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PÉTER VARGA, ZSOLT BERNERT, GYULA GYENIS, ERZSÉBET FÓTHI

MULTIVARIATE STATISTICS ON ROMAN AND MIGRATION PERIOD POPULATIONS OF THE CARPATHIAN BASIN

ABSTRACT: At the end of the 19th century Lipp, Vilmos uncovered more than 6,000 graves that might have belonged to Keszthely Culture, the graves of the cemeteries of Fortress Keszthely-Fenékpuszta and Keszthely-Dobogó among them. Lipp's crew followed the routine practice of their days: the only parts of skeletons taken into storage were well-preserved skulls, all the other bones were reburied without examination. We analysed 102 skulls from these excavations. The findings of the two burial sites were evaluated as a combined entity, as the archaeological documentation did not indicate clearly their accurate origin. Since anthropological materials of the two cemeteries proved to be very similar, they were drawn together as Keszthely-District. We inherited only a very limited amount of well-preserved anthropological material of Keszthely Culture, therefore the results of our present analysis could provide a significant contribution to the general anthropological understanding of the populations bearing this culture.

KEY WORDS: Keszthely Culture – Avar age – Roman period – Physical anthropology

INTRODUCTION

The Keszthely-Fenékpuszta headland was almost continuously inhabited since the Late Neolithic period. In the 4th century A.C. the Romans constructed a fort there. After the middle of the 6th century a new, Late Antique culture, non-indigenous population settled down in the fort of Keszthely-Fenékpuszta and within its zone of 50 km radius (*Figure 1*). Their culture was markedly different to that of the Avars. The majority of researchers dated the utilization period of cemeteries within the fort and in front of the southern wall between 568–630 (Müller 1987). Under Keszthely Culture we mean the archaeological heritage of populations that lived inside the Avar Empire, around Keszthely in a circle of almost 50 kilometer radius in the 6th to 8th centuries time interval, and could be characterized with a specific set of finds: disk shaped fibulae, style needles, earings with small baskets, snake-headed bracelets – mainly in the graves of women (Kovrig 1958, Kiss 1968).

Opinions are divided on the origins of this population. Kovrig (1958) stated that Keszthely Culture was built up by romanized native groups surviving in the Avar period, which managed to preserve their cultural independence even after the Avar conquest. According to G. Kiss (1992) a Late Antique culture population fragment of unknown origin migrated from the northern shores of the Adriatic into the Avar Empire and settled there in a comparatively small region, as an island of Christianity. It was the view of Sági (1961, 1970) that the fort's community was made up of the surviving Late Antique population and immigrated western Germanic elements, who used the geographical position of the Fenékpuszta fort to establish vivid trade contacts towards Byzantium and Italy. According to Müller's opinion (1987, 1995) the Langobard – with a considerable portion of the romanized population of Pannonia – moved into Italy in 568, but the Late Antique communities of the Keszthely region did stay, for the new conquerors, the Avars, needed craftsmen and cultivators. The centre of this population – markedly non-Avar,

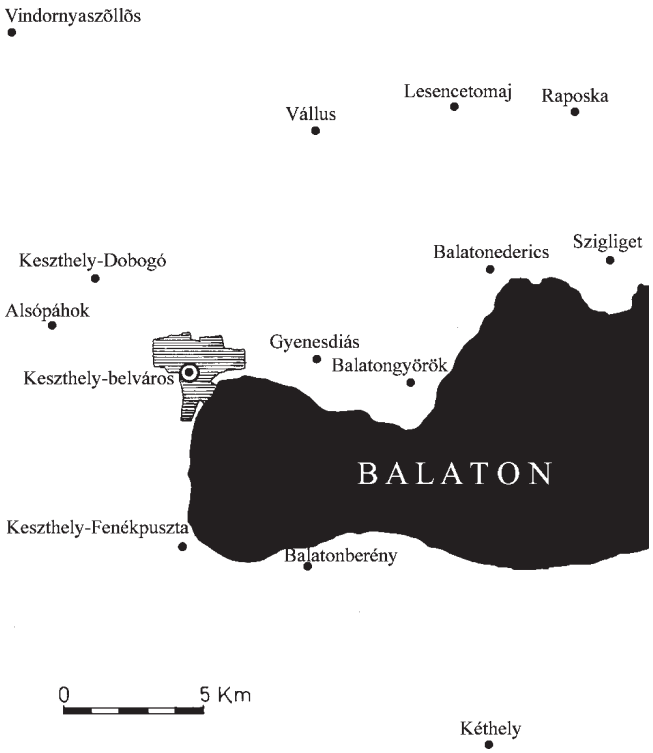

FIGURE 1. Geography of Keszthely Culture Sites (According to Müller 1992).

characterized by the Keszthely Culture – was the fort of Fenékpuszta. The leading social elite lived within its walls, and they buried their dead in the old Christian basilica. Lengyel (1971) separated two different groups by osseochemical analysis, therefore the Fenékpuszta fort population consisted of two strata between 568 and 630. The smaller group was made up of the Late Antique population's almost grave-goodless graves, the other of those of the settlers of 568 with their typical findings. We may conclude that scientific examinations also supported the division established by archaeological analysis, and we should consider the presence of a surviving Late Antique population beside that of the settlers an established fact. However, somewhen around 630 some overpowering reason brought the life of the Fenékpuszta settlement to an end. It was Kovrig who suggested that the population left the fort after some large scale devastation, and went to live to Keszthely at the beginning of the 7th century. This could explain the vanishing without preliminaries of "basketed earings' people" in Keszthely at the start of the 7th century (Kovrig 1958).

