

# BEYOND BALKANIZATION

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**Aleksander A. Yanevich**  
**Leonid Zaliznyak**

**BALTIC-PONTIC STUDIES**

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V O L U M E 5 • 1998

BALTIC-PONTIC STUDIES  
61-809 Poznań (Poland)  
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ADAM MICKIEWICZ UNIVERSITY  
EASTERN INSTITUTE  
INSTITUTE OF PREHISTORY  
Poznań 1998  
ISBN 83-86094-04-4  
ISSN 1231-0344

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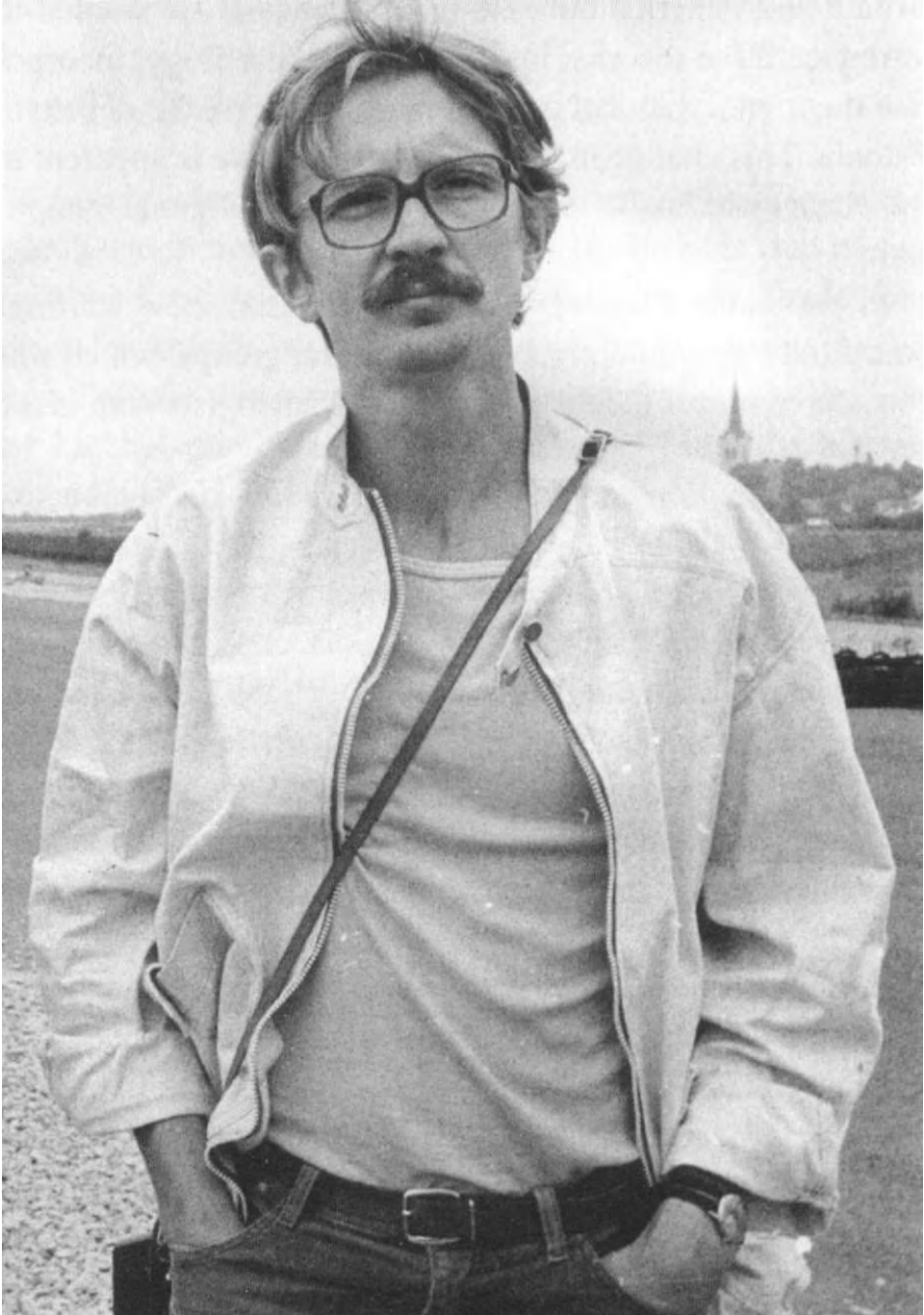
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Cover Design: Eugeniusz Skorwider

Linguistic consultation: Monika Wojcieszek

Printed in Poland

Computer typeset by PSO Sp. z o.o. w Poznaniu



In Memoriam Priit Ligi (24 May 1958 — 28 September 1994)



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## Editor's Foreword

This volume contains the majority of the papers presented during a conference that took place on 16th-21st May, 1997 in Łódź, Poland. The conference was organized by the Institute of Archaeology, University of Łódź and Département d'anthropologie, Université de Montréal (Canada). The conference was funded by the University of Łódź and by IREX (International Research & Exchanges Board), which also supported this publication. The publication was partly founded by the University of Łódź and by the Foundation of Adam Mickiewicz University, too.

The major questions of the conference were, 1) what is the current evidence for eastern or southern influences in the development of eastern European Mesolithic and Neolithic populations, and 2) to what extent are current political trends, especially the reassertion or, in some cases, the creation of ethnic and national identities, influencing our interpretations of the prehistoric data.

The idea for such a conference came into being through the co-organizers' long-term studies of the development of those prehistoric human populations which inhabited the vast region stretching north and east from the Oder river and Carpathian Mountains to the foothills of the Urals. In a tradition established in modern times by Gordon Childe, virtually all of the transformations of Eastern Europe's Neolithic Age human landscape have been assumed to be responses to prior developments in the Balkan peninsula and Danube basin. We think that a body of new evidence requires a renewed analysis of the distributions of cultural products, peoples, and ideas across Eastern Europe during the Mesolithic through the Early Metal Age within a much wider geographic context than previously has been the case. This includes giving adequate attention to the far-ranging interactions of communities between the Pontic and Baltic area with those located in both the Caucasus and the Aralo-Caspian regions.

We hope that this volume will contribute to such a redirection of future analyses.

Lucyna Domańska  
Ken Jacobs

## Editorial comment

1. All dates in the *B-PS* are calibrated [see: *Radiocarbon* vol.28, 1986, and the next volumes] (other versions are cited for the wish of authors). Deviations from this rule will be point out in notes.

