As and Zn (more than 0.60% for each of them) and with low content (0.10-0.18%) of Ni, Sb and Ag (Table 4).

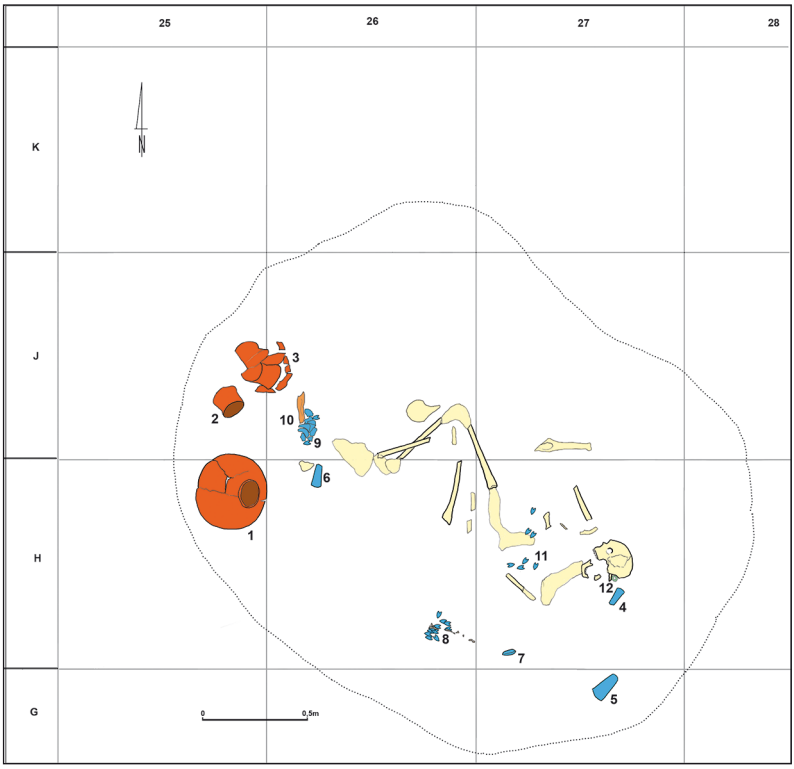


Fig. 4. Kichary Nowe, Site 2, Grave No. 26. Layout of burial and location of grave goods:
1-3 – vessels, 4 – stone battle-axe, 5-6 – polished flint axes, 7- – flint blade tool, 8 – concentration of flint arrowheads, 9 – deposit of flint blanks, 10 – tools of animal bone and of boar tusk, 11 – arrowheads dispersed in the region of the thorax, 12 – copper ornament (spiral).
Drawing: E. Gumińska, after original field documentation by M. Krakowiak

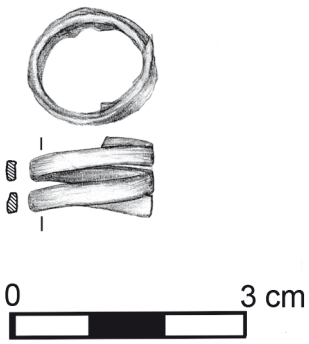


Fig. 5. Kichary Nowe, Site 2. Copper spiral ornament from Grave No. 26 (see Fig. 4: 12).
Drawing: E. Gumińska, processing: D. Wach

Table 3. Kichary Nowe, Site 2. Metal artefacts from graves belonging to the Kraków-Sandomierz group of the Corded Ware culture

No.	Grave No.	Type of find	Description	Metrics	Catalogue No.	Laboratory reference	Figure
1	29	Necklace	Circular with overlapping ends, made of copper wire, covered with a greenish patina Cu (99,23%) with a small addition of Ag, Ni, As and Sn	Diameter: - inner: 157- 160 mm - outer: 170 mm Wire thickness: 5-7 mm	X33-88 (KN-144/99)	CL: 16240	Fig. 6 (1), Fig. 7, Fig. 8
2	26	Spiral ornament	Made of copper tape, covered with a greenish patina and slightly damaged; 2Ľ coils. Cu (96,94%) with high content of Pb, As, Zn, and low amount of Ni, Sb and Ag	Ø: 15.35 mm height: 11.0 mm tape width: 2.6-2.8 mm tape thickness: 1.30 mm Flat part: lenght: 11.0 mm width: 4.65 mm	H27-286 (KN-239/97)	CL 11761	Fig. 4 (12), Fig. 5
3	29	Spiral ornament	Made of golden wire, left-side twisted, slightly conical in shape, 3l' coils; well preserved. Au (84,82 %) with Ag (10,76%)	Ø: 16.0-18.0 mm height: 16.0 mm wire thickness: 1.8 mm Flat part: lenght: 27.0 mm width: 5.0 mm weight: 7.7 g	X33-62 (KN-112/99)	CL: 12334	Fig. 6 (2), Fig. 9a
4	29	Spiral ornament	Made of golden wire, right-side twisted, cylindrical in shape, 3″ coils; well preserved. Au (89,55%) with Ag (9,66%)	Ø: 17.5-18.0 mm height: 14.0 mm wire thickness: 1.5-1.7 mm Flat part: lenght: 26.0 mm width: 5.0 mm weight: 7.1 g	X33-87 (KN-144/99)	CL: 12333	Fig. 6 (3), Fig. 9b
5	29	A miniature tool or a small-size tool tip	A small-size tool tip of the intermediate-retoucher type made of copper bar; well preserved, covered with a greenish patina. Cu (98,79%) with small additions of Ag, Sb, Fe, Pb	lenght: 13.6 mm width: 3.12 mm thickness: 1.4 mm	X32-38 (KN-144/99)	CL: 16241	Fig. 6 (4), Fig. 10a
6	29	A miniature metal tool tip	A miniature metal tool tip, probably a kind of intermediate-retoucher; presumably made of copper; completely covered with a greenish patina.	lenght: 8.1 mm width: 2.9 mm thickness: 1.95 mm	X32-38a (KN-144/99)	Not analysed	Fig. 6 (5), Fig. 10b
7	23	Copper ornament?	Traces of greenish tint of fragment of bone – probably trace of a copper object completely decayed	Few centimetres	S31-273 (KN-210/95)		Fig. 2, Fig. 3 (x)

Grave No. 29. The majority of the metal objects – five pieces – originate from this grave: the burial of an adult with a fairly strong body structure, presumably male, deceased at the age of 20-30 (Pyżuk 2006). He was lying on his right side along the S-N axis, head pointing towards S, the face directed to E, with legs strongly drawn up (Fig. 6). This grave contained a copper necklace (1), two golden spiral rings (2, 3) and two tapering ends of tools (tool tips) made of copper (4) and presumably of copper (5). Among the grave goods there were also: two vessels (beakers), two polished flint axes, a set of flint arrowheads (probably in a quiver), tools of flint blades and a set of flint knapping semi-products, mainly flakes, perhaps in an organic container, as well as a bone tool, probably a chisel (Table 2). Due to the number of elements and nature of this inventory, Grave No. 29 stands out not only from all the other graves of the Corded Ware culture at Kichary Nowe, but it is also among the 'richest' graves belonging to the Kraków-Sandomierz group of this culture in the Małopolska region (*e.g.*, Polańska 2016, 317).

All metal pieces were situated at the bottom of the burial chamber, at the same level as the skeletal remains. The necklace was lying flat at the height of the deceased's cervical vertebrae (Fig. 6: 1), and, at the moment of discovery, it was visible on both sides of those

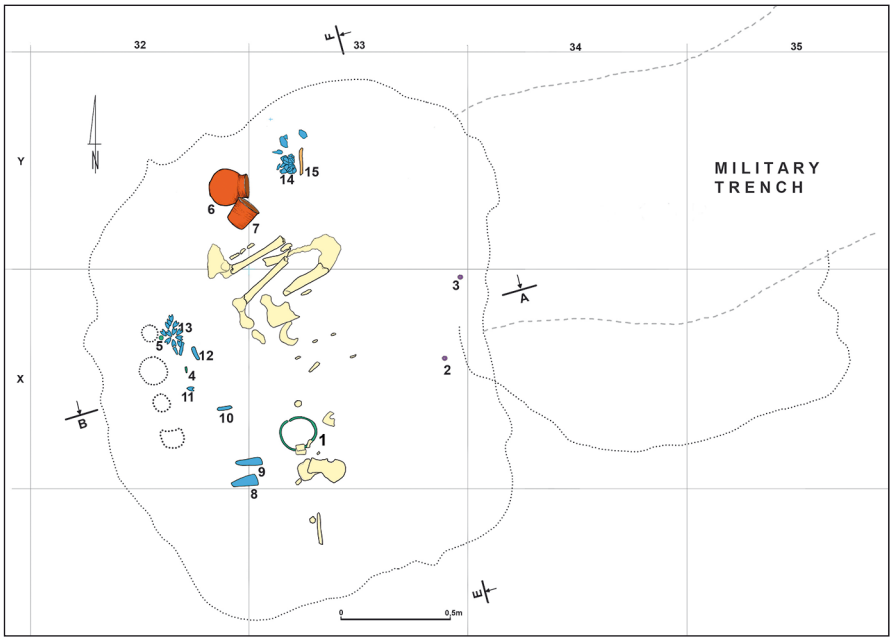


Fig. 6. Kichary Nowe, Site 2, Grave No. 29. Layout of burial and location of grave goods: 1 – copper necklace; 2-3 – gold spiral ornaments, 4 – bigger tool tip of copper, 5 – small tool tip, probably of copper, 6-7 – vessels, 8-9 – polished flint axes, 10-12 – tools of flint blades, 13 – set of flint arrowheads (probably remains of a quiver), 14 – deposit of flint blanks, 15 – tool of animal bone. Drawing: E. Gumińska, after original field documentation by M. Krakowiak

vertebrae (Fig. 7); its overlapping ends were on their thoracic side. Both spiral ornaments were found at the eastern edge of the chamber, below the entrance, in the proximity of the probable wooden timbering of the grave structure and some distance from the human remains: one of them (No. X33-62; Fig. 6: 2) was at a distance of about 0.45-0.60 m to the E of the deceased's head and slightly above the bottom of the chamber, the other (No. X33-87, Fig. 6: 3) was at the level of the bottom, at a distance of about 0.80 m to the E of the deceased's pelvis.

In contrast, the two tool tips were located in the western part of the burial chamber, behind the back of the deceased. The larger one (Fig. 6: 4) lay separately, flat on the bottom of the grave's niche, at the height of the lower torso of the deceased, approximately 0.30 m to the W of him. The smaller tip (Fig. 6: 5) was in the middle of a cluster of flint arrowheads (probably inside the remains of a quiver) situated at the height of the deceased's hips, at a distance of about 0.30 m to the W of them; this piece was inserted almost vertically among the arrowheads and pointed downwards with its tip.

(1) The necklace (No. X33-88; Fig. 8), in the form of a regular circle ('hoop') with overlapping ends, was made from a rather thick wire (0.5-0.7 cm in diameter), round in cross-section. Its inner diameter is 15.7 cm, the outer one – 17.0 cm; the ends overlap by 12 cm, or ¼ of its circumference. An analysis of its chemical composition (reference: CL 16 240) showed that it was made from almost pure copper (99.23%) with a small (0.1-0.2%) addition of Ag, Ni, As and Sn (Table 4).

(2-3) Two "twin", several-coil ornaments, each of them with one end flatly hammered, were made of spirally twisted, not very thick gold wire of circular cross-section. Both are dark yellow in colour, with a slightly reddish tinge in places. One of them (No. X33-62; Fig. 9: a) is left-side twisted, slightly conical in shape, with the other end slightly pointed; the other (No. X33-87; Fig. 9b) is right-side twisted, cylindrical in shape, and its other end is rounded. The flat parts of both specimens are hammered and flared over a rather long segment, with semi-circular ends. Both spirals were made of gold with silver, in the ratios 84.82:10.76 in the first case and 89.55:9.66 in the second. Both specimens are preserved intact; their metric data are given in Table 3 (see also Kowalewska-Marszałek 2000b; 2000c).

