

Current Trends in Dental Morphology Research

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**ODONTOLOGICAL ANALYSIS OF WIELBARK
CULTURE POPULATION FROM KOWALEWKO
CEMETERY, POLAND**

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ABSTRACT

The aim of the study is the assessment of biological distance between populations from Roman period on the basis of the frequency of odontological traits. It is well known that these traits are characterised by high inter-population differentiation, low sexual dimorphism, and their recording is loaded by relatively small intra and inter observer error. They also complete their growth early during the development and they are less sensitive than bones to unfavourable environmental conditions. The odontological traits are successfully used in the description and explanation of the microevolutionary and ethnogenetic processes.

This paper presents the results of the odontological differentiation of human populations identified by the archaeologists with Wielbark Culture and Czerniachów Culture from Roman period. The results may to some extent verify or reject the hypothesis concerning the continuation or discontinuation of the settlement of Oder and Vistula river-basin at the turn of the ancient and the early mediaeval times.

The skeletal material under study consists of permanent teeth that belonged to 80 individuals coming from the burial ground in Kowalewko in Great Poland from Roman period (1st–3rd c. A.D.). Eighteen odontological traits were taken into account. The comparative analysis was carried out on the basis of 12 populations (2 additional Wielbark ones, and 4 Czerniachów and Balts groups respectively). The frequency of the odontological traits among all populations was analysed using principal component analysis.

From the obtained results we can draw following conclusions: The populations of Wielbark Culture and Czerniachów Culture can not be differentiated as far as the frequency of odontological traits are concerned. They also exhibit similar intragroup variability. The Balts are characterised by a different frequency of 4 out of 8 traits in comparison with the above-mentioned craniological series; the odontological traits differentiate to a high degree populations belonging to varied ethnic

and cultural complexes and are a good tool for investigating the biological variability of skeletal populations

INTRODUCTION

The aim of the study is the assessment of biological distance between populations in Central Europe from the Roman period on the basis of the analysis of the frequency of odontological traits. These traits are characterised by high inter-population differentiation and the analysis of their occurrence enables researchers to obtain data concerning the genetic relationships between human populations identified with different ethnic complexes.

Odontological traits are used successfully in the description and explanation of both evolutionary and microevolutionary processes. Since teeth complete their growth during the early stages of an individual's development, they are greatly determined genetically and their morphological structures are sensitive to only slightly to environmental influences. Teeth are usually well preserved in archaeological material and are often the only source of observations of human remains (Kaczmarek, 1992; Kaczmarek and Pyżuk, 1985; Kozak-Zychman and Segeda, 1996, Papreckiené, 1981; Zubov, 1974, 1998; Zubov and Chaldieheva, 1979, 1989, 1993).

For many years in the fields of anthropology, archaeology and linguistics there has been a heated discussion about the process of Slavs ethnogenesis. Recently, this has led to many controversial hypotheses that influence the historical and ethnic interpretations (Godłowski, 2000; Piontek, 1991, 1992, 1993).

The results of this paper on the odontological differentiation of Wielbark and Czerniachów populations from Roman period may to some extent verify or reject the hypothesis that refers to the continuation or discontinuation of the settlement in Oder and Vistula river-basin at the turn of the ancient and the early mediaeval times.

MATERIAL AND METHODS

The skeletal material comes from the burial ground in Kowalewko in Great Poland 20 kilometers to the North of Poznań. The excavations were carried on for 4 years between 1995–1998 by the archaeologists from the Archaeological Museum in Poznań in co-operation with an anthropologist from the Institute of Anthropology of Adam Mickiewicz University in Poznań (Skorupka, 2001).

