ANNALES HISTORICO-NATURALES MUSEI NATIONALIS HUNGARICI
Volume 88. Budapest, 1996 pp. 223–233.

Palaeodemographic estimation of the Hungarian Conquest Period cemetery of Tiszafüred*

E. FÓTHI[1] & Á. FÓTHI[2]

[1]*Department of Anthropology, Hungarian Natural History Museum*
H–1062 Budapest, Bajza utca 39, Hungary
[2]*Department of General Computer Science, Eötvös Loránd University*
H–1088 Budapest, Múzeum krt. 6–8, Hungary

FÓTHI, E. & FÓTHI, Á. (1996): Palaeodemographic estimation of the Hungarian Conquest Period cemetery of Tiszafüred. – *Annls hist.-nat. Mus. natn. hung.* **88**: 223–233.

Abstract – The Conquest Period cemetery of Tiszafüred-Nagykenderföldek is located in Northern Hungary in the upper Tisza region. The remains of 113 individuals were found in graves forming lines. Detailed demographic analysis was carried out. Age at the time of death was divided into five-year intervals. Mortality curve, survivorship curve, life expectancy, population size and population age structure are discussed. The ratio of children and adults turned out to be very close to that expected (0.33). Life expectancy at birth was 32.15 years. Sex ratio is almost balanced and it is not indicating any irregular occurrence. The population's mortality curve indicated that most people died in the 0–4 and 5–9 years intervals. There is a mortality peak in the 30–39 years interval and there is another bigger one between 60–64. Women's mortality indices were significantly worse in the period of fertility but in older ages they had the same values as men had. With 4 figures and 4 tables.

INTRODUCTION

The group of peoples called Uralian emerged from the mist of time on the Eastern side of the Ural mountains sometime between 4000–3500 B.C. The ancestors of the Hungarians were some of them. That region at the foot of the Urals was the ancient homeland of Finno-Ugrian peoples (Fig. 1). Their unity resolved at about 2000 B.C. The Finnish group took a northern route up by the river Volga and some of them even reached the Baltic. They were the ancestors of Volga-Baltic Finnish. The Ugor group also broke up between 1000–500 B.C. That was the starting point of a separate life for the ancient Hungarian people. They crossed the Ural mountain range and they established their new home in Magna Hungaria – that is the territories between the rivers Volga and Kama. The Great Migration of the Steppe initiated by the Huns did not avoid the territories of the Hungarians. First they moved to the Don and Donyec river regions on the borders of the powerful Khazar empire. This was the region preserved as Levédia in tradition. In 889 the repeated attacks of a nomad Turkish people called Pecheneg forced the Hungarians to take refugee between the rivers Dnepr and Dnestr to the west of Levédia in the

* This study was supported by the Hungarian Scientific Research Fund (OTKA 3161 & 3162).

region called Etelköz. In 895 they moved under the leadership of prince ÁRPÁD into their present homeland in the Carpathian Basin. Here we must remark that quite a number of arguments point out this event as the last in a chain when several waves invaded the Carpathian Basin in about 300 years. This theory is in the heart of the double-conquest concept of GY. LÁSZLÓ. The Hungarians started a large number of long-range mounted raids, a number of them of campaign size, against southern and western countries up to 955. This way they became notorious with our neighbours to the present day. The last pagan Hungarian prince GÉZA recognised the acceptance of western Christianity as the only chance of integrating Hungarians in medieval Europe. King SAINT STEPHEN I set Hungary once and for all on this course when he militantly supported the fast spread of Christianity and European culture. He also started to form a feudal state structure (BENDA 1986).