(4) A miniature tool, or (rather) a metal tool tip of the intermediate-retoucher type (No. X32-38; Fig. 10: a), made of a copper bar, is well preserved, covered throughout with a greenish patina. It is a small-sized specimen (Table 3), characterised by an elongated shape with an asymmetrical, flat-convex outline and a rectangular cross-section. The apical part is narrow, asymmetrically tapered; apex obtuse, lateral edges slightly raised. There are traces of transverse, arched indentations on one surface, occupying about 2/3 of the length of the specimen (in its medial and epi-basal parts). The results of the chemical composition analysis (reference: CL 16 241) indicate that the tool was made of copper (98.79%) with small additions of Ag and Sb (0.17-0.10%), as well as of Fe, and with a slightly larger quantity of Pb (Table 4).

Fig. 7. Kichary Nowe, Site 2, Grave No. 29. Copper wire necklace and human skeletal remains at the moment of unearthing (seen from the NNW). Photo H. Kowalewska-Marszałek

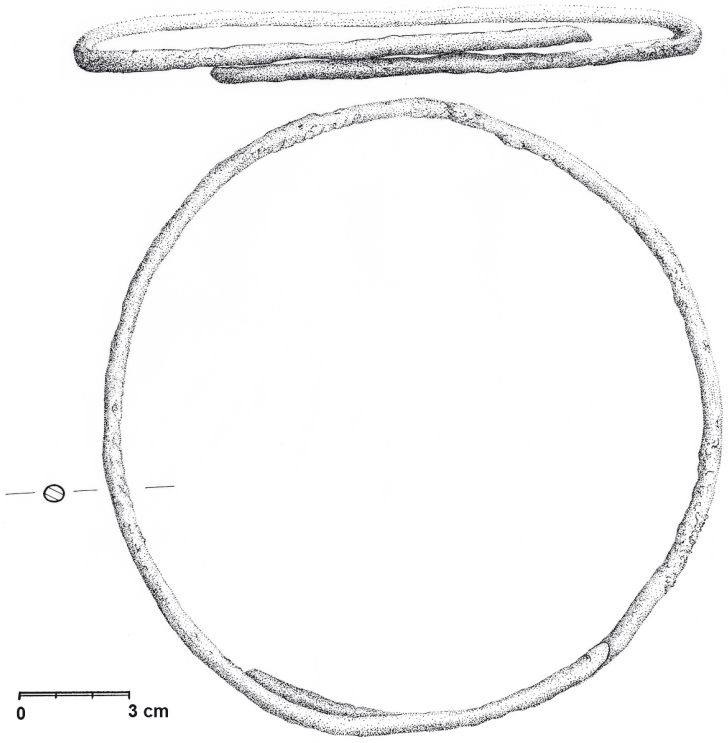


Fig. 8. Kichary Nowe, Site 2. Copper wire necklace from Grave No. 29 (see Fig. 6: 1). Drawing: E. Nos

Table 4. Metal artefacts of the Corded Ware culture from the western part of the Little Poland: results of chemical analyses and attribution to 'Copper compositional groups'. The colour scale represents the quantitative diversity of individual elements (Chemical analyses carried out by Bio- and Archaeometric Laboratory, former Central Laboratory, Institute of Archaeology and Ethnology, Polish Academy of Sciences, Warsaw)

Site	Laboratory Reference	Type	Cu	Al	Si	Ti	Cr	Mn	Fe	Ni	Zn	As	Ag	Sn	Sb	Pb	S	Au	Bi	Compositional Group	Group No.
Kichary Nowe 2, Grave 26	11761	spiral	96.94	0.00	0.21			0.02	0.05	0.18	0.60	0.72	0.10	0.06	0.16	0.95				AsSbAgNi	16
Kichary Nowe 2, Grave 29	16241	tool tip	98.79	0.07	0.00	0.07	0.00	0.01	0.19	0.00	0.03	0.00	0.17	0.00	0.10	0.48	0.01	0.08		SbAg	7
Kichary Nowe 2, Grave 29	16240	necklace	99.23	0.05	0	0	0	0	0.06	0.13	0	0.10	0.20	0.1	0.05	0	0.05	0.04		AsAgNi	15
Kolosy, Grave 4		awl	97.23	0			T	T	0.081	0.90	0	0.53	0.91	0.086	0.68	0.4		0.015	0.056	AsSbAgNi	16
Malżyce, Grave 2	14190	tool tip	95.4				0.00		0.19	0.09	1.07	0.00	0.79	0.18	0.21	1.15		0	0	SbAg	7
Malżyce, Grave 12	16048	spiral (10)	98.28				0.02		0.24	0.00	0.24	0.00	0.00	0.71	0.20	0.12		0.00	0.00	Sb	3
Malżyce, Grave 12	16049	spiral (11)	98.32				0.06		0.07	0.23	0	0	0.39	0.02	0.11	0.36		0	0	SbAgNi	13
Mierzanowice 1, Grave 81	1293	spiral	99.07				0.03		0.16	0.00	0.00	0.03	0.30	0.03	0.06	0.066		0.00	0.07	Ag	4
Mierzanowice 1, Grave 83	1299	spiral_1	98.46				0.01		0.09	0.00	0.00	0.68	0.18	0.00	0.053	0.48		0.00	0.04	AsAg	9
Mierzanowice 1, Grave 83	1300	spiral_2	98.45				0.01		0.07	0.00	0.00	1.40	0.05	0.021	0.00	0.00		0.00	0.00	As	2
Mierzanowice 1, Grave 83	1307	necklace	98.92				0.01		0.10	0.06	0.00	0.03	0.32	0.00	0.22	0.18		0.01	0.17	SbAg	7
Pełczyska, Grave 32	14189	ring	93.99		0.51		0		0.24	0.04	0.89	0	2.83	0.06	0.55	0.65		0	0	SbAg	7
Smroków 17, Grave 1?	16047	wire (fgm)	97.58				0.03		0.1	0.24	0.55	0.77	0.17	0	0	0		0	0	AsAgNi	15

Site	Laboratory Reference	Type	Cu	Al	Si	Ti	Cr	Mn	Fe	Ni	Zn	As	Ag	Sn	Sb	Pb	S	Au	Bi	Compositional Group	Group No.
Wilczyce 10, Grave 15	18188	retoucher	99.33				0.03		0.13	0.00	0.00	0.00	0.00	0.02	0.06	0.06		0.00	0.00	Cu	1
Wilczyce 10, Grave 15	18189	plate	98.21				0.01		0.05	0.00	0.00	0.53	0.13	0.00	0.00	0.55		0.00	0.00	AsAg	9
Zielona 3, Grave 3	?	Awl or retoucher	98.56	0	0.25		0	0	0	0.56	0.14		0.32	0	0	0.07				AgNi	8
Żerniki Górne, Grave 137	137_1	spiral (?)	99.35	0.015			0.01	0.01	0.03	0.09	0.07	0.00	0.05	0.11	0.11	0.10		0.00	0.07	Sb	3
Żerniki Górne, Grave 137	137_2	pendant?	92.38	2.00			0.001	0.30	1.00	0.02	0.30	0.00	0.10	0.00	0.40	2.50		T	1.00	SbAg	7
Żerniki Górne, Grave 137	137_3	pendant?	97.52	0.05			T	0.005	0.00	0.025			0.10		0.30	1.00			1.00	SbAgNi	13
Żerniki Górne, Grave 138	138	pin (fgm.)	98.878	0.025			0.016	0.01	0.05	0.03	0.1	0.80	0.10	0.00	0.00	0.00		0.00	0.00	AsAg	9
Żerniki Górne, Grave 33	1313	Ring	99.25	T			0.01	T	0.00	0.04	0.00	0.03	0.48	0.00	0.05	0.13		0.01	T	Ag	4
Żerniki Górne, Grave 78	1449	Spiral 1	97.76	T			0.00	T	0.04	0.07	0.00	0.06	0.52	0.01	0.28	0.88		0.01	0.37	SbAg	7
Żerniki Górne, Grave 78	1450	spiral_2	96.48	T			0.00	T	0.06	0.06	0.00	0.94	0.50	0.02	0.46	0.82		0.01	0.66	AsSbAg	12

According to: Kempisty 1978; Hensel 1990; Hensel 1992; Kempisty, Włodarczak 2000; Włodarczak *et al.* 2003; Włodarczak 2004; Rudnicki, Włodarczak 2007; Jarosz *et al.* 2009; Gan 2019)

(5) A smaller metal tool tip (probably a kind of intermediate-retoucher), presumably made of copper (chemical composition not analysed), its surface is completely covered with a greenish patina (No. X32-38a; Fig. 10: b; Table 3). It has an asymmetrical, wedge-shaped outline and one-sided flattened cross-section, irregularly rectangular at the apex and oval-rectangular further down the shaft. Its amorphous apex is blunt and "compacted", the lateral edges are slightly raised.

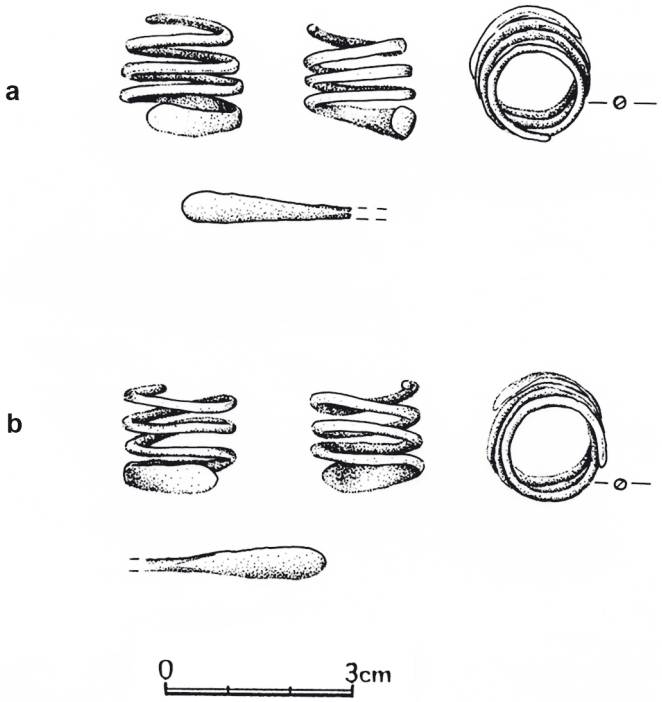


Fig. 9. Kichary Nowe, Site 2. Gold spiral ornaments from Grave No. 29: a – spiral No. X33-62 (see Fig. 7: 2); b – spiral No. X33-87 (see Fig. 7: 3). Drawing: E. Nos

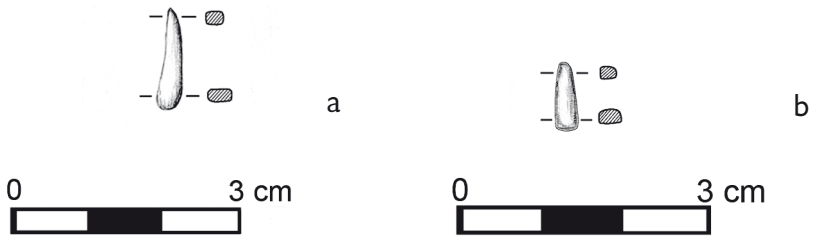


Fig. 10. Kichary Nowe, Site 2. Metal tool tips from Grave No. 29: a – copper tool tip No. X32-38 see Fig. 7: 4); b – small tool tip, probably of copper, No. X32-38a (see Fig. 7: 5). Drawing: E. Gumińska (Processing: D. Wach)

DISCUSSION

The metal artefacts in question, as well as traces of copper, were discovered in three graves of a niche-construction. Each of these graves contained a primary individual inhumation (Kowalewska-Marszałek and Duday in print). The deceased were buried in contracted position, on their right (Graves No. 26 and No. 29) or on the left side (Grave No. 23). All of them were young adults (adultus in Graves No. 23 and No. 29; juvenis/adultus in Grave No. 26). Due to the poor state of preservation of the skeletal remains, the sex of the deceased could not be anthropologically determined for certain; thus, a person from Grave No. 23 was identified as 'presumably female', and those from Graves No. 26 and No. 29 – as 'presumably male' (Pyżuk 2006). This diagnosis seems to be confirmed by both the details of the arrangement of the dead and the nature of the accompanying grave goods (Table 2; see also Włodarczak 2006, 59).

