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THE RECONSTRUCTION
OF THE ANTHROPOLOGICAL COMPOSITION
OF THE BRONZE AGE POPULATION

(BURIAL GROUNDS OF KIVUTKALNS, LATVIAN SSR)

ABSTRACT — Large series of skulls from one burial ground require a complete intergroup analysis which permits to reveal the anthropological composition of the population. Mathematical methods, the data about the burial rites, topography of the graves and demographical facts have been used in the analysis of male and female skulls from the Kivutkalns burial ground. Considering all these data it was possible not only to reveal the complicated anthropological composition, but also to disclose the causes of the non-homogeneous racial composition of the population during the Bronze Age in Latvia.

KEY WORDS: Bronze Age cemetery — Palaeodemography — Metrical Analysis — Typology.

Burial grounds comprising a great number of graves, often feature a non-homogeneous population from the anthropological and ethnical point of view. Burial grounds of such type are usually situated at places where differing, but at the same time synchronous archaeological cultures border, or near large rivers, serving as waterways in the past or close economically convenient centres — not far from places where flint, amber, iron ore etc. were obtained.

The skulls from such burial grounds, in case they constitute a large series, should be subjected to intergroup analysis. In such cases one should not limit oneself to giving the mean values of dimensions only, because they would merely reflect a certain mean anthropological type of population which has never really existed. Besides, an intergroup analysis should be performed not only regarding the male skulls, but also the female ones, because in doing so, more information could be obtained. Nevertheless, if it is possible to define the sex and the age of a great number of the buried or all of the dead ones at the burial ground, and correlate these data with the topography of the graves and the archaeological information about them,

the researcher is provided with a rare opportunity to reveal the demographic and social structure of the society under investigation, to understand the character of marriage links and the institution of family as a whole (Denisova, 1984).

TABLE 1. Distribution of the Burials at Kivutkalns According to their Sex and Age

Groups as per age and sex	Number of individuals	%
Total number of grown-ups and children: Including:	237	100.00
men (16—18 years and older)	96	40.51
women (16—18 years and older)	43	18.14
Children and adolescents up to 16 years of age Including:	98	41.35
Children up to 8 years of age	79	80.61
Adolescents 8—16 years of age	19	19.39

We were fortunate enough to study a well preserved series of skulls from the Kivutkalns burial grounds, referring to the Bronze Age, situated near the place where the two large rivers — the Daugava and the Lielupe fall into the Gulf of Riga. We managed to define the age and the sex of the individuals from 237 graves.

69 male and female skulls suitable for study, were investigated, that constituted 40 per cent of the total number of the dead grown-up individuals and it was a rather representative selection.

The population burying their close ones at the Kivutkalns burial ground, judging by the series of male skulls, was characterized by a comparatively long, narrow and high brain case and a face that was narrow, medium-high and strongly profiled in the horizontal direction, moderately protruding nose and a high nose bridge (Table 2). Nevertheless, the female series of skulls possess a slightly different set of features. The main difference lies in the width of the face.