In the future anthropology could play a significant part in the clarification of the origins of the population that can be characterized by Keszthely Culture. The condition of this is the systematic processing of anthropological material uncovered in Keszthely Culture cemeteries. With our present paper we would like to contribute to this effort.

MATERIAL AND METHOD

At the end of the 19th century Lipp, Vilmos uncovered more than 6,000 graves characterized by Keszthely Culture features, among them those of the Keszthely-Fenékpuszta fortress and the cemetery of Keszthely-Dobogó. Following the routine of those times only well preserved skulls (without mandibles) were saved, all other bones were reburied without anthopological examination. Today the anthropological material of the two sites is represented by only 102 skulls, held in the Anthropological Department of the Hungarian Natural History Museum. We evaluated the finds of the two cemeteries combined, as the excavation's documentation did not make it possible to decide from which cemetery they did originate. The results of previous analyses also supported this combined handling, as they indicated a homogeneous population for the complete material. Since anthropological materials of the two cemeteries proved to be very similar, they were drawn together as Keszthely-District.

Our analysis could gain significance because till now only a very limited amount of well preserved anthropological material has been available, and therefore our results could provide a useful contribution to our anthropological understanding of the bearers of this culture.

TABLE 1. Degree of sexualization of the examined traits (20-x years of age).

Sexing traits	Males			Females		
	M	N	Repr. (%)	M	N	Repr. (%)
Tuber frontale et parietale	+0.33	48	100.00	–0.74	53	98.15
Glabella, arcus superciliaris	+0.46	48	100.00	–0.65	54	100.00
Processus mastoideus	+0.19	47	97.92	–0.98	51	94.44
Protuberantia occipitalis externa	+0.23	47	97.92	–1.06	48	88.89
Squama occipitalis	+0.30	47	97.92	–0.92	50	92.59
Margo supraorbitale	–0.38	47	97.92	–1.31	54	100.00
Arcus zygomaticus	+0.34	38	79.17	–0.53	49	90.74
Facies zygomaticus	+0.77	39	81.25	–0.62	52	96.30
Corpus mandibulae	–0.43	7	14.58	–1.00	3	5.56
Protuberantia mentalis	+0.29	7	14.58	–0.33	3	5.56
Angulus mandibulae	+0.57	7	14.58	–0.33	3	5.56
Caput mandibulae	+0.67	6	12.50	–1.00	3	5.56
Mean	+0.15	32.33	35.14	–0.41	35.25	34.06

TABLE 2. Abbreviated life table of population of the Keszthely-District cemeteries.

Age groups	No. of deaths (Dx)	% of deaths (dx)	Life expectancy (ex)
0	0.00	0.00	42.95
1–4	0.00	0.00	41.95
5–9	0.00	0.00	37.95
10–14	0.00	0.00	32.95
15–19	3.89	3.82	27.95
20–24	3.33	3.27	23.96
25–29	11.50	11.28	19.72
30–34	14.00	13.73	17.10
35–39	12.27	12.04	15.05
40–44	13.21	12.96	12.75
45–49	12.08	11.85	10.85
50–54	10.14	9.95	9.04
55–59	8.10	7.94	7.12
60–64	8.34	8.18	4.91
65–69	3.67	3.60	3.87
70–74	0.92	0.90	2.50
75–79	0.48	0.47	0.00
Total	102	100	
Age groups	**No. of deaths**	**% of deaths**	**Life expectancy**
Males	**(Dx)**	**(dx)**	**(ex)**
15–19	0.00	0.00	32.65
20–24	0.24	0.50	27.65
25–29	2.61	5.43	22.77
30–34	3.23	6.73	18.94
35–39	3.33	6.95	15.21
40–44	9.58	19.98	11.31
45–49	10.06	20.98	9.22
50–54	7.66	15.98	7.79
55–59	5.33	11.12	6.40
60–64	3.70	7.72	4.91
65–69	1.57	3.28	3.95
70–74	0.40	0.84	2.50
78–79	0.24	0.50	0.00
Total	48	100	
Females	**(Dx)**	**(dx)**	**(ex)**
15–19	3.89	7.21	23.78
20–24	3.09	5.73	20.43
25–29	8.89	16.48	16.61
30–34	10.77	19.96	14.91
35–39	8.94	16.56	14.80
40–44	3.63	6.73	15.78
45–49	2.02	3.75	14.05
50–54	2.48	4.59	10.88
55–59	2.76	5.12	7.91
60–64	4.64	8.59	4.90
65–69	2.10	3.90	3.81
70–74	0.51	0.95	2.50
75–79	0.24	0.44	0.00
Total	54	100	

When scoring morphological sex we took into consideration 12 anatomical characteristics that presented sexual dimorphism (Éry *et al.* 1963, Acsádi, Nemeskéri 1970, Éry 1992a). For estimating age at the time of death we utilized ossification of cranial sutures (Nemeskéri *et al.* 1960, Meindl, Lovejoy 1985), and the method of Lamendin and his collaborators (1992) based on the alteration of frontal teeth's roots' diaphaneity, as well as the wear of teeth on the basis of the observations of Brothwell (1963) and Huszár (1976). Absolute measurements of skulls were taken and the indices calculated according to Martin and Saller (1957). We applied the categories of Alekseev and Debets for the classification of anthropometrical features (Alekseev, Debets 1964). Cranial capacities were calculated by the method of Lee and Pearson (Lee, Pearson *cit*. Éry 1992a). Ten characteristics were examined in the morphological description of skulls.