All the metal objects discussed above are undoubtedly elements of grave inventories, as indicated by both their nature and their location within the burial chambers, which is usually in the direct vicinity of human remains. Personal ornaments were situated in the region of the head (the spiral from Grave No. 26), and at the neck (necklace from Grave No. 29) or on the arm of the deceased (presumed ornament from Grave No. 23). At the same time, tools (tool tips) were placed behind the back of the deceased (Grave No. 29), according to the rule respected in graves belonging to the Kraków-Sandomierz group of the Corded Ware culture (Włodarczak 2006, 68).

The two ornaments of gold wire from Grave No. 29, although they were found some distance from most of the human remains, were located near the floor of the burial chamber, as were the skeletal remains and other grave goods; moreover, one of these ornaments was found together with a few small fragments of bones (from the skull and thorax of the deceased). It must therefore be assumed that these artefacts were also elements of the grave inventory, and their location at the time of discovery resulted of post-depositional processes (Kowalewska-Marszałek 2000c, 351; Kowalewska-Marszałek and Duday, in print).

Necklaces

Copper wire necklaces are not among the finds frequently encountered in Neolithic inventories in Poland. Until recently, only two specimens of this type were known from the Kraków-Sandomierz group of the Corded Ware culture: one from Nowy Daromin near Sandomierz (Antoniewicz 1925, 244-247) and the necklace discussed above from Kichary Nowe in the same area. Another one, associated with this group but differing stylistically from the previous ones, is a necklace-pendant from Mierzanowice Site 1, Opatów district (Salewicz 1937, 54; Uzarowiczowa 1970, 204, 205). In recent years, the number of finds has increased thanks to recent discoveries in Eastern Poland: at Klekacz, Site 10, Tomaszów Lubelski district (Machnik *et al.* 2009, 31) and in Szczytna, Site 6, district of

Jarosław (Hozer *et al*. 2017, 96-100); as to a specimen from Strzyżów near Hrubieszów, its cultural affiliation is uncertain (Dąbrowski and Hensel 1983). However, these are still rare finds.

Nowy Daromin, currently part of the village of **Daromin, Sandomierz district.** The necklace, discovered in the 1920s, was part of the inventory of Grave I – the burial of a presumably young woman, placed in a contracted position on her left side, with her head to the N and face to the E (Antoniewicz 1925, 246, fig. 3). The grave also contained two vessels (an amphora and a beaker) as well as three blades and two flint flakes (Antoniewicz 1925, 245-247). The necklace, in the form of a regular circle 12.5 cm in diameter, was made of wire with a circular cross-section, approximately 0.5 cm thick. Its ends overlapped halfway around the circumference, forming 1.5 coils, and were shaped differently: one sharply, the other was thickened and bent 'hooked or in a circle' (Antoniewicz 1925, 246).

The necklace from Daromin represents the closest analogy to that from Kichary Nowe. In both cases, the artefacts were in a similar position in relation to the deceased (who presumably were different in gender but of similar age). Both belong to the specimens with overlapping ends ('Type 2', *cf.*, Novotná 1981, 121). They differ in the diameter size (the Daromin necklace is the smaller of the two), in the formation of the ends (straight and identical in the specimen from Kichary Nowe, and diversified in the case of Daromin), as well as in the 'degree of coiling': in the Kichary necklace the ends overlap by about Ľ of the circumference, while in the Daromin specimen – by about 1/2 (Table 5).

An interesting feature is the similar length of the wire pieces used to make these necklaces: it is 65 cm for the specimen from Kichary Nowe, and approximately 60 cm for that from Daromin. Hence, presumably, with the smaller diameter of the latter, the greater length of the section of overlapping ends. It seems, therefore, that the makers of necklaces, having at their disposal 'standard' pieces of copper wire of similar lengths, customised each product, perhaps by adapting the particular piece to the body-built of the person for whom it was intended.

Mierzanowice Site 1, Opatów district. The third specimen from the Sandomierz Upland is a necklace-pendant, distinctly different from those mentioned above. It was found in Grave 83: a burial of an adult male lying supine with his legs on his left side (Uzarowiczowa 1970, 204), along the NE-SW axis, with his head to the NE. The necklace was situated next to the skull of the deceased, under his mandible (Salewicz 1937, 54; fig. 20: c). The grave inventory also contains a vessel (a beaker), a flint axe, a small fragment of a bone object, and two copper wire spiral ornaments, as well as 33 small pottery sherds and 13-16 flint specimens. However, the attribution of these latter finds to this grave is not entirely certain, nor is their number (see Uzarowiczowa 1970, 204, 205).

The necklace-pendant was made of 'copper or bronze sheet' (Salewicz 1937, 54), also referred to as a 'flat bar' (Uzarowiczowa 1970, 205). According to the results of the chemical composition analysis (reference: CL 1307), this specimen is made of almost pure (98.92%) copper (Hensel 1992, 107). It is an approximately crescent-shaped object, asymmetrical,

Table 5. Copper necklaces in the Corded Ware culture, SE Poland

Site	Type of grave	Sex and age of the deceased	Orientation and position of the deceased	Necklaces dimensions	Radiocarbon dates (BP)	Comments, literature
Kichary Nowe Site 2, grave No. 29	Niche grave	Presumablymale, adultus	S-SE – N-NW, face to E or E-NE right side	Diameter: – inner: 157-160 mm – outer: 170 mm; wire thickness: 5-7 mm	4110±80 (Ki-7942)	The 'richest' burial inventory of this cemetery Kowalewska-Marszałek 2000c, 349; 2007, 94-96
Klekacz Site 10, grave 1	Central grave (pit grave?)	Adult male, age of about 30	W-SW-E-NE, head to W-SW; flexed, right side	Diameter: 168 x 200 mm; wire thickness: 3-7 mm	4045±35 (Poz.25614)	Burial with stone battle-axe; Machnik *et al*. 2009, 32
Mierzanowice Site 1, grave 83	Pit grave?	male	NE-SW, head to NE; lying supine with legs on his left side	Lenght: 200 mm; maximum width: 30 mm; thickness: 2 mm		Burial with two spiral ornaments of copper; Salewicz 1937, 54-55; Fig. 19-20; Uzarowiczowa 1970, 204-205
Daromin (= Nowy Daromin) Grave I	Pit grave	Young, female?	NE-SW, head to NE; flexed, left side	Diameter: 125 mm; wire thickness *ca* 5 mm		Antoniewicz 1925, 245-247
Szczytna Site 6, grave 4	Niche grave	Male, adultus, age of 20-30	N-S, head to S, face to E flexed, right side	Diameter: 200 mm; wire thickness: 3 mm	4050±60 (MKL-1047); 3951±37 (UB-28880)	Very 'rich' burial, with copper battle-axe; Hozer *et al*. 2017: 38-48

with side parts tapering unevenly from the centre of the specimen, where its width is greatest, towards the edges with straight-cut ends. A small indentation is visible in the middle of its longer inner edge. At the same time, a not very large projection is observable at the corresponding point on the outer edge, giving the whole a slightly triangular shape. Its cross-section is flat-convex. There are small circular holes at both ends: a single one (maybe, the only one preserved) on the narrower side of the specimen and two on its wider side. The length of the necklace is 20 cm, with a width of 1-3 cm and a thickness of 0.2 cm (Uzarowiczowa 1970, 205).

Both Kazimierz Salewicz, describing the object in question as a 'pendant' (Salewicz 1937, 54), and other researchers (*e.g.*, Machnik 1966, 55; Uzarowiczowa 1970, 218, 219; Kempisty 1982, 67) emphasise its similarity to boar tusk pendants, even considering it an imitation of an ornament of this kind. Such pendants, although already known in pre-Corded times (*e.g.*, Kulczycka-Leciejewiczowa 1979, 163, fig. 87: 5), are not encountered frequently in assemblages of the Corded Ware culture; they became more widespread only in the early Bronze Age (*e.g.*, in the assemblages of the Mierzanowice and the Strzyżów cultures). However, ornaments of this type, although not very numerous, are also known from the Corded Ware culture, for example, from the site of Velké Bílovice district. Břeclav in Moravia (Šebela 1999, 164; Pl. 120:3, 211:4) as well as from a few sites in Germany, *e.g.*, Friedrichsaue Kr. Aschersleben, 'Galgenberg' (Matthias 1968, 26, 27, Taf. 12: 6, 7), Artern Kr. Artern (Matthias 1974, 30, Taf. 7: 15), Burgörner Kr. Hettstedt (Matthias 1974, 80, Taf. 27: 6). In addition, boar tusk objects found in Corded Ware grave inventories are not always ornaments but may belong to the category of tools, probably used for scraping (Machnik 1966, 54) or in flint processing (Włodarczak 2006, 38). This type of use has recently been confirmed by traseological studies of finds from a grave associated with the Malice culture at Świerszczów, Hrubieszów district (Zakościelna and Osipowicz 2024, 345).

It can also be noted that the specimen from Mierzanowice reveals certain resemblances to the so-called 'diadems' originated in the Middle Dnipro culture (Artemenko 1967, 34-36, fig. 21, 23) or 'pectorals' known, among others, from the Řivnáč culture (*e.g.*, from Velvary okr. Kladno in Bohemia; Dobeš 2013, 57). Then, it cannot be ruled out that we are dealing here with some kind of transformation of the idea of such an object or with some kind of its imitation (not very successful). The latter eventuality could be supported by the observation that this specimen is 'quite primitively and unevenly made', as well as by the supposition that it may be a local product (Uzarowiczowa 1970, 219).

Other necklaces associated with the Corded Ware culture, originating from the territory of Eastern Poland, including those from Klekacz and Szczytna, as well as a possibly related specimen from Strzyżów, are open necklaces with flattened and curled ends, forming a type of earring (Table 5). They belong to 'Type 1' (Novotná 1981, 121), a less common variety, of which specimens with hooked ends are also found (Dąbrowski and Hensel 1983, 83).

Klekacz Site 10, Tomaszów Lubelski district. The necklace was found in a central grave (Feature 1) within the only barrow on the site, containing the burial of a young

male aged approximately 30 years. The burial was oriented along the WSW-ENE axis; the deceased rested in a contracted position on his right side, head to the W-SW. The necklace was located next to the remains of the skull. A single vessel (an amphora) and a 'boat-shaped' battle axe of diabase, as well as one triangular arrowhead made of Volhynian flint (Machnik *et al.* 2009, 32-35) were also discovered in this grave, forming a typical inventory of the Corded Ware culture (Włodarczak 2006, 66-77).

The necklace, of slightly flattened oval shape, is an open specimen with hooked ends. It was made of copper wire of varying thickness, circular in cross-section, except for the flatly flared central part, where the presence of remnants of tubular bone beads was noted (Machnik *et al.* 2009, 32-35, fig. 23). Dimensions of this specimen: 16.8 × 20 cm, wire thickness: 0.3-0.7 cm. Analysis of the chemical composition revealed that it was composed of copper with a small amount of Ag (Nosek and Stępiński 2011, 404).