MATERIAL AND METHOD

The cemetery of Tiszafüred-Nagykenderföldek is located in Northern Hungary in the upper Tisza region. There the soil is extremely light, sandy. This fact has its advantages as this sort of soil preserved bones very well. Therefore most of the finds were in better than usual condition. However, it was also the reason of some misfortune. Only three fourth of the cemetery could be analysed because some of it were utilised as a sand-pit. The cemetery was uncovered by ISTVÁN FODOR. The remains of 113 individuals were found in graves forming lines. The grave-goods were

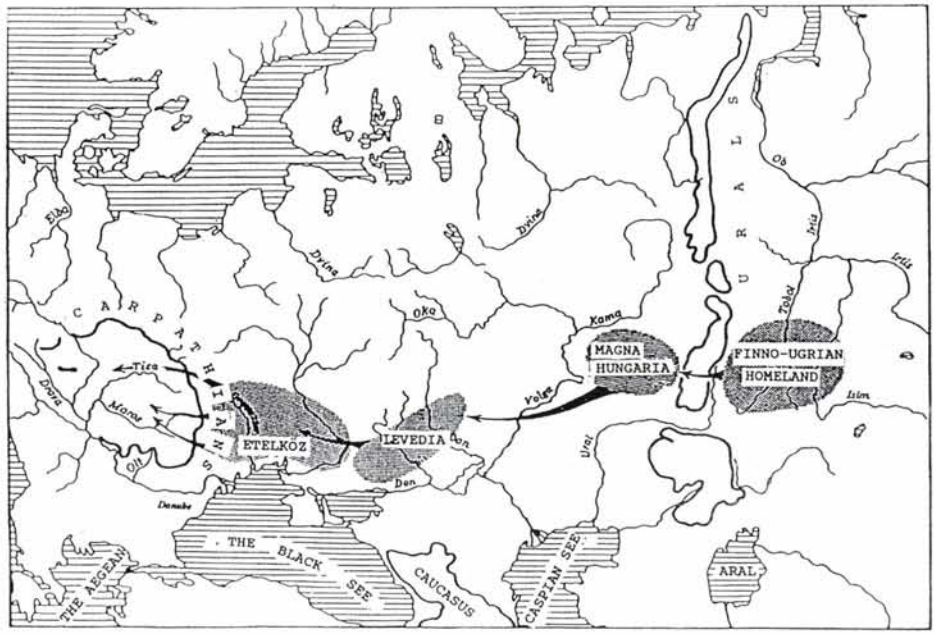

Fig. 1. Route of the Hungarians from the Urals to the Carpathian Basin

those characteristic for poor so-called common people: plain hair-rings, twisted and plane rings and bracelets (FODOR 1974, 1976). They practised some strange burial habits to protect themselves against apparitions. They mutilated the corpse and the head was buried about a half meter away. They bound up the corpse or the head was given some support (FODOR 1982, SZABÓ 1976). The cemetery is completely excavated. According to the leading archeologist the cemetery was used in the second half of the 10th century. Mainly the second and the third generations of the conquering Hungarians were buried there.

The reliability of a demographic reconstruction depends on the accuracy of the estimates of age and sex and the representation of the sample. Obviously, the most reliable methods available must be applied for estimating sex and age. Twenty-two features were applied for sex determination according to the method of ÉRY *et al.* (1963). Eruption of teeth according to UBELAKER (1989) and length of long bones according to STLOUKAL & HANÁKOVÁ (1978) were used for establishing the age of subadult individuals. Age determination for adults was made on the basis of four age indicators: the symphyseal face of the pubis applying the method of BROOKS & SUCHEY (1990), single rooted teeth according to LAMENDIN *et al.* (1992), sternal ends of ribs using the method of ISCAN *et al.* (1984, 1985) and dental attrition according to BROTHWELL (1963).

Age at death was divided into five-year intervals. Mortality curve, survivorship curve, life expectancy, population size and structure are discussed.

RESULTS

First let us see the distribution of *life spans* by age groups and by sex. Eighteen individuals died between 0–4, 16 between 5–9 and 4 between 10–14 years as it can be seen in Table 1. The number of those deceased in infant age was 38. That is 33% of the whole population. The ratio of children-adults was 33–67.

