Marta Krenz

SKELETAL MATERIALS FROM ŻERNIKI GÓRNE (POLAND) IN RELATION TO BIOLOGICAL VARIABILITY OF NEOLITHIC AND EARLY BRONZE AGE POPULATIONS IN CENTRAL EUROPE

Abstract. This paper presents the morphological differentiation of Neolithic and Early Bronze Age populations in Central Europe. The study focused on skeletal materials from Żerniki Górne (Poland) which belong to the Corded Ware Culture and Trzciniec Culture. The relation between biological variability and cultural differentiation was analysed on the basis of 10 skull measurements taking in to account the given archaeological cultures.

For the Neolithic and the Early Bronze Age, many Central European archaeological cultures have been distinguished on the basis of economic systems related to studied human samples. These systems can be called cultural adaptive strategies from the biological point of view. The main factor that differentiates these strategies is the role of agriculture in the general balance of economic activities. In this context, an interesting issue about the nature of relation between cultural differentiation and biological variability of Neolithic populations emerges. A question thus arises: is it reasonable, taking into account biological parameters of a population, to separate for analytical purposes particular groups on account of their adaptive strategy or, may be, they should be treated as a whole?

This paper is to serve as a preliminary assessment of the differentiation of Neolithic and Early Bronze Age populations of Central

Europe, with a particular attention paid to the populations of Corded Ware Culture and Trzciniec Culture from Żerniki Górne (Poland, Kielce voivodship; fig.1). This approach is determined by a perspective of further studies of these groups in relation to morphological stress indicators (enamel hypoplasia, *cribra orbitalia*, Harris lines) in order to evaluate general living conditions of these populations.
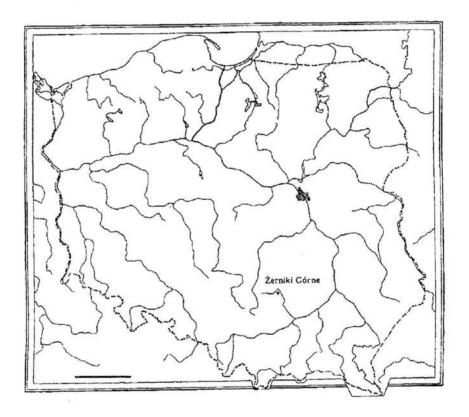

Fig. 1. Location of the Żerniki Górne site

Abbrev.: BB – Bell Beaker culture; BP – Band Pottery culture; CW – Corded Ware culture; FB – Funnel Beaker culture; SP – Stroked Pottery culture; Walter. – Walternienburg culture; nt – turn of the Neolithic and the Bronze Age

The purpose of this paper is to answer the following questions:
1) What is the structure of the biological differentiation of Neolithic and Early Bronze Age populations of Central Europe, particularily those

of Corded Ware Culture and the Trzciniec culture from Żerniki Górne with reference to their adaptive strategies?

2) Do the populations of Corded Ware Culture and Trzciniec culture form random samples in comparison with other groups of the Corded Ware Culture and Early Bronze Age cultures?

If the assumption that the main criterion of morphological similarity between populations is a respective archaeological culture will prove true and if it confirms that the populations of Corded Ware Culture and Trzciniec culture from żerniki Górne do not morphologically differ from other Central European groups of analogous cultural units, regarding these two populations from żerniki as separate objects of further studies would be reasonable.

Materials and methods

In order to illustrate and compare the morphological structure of various Neolithic and Early Bronze populations from Central Europe, the standard set of 10 cranial measurements was applied:
g-op
eu-eu
ba-b
n-pr
n-ns
mf
ek
OH
ap. pirif.

Skull data from previously published materials were used (tab. 1). Documentation on the populations from Żerniki Górne was available thanks to the courtesy of Prof. A. Wiercińska from the State Archaeological Museum in Warsaw, however this paper only includes data on the populations of Corded Ware Culture and Trzciniec culture – other archaeological cultures were excluded from the analysis on account of their insufficient number.