The necklace from **Szczytna Site 6, Jarosław district** was part of the inventory of Grave 4 of a niche construction and N-S orientation, with the burial of an adult male lying on his right side, head to the S. The very rich inventory of this burial included six other metal objects (a copper axe, two intermediate-retouchers and three small rings of copper wire), in addition to five vessels, numerous flint implements (an axe, five arrowheads, two blade tools, two blades, 41 flakes and their fragments), a whetstone and an animal bone chisel (Hozer *et al.* 2017, 41-48).

The necklace was located in the region of the deceased's head and neck. It was approximately circular in shape, with a diameter of 20 cm, made of wire of circular cross-section and 3 mm thick. It is an open specimen, with one end straight and the other hooked; both ends gradually tapered and slightly pointed (Hozer *et al.* 2017, 43, fig. 25: 6, photo 35: 3, 5). According to the results of analysis of the chemical composition (Hensel and Pawlicka 2017, 222), it was made of copper with a rather significant addition of Pb and Au (more than 0.5%), as well as an addition of Al, Ag and Fe, with the traces of Sn; As, Ni and Sb were completely absent.

The necklace from **Strzyżów, Hrubieszów district**, found at a destroyed site, may also be associated with the Corded Ware culture, which seems to be supported by its similarity to the aforementioned specimens from Klekacz and Szczytna. Partly preserved (only two deformed fragments), it was fabricated from wire of circular cross-section. In contrast, the cross-section of its hooked end is rectangular (Dąbrowski and Hensel 1983, 73, fig. 1: 16). It is made from almost pure copper (Cu: 99.27%) with a few impurities in the form of trace amounts of As, Ag, Sn, Pb, Fe and Al (Dąbrowski and Hensel 1983, 71, table 1). Due to the conditions of discovery, no contextual data are available. This prevents the precise dating of this specimen and reduces the possibility of clarifying whether it should be associated with the Corded Ware culture, although it seems possible (Dąbrowski and Hensel 1983, 83).

As can be seen from the above review, the only close analogy for the necklace from Kichary Nowe is the specimen from Daromin. The object from Mierzanowice is completely

different, and three other finds, revealing a high degree of stylistic uniformity among themselves, diverge quite markedly, too.

Findings of copper necklaces are also rare in other areas of the Corded Ware culture (*e.g.*, Ottaway 1992, 283-285; Podborský 2004, 187; Hozer *et al.* 2017, 96). Few specimens originate from Central and Eastern Europe, with most of them – five or six pieces – from Bohemia (*e.g.*, Šumberová 1992, 122-124; Dobeš 2013, 57-60, further literature cited there). Single objects were found in Moravia, specifically in Dětkovice, district. Vyškov, Grave 1 (Šebela 1999, 48; pl. 13.2; 214: 2) and in Hoštice (Podborský 2004, 187) as well as in Ukraine, in Kryłos VI, Stanisławów district (Sulimirski 1968, 133, 134, fig. 11: 3; Sveshnykov 1974, 44, 45; see also Machnik 1979, 59). Necklaces of this kind are also known from assemblages of the Middle Dnipro culture, *e.g.*, from Strelica in the Homel region of Belarus (Artemenko 1967, 33-35, 90-99, fig. 22; 1976: 69-86), and of the Bell Beaker culture *e.g.*, Inzersdorf Grave 532 in Lower Austria (Neugebauer and Neugebauer 1992, 144, Abb. 6: 3).

Specimens with overlapping ends are even more scarce. As analogues to the necklace from Kichary Nowe, finds from Bohemia can be pointed out here: a necklace from Grave 5 at Kralupy on the Vltava River, Lobeček, okr. Mělník (Buchvaldek *et al.* 1997, 151, fig. 45: 4; Dobeš 2013, 57, 58, pl. 15: 1), probably a necklace from Grave 41/82 in Břešťany okr. Teplice (Buchvaldek and Velimský 1987, 76, fig. 20: 3-6; Dobeš 2013, 57, pl. 14: 2) and, possibly, that from Grave 41 in Čachovice, okr. Chomutov (Neustupný and Smrž 1989; Dobeš 2013, 57, pl. 14: 3), as well as necklaces from the aforementioned cemeteries in Dětkovice and Inzersdorf, and from Grave 43 in Strelica (Artemenko 1967, 35, 90; figs 22: 4 and 53: 10; 1976, 81, 82, fig. 7: 10).

It is worth noting that copper wire necklaces represent a wide temporal spectrum. They are present in assemblages earlier than the Corded Ware time, starting with the Bodrogkeresztur culture (Wilk 2014, 232, further literature there), they occur in inventories of the Baden culture in Slovakia and Lower Austria (Novotná 1984, 2; Podborský 2004, 187; Novotná and Soják 2013, 197) as well as in the hoard from Horodnica, Horodenka district (Sulimirski 1961, 92, 96, pl.1: 5) classified as belonging to the Trypillia culture. Three specimens belonging to the Lublin-Volhynia culture and originating from the cemetery in Książnice, Busko Zdrój district, Graves 2 and 8, are very close typologically to the finds from Kichary Nowe and Daromin, especially the necklace from Grave 2 (Wilk 2004, 227, fig. 4: 3; 2014, 227, fig. 10: A, C). Necklaces of this type also occur in later assemblages associated with the Early Bronze Age, *e.g.*, in Łubcze Site 38, Tomaszów Lubelski district in Poland (Machnik *et al.* 2009, 107, fig. 85: 3), in Sudoměřice II, Bez. Hodonín in Moravia (Šikulová 1961, 8-11, fig. 2: 4; Peška and Šebela 1992, 133, Abb. 2: 2) or in Jelšovce distr. Nitra, Grave 444/85 in Slovakia (Bátora 1991, 123, fig. 33: 10).

As shown in the list of graves with copper necklaces in the Corded Ware culture (Table 5), the majority of them were male burials (certain or probable); only in one case (Daromin) was the necklace probably part of the grave equipment of a young woman. It seems, however, that such a picture may be due to the small number of finds rather than the actual

rule: for example, in Bohemia, necklaces are just as common in women's graves and even in children's burials (*e.g.*, in the aforementioned graves in Břešťany and Čachovice).

What is noticeable, however, is the diversity of the graves in question in terms of "richness". Two of them, in Szczytna and at Kichary Nowe, belong to the 'very rich' category, standing out both in terms of number and the nature of the grave goods (gold ornaments at Kichary, a unique copper battle-axe in Szczytna). In contrast, the grave from Daromin contained a rather modest set of grave goods.

Another interesting point is the function of these necklaces. Their dimensions (diameters) indicate that objects of this kind could not be inserted over the head, but had to be twisted directly around the neck of the person in question (Antoniewicz 1925, 246), so it is possible that they were worn not very often (maybe only once?). Thus, it was probably not the 'usual' function of an ornament, put on and taken off at will. Two possibilities of interpretation arise here: first, the necklace was put on during the person's life and, maybe, was worn by this person permanently, for the rest of his (or her) life. In such cases, it would have to be put on after the individual's stage of growth had ended, or it would have to be prepared with some 'reserve', taking into account the growth of the individual. The second possibility is that the necklace was twisted around the neck of the deceased (Machnik 1966, 55).

The rarity of occurrence and the 'atypical' (in relation to 'ordinary' ornaments) way in which they were used suggest that copper necklaces may have a special function. It can therefore be thought that the presence of such an object was linked to the personal status or specific social position of the deceased rather than merely to their gender. A similar assumption can also be formulated regarding the presence of spiral ornaments (Jarosz 2016, 524).

Spiral ornaments ('earrings')

The cemetery at Kichary Nowe is another site in the Małopolska region where ornaments in the form of several coiled spiral twists with one end flattened have been discovered. All three specimens found there are similar in form and represent the same category; they differ in the type of raw material used and technological details: one spiral was made of copper strip, two – of golden wire. There are also differences as to their dimensions: the gold spirals are slightly larger and much more massive than the copper specimen, and the number of coils is also greater in their cases.

Spiral ornaments made of copper are very characteristic for graves associated with the Corded Ware culture (*e.g.*, Machnik 1966, 55; Kempisty 1982, 68; Włodarczak 2006, 40, 120). They are known from other cemeteries of the Kraków-Sandomierz group of this culture (Table 1), among others from Mierzanowice Site 1, Graves: 81 and 83 (Uzarowiczowa 1970, 203-205) and from Daromin, Grave II (Antoniewicz 1925, 248), the nearest territorially sites to Kichary, situated a dozen or so kilometres to the W and NW. They occur also in

grave inventories located to the E of the Vistula River: in Lublin-Sławinek, Site 1-2 Grave 2 (Polańska 2016, 315, 322) and Site 3 Grave 3 (Jarosz and Rejniewicz 2016, 337, 338), in Szczytna Site 5, Graves: 217 and 220 (Hozer *et al.* 2017, 19, fig. 8: 6-9, 26, fig. 13: 10, 11) and in Łubcze Site 37, Grave 3 (Machnik *et al.* 2009, 105; fig. 78: 4).

As mentioned before, the gold spirals from Grave No. 29 are almost identical in form. Their flattened parts are noticeably wide and elongated, with rounded ends that bring them closer to the later ornaments of the willow leaf style (Kempisty 1982, 75; see also Machnik 1982, 83; Kadrow 2000, 144-150). By contrast, the flattened part of the copper spiral from Grave No. 26 is only slightly widened and trapezoidally shaped, which in turn is typical of specimens from the Kraków-Sandomierz group of the Corded Ware culture (Włodarczak 2006, 118; Polańska 2016, 322).

The gold specimens are unique in the Corded Ware culture in terms of the raw material used (Kowalewska-Marszałek 2000c, 351). However, their form refers to several copper ornaments, *e.g.*, from the cemetery at Małżyce, Grave 12 (Jarosz *et al.* 2009, 222, fig. 35: 11) or from Lublin-Sławinek Site 3, Grave 3 (Jarosz and Rejniewicz 2016, 337, 338, fig. 8: 8) – these specimens are, however, slightly smaller and less massive than the finds from Kichary, with more stocky proportions of their flattened parts. In turn, the elongated flat parts of the spiral rings from Kichary bring them closer to the finds from Grave 261/64 from Kraków-Nowa Huta, the 'Kopiec Wandy' site (Hachulska-Ledwos 1967, 91, pl. 2: 11, 12), admittedly linked to the very beginning of the Bronze Age – the Chłopice-Vesele (proto-Mierzanowice) phase (Hachulska-Ledwos 1967, 98).

The spirals made of gold from Kichary Nowe do not find any analogy, as mentioned above, in the Corded Ware culture inventories, where finds from this raw material are very few. Three specimens of gold are known from Moravia: these ornaments are very similar to each other, made of a rather thin wire with overlapping straight ends: a spiral from Barrow 6 in Letonice, with a diameter of 12 mm (Šebela 1999, 88, pl. 43: 2) and two more, from sites: Olomouc-Nemilany 3, Grave 31, with a diameter of 8 mm and Olomouc-Slavonín 1, Grave 72, with a diameter of 11-12 mm (Peška 2004, 95, fig. 5: 1, 101, fig. 7). All of them were made of gold wire with thicknesses of, respectively: 1.7 mm, 1.4 mm and 1.2 mm, forming 1.25 (Nemilany) or 1.5 coils (Letonice, Slavonín). The specimens from Kichary differ from these in both form and size, and they are also much more massive.

Formally close to the gold spirals from Kichary are also some copper specimens from Bohemia, including one of the spirals from the site in Praha-Jínonice (Havel and Kovářík 1992, 98, Abb. 3: 6a, 6b; Buchvaldek and Kovářík, 1993, 130, fig. 16: 6), one specimen from Třebusice (Buchvaldek *et al.* 1997, 140, fig. 31: 8, 9; Dobeš 2013, 86, pl. 19: 12b) and two from Grave 14/1964 in Vikletice (Buchvaldek and Koutecký 1970, 50, 255, Abb. 90: 8, 9; Taf. 32: 14, 15; 45: 4, 5; Dobeš 2013, 87, pl. 19: 19). They are identical in shape although sometimes different in the number of coils.