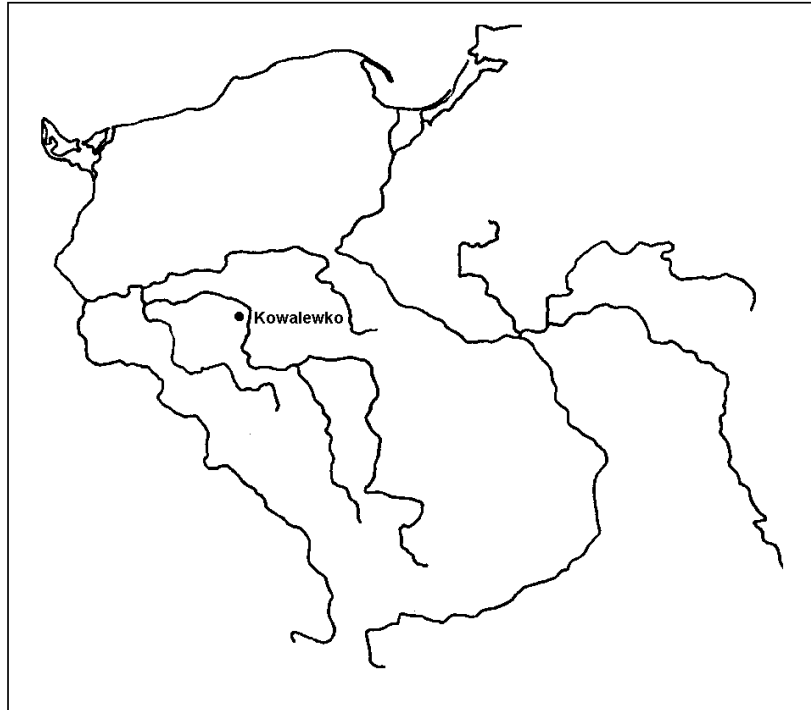


Figure 1. Location of cemetery in Kowalewko

The excavations resulted in the exploration of 498 skeletal and cremation graves. The archaeological description of the cemetery and its chronological and cultural characteristics were presented by Makiewicz (1998) and Skorupka (2001) who identified the population from Kowalewko with Wielbark Culture.

The cemetery was dated to the Roman period, from the second half of 1st c. to the beginning of the 3rd c. A.D. It was used for about 170 years (seven generations) and one generation is supposed to have been composed of 80 persons (Makiewicz, 1996). The skeletons were badly preserved and only several skulls and long bones were analysed. The better state of preservation presented fragments of maxillae and mandible with teeth (Rewekant and Segeda, 2001).

The skeletal material under study consists of permanent teeth that belonged to 80 individuals. Their age at death and sex were estimated according to the methods recommended by European anthropologists (Piontek, 1999).

As for the sex estimations it was impossible to always use the same traits since the skeletons were fragmentary. In most cases traits of the skull and pelvis were taken into account and occasionally ones that express sexual dimorphism to

a lesser degree. Twenty percent of the individuals remained unsexed. Age at the time of death was estimated on the basis of the degree of ossification of various morphological structures. The number of erupted permanent teeth and the length of long bone shafts were used to estimate the age at death of children (Stloukal and Hánaková, 1977; Ubelaker, 1989).

The age at death of adult individuals was estimated taking into account the degree of cranial suture obliteration, tooth-wear patterns and, in some cases, phases of pubic symphysis modification and dimensions of epiphyses medullary cavities of humerus and femur.

Overall, teeth belonging to 14 male, 32 female and 14 child skeletons were analysed. Since in the case of 13 individuals it was not possible to estimate sex and more precise age at death they were included in this group of persons who had died during their adult life (over 20).

The frequency of eighteen odontological traits of the permanent teeth were analysed. All traits were recorded according to the methodology used in physical anthropology and described by Turner (1987) for ASU project (Arizona State University) and also by Zubov (1968, 1974, 1977), based on research projects realised by Russian anthropologists and anthropologists from various countries in Asia and Central and Eastern Europe (Balčiūnienė and Jankauskas, 1993; Balčiūnienė and Malinowski, 1993; Ismagulov and Sichimbajeva, 1989; Kaczmarek, 1979, 1980a, 1981a, 1981b, 1988, 1991, 1992; Kaczmarek and Pyżuk, 1985; Kaszybadze, 1984; Kozak-Zychman and Segeda, 1994; Papreckienė, 1981; Papreckienė and Česnys, 1981, 1983, 1984, 1987; Salivon, 1972; Segeda, 1989, 1993, 1994, 2000, 2001; Steślicka, 1967, 1970; Zubov, 1973, 1998; Zubov and Chaldiejeva, 1979, 1989, 1993; Źądzińska, 1996).

Description of traits was made mainly in accordance with definitions proposed by Zubov (1968, 1974) considering the necessity for comparison with other results for populations from Eastern and Central Europe.