2. The names of the archaeological cultures (especially from the territory of the Ukraine) are standarized according to the English literature on the subject (e.g. Mallory 1989). In the case of a new term, the author's original name has been retained.

**Leiu Heapost**

## GENETIC HETEROGENEITY OF FINNO-UGRIANS (ON THE BASIS OF ESTONIAN MODERN AND ARCHAEOLOGICAL MATERIAL)

### 1. INTRODUCTION

Estonians, a small and one of the westernmost population of the Finno-Ugric language group are surrounded by the other peoples of Baltic-Finnic language group (Finns, Karelains, Votic, Vepsians, Izhorians, Livonians). The majority of neighboring peoples belong to the Indo-European language group (Latvians, Lithuanians, Russians and the others at the coastal countries of Baltic Sea — Poles, Germans, Danes, Swedes).

Nowaday Finno-Ugric and Samojed (Uralic) language groups peoples live in a vast territory from the Baltic Sea to the Taymyr Peninsula in Siberia, and from the Arctic Ocean to the Danube, the middle reaches of Volga and Irtysh river in South.

Estonians, in spite of the rather restricted territory inhabited by them, are not homogeneous in respect to their racial composition. While the greatest linguistic differences appear between the northern and southern parts of Estonia [Kask 1959], the greatest anthropological differences appear in west-east direction. On the basis of somatological data, two principal anthropological types have been stated among the Estonians — the West-Baltic and the East-Baltic [Aul 1936]. The West-Baltic type (comparatively dolichocephalic, with tall stature) predominates in West Estonia, while the East-Baltic type (more brachycephalic, with somewhat shorter stature) occurs mainly in East Estonia, especially in the South-East region, but also in some localities of South-West Estonia. The zones of distribution of the above-mentioned types are not isolated territories but they fuse gradually with one another. Both types are somatologically polymorphous.

The aim of this report is to give a short anthropologic characterisation, the structure and the anthropologic position of Estonians in Europe on the basis of recent anthropological studies in Estonia. For that genetic data, but also cranio-logical and odontological data have been used. From that arise certain problems concerning the genetic — morphologic and linguistic diversity.

## 2. HETEROGENEITY OF ESTONIANS

**Genetic heterogeneity.** Genetic data are based on 7 blood group systems, the trait of PTC tasting, and colour blindness. The material was collected by the author from 39 localities in different regions of Estonia [Heapost 1994]. All the individuals examined were indigenous Estonians, all the grandparents and parents of which have been born in the same locality. The local samples were joined into seven regional groups (Fig. 1) more or less according to the main dialectal areas [Murumets 1982; 1983].

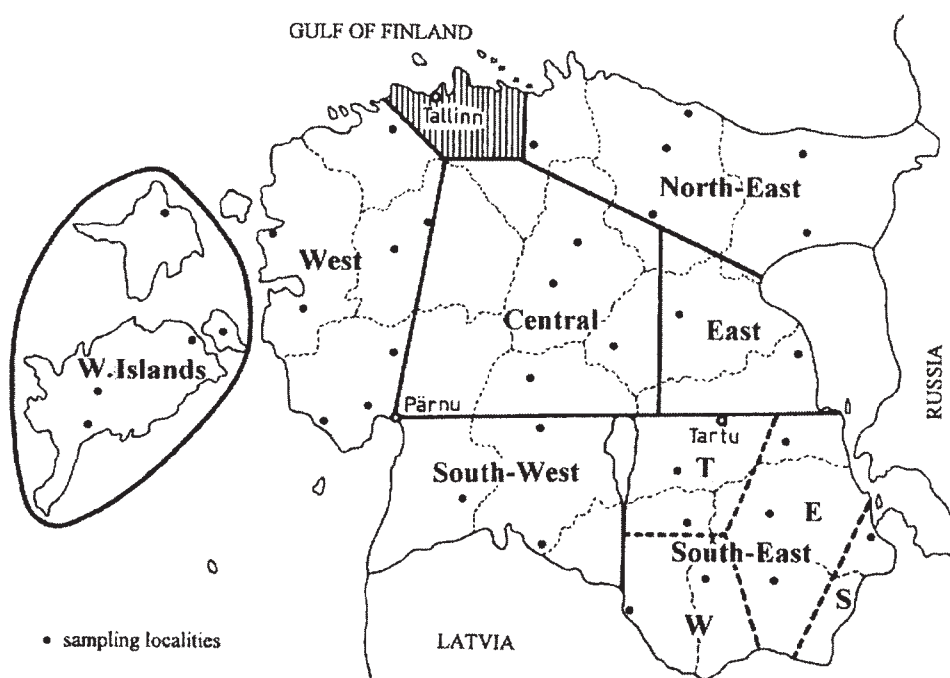


Fig. 1. Regional division of Estonia used in this study. The South-East region is divided into four local dialect areas: T = Tartu, E = East-Võru, W = West-Võru, s = Setu.

The differences of allele frequencies between the regional populations are valued by the chi-square method. The degree of genetic diversity of the groups is determined by the method of genetic distances [Cavalli-Sforza, Edwards 1967]. The grouping of populations on the basis of these distances is made using cluster analysis.

Data for international comparisons were taken from literature: for Finns and Finnish Swedes [Nevalinna 1973; Virtaranta-Knowles, *et al.* 1991], Hungarians

[Mourant, *et al.* 1976; Walter, Danker-Hopfe 1993], Karelians [Shneider, Tihomirova 1991], Komis [Eriksson, Frants 1982], Lapps [Mourant, *et al.* 1976; Cavalli-Sforza, *et al.* 1994; Walter, Danker-Hopfe 1993], Latvians [Kariks, *et al.* 1966; Race, *et al.* 1948; Heapost 1994], Lithuanians [Harvey, *et al.* 1983], Mansi [Davydova 1974], Maris [Eriksson, *et al.* 1979], Russians [Umnova, *et al.* 1968], Swedes [Beckman 1959], Udmurtians [Shneider, *et al.* 1989], Vepsians [Heapost 1994], Vologda Russians [Sistonen, *et al.* 1993] and data about European populations by their language groups [Walter, Danker-Hopfe 1993], also data about European populations [Mourant, *et al.* 1976; Cavalli-Sforza, *et al.* 1994].