Comparative analysis was carried out on the basis of crania's similarities in size and shape. Cemeteries were characterized by men's craniological measurement averages. We utilized the following 10 measurements of Martin: 1, 8, 9, 17, 45, 48, 51, 52, 54, 55.

The first six measurements were chosen to describe the size and shape of skull in a multi-directional, global way. With the latter 4 we intended to outline the finer details of the face. For comparison we utilized systematic cluster analysis (Fóthi, Fóthi 1992). This process was carried out on IBM compatible personal computer by the purpose-built software of Breiner (1988). Data were transformed by C-transformation in the presented dendograms, biological distance was calculated by the Penrose method, distance matrix was analysed by dual sequential method.

RESULTS

Sexual expressedness

In *Table 1* we presented the averages according to sex of the 12 sexual characteristics examined. Average sexual expressedness of men was +0.15, that of women –0.41. The sexual dimorphism observable on the skulls was small, the population had a feminine character. *Facies zygomaticus* (+0.77) and *glabella – arcus superciliaris* (+0.46) proved to be the most masculine hall-marks, while *processus mastoideus* (+0.19) and *protuberantia occipitalis externa* (+0.23) the least masculine. *Margo supraorbitale* (–1.31) and *protuberantia occipitalis externa* (–1.06) presented themselves as the most feminine features of women, while *protuberantia mentalis* (–0.33) and *angulus mandibulae* (–0.33) as the least feminine ones. The greatest sexual difference was observable on *facies zygomaticus* and on *squama occipitalis*.

TABLE 3. Age groups and sex distribution of skeletons.

Age groups \ Sex	Males	Females	?	Together
Juvenis	0	4	0	5
Adultus	10	31	0	40
Maturus	33	11	0	44
Senium	5	8	0	13
?	0	0	0	0
Total	48	54	0	102

TABLE 4. Measurements and indices of skulls.

Martin No.	Males					Females				
	N	M	Vmax	Vmin	S	N	M	Vmax	Vmin	S
1	46	182.9	200.0	171.0	6.7	45	176.6	187.0	160.0	6.0
5	38	100.4	114.0	91.0	4.7	39	96.8	104.0	89.0	3.2
8	44	138.1	155.0	130.0	5.6	46	133.8	144.0	126.0	4.4
9	47	96.1	106.0	87.0	5.0	47	93.1	115.0	85.0	5.0
10	46	118.8	135.0	101.0	7.0	48	113.5	130.0	98.0	5.9
11	43	121.6	133.0	110.0	5.4	44	116.7	126.0	103.0	5.2
12	44	110.5	124.0	100.0	5.8	46	107.8	119.0	98.0	5.0
17	38	133.5	148.0	119.0	5.8	39	128.8	140.0	119.0	5.3
20	43	113.8	124.0	105.0	4.0	42	109.6	120.0	101.0	3.9
32	35	85.5	99.0	72.0	5.4	44	85.4	94.0	76.0	4.1
38	43	1407.1	1680.9	1211.3	90.4	39	1265.0	1432.4	1060.0	80.4
40	29	93.8	101.0	87.0	4.0	33	90.1	97.0	82.0	3.3
43	44	103.6	112.0	95.0	3.9	47	99.8	108.0	91.0	3.5
45	24	129.6	141.0	122.0	4.5	40	123.6	132.0	116.0	4.3
46	33	93.4	101.0	83.0	4.6	43	92.0	118.0	83.0	5.5
47	2	120.0	122.0	118.0	2.8	2	106.0	111.0	101.0	7.1
48	29	67.0	75.0	46.0	5.7	37	64.8	72.0	54.0	3.9
51	35	40.7	45.0	37.0	2.1	44	40.2	45.0	36.0	2.2
52	35	31.6	35.0	23.0	2.5	44	32.8	38.0	24.0	3.0
54	37	24.3	29.0	21.0	1.7	43	24.0	29.0	20.0	2.3
55	37	50.5	55.0	34.0	3.7	44	49.6	56.0	41.0	2.9
62	30	44.5	50.0	38.0	2.9	38	42.9	56.0	38.0	3.4
63	19	39.9	47.0	29.0	4.4	32	37.6	42.0	31.0	2.9
65	2	102.5	103.0	102.0	0.7	1	96.0	96.0	96.0	–
66	2	30.0	32.0	28.0	2.8	1	29.0	29.0	29.0	–
70	1	61.0	61.0	61.0	–	1	53.0	53.0	53.0	–
71	2	29.5	30.0	29.0	0.7	1	32.0	32.0	32.0	–
72	29	86.9	98.0	79.0	4.0	34	86.2	94.0	79.0	3.8
73	33	87.7	98.0	80.0	4.2	40	88.2	97.0	76.0	4.6
74	24	80.5	95.0	58.0	7.9	32	81.9	93.0	67.0	6.7
75	13	61.8	73.0	30.0	11.5	18	65.2	82.0	57.0	7.3
75(1)	11	22.7	34.0	16.0	6.2	16	23.9	33.0	14.0	4.2
8:1	44	75.7	88.1	69.1	3.9	44	75.8	81.4	70.3	2.9
17:1	38	72.9	80.2	65.0	3.2	38	73.3	78.5	67.4	2.8
17:8	37	96.9	105.9	84.4	5.5	38	96.7	107.8	87.9	4.4
20:1	43	62.3	67.2	58.0	2.2	40	62.2	66.5	57.1	2.1
20:8	43	82.6	88.7	73.5	3.3	40	82.0	91.4	75.9	3.1
9:8	44	69.4	76.6	64.9	2.9	45	69.7	85.8	64.0	3.7
47:45	2	93.4	94.6	92.2	1.7	2	85.2	86.3	84.1	1.6
48:45	19	51.6	59.5	35.4	5.2	33	52.7	59.7	42.9	3.6
52:51	35	78.1	89.7	53.5	8.2	44	81.6	97.4	66.7	6.9
54:55	37	48.4	70.6	40.7	5.4	43	48.6	59.2	39.2	5.1
63:62	15	88.8	100.0	63.8	8.5	28	88.1	100.0	58.9	10.4