Note that close analogues for the Kichary gold finds can also be seen among the artefacts associated with the Bell Beaker culture, such as the golden spirals from the site in

Přerov-Předmostí (Medunová-Benešová 1962, 235, 236, fig. 1: 7; more on this topic: Peška 2004, 105; see also Stuchlík 2011, 343-346, fig. 5: 6, 7). On the other hand, similar copper ornaments from the Praha-Lysolaje locality (Grave I), initially associated with the Bell Beaker culture (Hájek 1968, 63-64), are currently – despite some doubts – rather linked with the Corded Ware assemblages (Moucha 1992, 83, Abb. 2: 5, 6; Dobeš 2013, 85).

It is also noteworthy that, as mentioned above, both gold spirals from Kichary are very similar, each of them being a 'mirror image' of the other, which is reflected in their right – and left-handedness. Thus, these are not objects put together at random, but a deliberately selected pair of ornaments, made, perhaps, by a single maker (which is not contradicted by the noticeable slight differences between them). This situation does not seem unique: it is also the case with other grave assemblages, such a set of Grave 41/82 from Břešťany near Teplice, where four spirals formed two pairs, differing in size (Buchvaldek, Velimský 1987, 76, fig. 20:3-6; Šumberová 1992, 120) or that of Grave 24 in the Praha-Jínonice cemetery (Buchvaldek, Kovářík 1993, 130), as well as the above-mentioned Grave 14/1964 from Vikletice with a pair of 'twin' spirals (Buchvaldek and Koutecký 1970, 255, see above). The same could be applied to specimens from the Přerov-Předmostí locality of the Bell Beaker culture (Medunová-Benešová 1962, 235-236, fig. 1: 7). It can therefore be considered that the set of spirals from Kichary confirms a regularity more widely observed (Buchvaldek 1986, 92).

The copper spiral ornament from Grave No. 26 at Kichary has analogies among the currently known finds, both in terms of form and dimensions, as well as the raw material used in its manufacture. These artefacts come from both Polish sites and from neighbouring areas. The greatest formal similarity to the specimen in question may be observed in relation to one spiral (the larger one) from Grave 2 in Lublin-Sławinek Site 1-2 (Głosik 1968, 106, pl. 5: C-1; Polańska 2016, 322, fig. 6:16), to one item from Grave 83 in Mierzanowice (Salewicz 1937, fig. 20a; Uzarowiczowa 1970, 205, fig. 6: c) and to another one, from Grave 78 in Żerniki Górne (Kempisty 1978, 71, fig. 88: 3b) as well as both specimens from Grave 220 in Szczytna (Hozer *et al.* 2017, 26-27, fig. 13: 10, 11). The spiral ring from Grave II in Daromin (Antoniewicz 1925, 249, fig. 5: a) differs in the greater number of coils. Only the specimens from Lublin-Sławinek and from Szczytna were made of a metal strip, like the spiral from Kichary; the others represent the 'wire' variety of ornaments of this type (Kempisty 1982, 69).

The occurrence of one or two spirals in the same grave inventory is also typical of the Kraków-Sandomierz group. Ten grave assemblages contained two specimens each; in most of them, they were located near the head of the deceased, in three cases (Malżyce, Grave 12; Żerniki Górne, Grave 78; Lublin-Sławinek, Site 1-2, Grave 2) – on both sides of the head. In three other graves, the spirals occurred some distance from each other: in Grave II from Daromin one of them lay near the head of the deceased, the other was found above the shin bones (Antoniewicz 1925, 248), in Grave 3 from Lublin-Sławinek Site 3 one piece was located at chest level and the other below the legs of the deceased (Jarosz

and Rejniewicz 2016, 337), while in Grave No. 29 from Kichary Nowe both ornaments were found a short distance from the head and pelvis of the deceased (*cf*., above). Similarly, spirals occurring singly were mostly located on the temple of the deceased: right (Bosutów, Kraków-Mogiła, Łękawa, Żerniki Górne, Grave 137) or left (Kichary Nowe, Grave 26). Only in one case (Żerniki Górne, Grave 103) was the spiral found on the left forearm of a woman buried there (Kempisty 1978, 96).

Spiral ornaments are commonly interpreted as 'earrings' or 'rings', depending on their size and location in relation to the body of the deceased. As for the spiral from Grave No. 26 at Kichary, its location (near the skull, close to the left temple) clearly indicates that it should be considered a head ornament, most likely used to hold a strand of hair. Such an interpretation is also supported by the size of the specimen, which practically rules out the possibility of using it as a finger ring. This corresponds to the interpretation of most finds of this kind (*e.g*., Machnik 1966, 55; Kempisty 1978, 263; Ottaway 1992, 283; Peška 2004, 107; Włodarczak 2006, 40, 77). Also, both spirals from Grave No. 29 seem to have had an analogous function (Kowalewska-Marszałek 2000c: 351), although in this case, there are no direct indications derived from their location; this assumption is supported by their size, only slightly larger than that of the specimen from Grave No. 26.

Multiple spiral coils of copper wire or strip are relatively frequent in inventories of the Corded Ware culture in Central Europe, particularly from Bohemia, Moravia and Germany (*e.g*., Machnik 1966, 55; Kempisty 1982, 68; Buchvaldek 1986, 32; Jacobs 1989, 2-9; Ottaway 1992, 283-285; Šumberová 1992, 119; Dobeš 2013, 81-87), constituting the most common category within the group of fine copper ornaments (Ottaway 1992, 285). Twenty three (or twenty four) artefacts, preserved in whole or in fragments, are currently known from western Little Poland (Table 1); nine or eleven more come from areas to the east of the Vistula. Among them, it is possible to distinguish specimens with one end flattened and sometimes rounded, and those with one or both ends pointed (Kempisty 1982, 68). Both of these types can come in two varieties: of wire or of metal strip. Most specimens from the Little Poland region belong to the former and were made of wire; this also applies to the two gold spirals from Kichary. The third spiral from this cemetery, made of a narrow strip, stands out in this respect.

Until recently, specimens made of copper strip were known only from outside of Poland, mainly from German and Bohemian sites (Kempisty 1982, 68). Nowadays, they are also known from Polish lands: fragments of a spiral made of a splayed wire with a rectangular cross-section were found in Grave 12 in Malżyce (Jarosz *et al*. 2009, 222), and a fragment of an ornament made of a narrow copper strip occurred in Pełczyska (Rudnicki and Włodarczak 2009, 229). Narrow strip (or flattened wire?) was also used to make one of two spirals from Grave 2 in Lublin-Sławinek Site 1-2 (Polańska 2016, 315, 322, fig. 6: 16) and an ornament from Grave 3 in Łubcze Site 37, barrow 1 (Machnik *et al*. 2009, 105, fig. 78: 4) as well as four whole and two partially preserved specimens from Graves 217 and 220 in Szczytna Site 5 (Hozer *et al*. 2017, 19, fig. 8:6-9, 26, fig. 13: 10, 11). Therefore, the previously

drawn image concerning a certain 'regionalisation' of metal finds, according to which artefacts made of copper strips seemed related rather to the western zone of the Central European area of the Corded Ware culture (Kempisty 1982, 69), appears to have changed slightly.

Traces of copper patina – remnants of ornaments?

The greenish colouring of the bone fragment, noticeable in the case of the burial from Grave No. 23 at Kichary Nowe, was also noted in nine other cases in the Kraków-Sandomierz group (Table 1). What is noteworthy is the recurrence of the location of such traces: they were observed most frequently in the region of the head of the deceased (including three of them on the temporal bone: in Łękawa and in Żerniki Górne, Graves 120 and 135) and three times in the area of the neck and chest. The upper limb was concerned in two cases: Lublin-Sławinek Site 1-2, Grave 1 and Kichary Nowe Grave No. 23; in both of them, the greenish tint was located on the left ulna of the deceased (Polańska 2016, 307, fig. 2 (A): 4; Kowalewska-Marszałek and Duday in print). These discolourations are interpreted as traces of a 'copper object (probably an ornament' (Polańska 2016, 307). It is noteworthy that both are female burials (an adult woman buried in the grave of Lublin, presumably a woman – in that of Kichary). They appear almost identical as to the position and orientation of the deceased, especially the arrangement of the limbs (both the upper and lower) in both graves (Figs 2 and 3; see also Polańska 2016, fig. 2: A).

A rather obvious association with arm ornaments of the bracelet type comes to mind here, but, as Marta Polańska rightly points out, bracelets are so far not known from the inventories of the Kraków-Sandomierz group (Polańska 2016, 322). They would therefore be the only remains, so far, of such objects, both preserved in a form that does not allow for closer identification, if we do not consider the possible two specimens from Strzyżów, however, coming from a destroyed site, from feature (features?) of uncertain chronology (Dąbrowski and Hensel 1983, 80) and not belonging to this group as well.

The hypothesis of the presence of bracelets in the two graves mentioned above (*i.e.*, Kichary Nowe and Lublin-Sławinek), although impossible to prove at present, does not seem unfounded. However, bracelets, although not very common in the Corded Ware culture, are known from grave inventories from Bohemia (Ottaway 1992, 283-285; Šumberová 1992, 117-119; Dobeš 2013, 61-63), Germany (*e.g.*, Matthias 1982, 71, Taf. 40: 10; Kempisty 1982, 67; Jacobs 1989, 7, 8, fig. 3: 1, 7), as well as from the area of the Middle Dnipro culture, *e.g.*, from Strelica (Artemenko 1967, 36). These include objects made of thin copper strip: *e.g.*, Halle-Dölauer Heide, Barrow 17 (Matthias 1982, 71, Taf. 40:10, see also Kempisty 1982, 67) and Strelica Grave 4 (Artemenko 1967, 36, fig. 24: 5), and it seems that it is specimens of this type, probably less durable than the more massive wire objects, that may have been in the two graves in question. A second possibility is the presence of ornaments of a complex nature, being a combination of copper elements and others of organic origin (*e.g.*, cords, thongs, tissue…). This possibility seems a very likely

one, as Corded Ware grave inventories contain ornaments made from different types of raw material, *e.g.*, a necklace from Klekacz with strung bone beads (Machnik *et al.* 2009, 35) or bracelets from the Vrbice site in Bohemia, with pendants-imitations of dog teeth (Dobeš 2013, 62, pl. 15: 8). Bracelets made of several small copper plates are also known (Šumberová 1992, 117).

There is another possibility to explain this effect: the presence of some small copper object in proximity to the forearm, but not necessarily a hand ornament. Such a situation can be observed, for example, in the case of Grave 103 in Żerniki Górne, where a small copper spiral was found near the left forearm of a woman buried there (Kempisty 1978, 96). It is noteworthy that both the orientation and the details of the arrangement of the skeletal remains from this grave correspond very clearly with the burials from Kichary Nowe and Lublin-Sławinek mentioned above.

Tools and tool tips

As has been repeatedly pointed out, ornaments predominate among metal finds in the Central European Corded Ware assemblages, and tools are only rarely encountered there (*e.g.*, Kempisty 1982, 67; Ottaway 1992, 283; Włodarczak 2006, 40). In the Little Poland area, these are mainly the aforementioned so-called intermediary-retouching tools: small specimens of various sizes and no standard form. Copper awls are better distinguished, but their presence, however, is sporadic: they occurred only in Kolosy, Grave 4 (Kempisty 1978, 238) and in Zielona, Grave 3, the last specimen being also qualified as retoucher (Włodarczak 2004, 316, 318, fig. 10: 2; 2006, 40).

