AKADÉMIAI KIADÓ

Acta Archaeologica Academiae Scientiarum Hungaricae

75 (2024) 1, 107–158

DOI:
10.1556/072.2024.00007

ORIGINAL RESEARCH PAPER

The investigation of ninth–eleventh century burials from Himod (NW Hungary)
Physical anthropology data in the light of artifact typology

Piroska Rácz* and Péter Langó

HUN-REN Research Centre for the Humanities Institute of Archaeology, Tóth Kálmán utca 4, H-1097 Budapest, Hungary

Received: September 20, 2023 • Revised manuscript received: February 19, 2024 • Accepted: March 20, 2024

ABSTRACT

This study presents the results of a classic physical anthropological and paleopathological study of the early medieval human bone material from the Himod-Káposztáskertek site. A smaller part of the graves can be dated to the ninth century but the majority of graves dates to the tenth–eleventh century. Since the possibility of population continuity was raised, the archaeological data related to the question were also reviewed (with special emphasis on the typology of a knife found in Grave 68), with the intent of seeing whether the anthropological data supported this hypothesis. Both samples represent only a small number of cases and the remains are poorly preserved. The ninth century series especially provided very little data, ultimately making comparison impossible. The remains of 25 individuals were found in the Carolingian cemetery section: childburials number 15, the juvenile age group is not represented by any skeletons, there are ten adult burials (4 males, 5 females, 1 of undeterminable sex). The skeletons from 87 individuals were excavated from the tenth–eleventh century section of the cemetery, of which 25 were children, 5 were juveniles, and 57 were adults (29 males, 28 females). For both men and women, people of tall stature form the majority; male skulls are characterized by large absolute dimensions, mainly a broad forehead and a broad face. Fractures, degenerative changes of the spine and extra-vertebral joints (especially the elbow joint) were common. Tuberculosis infection was suspected in the case of one individual. Legg-Calvé-Perthes disease with bilateral involvement and a rare developmental disorder, congenital scoliosis, occurred in the material as well.

KEYWORDS

Paleoanthropology, Carolingian period, tenth–eleventh century, Western Hungary, population continuity, congenital scoliosis

ARCHAEOLOGICAL BACKGROUND

In the spring of 2000, the Himod-Káposztáskertek site was excavated in the southwestern part of Győr-Moson-Sopron County in the form of a preventive archaeological recovery. Unfortunately, due to the layout of the planned development, the site was not fully explored. However, in spite of this limitation, features belonging to various periods were found in a 500 m long and 7 m wide section (Fig. 1). Prehistoric finds represented the Linearband, Lengyel and Late Copper Age, Baden cultures as well as the Celtic Iron Age.[1] In addition, 162 burials[2]

*Corresponding author.
E-mail: racz.piroska@abtk.hu

[1]A total of 94 features were considered prehistoric. cf.: Egry and Tomka (2003) 147–148.

[2]On the phasing of the site and relevant burials see: Egry and Tomka (2003) 148; Tomka (2010) 200. The total number of Carolingian and Árpád Period graves reported by Péter Tomka was 152 but, in fact, only 112 graves can actually be assigned to these two periods.