TABLE 5. Distribution of indices according to Alekseev and Debets.

Martin No.	Classification	Males			Females			Together	
			N	%		N	%	N	%
8:1	Hyperdolichocrane	67.7–73.2	11	24.4	68.5–74.1	14	32.6	25	28.4
	Dolichocrane	73.3–76.4	21	46.7	74.2–77.3	15	34.9	36	40.9
	Mesocrane	76.5–79.9	7	15.6	77.4–80.8	12	27.9	19	21.6
	Brachycrane	80.0–83.1	5	11.1	80.9–84.0	2	4.6	7	8.0
	Hyperbrachycrane	83.2–88.7	1	2.2	84.1–89.7	0	0.0	1	1.1
	Total		45			43		88	
17:1	Ultrachamaecrane	–67.7	2	5.1	–63.8	0	0.0	2	2.7
	Hyperchamaecrane	67.8–69.2	3	7.7	63.9–69.4	5	13.5	8	10.8
	Chamaecrane	69.3–72.3	10	25.6	69.5–72.5	8	21.6	18	24.3
	Orthocrane	72.4–75.6	18	46.1	72.6–75.8	18	48.6	36	48.6
	Hypsicrane	75.7–78.7	5	12.8	75.9–78.9	6	16.2	11	14.3
	Hyperhypsicrane	78.8–84.2	1	2.6	79.0–84.5	0	0.0	1	1.3
	Total		39			37		74	
20:1	Hyperchamaecrane	55.0–59.4	3	6.8	55.2–59.6	5	12.5	8	9.5
	Chamaecrane	59.5–61.8	18	40.9	59.7–62.0	14	35.0	32	38.1
	Orthocrane	61.9–64.7	16	36.4	62.1–64.9	17	42.5	33	39.3
	Hypsicrane	64.8–67.1	6	13.6	65.0–67.3	4	10.0	10	11.9
	Hyperhypsicrane	67.2–71.6	1	2.3	67.4–71.8	0	0.0	1	1.2
	Total		44			40		84	
17:8	Hypertapeinocrane	–87.9	3	7.9	–87.1	0	0.0	3	4.0
	Tapeinocrane	88.0–92.3	3	7.9	87.2–91.4	4	10.8	7	9.3
	Metriocrane	92.4–97.0	12	31.6	91.5–96.1	15	40.5	27	36.0
	Akrocrane	97.1–101.4	10	26.3	96.2–100.4	9	24.3	19	22.3
	Hyperakrocrane	101.5–109.2	10	26.3	100.5–108.2	9	24.3	19	22.3
	Total		38			37		75	
20:8	Hypertapeinocrane	.75.8	1	2.3	–75.1	0	0.0	1	1.2
	Tapeinocrane	75.9–78.9	3	6.8	75.2–78.2	3	7.7	6	7.2
	Metriocrane	79.0–82.8	19	43.2	78.3–82.1	20	51.3	39	46.9
	Akrocrane	82.9–85.9	15	34.1	82.2–85.2	11	28.2	26	31.3
	Hyperakrocrane	86.0–91.8	6	13.6	85.3–91.0	4	10.2	10	12.0
	Ultraakrocrane	91.9–	0	0.0	92.1–	1	2.6	1	1.2
	Total		44			39		83	
9:8	Hyperstenometopic	57.0–62.7	0	0.0	57.3–63.0	0	0.0	0	0.0
	Stenometopic	62.8–66.0	3	6.6	63.1–66.3	7	15.9	10	11.2
	Metriometopic	66.1–69.6	20	44.4	66.4–69.9	16	36.4	36	40.4
	Eurymetopic	69.7–72.9	18	40.0	70.0–73.2	17	38.6	35	39.3
	Hypereurymetopic	73.0–78.7	4	8.8	73.3–79.0	3	6.8	7	7.9
	Ultraeurymetopic	78.8–	0	0.0	80.1–	1	2.3	1	1.1
	Total		45			44		89	
47:45	Euryprosopic	80.6–85.8	0	0	80.2–85.4	1	50	1	25.0
	Mesoprosopic	85.9–91.6	0	0	85.5–91.1	1	50	1	25.0
	Leptoprosopic	91.7–96.9	2	100	91.2–96.4	0	0	2	50.0
	Total		2			2		4	
48:45	Hypereuryene	–48.3	2	10	–48.1	4	12.5	6	11.5
	Euryene	48.4–51.4	8	40	48.2–51.2	5	15.6	13	25.0
	Mesene	51.5–54.9	5	25	51.3–54.7	16	50.0	21	40.4
	Leptene	55.0–58.0	4	20	54.8–57.8	5	15.6	9	17.3
	Hyperleptene	58.1–	1	5	57.9–	2	6.2	3	5.8
	Total		20			32		52	