Here we must stop for a moment. A good number of Conquest period cemeteries contained very few dead children. Table 2 indicated only 6% of death between 0–4 years in some cemeteries. At the same time the reconstructed ÁRPÁD period mortality table of ACSÁDI & NEMESKÉRI (1970) produced a ratio of children and adults of 40–60. This table is the standard model in use. Table 2 made it evident that the sample of Tiszafüred came the closest to that ratio. Several theoretic explanations could be found for the small number of dead children.

1. The Conquering Hungarians had extremely good mortality values.
2. Children were buried somewhere else.
3. Children were not buried as deep as adults. Therefore agricultural activities and soil erosion destroyed much more of their remains. As the upper layers of soil contain more humus, we must take into consideration humus acids, as well as a higher level of microfaunal activities.
4. Smaller thin and fragile bones anyway were easier destroyed and lost.

The first explanation has very little to support it. There is no rational fact to prove that almost no suckling was lost thanks to extremely favourable conditions. So this idea can be rejected. Theoretically children could be buried at some other place. However, no children's cemetery was ever found and anyway, why were there exceptions? Little dead individuals were buried in each cemetery, though in small numbers. I think the third and fourth explanations are the most probable. As we all experienced the excavation and ana-

Table 1. Age and sex distribution of individuals interred in the Tiszafüred cemetery

Age interval	No. of deaths (Dx)	
0–4	18	
5–9	16	
10–14	4	
	Males	Females
15–19	1	3
20–24	0	4
25–29	2	3
30–34	2	8
35–39	6	2
40–44	3	4
45–49	1	3
50–54	3	3
55–59	7	2
60–64	8	4
65–69	1	1
70–74	1	3
Total	35	40
Total number of deaths	113	

lysis techniquies of archeology became much more refined in the last decades. Especially the younger generation of archeologists accepted the fact that the more detailed material they provided to the anthropologist the more valuable contribution they could expect in exchange. The more recent excavations produced and preserved not only big bones like humerus, femur etc. but even the smallest knuckles. The number of dead infants within

Table 2. Age group distribution of different populations

Age groups	Tengelic N = 33 10th c. $e_x^0 = 34.2$ (ÉRY 1971)	Kál N = 68 10th c. $e_x^0 = 34.9$ (ÉRY 1970)	Sárbogárd N = 100 10th c. $e_x^0 = 32.1$ (ÉRY 1968)	Tiszafüred N = 113 10th c. $e_x^0 = 32.15$	ÁRPÁD model 10–12th c. $e_x^0 = 28.7$ (ACSÁDY & NEMESKÉRY 1970)
0–4	6.0	14.1	11.1	15.9	30.8
5–9	12.1	7.8	15.7	14.2	4.6
10–14	15.1	5.3	7.3	3.5	4.0
15–19	–	3.1	5.0	3.5	4.2
20–39	21.2	21.0	20.2	23.9	19.1
40–59	39.4	38.5	27.7	23.0	25.2
60–x	6.1	10.1	13.1	15.9	12.1

populations was growing in parallel with this refinement process. Therefore we could accept the ratio of 33–67 between the children and adults of Tiszafüred.

There were 35 men and 40 women who died in adult age (Table 3). This ratio is 0.875. One of the oldest concepts is that the Hungarians invading the Carpathian Basin had a severe shortage of women. The following explanation was given for it. The sweeping Pecheneg attacks forced the Hungarians to evacuate their previous homeland in Etelköz in a hurry. A portion of women and children did not survive the attacks while a large number of men was on a far-away military expedition against the Franks. The Tiszafüred cemetery could provide no information on this earlier event as it came into use only in the middle of the 10th century. Only the very few surviving into senium could come from the original Conquerors of 895. If there was any deformation in the ratio of sexes at the conquest its traces were lost just a few decades later.

Population's mortality curve indicated that most people died between 0–4 and 5–9 years intervals (Fig. 2). There is a mortality peak in the 30–39 years interval and there is another bigger one between 60–64.

When analysing the age at the time of death of the sexes we could establish a smaller number of men died young than women did. The majority of male (16) individuals deceased in mature age and it was 40% of men. This number and this ratio occurred earlier with women in adult age.