The studied genetic systems and the allele frequencies for the Estonian mean and the four most different regions are given on Table 1. As occurs, there are relatively great differences between the regional subgroups, especially in Duffy, Lewis and Rhesus systems. Although heterogeneity may be observed in the distribution of different allele frequencies, an east-westerly direction in anthropological features can still be observed as in case of alleles of MN system for example. *M* frequency is higher in eastern and lower in western regions of Estonia. *M* frequency is common to Baltic Finns (Finns 64%, Vepsians 64%, Karelians 63%, Estonians in eastern districts 63-64%) northern Russians (64%), and Baltic nations (64-65%). *M* frequency is also high in some districts of Belorussia and the Ukraine [Mikulitch 1989; Danilova 1971]. Very common is that allele in Near East, in India. In western populations, but also in eastern Finno-Ugric peoples, the *M* frequency is below 60%. Some of West-Estonian regions differ from other Balto-Finnic regions having a relatively low *M* frequency (as in general Saaremaa group, in the western coastal area — 53-58%). This frequency is nearer to that in Finnish Swedes (60%) and resembles the *M* frequency of Swedes in Southern and south-eastern regions of Sweden (54-57%) [Beckman 1959]. The high *M* frequency seems to be connected with the ethnical component originating from a southern part of East Europe. *MS* haplotype frequency of MNSs system in Estonia (32%) is higher than in the other European populations. Estonians are close to Finno-Ugric peoples Karelians, Udmurtians, northern Russians, the Baltic language peoples, but also to the more southern peoples — Greek language group people and to Sardians (33%) and Rumanians (30%) from the Romance language group [Walter, Danker-Hopfe 1993]. The relation of *MS:Ms* in Estonians ( $\sim 1$ ) is different from that of the most Finno-Ugric and European populations, having similarities with that in Lapps, in Greek language group, in Sardians and Rumanians from the Romance language group; the Celtic language group is also comparatively close to Estonians. The relation of *NS:Ns* in Estonians ( $\sim 0.12$ ) is similar to that in Maris, Mansi and in Celtic language group.

*CDE* haplotype frequency from Rhesus system in Estonians is especially high (2%). That frequency is comparatively high also in northeastern and eastern Finno-Ugric peoples — Karelians, Vepsians, Mansi, being very high in Komi-Permians (3,8%). In West European populations the *CDE* frequency is very low, except for Greek group (2%), and a Gaelic speaking sample from Scotland (1,5%). The *cde* frequency as in the other population-genetic markers in Estonians (the mean 33%) shows a heterogeneity with the highest frequency on West-Estonian Islands (38%).

Table 1

Allele frequencies of the polymorphic systems used in all investigated Estonians and in the four most different regions

System and alleles	Estonia, Mean (min-max)	West Islands	West Estonia	North-East Estonia	South-East Estonia
<b>ABO:</b>					
A <sub>1</sub>	0.2009 (0.1289-0.2489)	0.2126	0.1851	0.2008	0.2072
A <sub>2</sub>	0.0391 (0.0194-0.0824)	0.0433	0.0317	0.0489	0.0382
B	0.1606 (0.0950-0.2038)	0.1443	0.1737	0.1267	0.1829
0	0.5993 (0.5164-0.6983)	0.5998	0.6096	0.6235	0.5716
n	2722	650	456	330	573
<b>Duffy:</b>					
Fy <sup>a</sup>	0.3562 (0.2291-0.4426)	0.3591	0.2811	0.2924	0.3730
n	1544	224	183	153	486
<b>Kell:</b>					
K	0.0483 (0.0208-0.0885)	0.0330	0.0447	0.0510	0.0548
n	1614	324	183	151	462
<b>Lewis:</b>					
le	0.4445 (0.3368-0.6268)	0.4431	0.5184	0.3368	0.4610
n	1711	327	186	97	454
<b>MN:</b>					
M	0.6174 (0.5303-0.7357)	0.6166	0.5791	0.6445	0.6231
n	5249	639	613	550	1214
<b>MNSs</b>					
MS	0.3161 (0.3083-0.3221)		0.3121	0.3083	0.3187
Ms	0.3251 (0.3101-0.3361)		0.3101	0.3361	0.3287
NS	0.0379 (0.0370-0.0393)		0.0378	0.0370	0.0393
Ns	0.3209 (0.3133-0.3300)		0.3400	0.3186	0.3133
n	267		90	97	80
<b>P:</b>					
P <sub>1</sub>	0.3907 (0.2893-0.5286)	0.3970	0.4532	0.3369	0.3896
n	1969	327	258	206	590
<b>Rhesus:</b>					
cDe (R <sub>0</sub> )	0.0389 (0.0000-0.0975)	0.0416	0.0198	0.0356	0.0248
CDe (R <sub>1</sub> )	0.3902 (0.2953-0.4897)	0.3960	0.4243	0.0335	0.4047
C <sup>w</sup> De (R <sub>1</sub> <sup>w</sup> )	0.0280 (0.0100-0.0545)	0.0227	0.0253	0.3479	0.0332
cDE (R <sub>2</sub> )	0.1529 (0.0751-0.2176)	0.0869	0.1292	0.1803	0.1740
CDE (R <sub>2</sub> )	0.0208 (0.0000-0.0925)	0.0206	0.0046	0.0470	0.0253
cde (r)	0.3287 (0.2423-0.4072)	0.3805	0.3350	0.3249	0.3177

System and alleles	Estonia, Mean (min-max)	West Islands	West Estonia	North-East Estonia	South-East Estonia
<i>Cde</i> (r')	0.0271 (0.0000-0.0790)	0.0243	0.0497	0.0309	0.0127
<i>cdE</i> (r'')	0.0134 (0.0000-0.0540)	0.0274	0.0121	0.0000	0.0077
n	2039	330	257	209	558
PTC-tasting:					
t	0.5007 (0.3475-0.6358)	0.6003	0.4976	0.4900	0.4780
n	2796	332	571	366	685

The *cde* frequency decreases eastwards (being in Eastern Estonia — 32%). The Estonians' mean *cde* frequency is the closest to Vepsians, Finns, but it is higher than that in Komis, Udmurtians, Lapps, especially in Mansi. The *cde* frequency in western Estonians is closer to Baltic peoples, Russians, the whole slavic group (38.5%), the Germanic group (38.8%). A comparatively low *cde* haplotype frequency like in South-East Estonia can be found among the most southern peoples of the Romance language group (Italians — 35.4%, Corsians — 33.2%, especially low in Sardians — 22.4%) also in Greeks (27.7%).