TABLE 2. *Series of crania from Kivutkalns*

Features	Male crania			Female crania		
	n	x	S	n	x	S
1.	43	192.3	7.03	24	181.3	3.85
8.	42	136.7	5.92	25	133.0	4.57
17.	38	141.3	4.55	25	134.5	4.59
9.	43	96.6	3.37	25	94.0	3.96
5.	37	107.6	5.05	24	100.2	5.34
40.	35	100.4	5.73	23	94.7	5.67
45.	38	128.9	4.68	26	125.3	4.60
48.	39	73.1	3.01	24	66.9	3.22
47.	37	121.6	5.63	18	111.8	5.12
43.	41	104.5	4.11	23	101.6	4.87
46.	29	93.9	4.64	19	92.4	5.49
55.	38	53.5	2.45	23	48.2	2.30
54.	38	23.7	1.86	23	24.1	1.94
51.	40	43.5	1.75	25	42.2	2.18
51a.	32	40.0	1.47	24	38.7	2.02
52.	34	34.8	2.19	25	33.9	2.02
50.	38	18.6	1.66	24	17.5	2.37
DC	29	20.4	1.83	22	20.0	2.73
DS	29	13.2	1.43	22	11.7	1.33
SC	34	9.6	1.51	23	9.3	1.57
SS	34	5.2	1.05	23	4.0	0.85
77.	36	136.3	4.11	23	138.6	4.71
∢ ZM	28	124.9	3.60	18	128.5	3.73
DS : DC	29	65.2	8.08	22	59.6	11.17
SS : SC	34	55.2	13.31	23	43.1	9.22
72.	36	84.6	2.62	23	82.2	3.39
73.	34	85.9	3.32	19	83.3	2.89
74.	34	79.8	4.53	19	78.5	4.69
75(1).	31	26.9	4.78	19	25.6	5.36
32.	38	81.8	4.99	22	82.4	4.05
	37	75.4	6.00	22	78.1	4.74
	31	4.9	1.71	16	4.7	1.48
8 : 1.	41	71.0	3.78	24	73.3	3.16
17 : 1.	38	73.5	3.41	24	75.2	2.86
17 : 8.	37	103.9	5.62	24	101.3	5.51
9 : 8.	41	71.0	2.92	24	70.5	2.39
9 : 45.	38	75.5	2.78	24	74.8	2.55
45 : 8.	37	94.2	3.60	24	94.5	2.72
48 : 45.	37	56.7	2.92	24	53.7	3.27
47 : 45.	35	94.5	5.46	18	89.4	6.00
48 : 17.	35	51.5	2.16	18	49.9	3.13
52 : 51.	39	80.0	5.32	25	80.4	5.20
54 : 55.	37	44.3	4.16	23	50.0	4.45

The mean value of the zygomatic diameter of male skulls is 128.9 mm, that of female ones — 125.3 mm. The difference between them is only 3.6 mm, that indicates the upset sexual dimorphism. If there were normal sexual dimorphism in the female series of skulls, the mean value of the skull diameter should be 120.3 mm. Thus, the female skulls are characterized by a considerably broader face than that of men.

It should be noted that the width of face is of high taxonomic value, permitting to differentiate the Northern and Southern Europeoids within the Europeoid race. Thus, one may suppose that in the given case the female and male series, differing in zygomatic diameter, belong to anthropological types of different origin.

Another important difference between female and male skulls is concerning the horizontal profile of the face. The mean values of nasomalar angle and zygomaxillary angle of male skulls reflect Europeoid features (136° and 125° respectively), whereas for female skulls they are on the verge of the Europeoid and Mongoloid values. The analysis of individual data revealed that many female skulls possess a weakly profiled face.

Thus, a preliminary analysis of the mean values of skull dimensions testifies to the fact that the male and female series represent two different anthropological types. This condition called for a more detailed intergroup analysis of male as well as female series of skulls. For this purpose we carried out calculations of intergroup coefficients of correlation separately for male and female series of skulls. This analysis is based on the existence of normal functional interdependence of skull metrical features in homogeneous series of skulls. The degree of interdependence between each of the dimension pairs, even in homogeneous series, is not always a strictly constant value and can fluctuate within a certain range. More constant is the direction of correlation which for the greater part of dimensions in homogeneous series is frequently a positive one. If the series of skulls as per anthropological composition is non-homogeneous, the normal functional interdependence between the dimensions is upset. This discrepancy is reflected not only in the absolute value of correlation coefficients, but also in the direction of correlation.

The coefficients of correlation for 17 dimensions within each pair of male and female series of skulls were calculated. The analysis of these correlation coefficients revealed the existence of a weak functional interdependence for a large number of dimensions, and rather often coefficients with a negative sign. Thus, the correlation with a "minus" sign in the female series was detected in 67 cases (49.3 per cent) out of 136 coefficients, but in the male series it was 30 in 56 cases (41.2 per cent). In most instances the interdependence between the dimensions is more often weak or close to zero (Table 3).