Survivorship curve of the population as a whole indicated that half of them died before the 35–39 years interval and half of them survived (Fig. 3). The survivorship curve evidently indicated the mortality rate difference of sexes, too. 50% of men alive in their fifteenth year survived in the 50–54 years interval. The same ratio of women was only 30%. Fifty percent of survivors was characteristic for women in the 40–44 years interval.

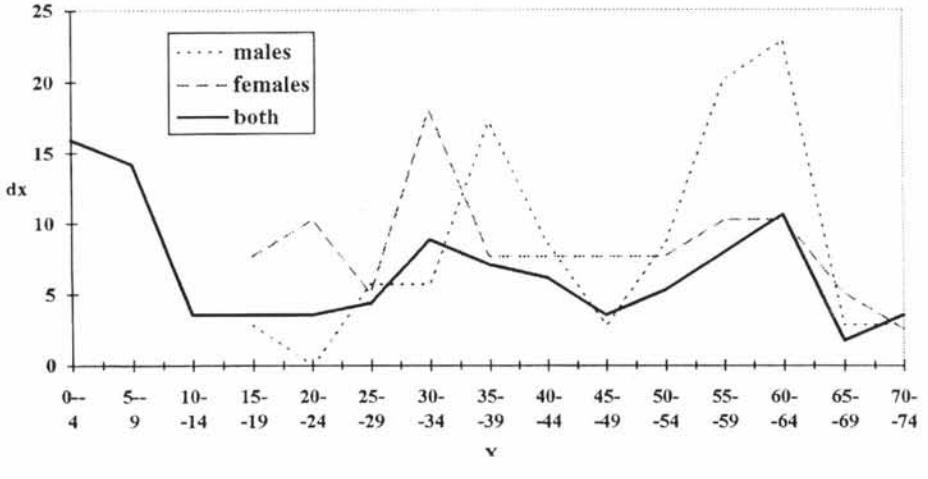

Fig. 2. Mortality curves calculated from the Tiszafüred population

Table 3. Life table reconstructed from skeletons of the Tiszafüred cemetery

Age interval (x)	Dead number (D_x)	Dead percentage (d_x)	Survivors entering (l_x)	Probability of death (q_x)	Life expectancy (e_x^o)
		Both			
0–4	18	15.93	100.00	0.1593	32.15
5–9	16	14.16	84.07	0.1684	32.76
10–14	4	3.54	69.91	0.0506	33.89
15–19	4	3.54	66.37	0.0533	30.57
20–24	4	3.54	62.83	0.0563	27.15
25–29	5	4.42	59.29	0.0746	23.62
30–34	10	8.85	54.87	0.1613	20.32
Age interval (x)	Dead number (D_x)	Dead percentage (d_x)	Survivors entering (l_x)	Probability of death (q_x)	Life expectancy (e_x^o)
35–39	8	7.08	46.02	0.1538	18.75
40–44	7	6.19	38.94	0.1591	16.70
45–49	4	3.54	32.74	0.1081	14.39
50–54	6	5.31	29.20	0.1818	10.83
55–59	9	7.96	23.89	0.3333	7.69
60–64	12	10.62	15.93	0.6667	5.28
65–69	2	1.77	5.31	0.3333	5.83
70–74	4	3.54	3.54	1.0000	2.50
		Males			
15–19	1	2.86	100.00	0.0286	34.64
20–24	0	0.00	97.14	0.0000	30.59
25–29	2	5.71	97.14	0.0588	25.59
30–34	2	5.71	91.43	0.0625	22.03
35–39	6	17.14	85.71	0.2000	18.33
40–44	3	8.57	68.57	0.1250	17.29
45–49	1	2.86	60.00	0.0476	14.40
50–54	3	8.57	57.14	0.1500	10.00
55–59	7	20.00	48.57	0.4118	6.32
60–64	9	22.86	28.57	0.8000	4.00
65–69	1	2.86	5.71	0.5000	5.00
70–74	1	2.86	2.86	1.0000	2.50
		Females			
15–19	3	7.50	100.00	0.0750	27.00
20–24	4	10.00	92.50	0.1081	23.99
25–29	3	7.50	82.50	0.0909	21.59
30–34	8	20.00	75.00	0.2667	18.50
35–39	2	5.00	55.00	0.0909	19.32
40–44	4	10.00	50.00	0.2000	16.00
45–49	3	7.50	40.00	0.1875	14.38
50–54	3	7.50	32.50	0.2308	12.12
55–59	2	5.00	25.00	0.2000	10.00
60–64	4	10.00	20.00	0.5000	6.88
65–69	1	2.50	10.00	0.2500	6.25
70–74	3	7.50	7.50	1.0000	2.50