A wide range variation is characteristic of the other allele frequencies as well. The mean frequency of  $Fy^a$  in Duffy system in Estonia is lower than in the other peoples compared, having similarities in more southern populations as in Italy and Near East.

Our genetic data are in good agreement with the other anthropological investigations suggesting that the biggest differences in Estonia can be found between the subpopulations of Western and Eastern regions: the genetic distance between these populations is about three times bigger than that between the Northern and Southern ones [Heapost 1994].

By the grouping of some local populations on the basis of genetic distances most samples are clustered very well into the bigger regional groups with their nearest neighbours. However, there exist two exceptions. First, the sample of Muhu Island is clearly different from the other West-Island (Saaremaa and Hiiumaa) samples, being clustered together with North-Eastern group. Some differences between the Muhu and the other West-Islands samples, and the similarities of the Muhu group to the West-Estonian coastal and North-Eastern samples are expressed also in dermatoglyphic data [Horn 1974]. Secondly, the sample of West-Võru dialect area stands relatively far from the other South-Eastern groups. At that time, the Setu sample is closely related to most of the South-Eastern and East Estonian groups [Heapost 1993a, b]. A greater frequency of "western traits" in the West-Võru dialect area in South-East Estonia has also been observed in anthropological [Aul 1964] and linguistical data [Kask 1956]. According to the archaeological data these differences could have appeared in the first centuries of our era together with the

Table 2

Allele frequencies of the polymorphic systems in Estonians, in some Finno-Ugric and in other peoples or peoples by their language group

Locus	A1A 2B0				Rhesus								MN		MNSs					P	K	Fy
	A1	A2	B	0	CDE	CDe	Cde	cDE	cDe	cdE	cde	M	N	MS	Ms	NS	Ns	P1	K	Fya		
Populations, Language groups																						
Estonians	.201	.039	.161	.599	.021	.418	.027	.153	.039	.013	.329	.617	.383	.316	.325	.038	.321	.391	.048	.356		
Karelians	.137	.038	.193	.632	.011	.377	.023	.134	.080	.000	.375	.631	.369	.277	.345	.106	.272	.445	.042	.458		
Vepsians	.182	.047	.135	.636	.014	.453	.014	.108	.084	.000	.327	.644	.356	–	–	–	–	.463	.057	.438		
Komi-Zyr	.123	.046	.221	.610	.010	.376	.011	.258	.059	.002	.284	.504	.496	.243	.307	.109	.341	.499	.066	.522		
Komi-Per	.202		.193	.605	.038	.345	.000	.239	.090	.071	.217	.539	.461	.161	.397	.100	.342	.386	.033	.495		
Maris	.187		.265	.549	.000	.454	.005	.140	.030	.000	.371	.589	.411	.211	.351	.050	.388	.456	.017	.599		
Udmurtians	.180	.030	.236	.554	.000	.415	.020	.268	.092	.000	.185	.605	.395	.269	.325	.088	.318	.290	.045	.502		
Hungarians	.231	.067	.142	.560	.002	.422	.016	.144	.026	.006	.384	.575	.425	.244	.331	.107	.318	.384	.042	.446		
Mansi	.170		.188	.642	.010	.302	.000	.466	.154	.027	.049	.449	.551	.086	.336	.068	.510	.335	.004	.588		
Lapp	.137	.266	.091	.506	.000	.610	.012	.172	.048	.000	.167	.545	.455	.257	.256	.137	.350	.439	.020	.695		
Finns	.214	.094	.125	.566	.000	.428	.012	.183	.035	.002	.339	.643	.357	.247	.395	.078	.280	.451	.020	.471		
Swedes	.216	.087	.079	.618	.000	.417	.010	.167	.019	.004	.383	.562	.438	.241	.321	.086	.352	.545	.037	.422		
Latvians	.197	.050	.167	.586	.002	.444	.023	.139	.015	.002	.375	.668	.332	.266	.366	.062	.306	.411	.023	.465		
Lithuanians	.218	.035	.094	.652	.000	.439	.024	.139	.022	.000	.366	.644	.356	.277	.367	.065	.291	.483	.048	.487		
Russians	.256		.164	.580	.001	.418	.022	.161	.033	.003	.362	.551	.449	.249	.356	.079	.316	.496	.036	.494		
Russians V	.163	.064	.186	.587	.000	.413	.012	.148	.035	.000	.392	.636	.364	.268	.368	.082	.282	.476	.059	.479		
Germanic	.208	.071	.080	.641	.001	.423	.011	.152	.019	.006	.388	.548	.452	.242	.306	.071	.381	–	–	–		
Celtic	.138	.043	.076	.744	.006	.401	.009	.157	.024	.006	.397	.574	.426	.265	.309	.052	.374	–	–	–		
Romance	.198	.048	.072	.681	.005	.529	.014	.101	.026	.006	.318	.562	.438	.251	.311	.087	.351	–	–	–		
Greek	.209	.060	.095	.636	.021	.497	.023	.126	.043	.012	.277	.564	.436	.272	.292	.123	.314	–	–	–		
Slavic	.241	.047	.147	.565	.003	.429	.017	.135	.028	.003	.385	.571	.429	.241	.330	.093	.336	–	–	–		
Basque	.181	.086	.027	.706	.005	.395	.029	.072	.029	.003	.466	.547	.453	.225	.322	.104	.349	–	–	–		
Romany	.221	.099	.112	.568	.001	.567	.029	.082	.006	.002	.313	.750	.250	.211	.539	.101	.149	–	–	–		



appearance of stone graves which are characteristic of more western districts of Balto-Finns [Laul 1986]. In the Eastern area, another kind of material culture was widespread (sand barrows). In the Western part of Võru dialect territory, where the stone-graves spread, western features are also present in the population genetic characters.

In comparison of regional populations with one another it has been revealed that the genetic differences between all seven regions (like the main dialect regions) are statistically significant, with the exception of the East group, which is very similar to the southern regions [Viikmaa, Heapost 1996]. As it is demonstrated by the clustrogram of genetic distances, the Central, South-West, East, and South-East regions are very close. The North-East, West Islands, and West-Estonia are standing separately (Fig. 2).