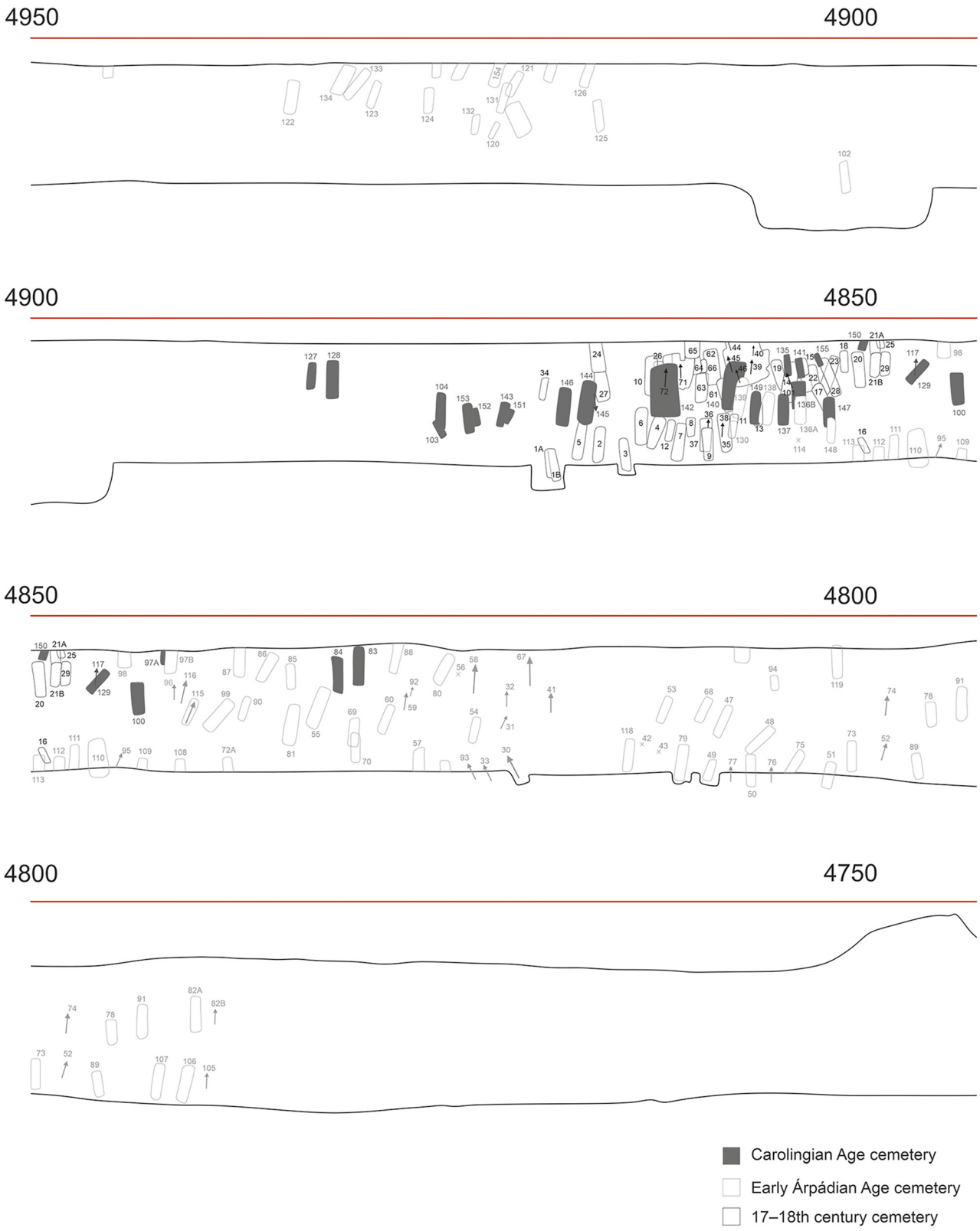

Fig. 1. Himod-Káposztás. Plan of the cemetery

and 110 features from a fourteenth–sixteenth century village came to light at the site.[3] The graves are distributed as follows: 25 graves belonged to the Carolingian section of the cemetery,[4] 87 burials could be assigned to the early Árpád Period (tenth–eleventh century) part of the cemetery,[5] while 50 of the deceased were found in graves from an early Modern Age cemetery (see Table 1 for the chronological positions of the graves). Among the partially excavated cemeteries, the Carolingian graves and the tenth–eleventh century section of the cemetery deserve special attention, primarily because, based on their succession in time, their existence raises the possibility of population continuity. Before we touch upon the problems relevant to this question, however, it is worth briefly introducing the three cemeteries from different periods (Fig. 2).

The ninth century graves were worked on by Péter Tomka, excavator of the site. These graves were arranged roughly in a single row on top of a low elevation.[6] They formed a partial overlap with the tenth–eleventh century early Árpád Period cemetery.[7] The ninth century graves were deeper than the burials from the Árpád Period. Their characteristic feature is the use of coffins[8] and the appearance of grave goods that formed the general basis of the dating to the ninth century.[9] In certain cases (such as that of Grave 100), Péter Tomka assumed an early date for particular graves based on the shape of the grave pit.[10] The observed superpositions and the find materials recovered from the graves, made distinguishing the ninth century group possible for some of the shallower children's burials.[11]