Life expectancy at birth was 32.15 years. Men surviving to adult age had much better life expectancy than women in the junior interval. Men of 15–19 years age could expect 8 years longer lives than women of comparable age. Men had significantly better life expectancies up to the 30–34 years interval. From this point the two sexes had almost the same life expectancy till the age of fifty. Women had a slight advantage over fifty but it was not a significant difference (Fig. 4).

Population size also deserved some attention. The more accurate data we manage to establish at the start the more reliable results we can gain. It is true for all elements of demographic reconstruction and so it also stands for the size of the population. According to the archeologist leading the excavation the cemetery was used for about fifty years.

This formula was used to obtain an estimate of the total population size:

$$P = \frac{1000 \times N}{M \times T}$$

where P is the size of the population, N is the number of death, M is the crude mortality rate, T is the number of years the cemetery was in use.

The value of M can be calculated from the life table by the formula

$$M = \frac{1000}{e_x^0}$$

where e is the life expectancy at birth (UBELAKER 1989).

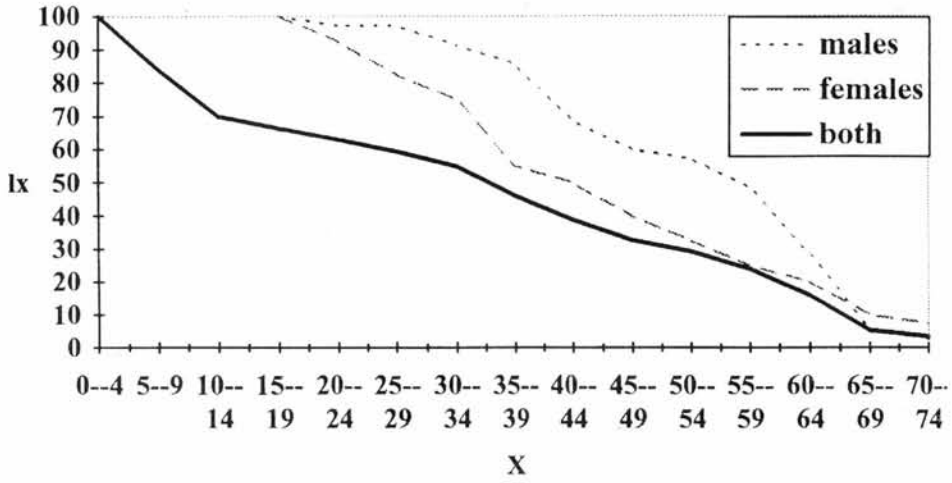

Fig. 3. Survivorship curves calculated from the Tiszafüred population

Table 4. Population's age structure

x	P	Pmod	Nx
	Both		
0–4	72.65	96.87	(14)
5–9	62.25	83.00	(12)
10–14	53.55	71.40	(10)
15–19	45.85	61.13	(10)
20–24	38.55	51.40	(9)
25–29	31.65	42.20	(9)
30–34	25.20	33.60	(8)
35–39	19.50	26.00	(6)
40–44	14.70	19.60	(5)
45–49	10.65	14.20	(5)
50–54	7.15	9.53	(4)
55–59	4.15	5.53	(1)
60–64	1.90	4.23	(3)
65–69	0.70	0.93	(1)
70–74	0.20	0.26	(0)
	Males		
15–19	24.25	32.33	(5)
20–24	20.80	27.73	(4)
25–29	17.40	23.2	(4)
30–34	14.10	18.8	(4)
35–39	11.00	14.67	(4)
40–44	8.30	11.07	(3)
45–49	6.05	8.07	(3)
50–54	4.00	5.33	(2)
55–59	2.15	2.87	(2)
60–64	0.80	1.07	(1)
65–69	0.20	0.27	(0)
70–74	0.05	0.07	(0)
	Females		
15–19	21.60	28.8	(5)
20–24	17.75	23.67	(5)
25–29	14.25	19.00	(4)
x	P	Pmod	Nx
30–34	11.10	14.80	(3)
35–39	8.50	11.33	(3)
40–44	6.40	8.53	(2)
45–49	4.60	6.13	(2)
50–54	3.15	4.20	(3)
55–59	2.00	2.67	(1)
60–64	1.10	1.46	(1)
65–69	0.50	0.67	(0)
70–74	0.15	0.20	(0)

We carried out the possible simplification and calculation:

$$P = \frac{N_x e_x^0}{T} = \frac{113 \times 32.15}{50} = 72.66$$

Approximately one fourth of this cemetery was destroyed as I already mentioned. Therefore our result is only three fourth of the real one; that is 97. It means that 97 individuals made up the population in a given time.

If we carry out this process in each age and sex we obtain the *population's age structure* in a given time. The relevant data had to be put into the formula in each process of estimation. Table 4 shows the population's age structure, where x is the age group, P is the number of individuals who are older than x, Pmod is modified P and the round numbers in brackets show the number of individuals who belonged to the relevant age group intervals. When estimating the numbers of contemporary adults the result was 51. The separate estimation of sexes indicated 27 men and 24 women contemporaries. As it can be seen in Table 1 there were more women than men buried in the cemetery. At first sight it seems to be a contradiction. The difference of sexes was brought about by the worse mortality values of women. The result also indicated that the men of the population suffered no war losses while the cemetery was used. It clearly corresponded to historical data. No significant battle or campaign was fought by the Hungarians after the defeat at Augsburg in 955. This given period was comparatively peaceful.

Family size also deserved some attention. We can see in Table 4 that there were 36 children and 10 juvenilis in a given time. Their parents might be between 20–39 years. There were 31 in this interval (16 men and 15 women). We can state that the community of Tiszafüred consisted of approximately 15 families with 3 children in general and about 10 older couples.

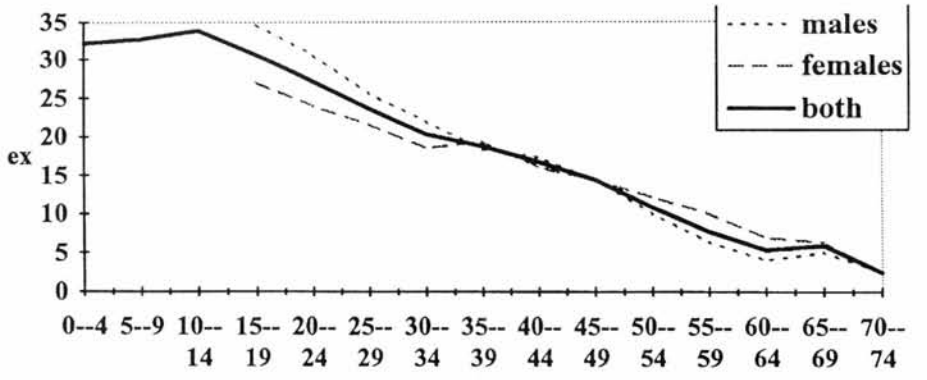

Fig. 4. Life expectancy in the Tiszafüred population

CONCLUSIONS

We are absolutely aware that palaeodemography is an especially delicate matter. The most evident trap for our thinking – and the one that seems to be the most difficult to avoid – is to consider results of it to be absolute. We consider our results as only a tendency. Although there are many problems with representation of the population, determination of sex and age etc we cannot give up the concept that information can be obtained by applying palaeodemographic analysis.