Demographical results

All demographical analyses are based on accurate age estimation and determination of sex. At the excavation of Lipp, Vilmos only intact skulls were saved, therefore the sample analysed provided an evidently limited representation of the whole population.

The ratio of men and women was approximately balanced (0.92). There was no child cranium in the material analysed. Individuals who died as young adults were present in the series only in small number (4 women). We see the reason for this in the fact that only intact skulls were saved, and the crania of juveniles tend to fall apart along the open sutures. The majority of women examined died in adultus age, peak of mortality could be put to the age group 30–34 years. The majority of men survived into maturus age, their maximum of mortality was between

TABLE 5. Distribution of indices according to Alekseev and Debets (continued).

Martin No.	Classification		Males N	Males %		Females N	Females %	Together N	Together %
	Ultrachamaeconch	–65.0	2	5.5	–67.3	1	2.3	3	3.8
52 : 51	Hyperchamaeconch	65.1–73.8	8	22.2	67.4–76.4	8	18.6	16	20.2
	Chamaeconch	73.9–78.7	9	25.0	76.5–81.5	16	37.2	25	31.6
	Mesoconch	78.8–84.3	8	22.2	81.6–87.3	8	18.6	16	20.2
	Hypsiconch	84.4–89.2	6	16.7	87.4–92.4	6	13.9	12	15.2
	Hyperhypsiconch	89.3–98.0	3	8.4	92.5–101.5	4	9.3	7	8.9
	Total		36			43		79	
	Hyperleptorrhine	35.4–42.5	3	7.9	36.–43.3	9	21.4	12	15.0
54 : 55	Leptorrhine	42.6–46.6	10	26.3	43.4–47.5	9	21.4	19	23.8
	Mesorrhine	46.7–51.1	17	44.7	47.6–52.1	14	33.3	31	38.7
	Chamaerrhine	51.2–55.2	5	13.1	52.2–56.3	8	19.0	13	16.3
	Hyperchamaerrhine	55.3–62.4	2	5.3	56.4–63.6	2	4.8	4	5.0
	Ultrachamaerrhine	62.5–	1	2.6	63.7–	0	0.0	1	1.2
	Total		38			42		80	
	Hyperleptostaphyline	–75.7	1	6.7	–75.8	3	10.7	4	9.3
63 : 62	Leptostaphyline	75.8–82.6	2	13.3	75.9–82.7	8	28.6	10	23.3
	Mesostaphyline	82.7–90.3	4	26.6	82.8–90.5	0	0.0	4	9.3
	Brachystaphyline	90.4–97.2	7	46.7	90.6–97.4	13	46.4	20	46.6
	Hyperbrachystaphyline	97.3–109.6	1	6.7	97.5–109.8	4	14.3	5	11.5
	Total		15			28		43	
		–1227	1	2.3	–1096	1	2.6	2	2.4
38	Oligencephalic	1228–1337	10	22.7	1097–1195	5	13.2	15	18.3
	Euencephalic	1338–1462	23	52.3	1196–1307	22	57.9	45	54.9
	Aristencephalic	1463–1572	8	18.2	1308–1406	9	23.7	17	20.7
	Hyperaristencephalic	1573–1770	2	4.5	1407–1582	1	2.6	3	3.7
	Total		44			38		82	

45–49 years of age (*Tables 2* and *3, Figure 2*). This phenomenon could be explained by pregnancies, miscarriages, and parturitions related events – mainly afflicting women of adult age.

Metric characteristics of skulls

Cranial measurements examined, the spread of measurements, minimum and maximum volumes and the number of cases were presented for men and for women in a table (*Table 4*).