Particular traits were observed on the basis of different numbers of individuals (from 34 to 68). The frequency of each trait in the studied group and also the frequency of its variants were calculated.

Following odontological traits were used in comparative analysis:

- 1) shovelling of I^1 ;
- 2) Carabelli's cusp on M^1 ;
- 3) four-cusped forms on M_1 ;
- 4) five-cusped forms on M_1 ;
- 5) four-cusped forms on M_2 ;
- 6) deflecting wrinkle of the metaconid of M_1 ;
- 7) the variant *2med* II position of the second furrow of the metaconid on M_1
- 8) distal crest of trigonid on M_1 .

The above-mentioned traits were selected from the eighteen ones analysed by (Rewekant and Segeda, 2001) taking into account following criteria:

- 1) the traits should not reveal inter-correlations as for the frequency of occurrence;
- 2) they should reveal high inter-group variability;
- 3) their degree or variant of formation can not change with an individual's age,
- 4) it should be easy to find comparative data for different populations.

The frequency of eight odontological traits in the population from Kowalewko was compared with data for 13 groups composed of: 2 populations identified by the archaeologists with Wielbark Culture (Gródek and Masłomęcz), 7 groups of Czerniachów Culture and also 4 Balts groups dated to the first century A.D., that represent different ethnic complex in comparison with the population under study.

RESULTS

Teeth of the population from Kowalewko are characterised by low frequency of distortion I² – 2.9%, low and medium frequency of diastema I¹ – 9.1%, low frequency of shovelling of I¹ – 3.8% and medium frequency of shovelling of I² – 15.2%. The occurrence of high reduction of upper second incisors was not recorded (variants 2 and 3). The frequency of Carabelli's cusp on M¹ was very high – 61.9% (Table 1).

Table 1. The number and the frequency of particular odontological traits

Trait	Variant of trait	Number of the studied teeth	Frequency (%)
Distortion of I2		34	100.0
	0	33	97.1
	+	1	2.9
Diastema I2 – I2		22	100.0
	0	20	90.9
	+	2	9.1
Reduction of I2		45	100.0
	0	37	82.2
	1	8	17.8
	2	0	0.0
	3	0	0.0
Shovelling of I1		53	100.0
	0	16	30.2
	1	35	66.0
	2	2	3.8

Trait	Variant of trait	Number of the studied teeth	Frequency (%)
	3	0	0.0
	(2,3)	2	3.8
		46	100.0
Shovelling of I2	0	6	13.0
	1	33	71.8
	2	7	15.2
	3	0	0.0
	(2,3)	7	15.2
		71	100.0
Form M1	4	69	97.2
	4-	2	2.8
	3+	0	0.0
	3	0	0.0
	(3+, 3)	0	0.0
		62	100.0
Form M2	4	4	6.4
	4-	43	69.3
	3+	1	1.6
	3	14	22.7
	(3+, 3)	15	24.3
		34	100.0
Form M3	4	0	0.0
		4	4
1	4-	6	17.6
	3+	13	38.3
	3	15	44.1
	(3+, 3)	28	82.4
		40	100.0
	Carabelli's cusp on M1	0	12
1		3	7.5
2		15	37.5
3		7	17.5
4		2	5.0
5		1	1.9
(2,3,4,5)		25	61.9
		64	100.0
Form M1	y6	3	4.7
	+6	1	1.6
	x6	0	0.0
	(Y6, +6, x6)	4	6.3
	y5	47	73.4
	+5	5	7.8
	x5	2	3.1
	(y5, +5, x5)	54	84.3