In brief the ratio of children and adults turned out to be very close to that expected. Life expectancy at birth was 32.15 years. The ratio of sexes was almost 1, so the number of men and women was almost the same. Women's mortality indices were significantly worse in the period of fertility but in older ages they had the same values as men had. The average size of the population could be approximately one hundred individuals. That is a community of 15 younger families with children and 10 older families.

REFERENCES

ACSÁDI, GY. & NEMESKÉRI, J. (1970): History of human life span and mortality. – Akadémiai Kiadó, Budapest, 246 pp.

BENDA, K. (ed.) (1986): Magyarország történeti kronológiája. 1. kötet. A kezdetektől 1526-ig.[Historical chronology of Hungary. Volume 1. From the beginning to 1526.] – Akadémiai Kiadó, Budapest, 350 pp.

BROOKS, S. & SUCHEY, J. M. (1990): Skeletal age determination based on the os pubis: a comparison of the Acsádi & Nemeskéri and Suchey & Brooks methods. – *Human Evolution* **5** (3): 227–238.

BROTHWELL, D. R. (1963): Digging up bones. The excavation, treatment and study of human skeletal remains. – British Museum, London, 194 pp.

ÉRY, K., KRALOVÁNSZKY, A. & NEMESKÉRI, J. (1963): Történeti népességek rekonstrukciójának reprezentációja. (A representative reconstruction of historic population.) – *Anthrop. közl.* **7**: 41–90.

ÉRY, K. (1968): Reconstruction of the tenth century population of Sárbogárd on the basis of archaeological and anthropological data. – *Alba Regia* **8–9**: 93–147.

ÉRY, K. (1970): Anthropological studies on a tenth century population at Kál, Hungary. – *Anthrop. Hung.* **9**: 9–62.

ÉRY, K. (1971): The anthropological examination of a tenth century population at Tengelic, Hungary. – *Anthrop. Hung.* **10**: 49–89.

FODOR, I. (1974): Tiszafüred-Nagykenderföldek (Szolnok m.). – In: *Régészeti Füzetek, I. Ser. 1.* **27**: 68–69.

FODOR, I. (1976): Tiszafüred-Nagykenderföldek (Szolnok m.). – In: *Régészeti Füzetek, I. Ser. 1.* **29**: 61.

FODOR, I. (1982): In search of a new homeland. The prehistory of the Hungarian people and the conquest. – Corvina, Budapest, 364 pp.

ISCAN, M. Y., LOTH, S. R. & WRIGHT, R. K. (1984): Age Estimation from the Rib by Phase Analysis: White Males. – *J. Forensic Sci.* **29**: 1094–1104.

ISCAN, M. Y., LOTH, S. R. & WRIGHT, R. K. (1985): Age Estimation from the Rib by Phase Analysis: White Females. – *J. Forensic Sci.* **30**: 853–863.

LAMENDIN, H., BACCINO, E., HUMBERT, J. F., TAVERNIER, J. C., NOSSINTCHOUK, R. M. & ZERILLI, A. (1992): A Simple Technique for Age Estimation in Adult Corpses: The Two Criteria Dental Method. – *J. Forensic Sci.* **37**: 1373–1379.

STLOUKAL, M. & HANÁKOVÁ, H. (1978): Die Länge der Längsknochen altslawischer Bevölkerungen unter besonderer Berücksichtigung von Washstumsfragen. – *Homo* **29**: 53–69.

SZABÓ, J. GY. (1976): Árpád-kori telep és temetője Sarud határában. III. A temető leírása és rendellenes temetkezéseinek párhuzamai. (Eine Siedlung und deren Friedhof aus der Árpádenzeit bei Sarud. III. Beschreibung des Friedhofes und Untersuchung der Aussergewöhnlichen Beisetzungen.) – *Egri Múz. Évk.* **14**: 17–89.

UBELAKER, D. H. (1989): Human Skeletal Remains. Excavation, Analysis, Interpretation. – Taraxacum, Washington, 172 pp.