The most significant cranial indices (*Table 5*) calculated from these measurements were interpreted with text. Men were long headed (dolichocrane) on the basis of length-width index, with medium high, low skulls (orthocrane, chamaecrane) according to length-height index, medium and high skulled (metriocrane, akrocrane) by the width-height index. They had medium wide and wide foreheads (metriometopic, eurymetopic) according to their frontoparietal index. On the basis of facial crania indices the upper faces of men were wide (euryene), medium wide

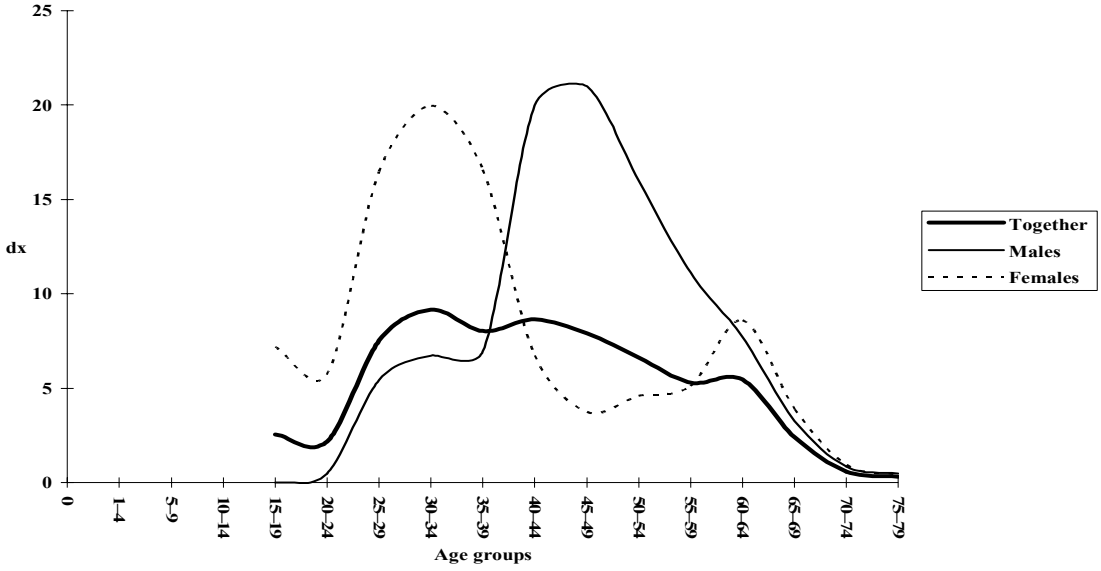

FIGURE 2. Mortality curve of the population of the Kesthely-District cemeteries.

TABLE 6. Sutures and ossicles.

Sutures and ossicles	Males			Females			Together		
	N	n	%	N	n	%	N	n	%
Sutura metopica	48	1	2.1	54	1	1.9	102	2	2.0
Sutura supranasalis	46	22	47.8	52	12	23.1	98	34	34.7
Ossa suturae coronalis (left)	47	0	0.0	52	2	3.8	99	2	2.0
Ossa suturae coronalis (right)	42	2	4.8	53	2	3.8	95	4	4.2
Os bregmaticum	46	0	0.0	53	0	0.0	99	0	0.0
Ossa suturae sagittalis	41	3	7.3	52	5	9.6	93	8	8.6
Os epiptericum (left)	35	6	17.1	49	10	20.4	84	16	19.0
Os epiptericum (right)	34	2	5.9	47	6	12.8	81	8	9.9
Ossa suturae squamosa (left)	43	2	4.7	53	2	3.8	96	4	4.2
Ossa suturae squamosa (right)	45	2	4.4	52	4	7.7	97	6	6.2
Os astericum (left)	44	7	15.9	53	4	7.5	97	11	11.3
Os astericum (right)	42	5	11.9	54	3	5.6	96	8	8.3
Os lambdae	41	3	7.3	52	12	23.1	93	15	16.1
Ossa suturae lamboidea (left)	43	20	46.5	50	19	38.0	93	39	41.9
Ossa suturae lamboidea (right)	42	17	40.5	57	26	45.6	99	43	43.4
Os incae	41	0	0.0	52	0	0.0	93	0	0.0

TABLE 7. Distribution of morphological characters.