The early Árpád Period section of the cemetery contained a total of 87 graves.[12] The traces of coffin use and food added as grave goods were characteristically absent from these burials, which were typically shallower than those from the ninth century.[13] The finds recovered from these graves correspond to the types associated with the early Árpád Period.[14] In addition to the positioning of the skeletal remains, the depth of these graves and the design of their pits helped in the identification of the graves in the absence of grave goods.[15] In addition, part of a much later, seventeenth–eighteenth century cemetery with 50 graves, fell within the excavated area.[16] These graves were, without exception, coffin burials. Their recognition was facilitated not only by the large number of coffin nails, but also by additional attire-related finds recovered from the graves. There were hairpins, pendants, rosaries, and remains of hair bands in the graves assigned to women and children. Buttons, iron hobnails for boots and spurs marked the burials of men. Coins issued during the reigns of the Habsburg emperors Ferdinand II (1630), Ferdinand III (1640) and Leopold I (1672) date some of the burials to the seventeenth century.

So far, no analysis of seventeenth–eighteenth century graves has been carried out, nor was the analysis of medieval and prehistoric features completed.

Among the graves, the medieval burials appeared in various publications, although those dated to the Early Modern Age remain unpublished. Since the grave numbering is continuous across the site (regardless of chronological periodization), it seems worthwhile to present

[3] Egry and Tomka (2003) 148.

[4] Tomka (2010) 205 erroneously mentions 24 graves, although he provides the description for 25 graves in the publication. cf.: Horváth (2022) 32.

[5] The analysis by Ciprián Horváth contained the data and description of a total of 86 graves, because his work does not include Grave 72/A. cf.: Horváth (2022) 10–32. Only a photo of this partially excavated burial is included in the field documentation. It contained no grave goods and neither was its plan drawn (see Fig. 2). Péter Tomka marked the grave as coming from the Árpád Period section of the cemetery for Piroska Rácz. Our present summary therefore also took this grave into account during analyses. For a description of the grave, see also: *Tomka Péter: Himod – "Káposztáskertek" 2000. 04.26 – 2000. 07.14. Ásatási Napló 29. (Rómer Flóris Művészeti és Történeti Múzeum, Régészeti Adattár)*. According to the description, the grave was 88 cm deep and was oriented East–West 268°. The skeleton lay on its back, in an extended position, without grave goods.

[6] Tomka (2010) 201. Abb. 3.

[7] Such superpositions were discovered for the ninth century Grave 140 and tenth–eleventh century Grave 139, located between Carolingian Grave 149 and Grave 138 dated to the Árpád Period, as well as between the ninth century child burial placed in Grave 97/A and the secondary burial, probably of a woman, in Grave 97/B. Cf.: Tomka (2010) 201–203; Horváth (2022) 23. In this latter case (Grave 97/A–B), the archaeological distinction is valid, if one accepts the narrow grave pit of Grave 97/B as a typical feature of Árpád Period funerary tradition. Cf.: Horváth (2022) 33–34. Overlaps between burials within the same period could be observed both in the Carolingian and early Árpád Period parts of this cemetery. Among the Carolingian burials, such superpositions were formed between Graves 103–104, Graves 117 and 129, Graves 143 and 151, as well as Graves 152–153. Cf.: Tomka (2010). However, only a single case of such overlap could be observed in the early Árpád Period cemetery, between Graves 133–134. Cf.: Horváth (2022) 33.

[8] The significance of the use of coffins is also clearly shown in Grave 147, which was, in part, distinguished from the Árpád Period graves based on this feature. Cf.: Tomka (2010) 221.

[9] Tomka (2010) 206–208; Horváth (2022) 42.

[10] Tomka (2010) 209; Horváth (2022) 42–45.

[11] This can be clearly seen in the case of Grave 151, where, based on the superposition observed during excavation, it could be established that this burial was earlier than Grave 143 that contained a typical ninth century ceramic vessel. The relationship between Graves 136/A–B is another good example. Cf.: Tomka (2010) 213, 218. However, the evaluation of Graves 136/A and 148 remains questionable. In the absence of relevant finds, Péter Tomka considered these to be Árpád Period graves. Ciprián Horváth also accepted his proposed interpretation. Cf.: Horváth (2022) 30, 32. However, the traditional archaeological dating of the graves is difficult, as the burials lacked finds. Furthermore, their orientation is exactly the same as that of the Carolingian graves overlapping these burials. Since there were superpositions within the ninth century section of the cemetery, it can not be ruled out that these burials also took place in this same period. Similarly to the aforementioned interpretation, this problem can only be resolved by carrying out further scientific analyses (radiocarbon measurements, aDNA tests, etc.).