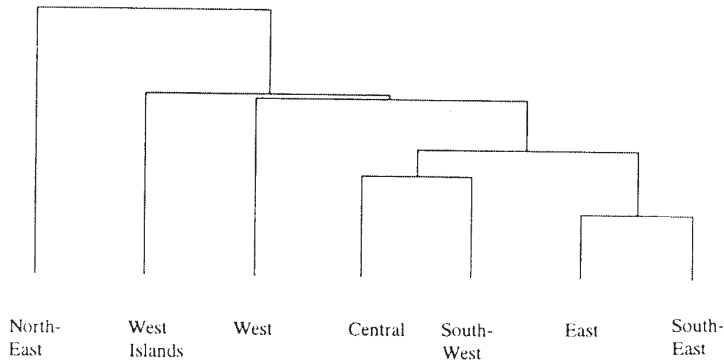


Fig. 2. Clustrogram of grouping of Estonian main regional populations based on cluster analysis using the genetic distance matrix of Cavalli-Sforza & Edwards [1967].

The comparison of the whole Estonian population with other Finno-Ugric and neighbouring populations is based on six blood group systems ( $A_1A_2BO$ , Rhesus, MN, P, Duffy, Kell, a total of 19 alleles). The genetic distances (Table 3) suggest that the Estonians are most closely related to the Russians and the Latvians, to their nearest neighbours, the Vepsians and Karelians are also very close to the Estonians, followed by the Finns, Lithuanians, Finnish Swedes, Komis and Maris.

To compare the Estonians with some other Finno-Ugric, neighbouring and some more western populations, five polymorphic systems were used ( $A_1A_2BO$ , Rhesus, MNSs, Haptoglobin, Transferrin; 23 alleles in total). In this case the Baltic language group was left out. According to this comparison (Table 4) the genetic distance is smallest between the Estonians and the Russians, followed by the Poles,

Table 3

Genetic distances by Cavalli-Sforza & Edwards between Estonians and some neighbouring and other Finno-Ugric peoples

	Vepsians	Karelians	Komis	Maris	Finns	Finnish Swedes	Latvians	Lithuanians	Russians
Estonians	0.0069	0.0074	0.0167	0.0189	0.0108	0.0115	0.0064	0.0114	0.0065
Vepsians		0.0029	0.0168	0.0128	0.0089	0.0075	0.0085	0.0072	0.0066
Karelians			0.0120	0.0104	0.0096	0.0095	0.0073	0.0094	0.0059
Komis				0.0082	0.0106	0.0103	0.0120	0.0133	0.0081
Maris					0.0080	0.0100	0.0079	0.0085	0.0058
Finns						0.0017	0.0041	0.0055	0.0043
Finnish Swedes							0.0063	0.0042	0.0051
Latvians								0.0045	0.0032
Lithuanians									0.0033

Table 4

Genetic distances by Cavalli-Sforza & Edwards between Estonians and some neighbouring and other peoples

	Finns	Swedes	Russians	Poles	Germans	Hungarians	Vologda Russians
Estonians	0.0095	0.0082	0.0038	0.0057	0.0057	0.0064	0.0097
Finns		0.0056	0.0078	0.0055	0.0082	0.0072	0.0045
Swedes			0.0051	0.0042	0.0012	0.0025	0.0068
Russians				0.0045	0.0043	0.0030	0.0079
Poles					0.0038	0.0027	0.0040
German Hungarians						0.0035	0.0078
							0.0066

the Germans, the Hungarians, the Swedes, then the Finns and the northern (Vologda) Russians. So we can conclude, that the linguistic unit does not correspond to the genetic one and the Finno-Ugric linguistic unit is clearly not a genetic unit.

The mean allele frequencies of the Estonians are comparable to those typical of the populations in North-East Europe, but the allele frequencies are characterised by tendencies in two opposite directions (like in other Finno-Ugric populations): Western (a higher frequency of K, Lu<sup>a</sup>, MS, Hp<sup>1</sup>, lower Fy<sup>a</sup>, CDe) and eastern (with higher B, CDE, with lower A<sub>2</sub>, P<sub>1</sub>, cde, t, Le (a+) phenotype) [Heapost 1994; Viikmaa, Heapost 1996].

**Craniological data.** To understand the population genetic characterization and structure of Estonians comparative studies of Estonian XI-XV centuries and Neolithic time cranial samples were carried through on the basis of cluster analysis. It was shown that Estonian cranial samples were assembled mainly into two clusters. The mesomorphic samples cluster embraces a large part of East-Estonian cranial samples. The other cluster combines the cranial samples of another type, with massive, very long and high dolichocran with high face skulls from almost all Estonia, especially from western and northern Estonia. Morphologically similar to that type of skulls were also the Neolithic Boat Axe Culture inhabitants skulls in Estonia [Heapost 1995].

Close similarities on the basis of craniological material were also shown between Estonian XI-XV centuries populations, especially those from East, Central and South-East Estonia, and many neighbouring populations — from Latvia, Finland, Karelia, North-West Russia and even Volga-Kama area [Heapost 1993a; 1995]. Most of these samples belong to the mesocran anthropological type with some local variations, and all the cranial samples, used in comparison, form completely mixed clusters with Estonian and other Finno-Ugric samples. The anthropological type represented by East-Estonian XI-XV centuries cranial samples in one or the other variant was spread on a large area of East-European forest belt. Evidently they have been closely related population groups. It is interesting to notice that the Finno-Ugrians of the Volga district had pure Europoid characters before any possible Slavic influence could have occurred. Next, the Estonian morphologically close cranial samples were summed up into two bigger ones. These two types of bigger samples were compared to some samples (mainly from 500-1500 AD) of neighbouring territories: the Baltic states, NW Russia, Volga-Kama district, Hungary, Poland, Germany, Denmark, Norway, Sweden), also to Kivutkalns Bronze Age sample, Boat Axe culture sample of Stone Age of Estonia and the cranial samples from Zvejnieki (Mesolithic to Late Neolithic). Cluster analysis on the basis of 10 cranial traits were used [Heapost 1997].

In Fig. 3 one can see, that the samples compared have been assembled mainly into two clusters — the mesocran, mesomorphic cranial samples from Eastern Estonia, North-Western Russia, Volga-Kama district (FU), Hungary, Poland, also the Selonians from Latvia, the Lithuanian sample belongs to one comparatively compact cluster (No 3-6). The mesocran samples subcluster characterized mainly by a lower cranial height is formed by German samples and a South-East Sweden sample (14-15). The Livonian sample (8) characterized mainly by a narrow head and face and a lower cranial height links to German's subcluster. The Norwegian sample stands separately and links to the mesocran cranial samples cluster (24). The other main cluster (20-22) is composed by the dolichocran samples (20-19) — West Estonian sample, Bronze Age Kivutkalns sample, Latvian samples (Zemgallians and Latgallians) and the Neolithic Boat Axe Culture sample from Estonia. The South-West Swedish sample also joins to that cluster. The dolichocran Zvejnieki samples but also the Zvejnieki Late Neolithic sample, the Danish and Jaunpiebalga sample from Latvia (25-22) joins with the dolichocran samples cluster on a higher level.