Tree diagrams illustrating the position of the studied populations, indicated by their morphological structure, were constructed by means of Statistica package (v. 5). Traits determining biological differentiation were revealed by principal components analysis (A. Matkiewicz, W. Ratajczak 1992). The calculations where done for a respective matrix of Euclidean square distances by the method of nearest proximity.
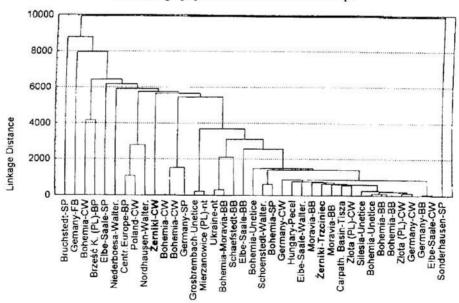
Table 1. Data from 10 cranial measurements of Neolithic and Early Bronze Age populations from Central Europe

Rec.	Population	Culture	Data source											
1	Elbe-Saale: Sonderhausen	SP	A. Bach 1978	13	187	139.4		99.6	134	68.8	50.4	41.3	32.2	23.5
2	Elbe-Saale	CW	A. Bach 1978	37	191.1	135.2	142.5	97.6	127.9	70.2	50.6	41	32	25.6
3	Elbe-Saale	SP	A. Bach 1978	40	188.6	138.5	141.7	98.1	131.4	71.8	51.1	40.6	32.3	24.6
4	Elbe-Saale	BB	A. Bach 1978	36	180.3	146.9	139.5	99.5	132.8	71.1	51	41.7	32.3	24.2
5	Germany	SP	I. Schwidetzky 1967	15	187.2	138.4	139.6	99.9	153.3	71	52	41.7	33	23.5
6	Germany	FB	I. Schwidetzky 1967	33	191	138.9	136.2	98.3	127.5	70.1	51	40.4	30.9	24.8
7	Germany	BB	I. Schwidetzky 1967	28	178.6	146.6	138.7	99	130.9	71.2	51.1	40.5	32.4	24.6
8	Germany	CW	I. Schwidetzky 1967	33	191.1	135	142.8	97.9	127.3	69.7	50.2	41.4	32.3	25.6
9	Poland: Brześć Kujawski	BP	A. Wierciński 1973	16	186.2	137.8	139.4	98.6	131.7	64.9	48.5	41.2	32.6	24
10	Poland: Złota	CW	B. Miszkiewicz 1958	24	187.2	139.7	137.8	97	129.6	69.9	51.8	42.8	33.2	25.6
11	Bohemia	SP	J. Jelinek 1973	41	193.8	134.3	142	98.2	130.5	67.7	50	40.8	32.2	25
12	Bohemia	CW	J. Jelinek 1973	12	191.5	136	144.6	94.2	122.5	67	48.9	39.7	32.1	25.5
13	Bohemia	CW	Z.K Zoffmann 1984	11	196.5	135.3	141.4	99.9	129.7	67	50	40.5	32	24.8
14	Bohemia	BB	J. Chochol 1964	11	178.4	146.5	142.3	99.1	133.5	71.2	51.2	40.2	32.2	24.5
15	Bohemia	Unetice	J. Chochol 1964	100	192.3	135.7	143.1	97.3	131.3	68.6	51.1	40.3	31.4	25.3
16	Bohemia	Unetice	J. Chochol 1964	20	192.8	134.9	146	96.1	131.4	70	53.1	40.1	30.1	26.1
17	Poland: Mierzanowice	nt	A. Gałasińska-Pomykol et al. 1967	18	189.7	141.1	137.4	96.5	132.9	69.7	53.2	43	33.7	25.8