Of great significance is also the fact that the interdependence both regarding the value and direction between the same features within male and female series is not equal. This difference is often expressed in opposite signs that is especially important in evaluating the anthropological composition of male and

TABLE 3. *Coefficients of correlation (Male and female skulls from Kivutkalns)**

	1	8	17	9	5	45	40	48	54	52	DS	SS	77	∢ ZM	72	32	8 : 1
1.		0.089	0.074	0.122	0.454	0.406	0.445	0.202	0.183	-0.040	-0.014	0.236	-0.410	-0.014	0.194	-0.182	-0.635
8.	-0.168		-0.038	0.421	-0.011	0.497	-0.265	-0.276	0.063	0.019	-0.064	-0.123	0.217	0.361	0.035	0.069	0.712
17.	0.115	-0.149		0.033	0.108	-0.215	0.072	0.261	-0.136	0.079	-0.334	0.169	-0.091	-0.352	0.098	0.249	-0.078
9.	0.106	0.611	-0.327			0.421	-0.010	-0.073	0.130	0.005	0.085	-0.060	-0.313	-0.272	0.123	-0.234	0.329
5.	0.534	-0.457	0.408	0.072		-0.051	0.458	0.243	0.071	-0.133	0.054	0.278	0.031	-0.034	0.185	0.108	-0.338
45.	-0.178	0.691	-0.286	0.639	-0.051		0.209	0.112	0.238	0.047	0.352	0.272	-0.284	0.087	0.151	-0.228	0.078
40.	-0.375	-0.290	-0.156	0.157	0.747	0.058		0.367	0.298	-0.314	0.101	0.501	0.181	-0.340	0.077	0.222	0.577
48.	0.060	-0.126	-0.290	0.126	0.003	0.020	-0.059		0.076	0.246	-0.107	0.223	0.087	-0.202	-0.177	-0.258	-0.379
54.	0.324	-0.168	-0.377	0.562	0.174	0.380	0.335	-0.089		0.010	0.204	0.073	-0.102	-0.067	-0.225	-0.156	-0.114
52.	0.353	-0.133	0.000	0.175	0.312	0.020	0.405	0.168	0.116		-0.173	-0.236	-0.245	-0.070	-0.197	-0.073	0.059
DS	-0.230	-0.229	0.111	-0.210	0.322	0.111	0.450	-0.150	-0.186	0.496		0.598	0.087	-0.083	0.076	-0.271	-0.096
SS	-0.267	-0.352	-0.019	-0.108	0.376	0.021	0.395	-0.087	0.027	-0.108	0.459		0.577	-0.323	0.116	0.102	-0.345
77.	-0.381	-0.469	-0.307	0.099	-0.741	0.090	-0.659	-0.258	-0.144	-0.310	-0.214	-0.312		0.444	-0.295	0.047	0.463
∢ ZM	0.400	-0.040	-0.276	0.156	0.237	0.104	-0.052	-0.189	0.595	-0.006	-0.055	-0.142	0.117		0.036	0.008	0.257
72.	0.508	-0.301	0.368	0.007	0.619	-0.147	0.150	0.235	-0.019	-0.381	-0.069	0.022	0.554	0.245		0.164	-0.121
32.	-0.044	0.196	0.320	-0.152	-0.263	-0.187	-0.116	0.022	-0.339	-0.269	-0.328	-0.269		0.320	0.022		0.173
8 : 1.	-0.621	0.878	-0.173	0.474	-0.619	0.642	-0.404	-0.122	-0.025		-0.064	-0.150		-0.321	-0.484	0.173	

* right top triangle — male skulls, left bottom triangle — female skulls

female skulls. Besides, within the male and female series the coefficients of correlation with equal sign (plus or minus) sharply differ as per their value.

The scope of the article does not allows us to analyse in detail the correlation coefficients. However, it may be noted that the revealed large number of correlation coefficients with a negative sign and low in value, point to the existence of more than two anthropological types in the composition of male as well as female series. If there are only two types in the skull series, the correlation coefficients are often of elevated values.

The analysis of correlation coefficient point to a nonhomogeneous anthropological composition of the population only, but does not reveal the criteria to be used for dividing the series into morphological variants. For this purpose we made use of archaeological data which were analysed through a mathematical method.