Trait	Variant of trait	Number of the studied teeth	Frequency (%)
	y4	6	9.4
	+4	0	0.0
	x4	0	0.0
	(y4, +4, x4)	6	9.4
Form M2		63	100.0
	y6	0	0.0
	+6	0	0.0
	x6	0	0.0
	(Y6, +6, x6)	0	0.0
	y5	2	3.2
	+5	3	4.8
	x5	8	12.7
	(y5, +5, x5)	13	20.7
	y4	1	1.6
	+4	15	23.8
	x4	34	53.9
	(y4, +4, x4)	50	79.3
Form M3		35	100.0
	y6	2	5.7
	+6	0	0.0
	x6	1	2.9
	(Y6, +6, x6)	3	8.6
	y5	3	8.6
	+5	3	8.6
	x5	4	11.4
	(y5, +5, x5)	10	28.6
	2	3	4
	y4	1	2.9
	+4	2	5.7
	x4	19	54.2
(y4, +4, x4)	22	62.8	
distal crest of trigonid on M1		60	100.0
	0	56	93.3
	+	4	6.7
deflecting wrinkle of the metaconid of M1		39	100.0
	0	34	87.2
	+	5	12.8
Tuberculum accessorium mediale internum on M1		68	100.0
	0	67	98.5
	+	1	1.5
Enamel extension on M2			
	typ1	4	7.2
	typ2	1	1.8
	typ3	18	32.1

Trait	Variant of trait	Number of the studied teeth	Frequency (%)
	typ4	18	32.1
	typ5	5	8.9
	typ6	9	16.1
	typ7	1	1.8
	typ(4,5,6)	32	57.1
	typ(5,6)	14	25.0
	(typ 4,5,6,7)	33	58.9
Form 1 pa on M1		15	100.0
	typ1	5	33.3
	typ2	1	6.7
	typ3	9	60.0
Form 2 med. on M1		38	100.0
	typII	8	21.1
	typIII	21	55.3
	typ fc	9	23.6

The occurrence of four-cusped forms on M_1 (y4, +4, x4) was recorded on a medium level – 9.4%, as well as the six-cusped forms on M_1 (y6, +6, x6) – 6.3%.

The population under study is characterised by a medium degree of reduction of the *hypokonus* on M^2 – 24.3% and somewhat higher reduction of M_2 (four-cusped forms) – 79.3%. The frequency of the distal crest of the trigonid on M_1 (6.7%) is moderately higher than the average value for European populations and the frequency of deflecting wrinkle of the metaconid of M_1 approximates it – 2.8%. The occurrence of *Tuberculum accessorium mediale internum* on M_1 (1.5%) is lower than the average in Europe.

The comparative analysis

Table 2 presents data concerning the frequency of the occurrence of 8 odontological traits in 6 populations of Czerniachów Culture, 3 of Wielbark Culture and 4 of Balts groups.

The frequency of trait in percents was converted into the frequency expressed in radians. A modified set of initial data was used in order to assess the degree of differentiation by means of the principal component analysis. This method converts original traits (in radians) into new traits (meta-traits) that are called the principal components. Particular principal components use the variability of the original traits to a different degree. Usually two or three of them describe from 70% to 80% of the variability of traits. Therefore, the principal component analysis reduces the multidimensional set of variety to two or three-dimensional level losing only an inconsiderable percent of information.

Table 2. Frequency of odontoglyphic traits in comparative populations

Populations	Number of trait															
	1		2		3		4		5		6		7		8	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Czerniachów Culture (Segeda, 1989)																
Zhuravka	23	4.3	32	28.1	28	7.1	28	0.0	36	97.2	13	7.7	12	25.0	26	7.7
Uspenka	1	0.0	6	66.7	10	10.0	10	10.0	5	80.0	6	0.0	7	14.3	9	11.1
Boromlya	9	11.1	12	58.3	17	11.8	47	11.8	18	88.9	10	20.0	10	20.0	15	0.0
Gavriliivka	10	0.0	12	8.3	11	18.2	11	18.2	13	0.0	5	20.0	4	25.0	7	0.0
Khomc'ke	4	0.0	16	25.0	11	9.1	11	9.1	8	100.0	7	0.0	6	50.0	9	0.0
Koblevo	2	25.0	7	57.1	9	0.0	9	0.0	11	90.9	4	0.0	5	0.0	2	0.0
Moldova	10	0.0	24	25.0	18	11.1	18	11.1	25	92.7	10	0.0	18	0.0	10	0.0
Wielbark Culture (Kozak-Zychman and Siegeda, 1994)																
Kowalewkowo (personal data)	53	3.8	40	61.9	64	9.4	64	6.3	50	79.3	39	12.8	38	6.7	60	21.1
Gródek	9	11.1	17	47.0	21	9.5	21	14.3	13	76.9	19	26.3	16	37.5	22	0.0
Masłomęcz	16	12.5	11	47.7	29	17.1	29	3.4	18	94.4	25	8.0	24	29.2	27	7.4
The Balts – the first century of A.D. (Papieskienė and Česnys, 1983)																
Latgaly Leyasbiteny	25	0.0	44	20.4	44	9.1	44	2.3	68	88.3	44	0.0	28	64.3	44	2.3
Latgaly Latgale	11	0.0	11	7.0	20	5.0	20	0.0	27	85.2	13	23.1	10	70.0	13	0.0
Zemgaly	10	5.0	28	14.3	31	16.1	31	0.0	49	89.8	14	14.3	15	40.0	14	0.0
Zhemaity	54	0.0	–	50.0	38	2.6	38	2.6	15	100.0	24	4.2	28	17.9	37	0.0