18	Moravia	Unetice	J. Chochol 1964	101	189.4	134.9	140.6	96	130	70.1	51.6	40.6	31.4	26.3
19	Germany: Grossbrembach	Unetice	H. Ullrich 1972	94	195.2	134.8	143.4	98.1	135.1	71.4	52.1	42	32.1	25.4
20	Poland: Silesia	Unetice	after Ullrich 1972	39	190.9	134.8	139.1	97.7	125.7	68.4	53.7	41.2	33.1	24.8
21	Central Germany	CW	R. Feustel, H. Ullrich 1969		188.6	133.5		97.6	128.4	69.2	49.6	41.3	32.2	25.6
22	Elbe-Saale: Nordhausen	Walter.	R. Feustel, H. Ullrich 1969	50	198.5	141.8		98.4	127.8	71.3	51.8	40.5	31	25.5
23	Elbe-Saale: Niederboesa	Walter.	H. Ullrich 1960, 1972	74	200.3	140.4		91.1		70	51	41	31.3	23.8
24	Elbe-Saale: Schaefstaedt	BB	H. Ullrich 1960, 1972		178.3	142.3	142.5	98.7	131	73	47	41.5	31.1	24.6
25	Elbe-Saale	Walter.	A. Bach 1978	33	194.4	140		96.8	128.6	70.6	51.6	40.4	31.6	26
26	Elbe-Saale: Bruchstedt	SP	A. Bach 1978	61	186	137	137.3	95	132.2	68	49	39.7	31.3	23.9
27	Elbe-Saale: Schoenstedt	Walter.	A. Bach, A. Bach 1972	64	189.4	137	138.8	96.6	129.4	70	51.6	40.4	32.4	26.8
28	Poland	CW	A. Wierciński 1973	14	192.9	138.9	136.4	100.1	130.9	69.3	51.1	42.8	33.2	24.8
29	Bohemia	CW	Z. Hoffmann 1984	11	196.5	135.3	141.4	99.1	129.7	67	50	40.2	32	24.5
30	Bohemia	BB	J. Chochol 1964	11	178.4	146.5	142.3	98.4	133.1	71.2	51.2	40.1	32.2	24.8
31	Bohemia/Moravia	BB	I. Jelinek 1964, J. Chochol et al. 1964	76	182.2	146.3	139.4	98.7	133.1	69.5	50	40.6	31.9	24.6
32	Moravia	BB	J. Chochol 1964		185.1	146.5	136.2	99.2	132.5	68.7	48.9	42.1	32.4	25.5
33	Poland: Złota	CW	B. Miszkiewicz 1958	78	185.6	139.1	136.5	96.9	129.4	68.5	53.9	43.7	32.8	25.6
34	Ukraine	nt	T. Konduktorova 1973	16	196.1	142.7	144.2	99.8	140.7	69.2	51	40.3	31.6	25.3
35	Central Europe	BP	Z. Zoffmann 1984	17	191.2	138.9	144.5	97.1	131.8	71.8	51.3	39.2	34	27.2
36	Carpathian Basin	Tisza	Z. Zoffmann 1980, 1984	33	189.2	134.1	138.8	98.4	130.3	68.4	50.8	41.9	32.8	25.1
37	Hungary	Pecel	J. Nemeskeri 1956	67	178.3	137.8	133.8	96.6	122.5	68.5	51.8	41	32.3	24.2
38	Poland: Zerniki Górne	CW	A. Wiercińska 1965-73	22	185	136.3	134.9	96.8	129.7	70.1	50.1	41	32.8	24.9
39	Poland: Zerniki Górne	Trzciniec	A. Wiercińska 1965-73	17	193.5	135.1	138	91.1	131	69.8	50.5	40.1	33.2	24.9