The graves yielded very scarce archaeological material. Bone pins were found in many graves as well as stones of ritual character. In many cases at the bottom of the grave an additional layer of white sand was found. We made use also of the orientation of the burials. The dead were often buried with their heads oriented to the east, but west-oriented burials were also found. We noticed that the stones in the graves, the white sand and the pins were rarely found buried together. These elements often appear in pairs in different combinations. Therefore we were interested in the character of occurrence of the mentioned features of burial customs (there were cases when the existence of one of them in the grave was not accompanied by the other), as well as how reliable and revealing the combinations of those or other features of the burial customs are.

To reveal the regularity in the distribution of the above-mentioned elements of the burial customs in the male and female graves separately, we made use of the coefficient of occurrence which has been described in the statistical manuals and has already been used in archaeological investigations (Yablonski, 1980).

The character of the two separate features is defined by the value and the sign of it (X). When calculating the above coefficient, the number of graves possessing both features (AB) and their absence (ĀB̄) is taken into consideration, as well as the number of graves having A feature, but lacking B (AB̄) and the number of cases of opposite composition (ĀB)

$$X = \frac{AB \cdot \overline{AB} - A\overline{B} \cdot \overline{A}B}{A \cdot B \, \overline{A} \, \overline{B}}$$

For female graves all three features of the above burial customs were of important differentiating value: white sand, bone pins and the stones. The presence of one of them often excluded the presence of the other. This permitted us to divide the female skulls into three groups taking into account the occurrence only of white sand in the graves, or only the presence of bone pins and or of only stones. Those skulls, which were obtained from the graves possessing two features, were excluded from the calculations.

All three female groups of skulls differ among themselves according to a whole set of features (*Table 4*). The skulls from the graves containing only the bone pins are characterized by an almost mesocranial form of the skull, its low brain case and medium height, broad (126.2 mm) mesene face and its flattened horizontal profile (nasomalar angle 140.9°) are the characteristic features.

The second group of skulls from the graves with stones, in contrast to the previous one, features considerably greater dimensions of the maximum length, they are characterized by dolichocrany have a high brain case, even a broader (128 mm) and orthognathous face, strongly profiled in the horizontal direction (nasomalar angle — 135°). Thus, regardless of the fact that broad-faced morphological forms have been presented by both the groups, they differ in their racial type.

The third group of skulls, having white sand at the bottom of the grave, markedly differ from the two previous ones by its strongly expressed dolichocrany and narrow face (119 mm).

The anthropological types of women should not be regarded as morphological variants within the limits of a single anthropological community since the difference between them is of essential character regarding traits of taxonomic value. This refers first of all to the width of the face, its horizontal and vertical profile. However, if synchrony of the skulls becomes important to consider also certain taxonomic value of the maximum length, maximum breadth and the basion-bregma height of the skull. Therefore, a sharply expressed dolichocranial form of the skull, representing the burial with the white sand only, and mesocranial form, characteristic of the burials with bone pins, should be regarded as anthropological types of different origin, that is confirmed by the differences in the face type.

The third anthropological type with moderate dolichocrany, is not intermediate as regards the previous two and may be considered as an independent anthropological type. The largest maximum length of the skull and the broadest face is characteristic of the skulls from the graves with stones. It should be added that these skulls possess a pronounced massiveness.

Two broad-faced anthropological female types straightly correspond to the Neolithic population of the East Baltic lands. One of them is genetically linked with the Narva culture tribes, the second one, having a broad and flattened face, is considered with the tribes of the Pitted-combed Ware culture. The third anthropological type characterized by slender and narrow face, has no analogy among the Neolithic population of the investigated territory.

The differentiating value of separate features of the burial custom in male graves has been weakly pronounced. For separating out male graves we made use of their localization in the cemetery, as well as of the differences in the skeleton position. As a result four groups of male burials were revealed. One group consisted of male skulls found in the graves where stones, as a rule, present. This is the only group of male graves which did not have separated localization in the burial ground, but in these graves the skeletons were always in extended position. The second group of the skulls is from the graves placed in the south-eastern part of the burial ground, where the men were often buried with their legs tied from the waist down. The third group consisted of male graves with a western orientation, situated in the north-eastern part of the burial ground, and the fourth one — of the male graves with their heads oriented to the east and having white sand in the graves, without bone pins and stones (mostly in the western part of the burial ground). Among the last two groups the hands are in bent position.