We also calculated the correlation coefficients between principal components and the original traits allowing us to assess which original traits primarily determined the arrangement of the investigated populations in relation to particular principal components.

Figure 2 presents the differentiation of the comparative populations (3 of Wielbark Culture, 7 of Czerniachów Culture and 4 of Balts groups) in relation to two principal components. The first one (over 37% of overall variability) uses the variability of as many as 4 original traits (shovelling of I^1 , Carabelli's cusp on M^1 , four-cusped forms on M_2 , fix-cusped forms on M_1) and separates the Balts populations from Wielbark and Czerniachów groups. The second one (27% of overall variability) describes the differentiation of populations considering the frequency of deflecting wrinkle of the metaconid of M_1 that is very similar in form and almost equally differentiated in the investigated ethnic and cultural complexes.

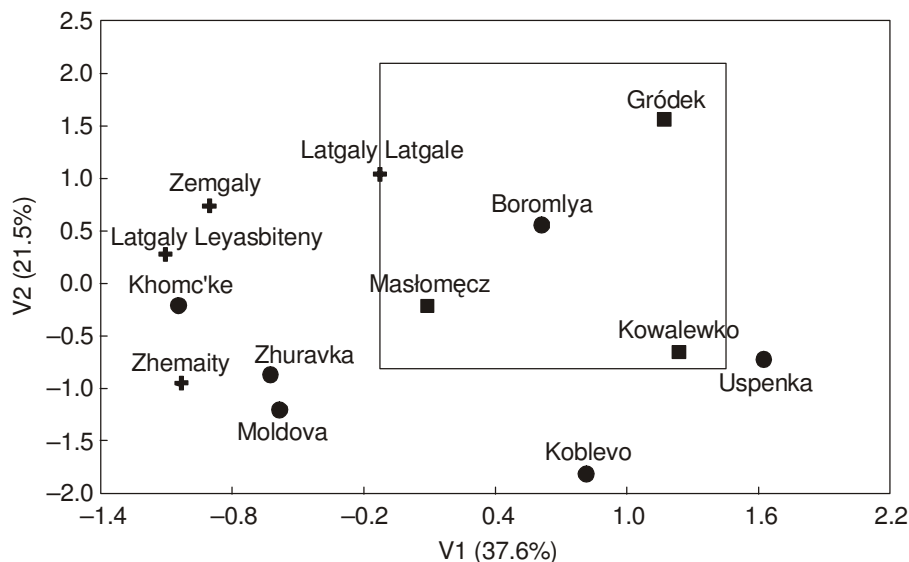


Figure 2. Differentiation of Wielbark Culture populations (squares), Czerniachów Culture (circles) and the Balts populations (crosses) in relations to two principals components

The comparative analysis reveals that the populations of Wielbark Culture and Czerniachów Culture cannot be differentiated as far as the frequency of odontological traits is concerned. They also exhibit similar intra-group variability. The Balts are characterised by a different frequency in 4 out of 8 traits in comparison with the above-mentioned series and they create a separate group.

CONCLUSIONS

1. Morphological traits of teeth (odontological traits) differentiated markedly the comparative populations that belongs to different ethnic and cultural complexes. Therefore, they are a good method for studying the biological differentiation of skeletal populations.
2. As regards the frequency of occurrence of odontological traits the populations identified with Wielbark and Czerniachów Cultures are very similar and they can not be included in different ethnic and cultural complexes.

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