Characteristics		Males		Females		Together	
		N	%	N	%	N	%
Arch of forehead	Vertical	16	34.0	37	68.5	53	52.5
	Intermediate	18	38.3	14	25.9	32	31.7
	Plain	13	27.7	3	5.6	16	15.8
	Total	47		54		101	
Profil of occiput	Curvoccipital	30	62.5	29	55.8	59	59.0
	Bathrocrane	14	29.2	21	40.4	35	35.0
	Planoccipital	4	8.3	2	3.8	6	6.0
	Total	48		52		100	
Form of the orbit	Rounded	7	18.9	20	37.0	27	29.7
	Rectangular	30	81.1	34	63.0	64	70.3
	Total	37		54		91	
Nose	Narrow	23	62.2	45	86.5	68	76.4
	Wide	14	37.8	7	13.5	21	23.6
	Total	37		52		89	
Spina nasalis anterior	Broca 1	4	11.1	8	18.2	12	15.0
	Broca 2	13	36.1	19	43.2	32	40.0
	Broca 3	9	25.0	12	27.3	21	26.2
	Broca 4	7	19.5	4	9.1	11	13.8
	Broca 5	3	8.3	1	2.2	4	5.0
	Total	36		44		80	
Margin of *apertura piriformis*	Anthropine	30	73.2	46	92.0	76	83.5
	Fossa praenasalis	3	7.3	2	4.0	5	5.5
	Sulcus praenasalis	8	19.5	2	4.0	10	11.0
	Total	41		50		91	
Alveolar prognathie	Vertical	4	11.8	4	8.2	8	9.6
	Moderate	23	67.6	29	59.1	52	62.6
	Expressed	7	20.6	16	32.7	23	27.8
	Total	34		49		83	
Fossa canina	Small	17	43.6	24	45.3	41	44.6
	Medium	12	30.8	20	37.7	32	34.8
	Large	10	25.6	9	17.0	19	20.6
	Total	39		53		92	
Glabella	Broca 1	1	2.1	5	9.3	6	5.9
	Broca 2	12	25.0	32	59.2	44	43.1
	Broca 3	12	25.0	16	29.6	28	27.4
	Broca 4	21	43.7	1	1.9	22	21.6
	Broca 5	2	4.2	0	0.0	2	2.0
	Total	48		54		102	

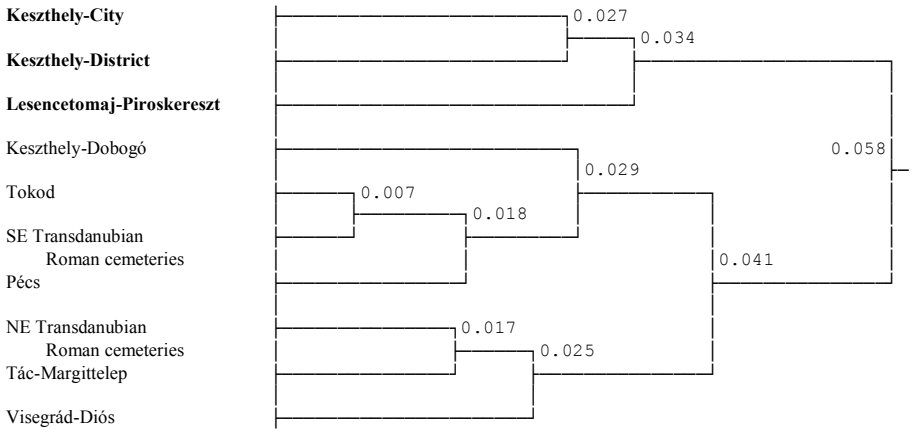

FIGURE 3. Comparison of Keszthely Culture populations and Roman period populations (C-transformation, Penrose-distance, Dual sequential method).

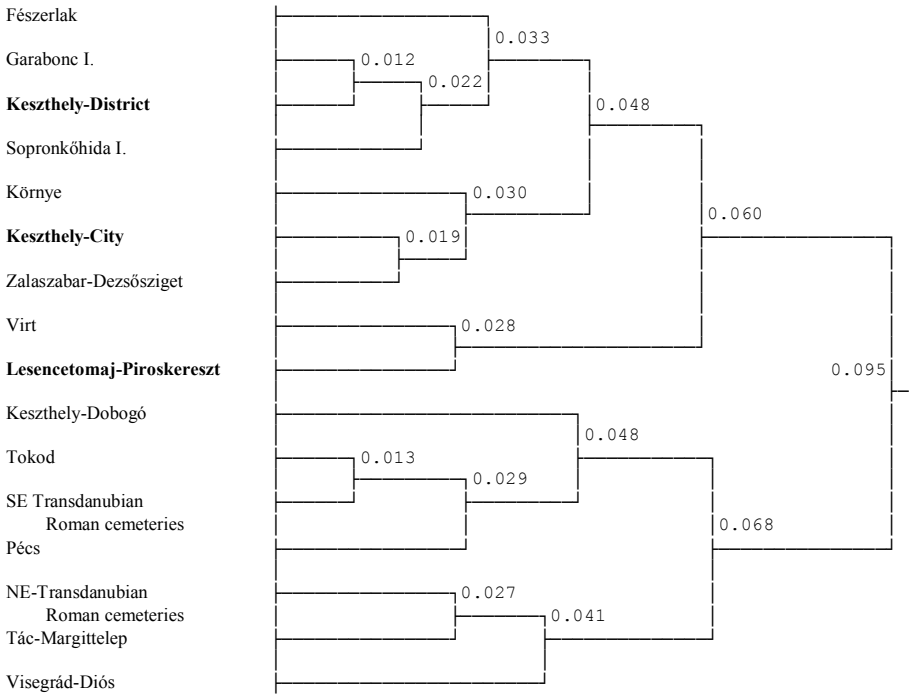

FIGURE 4. Comparison of Keszthely Culture, Roman Period and Avar age populations (C-transformation, Penrose-distance, Dual sequential method).

(mesene). Orbital cavity was most frequently low (chamaeconch), while nasal cavity medium wide (mesorrhine).