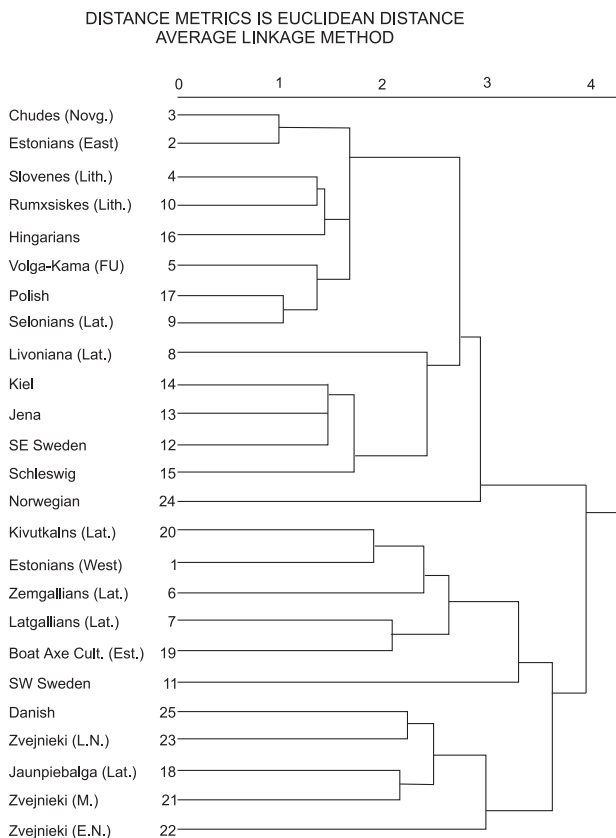


Fig. 3. Clustrogram of grouping of the cranial samples.

**Odontological data.** Odontological traits are of taxonomic peculiarities, dividing conventionally into s.c. “eastern” and “western” traits. The distribution frequency of eastern traits increase in the eastern direction and attain their maximum value in Mongoloid populations; the frequency of “western” traits increases in the western directions. In Estonia different parts can be characterized by different concentration of eastern and western features. The main classification unit in odontology is odontologic type, combined with complexes of respectiv traits [Zubov 1982].

On the territory of Estonia one can find the following odontological types [Sarap 1994]: 1) The Baltic variant of the Central European type (on the Islands and in Western Estonia, and in some parts of Eastern and Southern Estonia). The type is characterised by low occurrence of Eastern features and high occurrence of Western ones, and a strong reduction of lower molars. 2) The northern gracile type (spread in Central and Northeastern parts of Estonia, in some parts of Northern,

Southern, Southwestern and Southeastern Estonia). The special originality this type is characterised by a high frequency of eastern and western features occurring in parallel and a strong reduction of lower molar. A classical variant of Northern gracile type is spread in Southwestern and Northwestern Finland. The odontological type of the population in that district is close to eastern Estonians [Zubov, Haldeeva 1989]. 3) The influence of the North European relic type is observed in North-, East- and South-Estonia. That type is spread especially among the Lapp population and Northeastern Finns. Features of that type are also observed in Southeastern Finns, in Vepsians, Karelians, Komis and Maris. Peculiarity of this type is the coexistence of moderate frequency of Western features and a high frequency of some typical Eastern features. The combination of some “ultra-western” and “eastern” traits (the northern gracile type) of dental system in other Finno-Ugric populations, in the Baltic region as well as in the Volga and Ural regions is also ascertained [Zubov 1982; Zubov, Segeida 1986].

The conspicuous peculiarity of the Northern Gracile type is well expressed in the quantity of ISC (Index of Specific Combination). Usually, ISC does not exceed 150, (neither in Caucasoids nor in Mongoloids), but it is always larger among the representatives of Northern gracile type, attaining the value of 200-300 and even higher.

ISC varies in Estonia between 37-504. North-Eastern Estonia is especially prominent with ISC (502). Very high values of ISC occur in several South-Estonian local population samples (300-500). The ISC values are especially low in the dialect regions of the Islands, Western Estonia, and East-Estonia (72, 91, 81). In the latter a certain influence of the North European relic type besides the Central European odontological type has been observed. So the odontological data also show a considerable heterogeneity of the Estonians, where typical Finno-Ugric and more western complexes of traits have been intermingled.

By the index ISC Finno-Ugric peoples differentiate from all the other surrounding peoples and form a Finno-Ugric (not Uralic) odontologic community starting from Hungary and Finland and reaching to Western Siberia to the eastern boarder of the distribution area of Khants, Mansi and Samoyedes, the latter being quite different by their odontological type [Dubov 1990].

Two large areas of the elevated distribution of ISC index were established in worldwide comparison [Dubov 1990]: North Europe and Western Siberia — area of distribution of Finno-Ugric peoples (northern gracile type) and Southern Asia — from Mediterranean to India (area of southern gracile type). According to A.I. Dubov that connection should be genetical, while data of various sciences (ethnography, archaeology, linguistics) find evident southern roots of the ancestors of Finno-Ugric peoples.

In the Baltic States three odontological complexes have been established — Central European, Northern gracile and North European relic type. No absolute borders between these types which would follow the linguistic, ethnic or other differentiations have been observed. In Estonia the Central European and Northern gracile type are common. In Latvia Central European, Northern gracile and North

European relic type is spread, in Lithuania — mainly Central European type just like in Ukraine and in Russia in general. The presence of one odontological type in many ethnoses proves the pre-ethnic time of that [Zubov, Haldeeva 1989].

In Latvia the northern gracile type prevails. It is spread also on the territory of the narrowfaced variant of the West Baltic anthropological type in Latvia. That embraces also districts, once inhabited by Livonians and South-Estonians, extending into places farther off towards southern directions. The North European relic type is mainly spread in Eastern Latvia, where the East Baltic anthropologic type is spread [Gravere 1987]. An occurrence of the Northern gracile type traits among the other peoples is a clear evidence, that on these districts Finnic peoples have been mixed with the other ethnic groups. Such is the situation in the North-Western provinces of Russia.