Both finds from Kichary belong to a group of tools described as intermediary-retouching ones, but their function is difficult to determine. They probably refer to miniature metal tool tips, placed in handles made of organic materials (see *e.g.*, Strahm 1990-1991, 18, fig. 5: 11) and used in various ways. The differences in size and shape of the two specimens, as well as their separate location inside the same burial chamber, seem to indicate a possible different functions of both: perhaps, the more universal nature of the larger of the two, or, in the case of the smaller one, its closer association with flint processing (*e.g.*, manufacturing of arrowheads?).

Tools of this type, although not very numerous, are also known from other grave inventories, both within and outside the Kraków-Sandomierz group. The closest analogies among the known artefacts may be the tip of an intermediary tool from Grave 2 in Malżyce, district of Kazimierza Wielka (Włodarczak 2006, 40; 2014, 35, fig. 14: 16) and that from Grave 15 in Wilczyce Site 10, Sandomierz district (Boroń and Włodarczak 2019, 25; Gan 2019, 127); however, they are larger than the specimens from Kichary. Similarly, the finds from Szczytna, Jarosław district, two from Grave 220 (Site 5) and one from Grave 4 (Site 6), although similar in terms of form (Hozer *et al.* 2017, 26, fig. 13: 9, 43, fig. 24: 7, 8, photo 35: 6-8), are significantly larger. In this context, the finds from Kichary stand out above all

because of their very small dimensions, making them miniaturised equivalents of the other specimens of this type or of their working parts. At the same time, this would be another example in support of the thesis of the 'economical' use of raw material in Corded Ware metallurgy (Ottaway 1992, 285).

Chemical composition of the finds

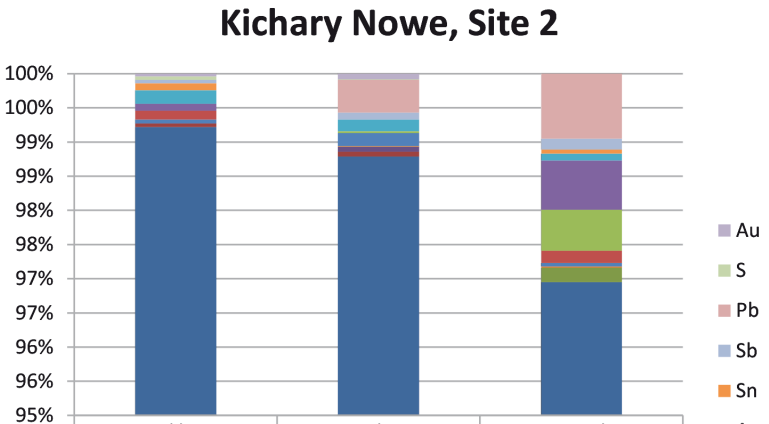
The results of the chemical composition analyses carried out for the Kichary Nowe artefacts complement the picture obtained for all metal objects associated with the Corded Ware culture from Little Poland and from adjacent areas to the east of the Vistula River (Kempisty 1978, 264, table 4; Hensel 1990, table 1; Hensel 1992, 107; Kempisty and Włodarczak 2000, 127, table 10; Włodarczak 2004, 318; Rudnicki and Włodarczak 2007, 229; Jarosz *et al.* 2009, 201; Nosek and Stępiński 2011; Polańska 2016, 322; Hensel and Pawlicka 2017, 221-226; Bugaj *et al.* 2019; Gan 2019, 128-130).

All three analysed copper specimens from Kichary Nowe reveal a copper content that is either very high (necklace: 99.23%, tool tip: 98.79%) or high (spiral ornament: 96.94%), with a small but distinct proportion of Ag (0.20, 0.17 and 0.10% respectively; lowest for the spiral). In contrast, they differ in the proportion of other elements, both in their assortment and quantity (Table 4; Fig. 11). The necklace has been worked from almost pure copper, containing (apart from Ag) small amounts of Ni, As and Sn (0.10%), with an almost complete absence of Sb, while the tool tip was made from copper with small amounts of Sb, Ag and Fe, and a relatively large addition of Pb; a complete absence of As is to note. The spiral ornament, on the other hand, was made of copper, in which the content of As (0.72%) significantly exceeds that of Sb (0.16%), and which also contains a significant admixture of Pb, a relatively large admixture of Zn, with small amounts of Ni and Ag. Such a composition allows the specimen in question to be considered as belonging to the so-called 'arsenical' copper (Dziekoński 1962, 82), contrary to the two other pieces from Kichary. According to the available data, one spiral ornament from Grave 83 in Mierzanowice (Hensel 1992, 107) and one from Grave 78 in Żerniki Górne were also made of 'arsenical' copper (Kempisty 1978, 264, table 4; Kempisty, Włodarczak 2000, 127, table 10). The spiral from Kichary is close to that from Żerniki, both in terms of the proportion of Cu (96.48%) and the relatively high content of Pb (0.82%). In contrast, they differ in the unequal content of As and Ag: in this respect, the specimen from Kichary is closer to the spiral from Mierzanowice (Fig. 12). In neither of these finds, apart from that of Kichary, was there any addition of Zn; also, the presence of Ni was evident. Traces of Sn were present in all three specimens.

It is worth noting that the chemical composition of the spiral from Kichary appears to be very similar to the characteristics of copper ore from the deposits known in the Kielce region, specifically from Miedzianka and Miedziana Góra (Dziekoński 1962, 86), which are approximately 50 km distant from the Kichary cemetery. But it is, of course, difficult to

judge the local provenance of the raw material used in this case. Interestingly, this similarity is not observed in specimens from Mierzanowice.

Both the necklace and the tool tip fit well within the general characteristics of metal artefacts of the Corded Ware culture in SE Poland. However, the spiral from Grave No. 26 stands out clearly because of the significant content of As, almost twice the average for all finds of the Kraków-Sandomierz group (Gan 2019, 129, fig. 2). Only a dozen other specimens belonging to the Corded Ware culture in Poland show similar or higher levels of As



	necklace	tool tip	spiral
Au	0,04	0,08	
S	0,05	0,01	
Pb	0	0,48	0,95
Sb	0,05	0,1	0,16
Sn	0,1	0	0,06
Ag	0,2	0,17	0,10
As	0,1	0	0,72
Zn	0	0,03	0,60
Ni	0,13	0	0,18
Fe	0,06	0,19	0,05
Mn	0	0,01	0,02
Cr	0	0	
Ti	0	0,07	
Si	0	0	0,21
Al	0,05	0,07	0,00
Cu	99,23	98,79	96,94

Fig. 11. Kichary Nowe, Site 2. Chemical composition of copper artefacts: necklace and tool tip (Grave No. 29) and spiral ornament (Grave No. 26). Using the results of chemical composition analyses carried out by Bio- and Archaeometric Laboratory, former Central Laboratory, Institute of Archaeology and Ethnology, Polish Academy of Sciences, Warsaw. Processing: H. Kowalewska-Marszałek

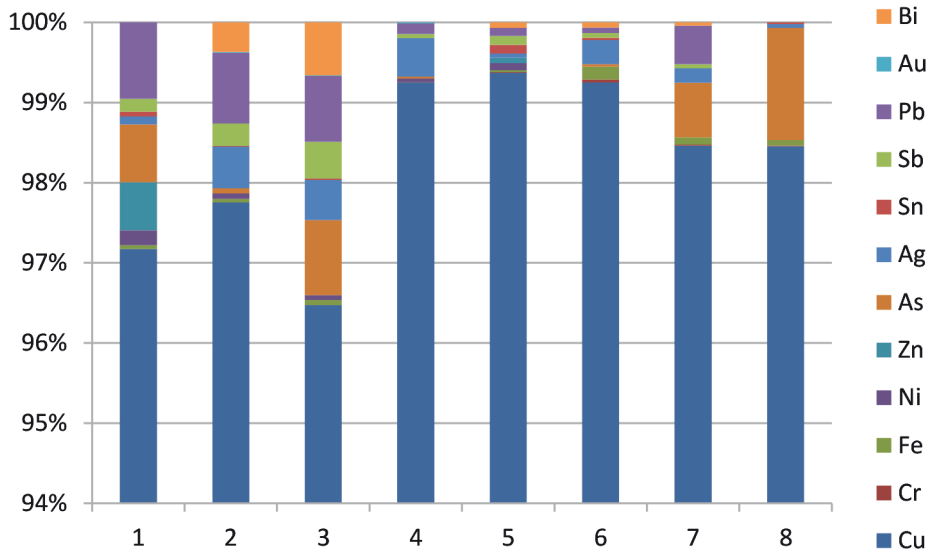


Fig. 12. Chemical composition of spiral copper ornaments (1-3, 5-8) and copper ring (4): 1 – Kichary Nowe, Grave No. 26; 2-3 – Żerniki Górne, Grave 78; 4 – Żerniki Górne, Grave 33; 5 – Żerniki Górne, Grave 137; 6 – Mierzanowice, Grave 81; 7-8 – Mierzanowice, Grave 83. Based on data by: Kempisty 1978; Hensel 1990; Hensel 1992; Kempisty and Włodarczak 2000; Gan 2019. Processing: H. Kowalewska-Marszałek

content: the above-mentioned spirals from Mierzanowice and Żerniki Górne, a fragment of a pin from the same cemetery, Grave 138 (Kempisty and Włodarczak 2000, 127, table 10), two spirals and twelve plates from Grave 217 in Szczytna, Site 5 (Hensel and Pawlicka 2017, 222) and one of the plates from Grave 54 in Mirocin, Site 24 (Bugaj *et al.* 2019, 198, table 2). The Ni content is also slightly higher than average in the case of Kichary, as is the Zn content. In turn, the high amount of Pb (0.95%), significantly higher than the average, places the specimen from Kichary among only a few finds with the highest Pb values, considered important for alloy properties (Hensel and Pawlicka 2017, 221; Gan 2019, 128). These include: two pendants from Grave 137 in Żerniki Górne, a spiral (a smaller one) from Grave 2 in Lublin-Sławinek Site 1-2 (Polańska 2016, 322), a retouching tool tip from Grave 2 in Malżyce (Gan 2019, 128, table 1) and one of the intermediary-retouching tools from Grave 4 in Szczytna Site 6 (Hensel and Pawlicka 2017, 222).

As can be seen from the data currently available, all the analysed artefacts related to the Corded Ware culture were made of copper, the proportion of which ranges from 91.77% to 99.35% and seems to be marginally higher for tools (mean: 96.61%) than for ornaments (mean: 96.55%). Specimens containing more than 96% pure copper account for about 2/3 of all finds, both ornaments and tools. At the same time some regional differences can be observed, related to the spatial grouping of sites belonging to the Corded Ware culture in three main regions: near Cracow (cluster SW), North-Little Poland (cluster N) and E from

the Vistula River (Fig. 1); the highest proportion of pure copper is shown by finds from cluster N, it is also higher than average in cluster SW, and clearly lower east of the Vistula (Fig. 13).

As additional components, Pb, Zn, Ni, Ag, As, Sb, and Sn are present in varying degrees of intensity. Their content varies, both in terms of the upper limits of their proportion and in terms of their average values (Gan 2019, fig. 2). Here, too, differences between ornaments and tools are marked, and some variation is also apparent between individual regional clusters of sites. It is worth noting that the 'cluster E' generally shows higher values than the averages for the whole set of finds; they are also higher than in the case of western Little Poland, *i.e.*, clusters SW and N (Fig. 13).