[12] Horváth (2022) 33.

[13] Egry and Tomka (2003) 148; Horváth (2022) 34–35.

[14] Langó (2021) 108–109; Horváth (2022) 35–41.

[15] Horváth (2022) 33–34.

[16] Publications erroneously refer to 52 burials. Cf.: Egry and Tomka (2003) 148; Tomka (2010) 200; Horváth (2022) 9.

Table 1. The archaeological periodization and publication of graves from the Himod-Káposztáskertek site

Grave No.	Periodization	Literature
1	Seventeenth–eighteenth century cemetery	unpublished
2	Seventeenth–eighteenth century cemetery	unpublished
3	Seventeenth–eighteenth century cemetery	unpublished
4	Seventeenth–eighteenth century cemetery	unpublished
5	Seventeenth–eighteenth century cemetery	unpublished
6	Seventeenth–eighteenth century cemetery	unpublished
7	Seventeenth–eighteenth century cemetery	unpublished
8	Seventeenth–eighteenth century cemetery	unpublished
9	Seventeenth–eighteenth century cemetery	unpublished
10	Seventeenth–eighteenth century cemetery	unpublished
11	Seventeenth–eighteenth century cemetery	unpublished
12	Seventeenth–eighteenth century cemetery	unpublished
13	Seventeenth–eighteenth century cemetery	unpublished
14	Seventeenth–eighteenth century cemetery	unpublished
15	Seventeenth–eighteenth century cemetery	unpublished
16	Seventeenth–eighteenth century cemetery	unpublished
17	Seventeenth–eighteenth century cemetery	unpublished
18	Seventeenth–eighteenth century cemetery	unpublished
19	Seventeenth–eighteenth century cemetery	unpublished
20	Seventeenth–eighteenth century cemetery	unpublished
21/A	Seventeenth–eighteenth century cemetery	unpublished
21/B	Seventeenth–eighteenth century cemetery	unpublished
22	Seventeenth–eighteenth century cemetery	unpublished
23	Seventeenth–eighteenth century cemetery	unpublished
24	Seventeenth–eighteenth century cemetery	unpublished
25	Seventeenth–eighteenth century cemetery	unpublished
26	Seventeenth–eighteenth century cemetery	unpublished
27	Seventeenth–eighteenth century cemetery	unpublished
28	Seventeenth–eighteenth century cemetery	unpublished
29	Seventeenth–eighteenth century cemetery	unpublished
30	Early Árpád Period cemetery	Horváth (2022) 10.
31	Early Árpád Period cemetery	Horváth (2022) 10.
32	Early Árpád Period cemetery	Horváth (2022) 10.
33	Early Árpád Period cemetery	Horváth (2022) 10.
34	Seventeenth–eighteenth century cemetery	unpublished
35	Seventeenth–eighteenth century cemetery	unpublished
36	Seventeenth–eighteenth century cemetery	unpublished
37	Seventeenth–eighteenth century cemetery	unpublished
38	Seventeenth–eighteenth century cemetery	unpublished
39	Seventeenth–eighteenth century cemetery	unpublished
40	Seventeenth–eighteenth century cemetery	unpublished

(continued)