The time of appearance of gracile dental complex in the forest belt of East Europe, also to Latvia, is presumed to be the Bronze Age. The gracile dental complex has been established in Latvian Kivutkalns people as well as in Balanovo culture people on Volga-Oka districts. These are supposedly genetically connected with southern gracil odontological type [Gravere 1987]. The Bronze Age Fatyanovo culture people on Volga-Oka (western) districts represent another odontological type, characterised by no reduction of molars.

**Index of Mongoloidness and Pigmentation.** Great anthropological variety is typical for Finno-Ugric peoples and among them variants of traits occur, which are common to the more eastern peoples (s.c. mongoloid addition). In studies of Finno-Ugric peoples K. Mark [1994] has brought into use the indexes of Mongoloidness (MI) and the Pigmentation (PI). The MI is based on 8 somatoscopic primary traits. In PI hair and eye colours are summarised. MI and PI show the position of a population group or a region on the s.c. scale of mongoloidness and pigmentation in comparison with the other Finno-Ugric peoples and their neighbours.

The differences in distribution of these traits between Estonian regions are not great and sometimes they even show an opposite trend. Altogether they still give a clear east-west tendency. The MI value is smallest in West Estonia (22.0), towards the East the mongoloid addition becomes more noticeable, which is seemingly connected with the East Baltic anthropological type. According to the increase of MI value the compared FU and neighbouring peoples can be placed as follows: Finnish Swedes (10.1), Western Finns (16.3), Mordvinians Erza (21.6), Karelians (28.0), Eastern Finns (29.5), Vepsians (30.1), Mordvinians-Mokša (32.8), Komis (33-39), Saami (46.6), Maris (48.3), Khanti-Mansi (about 85).

Eye and hair colour are the pigmentation traits of interest. These traits vary quite largely, but light colours still form the majority. In comparison with the neighbouring peoples, the very light pigmentation of Estonians is especially conspicuous. J. Aul [1964] states that as for average light degree of eye colour only very few peoples can compete with the Estonians. The hair colour of Estonians is comparatively even more light. The population of Islands, the Setu and South-West regions is of light pigmentation. In the rest of regions the pigmentation is very light, especially in North-East, Central and North Estonia [Mark 1994]. All the Balto-Finnic

peoples and also Finnish Swedes have a light or even a very light pigmentation. Among them the most light pigmented are North-East Estonians (PI 11.2), Eastern Finns (15.0) and West-Estonians (17.8); South-East Estonians have a slightly darker pigmentation (20.0), followed by Western Finns (22.5), Finnish Swedes (25.8), Karelians (26) and Vepsians (34.4). Thus, the most depigmented are the North-Eastern Estonians and Eastern Finns, but not the most Europoid (with the most lower value of MI) populations (as Finnish Swedes and Western Finns). Among the peoples of the Baltic states the Latvians and Lithuanians have a slightly darker pigmentation of eyes and a noticeably darker hair pigmentation than Estonians [Mark 1994].

Between the values of these two indexes no positive correlation has been found [Mark 1994]. Majority groups of larger MI value belong to the most light ones (as Central and North-East Estonia). The same phenomenon appears in Finland and at places also among the other Finno-Ugric peoples. On the basis of that K. Mark presumes, that a strong depigmentation process has taken place already in the groups mixed with mongoloid addition.

Heterogeneity of Finno-Ugric peoples is well expressed in dermatoglyphic traits. According to G. Heet and N. Dolinova [1997:128]: 1) Finno-Ugrians are extremely heterogeneous concerning dermatoglyphic traits, and exceed the average eu-roasiatic level of differentiation. It may be due to the initial heterogeneity of their ancestors as Finno-Ugrians have been mixing between themselves as well as with neighbouring populations. The process of mixing was most important in the whole anthropological history of the Finno-Ugrians. 2) Among the Finno-Ugrians two main racial components stand out quite distinctly: the Europoid and Mongoloid one. The Europoid component is subdivided into two variants. The majority of Finnic speakers belongs to the first one, it is the result of a cross-breeding of the Northern Europoids (who prevailed) with the Mongoloids of West Siberian origin. The second one is less represented and linked to the population of Volga region and Hungarians who include the marked share of Southern Europoid admixture. The Mongoloid component is connected with aboriginal population of Western and Southern Siberia. This picture is observed on both the territorial and ethnical levels.

### 3. DISCUSSION

All the types of studies presented in this paper reveal remarkable heterogeneity of Estonians. The mean allele frequencies of Estonians are comparable to those typical of the populations in North-East Europe, but the allele frequencies are characterised by tendencies in two opposite directions (like in other Finno-Ugric populations): western and eastern. The combination of some "western" or even "ultra-western" and "eastern" traits of dental system in Estonians and in other Finno-Ugric populations, in the Baltic region as well as in the Volga and Ural re-

gions has also been ascertained [Zubov 1982; Zubov, Segeda 1986; Sarap 1994]. In general, the differences are more impressive in western-eastern direction than in northern-southern direction. Some subgroups of the Estonians, especially in North-East and South-East show peculiarities characteristic to some more eastern Finno-Ugric peoples, whereas the western groups (especially in West Estonian mainland) are more strongly associated to the Indo-European neighbours. The dual branching of genetic data corresponds well with cranial, odontological and other anthropological data and the distribution of the two main anthropological types (West- and East-Baltic types) in Estonia. Cranial types in Medieval Estonia were common to a wide territory and similar cranial forms can be traced back to the local Bronze Age and the Neolithic. All of this suggests that the Estonians have a complex origin, indicating towards relations with the Finno-Ugric stem from one side, and with the Indo-European peoples from the other side.