The grouping of metal finds according to Oxford system with the methodology of the Flow Model (Perucchetti 2015, 50, 57-63) developed as the FLAME project (Pollard *et al.* 2018, 5, 85-115), due to the presence or absence in their composition of the four (apart from copper) 'essential' components, *i.e.*, As, Sb, Ag and Ni, carried out for all Corded Ware finds from Little Poland and areas to the E of the Vistula (Table 6; Fig. 14) indicates a rather large dispersion: the finds belong to as many as 12 'Copper compositional groups', out of 16 defined (Perucchetti 2015, 50, table 2; Perucchetti *et al.* 2015, table 3). The most prominent of these are two: Group 7 (Cu-Sb-Ag: 18 specimens) and Group 12 (Cu-As-Sb-Ni:

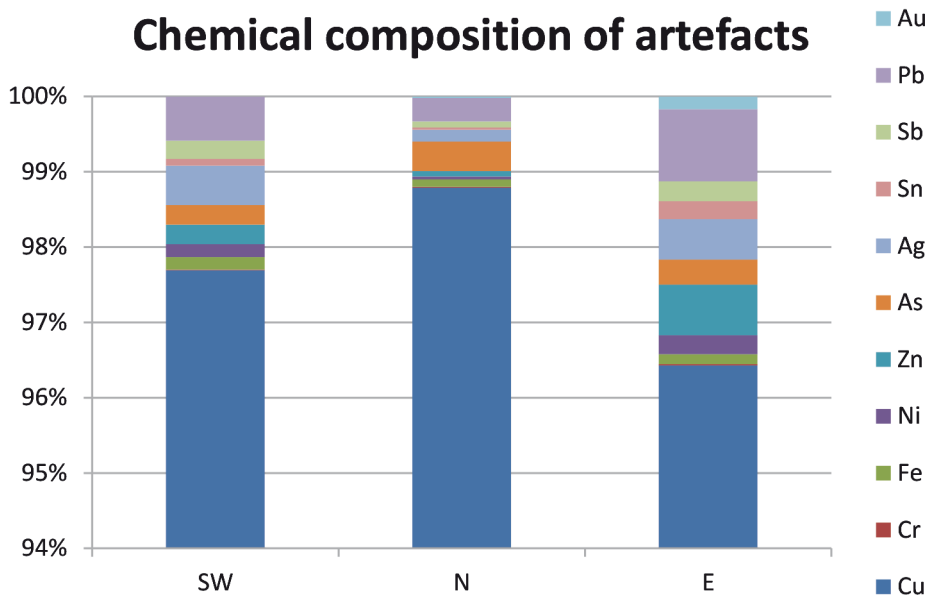


Fig. 13. Chemical composition of copper artefacts (average values) in three main regions: SW, N and E (see Fig. 1 and description in the text). Calculated based on data according to: Kempisty 1978; Hensel 1990; Hensel 1992; Kempisty and Włodarczak 2000; Włodarczak 2004; Rudnicki and Włodarczak 2007; Jarosz et al. 2009; Nosek and Stępiński 2011; Polańska 2016; Hensel and Pawlicka 2017; Bugaj et al. 2019; Gan 2019. Processing: H. Kowalewska-Marszałek

16 specimens). Quite distinct are also Groups 9 (Cu-As-Ag) and 16 (Cu-As-Sb-Ag-Ni), with 8 and 6 specimens, respectively; the others are much smaller and fairly even. Completely absent are finds belonging to four groups: 5 (Cu-Ni), 10 (Cu-Sb-Ni), 11 (Cu-As-Ni) and 14 (Cu-As-Sb-Ni).

Interestingly, the aforementioned differences between the eastern and western regions of the Corded Ware culture are also noticeable in this case. They concern above all the share of finds from the Group 12, dominant in the areas to the east of the Vistula, and almost absent in the western territory, where, in turn, the share of specimens from the Groups 1-4 is more distinct (Table 6; Fig. 14: b, c).

Generally, tools and ornaments are found within the same units. The exception is Group 12 (dominant in the areas to the east of the Vistula), which contains only ornaments: two spirals and 13 plates from Grave 217 in Szczytna, Site 5, as well as the only specimen from the western part of Little Poland: one of the spirals from Grave 78 in Żerniki Górne. Group 6 also stands out, to which only one tool belongs (one of the intermediate retouchers from Grave 4 in Szczytna, Site 6). It is-worth noting that the same specimen is also distinguished by the highest content of Pb (5.34%) in the whole assemblage of finds, which even makes it possible to classify it as 'lead bronze' (Hensel and Pawlicka 2017, 221).

Table 6. Frequency of metal artefacts of the Corded Ware culture in SE Poland in different 'Copper compositional groups' (based on data by: Kempisty 1978; Hensel 1990; Hensel 1992; Kempisty and Włodarczak 2000; Włodarczak 2004; Rudnicki and Włodarczak 2007; Jarosz et al. 2009; Nosek and Stępiński 2011; Polańska 2016; Hensel and Pawlicka 2017; Bugaj et al. 2019; Gan 2019)

Group No.	Description	Metal artefacts region W	Metal artefacts region E	Total
Group 1	Cu	2	1	3
Group 2	Cu As	2	1	3
Group 3	Cu Sb	2		2
Group 4	Cu Ag	2	2	4
Group 5	Cu Ni			0
Group 6	Cu As Sb		1	1
Group 7	Cu Sb Ag	6	12	18
Group 8	Cu Ag Ni	1	1	2
Group 9	Cu As Ag	3	5	8
Group 10	Cu Sb Ni			0
Group 11	Cu As Ni			0
Group 12	Cu As Sb Ag	1	15	16
Group 13	Cu Sb Ag Ni	2		2
Group 14	Cu As Sb Ni			0
Group 15	Cu As Ag Ni	2	3	5
Group 16	Cu As Sb Ag Ni	2	4	6
Total		25	45	70

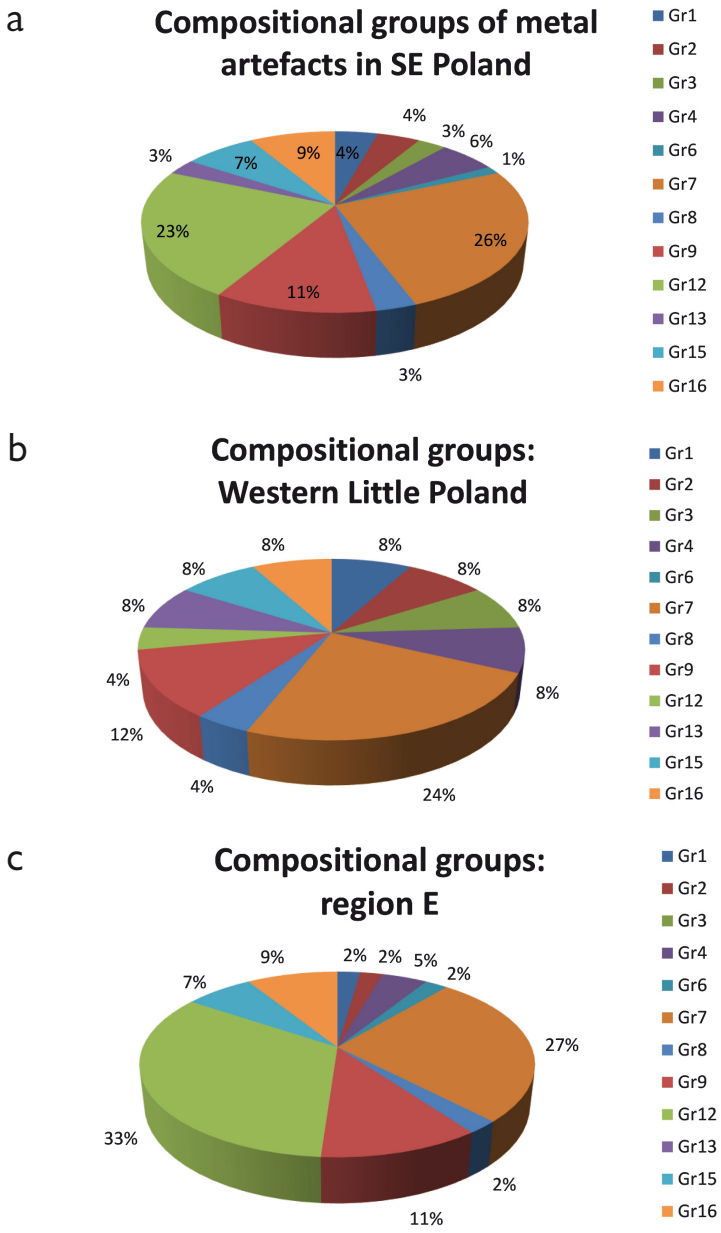


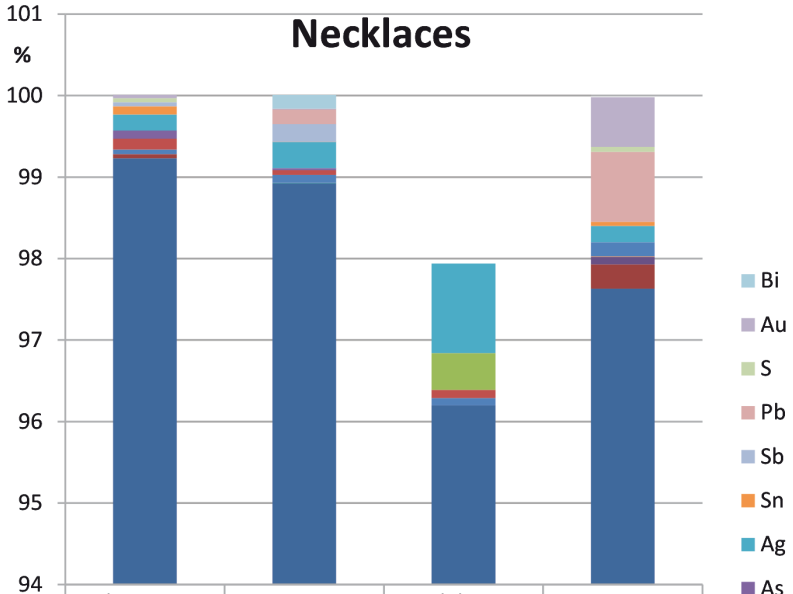
Fig. 14. Percentage of metal artefacts of the Corded Ware culture from different 'Copper compositional groups' (according to Oxford system): a – SE Poland (as whole); b – western part of the Little Poland; c – areas to the east of the Vistula River. Based on data by: Kempisty 1978; Hensel 1990; Hensel 1992; Kempisty and Włodarczak 2000; Włodarczak 2004; Rudnicki and Włodarczak 2007; Jarosz *et al.* 2009; Nosek and Stępiński 2011; Polańska 2016; Hensel and Pawlicka 2017; Bugaj *et al.* 2019; Gan 2019. Processing: H. Kowalewska-Marszałek

Group 7, which is dominant in the material of the Corded Ware culture of SE Poland, regardless of the location of finds, seems to predominate also among the Bohemian finds (although the small number of analyses requires treating this statement with caution). At the same time, it is a group whose presence is clearly marked in the Late Neolithic of southern France and Switzerland, and it is considered to be a unit of a rather 'western' pattern of distribution of finds (Perucchetti 2015, 181-184; Perucchetti *et al.* 2015, 611, fig. 8). In turn, Group 12 is well marked in the very beginning of the Early Bronze Age, above all in the areas to the NE of the Alpine region (more than half of all finds from this period belong to it), where it is very clearly associated, for example, with hoards and with finds of the Ösenringe type. The most frequent occurrence of artefacts from this group is observed in the areas of Central Europe (Perucchetti 2015, 204-210, 217, fig. 49; Perucchetti *et al.* 2015, 613, fig. 9).

Returning to the finds from Kichary, it can be noted that each of them should be placed in a different compositional group (Table 4). The necklace belongs to Group 15 (Cu-As-Ag-Ni) like the three plates from Grave 217 in Szczytna, Site 5, while the spiral is in Group 16 (Cu-As-Sb-Ag-Ni), together with other ornaments from Szczytna, Site 5: one spiral and one of the plates from Grave 217, as well as one spiral from Grave 220 (close to the spiral from Kichary also in terms of typology, *cf.*, above). There are also two tools in that group: an intermediary-retouching tool from the aforementioned Grave 220 in Szczytna and an awl from Kolosy (Kempisty 1978, table 4; Hensel 1990, table 1). The spiral from Kichary differs in having a higher proportion of Cu and Pb, and lower proportions of Sb, Ag and Ni; it also lacks the admixture of Au present in the specimens from Szczytna.