Results and discussion

Diagram in the fig. 2 reflects the biological differentiation of Neolithic and Early Bronze Age populations from the territory of Central Europe, belonging to different archaeological cultures. Populations of analogous cultural units show considerable biological similarity. The samples of Corded Ware Culture and Early Bronze cultures, which is focused on this paper, the are also marked by substantial morphological similarity within corresponding archaeological cultures. Therefore the fig. 2 supports the results of study of J. Piontek and A. Marciniak (1990, p. 76 and 99) that „the fact of belonging to a given cultural unit (adaptive system) is the main criterion for determination of morphological similarity of Central European" Neolithic populations. The fig. 3 illustrates the position of the Corded Ware Culture populations within other samples of the same culture in Central Europe. The population from Żerniki does not morphologically differ from other groups and shows remarkable similarity to the groups from Bohemia and Germany. The fig. 4 presents morphological similarity of the Trzciniec culture population from Żerniki to other Early Bronze groups from Central Europe. The figures 3 and 4 support the assumption that two studied populations from Żerniki Górne are random samples if compared with other Neolithic populations of the Corded Ware Culture and Early Bronze Age groups.

Fig. 2. Tree diagram showing morphological differentiation of Neolithic and Early Bronze Age populations from Central Europe

Fig. 3. Tree diagram showing morphological differentiation of Corded Ware Culture
populations form Central Europe
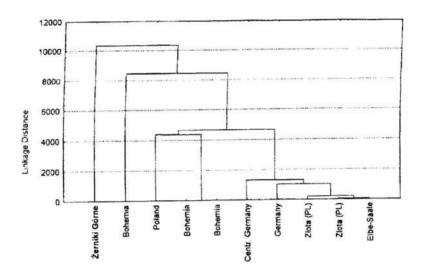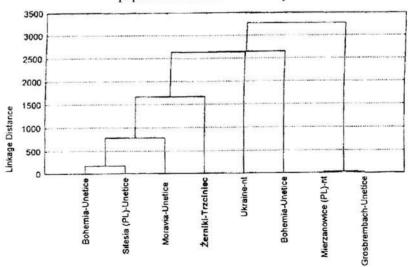Abbrev.: nt – turn of the Neolithic and the Bronze Age

Fig. 4. The diagram showing morphological differentiation of Early Bronze Age
populations from Central Europe

Tables 2 and 3 present the skull measurements which account for the differentation of Corded Ware Culture and Early Bronze Age cultures populations. They are mainly variables describing skull shape and orbital dimensions; high significance of obtained correlations is remarkable. In the case of the Corded Ware Culture the first principal component accounts for 44.8% of the total percentage of variability of all original variables; in the case of Early Bronze Age populations this value is 30.4% which reflects a strong relationship between the components and the original variables.

Tab. 2. Coefficients of determination and correlation between principal components V_i and original variables for 10 cranial measurements of Corded Ware Culture populations

	Variable	Coefficient of determination			Coefficient of correlation		
		V_1	V_2	V_3	V_1	V_2	V_3
1	g-up	0.889*	0.108	0.001	-0.943*	0.329	0.026
2	eu-eu	0.440***	0.405***	0.138	0.663***	0.637***	0.373
3	ba-b	0.664**	0.268	0.061	-0.815**	-0.517	0.248
4	ft-ft	0.537***	0.369	0.002	-0.733***	0.608	0.043
5	zy-zy	0.003	0.657**	0.139	0.051	0.811**	0.373
6	n-pr	0.408***	0.156	0.055	0.639***	-0.395	0.234
7	n-ms	0.420***	0.113	0.220	0.648***	0.336	0.469
8	mf-ek	0.401***	0.107	0.331	0.633***	0.326	0.576
9	OH	0.707**	0.143	0.036	0.841**	0.378	0.191
10	ap. pirif.	0.008	0.059	0.484***	0.087	0.244	0.696***

* significant for $\alpha < 0,001$; ** significant for $\alpha < 0,01$; *** significant for $\alpha < 0,05$
V_1 accounts for 44.76% of total percentage of variability; V_2 – 23.86%; V_3 – 14.67%

Tab. 3. Coefficients of determination and correlation between principal components V_i and original variables for 10 cranial measurements of Early Bronze age populations