Some combinations of traits and allele frequencies characteristic to Estonians and many other Finno-Ugric populations showing simultaneous "eastern" and "western" frequencies (for example, negative correlation of indices of Mongoloidness and Pigmentation, the northern gracile odontologic type, and some allele frequencies) cannot be explained by the assumption of Mongoloid admixture in the Caucasoid populations. We suppose that these antagonistic frequencies of different traits are tracks of the original genetic structure of the Finno-Ugric ancestor population which was not clearly differentiated in Mongoloid-Caucasoid directions. It does mean that the Finno-Ugric population represents a separate and ancient Caucasoid branch in the racial divergence. Continuity of archaeological culture in Estonia from the Mesolithic has been pointed out [Jaanimäe, *et al.* 1982]. Regardless of that the Late Bronze and Iron Age is proved to have been a decisive period in the Baltics. Great changes have taken place with the appearance of the stone cist graves on the coastal zone of Finland, on Saaremaa Island and mainly on the Northern coast of Estonia, in Northern Latvia. The settlement increased almost in all parts of Estonian territory. Earlier than in Estonia above-ground cairns have made their appearance in other lands around the Baltic, including Scandinavia. A special kind of coastal culture has inhabited the coastal areas of Estonia, South-West Finland, Åland, Eastern coastal area of Central Sweden, also Northern Latvia, especially the lower reaches of the Daugova River [Jaanimäe, *et al.* 1982]. Even today certain single similarities in some allele frequencies may possibly refer to that culture on the coastal areas of the Baltic [Heapost 1994]. Meanwhile in the Late Bronze Age great differences occur between the North and West Estonia, especially between the coastal districts of North and West Estonia on one side and the Southern Estonia on the other side. The population density in South-Estonia increased with the appearance of stone graves from northern part of Estonia, mainly from the southern direction AD, but also with South-Eastern connections. The regional differences (linguistic, anthropologic, genetic, etc.) of Estonia in modern times can probably be taken back to the same period. Already the Neolithic inhabitants of the Boat Axe culture in Estonia did not belong to the one and the same anthropological type [Aul 1935]. According to J. Aul, in prehistoric times the East and West Baltic types



did not occur in their pure forms either, and already at that time the territorial transition between these types was rather smooth, as it is nowadays. He also speculated that at that time these types were genetically not yet differentiated to such a degree as in modern times. The tribes of the Boat Axe culture and the Corded Ware culture were spread on a vast territory in Northern and Central Europe with the eastern variants of Fatjanovo and Balanovo cultures inbetween Volga-Oka Rivers [Kraynov 1972]. Two odontological types in the tribes of the Bronze Age Fatyanovo and Balanovo cultures have been established: Central European odontological type in Fatyanovo and northern gracile type in Balanovo culture peoples with southern components in it [Gravere 1987]. Both types are also presented in Baltic Finns today, also in Finno-Ugric populations, especially the northern gracile type with antagonistic traits in it. The northern gracile type features were also common in the Bronze Age Kivutkalns population, with some features indicating to the southern gracile odontological type [Gravere 1987].

Anthropologically, the Kivutkalns Bronze Age population had similar features with the narrowfaced Boat Axe and Corded Ware culture tribes in Saxonian-Thuringian, in Poland (Złota), also in Balanovo, and differentiate from broadfaced Fatyanovo and Boat Axe culture tribes of Estonia [Denisova 1975].

In anthropological differentiation of the Middle Age Baltic Finns, Balts and Slavic peoples on one side and Germans on the other side definitely expressed features of anthropological heterogeneity on the ground of proportions of the face and braincase of skull, typical of the tribes of Boat Axe and Corded Ware culture. A more or less exact geographic location of these Middle Ages types may probably be traced back to the prehistoric times [Alekseeva 1990].

According to comparative statistical studies of the European cranial samples from various periods of time, it turned out that the greatest changes in cranial measurements (the gracilization) have taken place between the Mesolithic and the Neolithic. Since then a separation into regions (East Europe, Balkan peninsula, Eastern middle Europa) reveals a series of regional differentiations [Schwidetzky, Rösing 1990]. The taxonomic structure of European populations has been analysed during three different periods — the Early Middle Ages, the Late Middle Ages and the Recent Period [Sokal, *et al.* 1987] and Finno-Ugric speakers always are centrally located and scattered throughout the graph, while skull series of some other language groups began to shift towards one or another direction on the graph. No special regions of phonetic space could be identified for Romance, Baltic, Hellenic, and Finno-Ugrian speakers.

In the literature we can find data, according to which the genetic distance between peoples correlates significantly with geography, but not with linguistics [Harding, Sokal 1988]. It is also shown that the speakers of Baltic-Finnic and Slavic groups do not differentiate genetically, there could not show genetic differences between Baltic and Slavic language groups etc. [Sokal, *et al.* 1996].

One may presume, that the population which came to the Baltic especially in the Bronze and the Iron Age, together with the close archaeological culture, may have been genetically, morphologically close, but linguistically may have not been

thoroughly differentiated yet. In the course of times, of course, different admixtures from eastern as well as from western populations were added.

**Some conclusions:** 1. All type of studies show genetic heterogeneity of Estonians. 2. The closest genetic similarities of Estonians with the neighbouring populations are not related to their language groups. 3. The mean gene frequencies of Estonians are comparable to those typical of the populations in North- and East Europe, but the gene frequencies are characterised by the tendencies in two opposite (western and eastern), but also southern directions as in other Finno-Ugric populations. 4. The craniological types spread in Estonia were common over a wide territory both in eastern and western districts. 5. Forms similar to the cranial samples of Medieval Times can be traced back to the local Bronze Age and the Neolithic. 6. The genetic heterogeneity and the antagonistic traits in Estonians seem to be a trace of the original genetic structure of Finno-Ugric ancestor population, which was neither Mongoloid nor Caucasoid.

*Translated by the author*

## ABBREVIATIONS

AR	– Archeologicke rozhledy, Praha.
AP	– Archeologia Polski, Wrocław.
AJPA	– American Journal of Physical Anthropology, New York.
CA	– Current Anthropology, Chicago.
KSIA	– Kratkiye Soobshcheniya Instituta Arkheologii Akademii Nauk USSR, Moskva.
KSIA (Ukraine)	– Kratkiye Soobshcheniya Instituta Arkheologii Akademii Nauk USSR, Kiev.
KSOGAM	– Kratkie Soobscheniya Odesskogo Gosudarstvennogo Arkheologicheskogo Muzeya, Odessa.
MASP	– Materialy po Arkheologii Severnogo Prichernomor'ya, Kiev.
MIA	– Materialy i Issledovaniya po Arkheologii, Moskva.
SA	– Sovetskaya Arkheologiya, Moskva.
SAA	– Soviet Anthropology and Archaeology, Moskva.
SE	– Sovetskaya Etnografiya, Moskva.

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This publication was supported by a grant from the International Research & Exchanges Board, with funds provided by the U.S. Department of State (Title VIII), The National Endowment for the Humanities (NEH), and the John D. and Catherine T. MacArthur Foundation. None of these organizations is responsible for the views expressed.

The publication was partly founded by the University of Łódź and by the Foundation of Adam Mickiewicz University too.

ISBN 83-86094-04-4  
ISSN 1231-0344