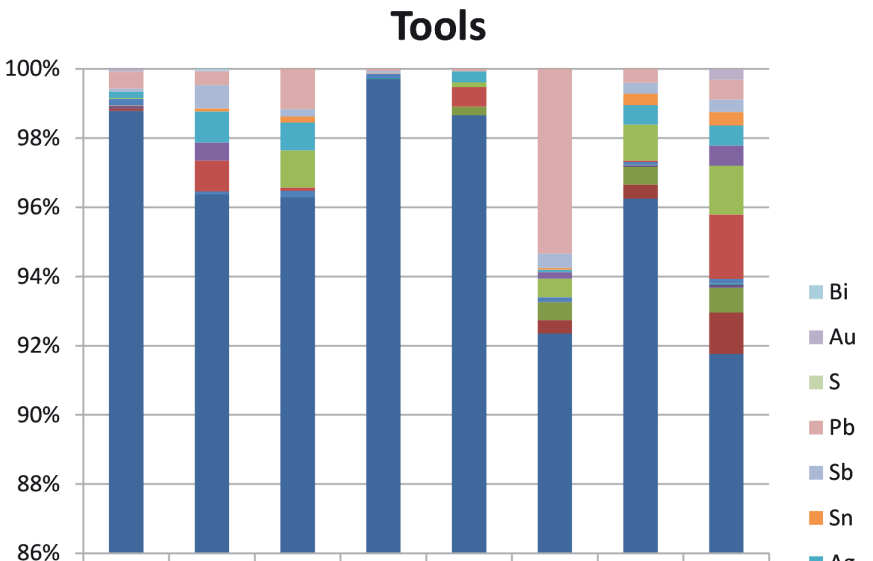
Differentiation is also evident with regard to individual categories of finds, *e.g.*, each of the four necklaces in question belongs to a different compositional group: the specimen from Kichary is attributable, as already mentioned, to Group 15, that from Mierzanowice can be associated with Group 7, the necklace from Klekacz – to Group 8 (as only one other artefact: awl-retoucher from Zielona) and that from Szczytna – to Group 4 (together with one plate from Grave 217 in Szczytna and two ornaments from Mierzanowice and Żerniki Górne). The necklaces from Kichary and Mierzanowice are similar in terms of the high proportion of Cu and of the clearly marked presence of Ag (respectively: 0.32% and 0.20%), but differ in the quantity of As and Ni (a more significant amount in the case of the Kichary specimen), as well as that of Sb (significant only in Mierzanowice). Moreover, there is also a small amount of Sn in the Kichary necklace, as well as Pb and Bi in the case of Mierzanowice. Differences are also evident in the other two necklaces: from Klekacz and Szczytna (Fig. 15).

The tool tip from Kichary should be placed in Group 7 (Cu-Sb-Ag), *i.e.*, the most abundantly represented among the finds of Corded Ware culture in SE Poland, together with two other tools: intermediaries from Grave 2 in Malżyce and from Grave 4 in Szczytna, Site 6. To the same Group 7 belong also ornaments: a necklace from Mierzanowice, a ring from Grave 32 in Pełczyska, one of the spirals from Grave 78 and a fragment of a pendant from



	Kichary Nowe	Mierzanowice	Klekacz	Szczytna
Bi	0	0,17		
Au	0,04	0,0083		0,61
S	0,05			0,06
Pb	0	0,18		0,86
Sb	0,05	0,22		0
Sn	0,1	0,00001		0,05
Ag	0,2	0,32	1,1	0,2
As	0,1	0,025		0
Zn	0	0	0,45	0
Ni	0,13	0,057	0,1	0
Fe	0,06	0,098	0,09	0,17
Mn	0			0,01
Cr	0	0,0105		0
Ti	0			0,09
Si	0			0
Al	0,05			0,3
Cu	99,23	98,92	96,2	97,63

Fig. 15. Chemical composition of copper necklaces from SE Poland: 1 – Kichary Nowe (Grave No. 29), 2 – Mierzanowice (Grave 83), 3 – Klekacz (Grave 1), 4 – Szczytna (Grave 4). Based on data by: Hensel 1992; Nosek and Stępiński 2011; Hensel and Pawlicka 2017; Gan 2019.
Processing: H. Kowalewska-Marszałek



	1	2	3	4	5	6	7	8
Bi		0,056	0	0,00				
Au	0,08	0,015	0	0,00		0	0	0,31
S	0,01					0	0	0
Pb	0,48	0,4	1,15	0,06	0,07	5,34	0,4	0,57
Sb	0,1	0,68	0,21	0,06	0	0,41	0,32	0,37
Sn	0	0,086	0,18	0,02	0	0,05	0,33	0,39
Ag	0,17	0,91	0,79	0,00	0,32	0,07	0,56	0,58
As	0	0,53	0	0,00		0,19	0	0,58
Zn	0,03	0	1,07	0,00	0,14	0,54	1,04	1,41
Ni	0	0,9	0,09	0,00	0,56	0	0,04	1,86
Fe	0,19	0,081	0,19	0,13	0	0,14	0,08	0,13
Mn	0,01	0			0	0	0	0
Cr	0	0	0	0,03	0	0	0,02	0,05
Ti	0,07					0	0,04	0,07
Si	0				0,25	0,52	0,51	0,72
Al	0,07	0			0	0,39	0,41	1,2
Cu	98,79	97,23	95,4	99,33	98,56	92,36	96,27	91,77

Fig. 16. Chemical composition of copper tools and tool tips from the Little Poland: 1 – Kichary Nowe (Grave No. 29), 2 – Kolosy (Grave 4), 3 – Małżyce (Grave 2), 4 – Wilczyce (Grave 15), 5 – Zielona (Grave 3), 6-7 – Szczytna (Grave 4), 8 – Szczytna (Grave 220). Based on data by: Kempisty 1978; Hensel 1990; Włodarczak 2004; 2006; Hensel and Pawlicka 2017; Gan 2019.
Processing: H. Kowalewska-Marszałek

Grave 137 in Żerniki Górne, one spiral from Grave 220 and ten plates from Grave 217 in Szczytna, Site 5. However, they all differ from the specimen from Kichary by a greater amount of Sb and especially of Ag.

The 'retoucher' from Wilczyce 10, Grave 15 seems to be the most similar to the tool tip from Kichary in terms of chemical composition: both are made of almost pure copper (over 98%), with a small amount of Fe, without Ni and As. The tool tip from Kichary, with a small addition of Ag and Sb, and (relatively high) Pb, as well as trace amounts of Pb and Sb, were also found in the object from Wilczyce. A tool from Zielona, Grave 3 (Włodarczak 2004, 316-318, fig. 10: 2), similar in copper content, differs from the Kichary specimen in the presence of Ni, more Ag, and less Pb, as well as the absence of Sb (Fig. 16).

The compositional variety evident in the case of Kichary is also noticeable at other sites of the Corded Ware culture, from which several specimens each come: Malżyce (three specimens, three compositional groups), Mierzanowice (four specimens, four groups), and Żerniki Górne (seven specimens, six groups). The exception in this respect is Szczytna, showing much greater homogeneity (44 specimens belonging to nine groups, mainly to Groups 7 and 12).

Such a marked diversity seems to indicate that the population of the Corded Ware culture from this region used a variety of sources of raw material, which may be due, among other things, to their participation in an intensive, long-distance exchange of metal objects.

CONCLUSIONS

In the cemetery of Kichary Nowe, metal artefacts have been found in three of the five Corded Ware graves currently known; one of these (Grave No. 29) contained as many as five metal finds: three made of copper and two of gold. This is a relatively high accumulation of metal objects, placing this cemetery in a unique position within the Kraków-Sandomierz group of the Corded Ware culture, in which finds of metal artefacts are not very common. According to Piotr Włodarczak's estimations, they occurred in only 14.9% to 17.9% of all graves of this group (Włodarczak 2006, 77), *e.g.*, in only 11.1% of graves in the Żerniki Górne cemetery (Kempisty and Włodarczak 2000, 127). On the other hand, regional differences between the Sandomierz Upland and the southwest part of the Little Poland region are also apparent in this regard, with a slightly higher frequency of occurrence of metal artefacts in the former area. The data from Mierzanowice, with three grave inventories with copper specimens out of 11 graves belonging to the Corded Ware culture (Uzarowiczowa 1970), seem to confirm this opinion, and it also applies to the cemetery at Kichary Nowe.

Differences are also observed between the Little Poland region and areas to the east of the Vistula in terms of the chemical composition of the finds in both regions. The finds

from Little Poland reveal a higher content of pure copper in the individual pieces, with a lower proportion of other admixtures, which clearly distinguishes them from the eastern areas. In turn, in the areas east of the Vistula, the picture of the overall metal finds is much more uniform than in the Małopolska region.

It should be noted that the three artefacts originating from Kichary Nowe are unique. This is most clearly visible in the case of the finds from Grave No. 29: an exceptional copper necklace and two spirals of golden wire, which are, to date, the oldest gold specimens known from Poland. Their presence in the same funerary assemblage makes it possible to consider this burial as unique and suggests the special status and the high prestige of the deceased buried there. Perhaps two smaller specimens (miniature tool tips) were also associated with his social and/or professional position.

The copper spiral (Grave No. 26) has more numerous analogues in the Corded Ware culture and in the Kraków-Sandomierz group as well. However, this ornament should also be considered a sign of individual prestige related to the deceased (Jarosz 2016, 524).

In general, the unitary nature of metal objects from Kichary Nowe does not necessarily allow generalisation to be made in this respect. It is worth noting, however, that this cemetery retains the fundamental proportions evident in the Corded Ware culture, namely the clear predominance of personal ornaments over tools. These ornaments were mainly found in male burials; in only one case was a copper object (most likely an ornament) discovered in a grave with a presumed female burial. This result, however, is due to the gender population structure in this cemetery.

Although the finds of metal objects are relatively numerous, there is no indication of their local manufacture, if we do not count a certain similarity of the chemical composition of one of the specimens to the nearby copper deposits (for which, however, there is no evidence of their exploitation in prehistory). It seems more likely, therefore, that they came to the site as the result of some kind of exchange mechanism, perhaps a long-distance one. Here, one can point to the south-east as a very likely direction of intercultural contact, as indicated, among other things, by the analogies concerning the forms and ornamentation of the vessels (Kowalewska-Marszałek and Duday in print). In addition, the analysis of the chemical composition of the finds from Kichary Nowe provides an opportunity to integrate them into a more general discussion of the provenance and distribution of metal finds in the Corded Ware culture and the Late Neolithic of Europe.

Acknowledgements

The author would like to thank Dr Mira Pyżuk (former Department of Applied Sciences, Institute of Archaeology and Ethnology, Polish Academy of Sciences, Warsaw) for the anthropological analyses of human skeletal remains from Kichary Nowe cemetery. I am grateful to Ms Elżbieta Pawlicka and Dr Ing. Zdzisław Hensel (Bio- and Archaeometric Laboratory, former Central Laboratory, Institute of Archaeology and Ethnology, Polish Academy of Sciences, Warsaw) for the chemical analyses of the metal artefacts from Site 2

at Kichary Nowe. Thanks are also due to Dr Paweł Gan (Bio- and Archaeometric Laboratory, Institute of Archaeology and Ethnology, Polish Academy of Sciences, Warsaw) for his kind help in verification of laboratory references of samples, as well as to the Reviewers for their positive evaluation and valuable comments.

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