According to their cranial indices women were long headed (dolichocrane), extremely long headed (hyperdolichocrane), medium high (orthocrane) by their length-height indices, with medium high brain-cases (metriocrane) on the basis of the width-height index. Their forehead was wide (eurymetopic) medium wide (metriometopic) by the transversal-frontoparietal index. According to facial crania indices the upper faces of women were medium wide (mesene), orbital cavity was mostly low (chamaeconch), nasal cavity medium wide (mesorrhine).

Morphological and non-metric features of skulls

The distribution of accessory sutures and sutural ossicles according to sex was summarized in *Table 6*. We feel it appropriate to emphasize the significant number of *sutura supranasalis* and *wormiana* bones observed with both sexes. *Os japonicum* was discovered on one skull (Inventory No. 453). This morphological variation does occur in the Mongolian great race.

Table 7 contains the morphological characteristics of skulls by distribution of sex. The forehead of men was most often pitched, but the transitional type was also frequent. Pitched forehead occurred the most often with women. Occiput was generally arched, but every third men and women had bathrocrane napes of the neck, which

conformed with large frequency of *ossa wormiana* observed in the occipital suture. According to the analysis of Bocquet-Appel (1984), supernumerary sutural bones occurred in larger numbers in populations that sufferred from longer or shorter nutritional troubles, or starved in extreme cases.

Skull's shape in view from above was oval, the population presented a very unified image in this aspect. Orbital cavites were dominantly angular on men, women had twice as much rounded orbital cavities than men. Noses were generally narrow, however more than a third of men had wide noses, while in women wide noses were only half as frequent than in men. *Spina nasalis anterior* most often presented Broca 2 grade. *Apertura piriformis* was of decisively anthropine character. Alveolar prognathy was generally small, *fossa canina* was shallow. *Glabellae* of men were most often Broca 4 grade, those of women Broca 2.

Taxonomical description

This mostly purely Europid population presented a very unified taxonomical image. The gracile Mediterranean type dominated both among the men and the women. Women had very small skulls, some of them staying close to the microcephalic region. It was also typical that men's skulls also bore feminine characteristics. The nordic and cromagnoid types were almost completely missing from this population. Some skulls with mongoloid features did occur among the women, these could be considered an alien element.

Comparative analysis

Keszthely Culture's population was represented by the cemeteries of Keszthely-City (Wenger 1977), Lesencetomaj-Piroskereszt (Fóthi, Bíró, manuscript), and the Keszthely-District cemeteries introduced in the present paper.

First of all we drew Roman period material into comparison. We were looking for answers to the question to what extent could continuity and contacts be established between Keszthely Culture's population and people living there earlier. We took into consideration the material of the following cemeteries:

Southeast-Transdanubian Roman ones (Vörösmart, Fazekasboda, Hidas, Zengõvárkony) (Wenger 1968), Northeast-Transdanubian Roman ones (Brigetio, Csákvár, Intercisa) (Nemeskéri 1954, 1956a, 1956b), Keszthely-Dobogó (Varga *et al*. 2004, manuscript), Pécs (Éry 1973), Tác-Margittelep (Éry 2001), Tokod (Éry 1981), Visegrád-Diós (Merczi 2001).

Keszthely Culture's population was also compared to the Avar period population of Hungary, of them we mention only the anthropologically most similar ones: Fészerlak (Fóthi 1988), Garabonc I (Éry 1992b), Környe (Tóth 1971), Sopronkõhida I (Gonda 1993), Virt (Hanáková *et al.* 1976), Zalaszabar-Dezsõsziget (Éry 1992b) (*Figure 5*).

It was a wide-spread view in archaeological literature that the roots of Keszthely Culture could be found among

FIGURE 5. Geographical location of the compared sites.

the local Pannon communities. When comparing the cemeteries of Keszthely Culture to the available Roman period ones, we may state that the anthropological material did not support this idea, on the contrary, it disproved it (*Figures 3, 4*). Keszthely Culture's cemeteries presented a sharp separation from those of the Roman period population and formed a different group (cluster). We may put it in another way too: all the Roman period cemeteries come under a different cluster. It must be especially emphasised that the population of Keszthely-Dobogó – representing the local Roman period inhabitants – was also different to the people of Keszthely Culture, and therefore it could not be considered a predecessor of the population bearing Keszthely Culture.

The difference between Keszthely Culture's and the Roman period's population became even more evident if we included in our comparison those Avar period cemeteries that anthropologically stood the closest to the Keszthely cemeteries (we do not go into the details of Avar period comparison for lack of space, only relevant results were utilized). The populations of the two periods showed a marked difference here too: Keszthely Culture and the anthropologically most similar Avar period populations – from the wider geographical region of Transdanubia (Zalaszabar-Dezsõsziget, Környe, Garabonc I, Sopronkõhida I, Fészerlak) – come into one cluster, while the other was made up exclusively of Roman period cemeteries (*Figure 4*).

At the same time it meant that the population of Keszthely Culture did not leave after the disapperance of the culture, but survived in the local population groups.

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Péter Varga
Zsolt Bernert
Erzsébet Fóthi
Department of Anthropology
Hungarian Natural History Museum
Ludovika tér 2
H-1083 Budapest, Hungary
E-mail: bernert@ludovika.nhmus.hu

Gyula Gyenis
Department of Anthropology
Eötvös Loránd University
Budapest, Hungary