Only the male skulls of the third and fourth groups are anthropologically close; therefore we joined them in one general group (see *Table 4*).

The group of male skulls from the graves with stones is characterized by a very large maximum length, dolichocrany, comparatively broad, high and strongly profiled (Europeoid) face. This anthropological male type has an analogous female series of skulls — of broad-faced morphological form, represented also in the graves with stones.

The next group of the skulls (the south-eastern part of the burial ground) includes an anthropological type with a very large maximum length, hyperdoli-

TABLE 4. *Anthropological types (Burial grounds of Kivutkalns)*

| Feature | Female burials | | | Male burials | | |
	with bone pins	with stones	with white sand	with white sand and westwards orientation	south-eastern part of the cemetory	with stones
	n = 10	n = 5	n = 6	n = 14	n = 8	n = 5
1.	179.6	184.2	182.6	189.2	196.7	196.0
8.	134.2	134.6	128.2	136.0	134.3	140.2
17.	132.7	136.4	136.8	138.8	141.7	145.0
9.	93.4	94.4	91.2	96.8	94.5	97.2
45.	126.2	128.5	119.0	128.3	125.7	132.8
48.	66.3	66.5	66.8	72.1	73.3	73.7
43.	102.1	104.0	96.0	105.0	102.4	104.0
46.	92.5	96.7	86.7	92.8	94.0	95.4
55.	47.8	48.0	47.6	53.1	54.2	53.2
54.	23.5	24.3	23.2	23.7	23.8	22.3
51.	42.5	43.2	40.5	43.0	42.2	43.6
52.	33.1	34.4	34.0	34.5	33.8	35.4
DC	19.5	21.6	18.6	21.1	20.4	19.0
DS	11.8	12.0	11.7	13.6	13.2	13.2
SC	9.0	9.9	8.7	9.6	10.1	9.0
SS	4.0	3.6	4.0	4.9	5.3	5.9
77.	140.9	135.1	138.1	136.5	134.0	136.9
⋊ ZM	128.2	—	128.3	127.2	123.1	124.2
DS : DC	61.6	57.1	63.0	64.7	65.1	69.7
SS : SC	44.4	36.1	46.4	50.7	54.8	65.7
72.	80.5	86.0	83.2	85.8	85.2	85.4
75(1).	25.5	—	26.0	27.8	25.3	27.4
32.	82.3	83.0	83.4	80.4	83.3	83.6
8 : I.	74.8	73.1	69.5	72.0	68.3	71.6
48 : 45.	52.7	52.4	56.2	56.0	58.4	55.3
52 : 51.	78.1	79.6	84.2	80.1	80.5	81.3
54 : 55.	49.4	50.7	48.9	44.4	42.9	41.9

chocrany, high, very narrow (125.7 mm) and strongly profiled face in the horizontal direction. No female series of skulls correspond to this anthropological type.

The third group of male skulls (from the burial grounds of western orientation, with white sand in the grave) differs from the previous one with a more slender structure of the skull, smaller maximum diameter, moderate height of basion-bregma, but also having a narrow and Europeoid type of face. Similar anthropological type has been represented in the female series of skulls.

To check the realiability and impartiality of the obtained results, we tried to evaluate the anthropological composition of the population under investigation by applying a mathematical method. Factor analysis was used for this purpose. The limited scope of the manuscript did not permit us to give a detailed analysis of the results obtained. We would only like to note that factor analysis completely confirmed the presence of the above three anthropological types in the composition of male and female population (Denisova, 1985).

Thus, as a result of the above analysis, the male population was characterized mainly by a narrow-faced anthropological type (in two variants), whereas in the female population broadfaced morphological forms prevailed. It was this condition of upsetting sex dimorphism between summary male and summary female series that was discussed at the beginning of the article (*Table 2*).

Narrov-faced anthropological types were not characteristic of the Neolithic population of the East Baltic lands. The appearance of narorw-faced population here in the Bronze Age testifies to the fact that a new population was migrating to the East Baltic lands during this period.