	Variable	Coefficient of determination			Coefficient of correlation		
		V_1	V_2	V_3	V_1	V_2	V_3
1	g-up	0.881*	0.059	0.033	-0.939*	-0.243	-0.181
2	eu-eu	0.059	0.878*	0.001	-0.243	0.937*	-0.035
3	ba-b	0.710**	0.096	0.152	-0.843**	0.309	0.390
4	ft-ft	0.070	0.134	0.592**	-0.264	0.366	0.769**
5	zy-zy	0.886*	0.082	0.005	-0.941*	0.287	-0.068
6	n-pr	0.246	0.034	0.035	-0.496	-0.183	-0.186
7	n-ms	0.002	0.006	0.069	0.044	-0.078	0.263
8	mf-ek	0.061	0.690**	0.001	-0.247	0.831**	0.035
9	OH	0.107	0.087	0.410***	0.327	0.295	-0.640***
10	ap. pirif.	0.015	0.002	0.098	-0.124	-0.044	0.313

* significant for $\alpha < 0,001$; ** significant for $\alpha < 0,01$; *** significant for $\alpha < 0,05$
V_1 accounts for 30.38% of total percentage of variability; V_2 – 20.68%; V_3 – 13.96%

To sum up, the populations from Żerniki Górne should be treated saparately in further research of morphological stress indicators, since the studied skeletal material came from human samples that are homogenous with reference to the respective socio-economic system. This approach is supported by the results of study of E. Gleń-Haduch (1995) which show differences in stress indicators frequency (enamel hypoplasia, *cribra orbitalia)* between various Neolithic and Early Bronze Age populations. This proves that studied samples were exposed to different living conditions and were differently adapted to them.

Literature

Bach A.,1978: *Neolitische Populationen im Mittelelbe-Saale-Gebiet*, Weimar.
Gleń-Haduch E., 1995: Ocena stanu biologicznego populacji neolitycznych i wczesnobrązowych z Wyżyny Małopolskiej, (in) *Zeszyty Naukowe Uniwersytetu Jagiellońskiego, Prace Zoologiczne* z. 41.
Kempisty A.,1978: Schyłek neolitu i początek epoki brązu na Wyżynie Małopolskiej w świetle badań nad kopcami, (in) Wydawnictwa Uniwersytetu Warszawskiego, Warszawa.
Matkiewicz A., Ratajczak W., 1992: *Principal Components Analysis*, WES Book Company, Poznań.
Piontek J., 1979: Procesy mikroewolucyjne w europejskich populacjach ludzkich, (in) *Seria Antropologia Nr* 6, Wydawnictwo Naukowe UAM, Poznań.
Piontek J., Marciniak A., 1990: Struktura antropologiczna a kulturowe strategie adaptacyjne populacji neolitycznych w Europie środkowej, (in) *Seria Antropologia Nr* 16, Wydawnictwo Naukowe UAM, Poznań.
Schwidetzky I., Resing F.W., 1989: Vergleichend-statistische Untersuchungen zur Anthropologie von Neolithikum und Bronzezeit, (in) *Homo*, Nr 40.

Summary

This paper focused on the issue of morphological differentiation of Neolithic and Early Bronze Age populations in Central Europe. With a perspective of further research of morhpological stress indicators, the analysis concentrated on skeletal materials from Żerniki Górne (Poland, Kielce voivodship) belonging to the Corded Ware Culture and to the Trzciniec culture. Relation between biological variability and cultural differentiation was analysed in potrticular. The morphological structure was evaluated on the basis of 10 cranial measurements found in literature.

The results of this study show that the main criterion of morphological similarity between populations is an archaeological culture they belong to. It also proved that the populations of Corded Ware Culture and Trzciniec culture from Żerniki Górne do not morphologically differ from other European populations which belong to analogous cultural units. Variables determining the biological differentiation between studied samples mainly refer to the skull shape and orbital dimensions.