By comparing the topography of the graves in the burial ground with the sex and age of the finds we managed to disclose a number of interesting regularities which permitted to reconstruct the social structure of the society and at the same time to better understand those causes that set such a non-anthropological composition of the population, represented at the Kivutkalns burial ground.

The Kivutkalns burial ground should be regarded as a burial monument of several clan communities. However, the causes of burial of the representatives of different clan communities in one cemetery were not merely defined by good neighbourly relations. When living, these clan communities were tied by exogamous marriage links, the peculiarity of which was that they existed between the clans of different ethnical and anthropological origin. Thus, exogamy here was a factor of mixing.

The male groups of graves differing antrhopologically, linked by a certain territory of the burial ground and the characteristic traditions of the burial customs, obviously, are representatives of separate patriarchal clan communities. On the contrary, the women characterized by one anthropological type, were not buried separately at specific areas of the burial ground. Their graves were scattered all over the burial ground, i.e., regardless their clan origin. It possibly points to the tradition of patrilocal marriage existing in their lifetime, when the women after marriage moved to the clan communities of men, where they made up its newly added part. But as blood kinship usually dominates over the bonds of wedlock in the patriarchal clan communities (ethnographic data testify it), then after their death only men where buried in specially allotted areas as they were linked by kinship, but women — wives belonging to other tribes, were buried in other areas of the burial ground, not taking into consideration their clan origin (Denisova, 1985, drg. 58, 61).

The existence of the weak interfamily links is, evidently, revealed by the fact that men and women are always buried separately. Graves of couples of men and women are not characteristic of the investigated burial fround, groups of family graves are also absent, only single graves with men and women buried separately at particular areas of the burial ground, have been located.

Now we are going to deal with the regularities in the location of the graves of children and adolescents. Children up to 7—8 years of age were often buried separately from the grown-up individuals. However, there are cases when the children up to 7—8 years of age were buried side by side or together with men in the same grave. Children's graves have no links with female burials. Evidently, it testifies to the existence of patrilineal reckoning of kinship. The disclosed links of adolescents with men also confirm this fact. Adolescent (8—14 up to 16 years of age) were buried separately from children up to 8 years of age, and rather often their graves are enclosed by the graves of grown-up men.

The revealed regularities in the location of the graves of children and adolescents permit to assume, firstly, the existence of patrilineal reckoning of kinship; secondly, observing the division of children and adolescents into age classes with an 8-year interval in the studied society.

To study the anthropological structure of the population, represented at the Kivutkalns burial ground, one more observation is of a certain interest; in that part of the burial ground where the female graves are situated, adolescent ones are found only in 1—2 cases. Since it was discovered that at the given cemetery the custom of burying men and women separately was strictly observed, adolescents found in the graves together with men should be regarded as boys. In such a case the small number of adolescent graves among the female ones show that adolescent girls having reached already the age 12—14, were married into other communities. The existence of early marriage among adolescent girls in ancient communities is confirmed by ethnographic data. This fact is of particular interest to us.

Observation of patrilocal marriage in the given society and the virtual absence of the graves of adolescent girls at the burial ground may testify to the fact that adolescent girls from mixed marriages (their existence in the above society does not cause any doubts to us) married and settled down in the communities of their husbands, and after their death they were buried in other cemeteries. Thus, mixing could not occur in the anthropological composition

of the female part of graves represented by our burial ground. It is just the situation that has been revealed in the female series of skulls of the Kivutkalns population.

On the contrary, mixing is rather distinctively expressed in the male series of population. As we were limited in our discussion we could not disclose this process in the present article. With time mixing should have been revealed also in the female part of population in the above society, as the circle of marriage links was gradually enlarged and was changing with the time. But the Kivutkalns burial ground existed for a short time. Only 3—4 generations were buried there. Besides, a narrow-faced population were newcomers to this area. Therefore the length of marriage links between the newcomers and the local population at the time the burial ground was founded, could not be extensive. It was this situation that helped reveal the non-homogeneous anthropological composition of the population, represented at the Kivutkalns burial ground.

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