Table 1. Continued

Grave No.	Periodization	Literature
41	Early Árpád Period cemetery	Horváth (2022) 10.
42	Early Árpád Period cemetery	Horváth (2022) 11.
43	Early Árpád Period cemetery	Horváth (2022) 11.
44	Seventeenth–eighteenth century cemetery	unpublished
45	Seventeenth–eighteenth century cemetery	unpublished
46	Seventeenth–eighteenth century cemetery	unpublished
47	Early Árpád Period cemetery	Horváth (2022) 11.
48	Early Árpád Period cemetery	Horváth (2022) 11–12.
49	Early Árpád Period cemetery	Horváth (2022) 12.
50	Early Árpád Period cemetery	Horváth (2022) 12.
51	Early Árpád Period cemetery	Horváth (2022) 12.
52	Early Árpád Period cemetery	Horváth (2022) 12.
53	Early Árpád Period cemetery	Horváth (2022) 13.
54	Early Árpád Period cemetery	Horváth (2022) 13.
55	Early Árpád Period cemetery	Horváth (2022) 13.
56	Early Árpád Period cemetery	Horváth (2022) 13.
57	Early Árpád Period cemetery	Horváth (2022) 13–14.
58	Early Árpád Period cemetery	Horváth (2022) 14.
59	Early Árpád Period cemetery	Horváth (2022) 14.
60	Early Árpád Period cemetery	Horváth (2022) 14.
61	Seventeenth–eighteenth century cemetery	unpublished
62/A	Seventeenth–eighteenth century cemetery	unpublished
62/B	Seventeenth–eighteenth century cemetery	unpublished
63	Seventeenth–eighteenth century cemetery	unpublished
64	Seventeenth–eighteenth century cemetery	unpublished
65	Seventeenth–eighteenth century cemetery	unpublished
66	Seventeenth–eighteenth century cemetery	unpublished
67	Early Árpád Period cemetery	Horváth (2022) 14–15.
68	Early Árpád Period cemetery	Horváth (2022) 15–16.
69	Early Árpád Period cemetery	Horváth (2022) 15.
70	Early Árpád Period cemetery	Horváth (2022) 15.
71	Seventeenth–eighteenth century cemetery	unpublished
72	Seventeenth–eighteenth century cemetery	unpublished
72/A	Early Árpád Period cemetery	unpublished
73	Early Árpád Period cemetery	Horváth (2022) 15–17.
74	Early Árpád Period cemetery	Horváth (2022) 17.
75	Early Árpád Period cemetery	Horváth (2022) 17.
76	Early Árpád Period cemetery	Horváth (2022) 17.
77	Early Árpád Period cemetery	Horváth (2022) 17–18.
78	Early Árpád Period cemetery	Horváth (2022) 18.

(continued)

Table 1. Continued

Grave No.	Periodization	Literature
79	Early Árpád Period cemetery	Horváth (2022) 18.
80	Early Árpád Period cemetery	Horváth (2022) 18.
81	Early Árpád Period cemetery	Horváth (2022) 18.
82/A	Early Árpád Period cemetery	Horváth (2022) 18–19.
82/B	Early Árpád Period cemetery	Horváth (2022) 19.
83	Early Árpád Period cemetery	Horváth (2022) 19.
84	Early Árpád Period cemetery	Horváth (2022) 19–20.
85	Early Árpád Period cemetery	Horváth (2022) 20.
86	Early Árpád Period cemetery	Horváth (2022) 20.
87	Early Árpád Period cemetery	Horváth (2022) 20.
88	Early Árpád Period cemetery	Horváth (2022) 20.
89	Early Árpád Period cemetery	Horváth (2022) 21.
90	Early Árpád Period cemetery	Horváth (2022) 21.
91	Early Árpád Period cemetery	Horváth (2022) 21.
92	Early Árpád Period cemetery	Horváth (2022) 21.
93	Early Árpád Period cemetery	Horváth (2022) 21–22.
94	Early Árpád Period cemetery	Horváth (2022) 22.
95	Early Árpád Period cemetery	Horváth (2022) 22.
96	Early Árpád Period cemetery	Horváth (2022) 22.
97/A	Carolingian Period cemetery	Tomka (2010) 209.
97/B	Early Árpád Period cemetery	Horváth (2022) 23.
98	Early Árpád Period cemetery	Horváth (2022) 23.
99	Early Árpád Period cemetery	Horváth (2022) 23.
100	Carolingian Period cemetery	Tomka (2010) 209.
101	Seventeenth–eighteenth century cemetery	unpublished
102	Early Árpád Period cemetery	Horváth (2022) 23.
103	Carolingian Period cemetery	Tomka (2010) 209–211.
104	Carolingian Period cemetery	Tomka (2010) 209–211.
105	Early Árpád Period cemetery	Horváth (2022) 23.
106	Early Árpád Period cemetery	Horváth (2022) 24.
107	Early Árpád Period cemetery	Horváth (2022) 24.
108	Early Árpád Period cemetery	Horváth (2022) 24.
109	Early Árpád Period cemetery	Horváth (2022) 24.
110/A	Early Árpád Period cemetery	Horváth (2022) 25.
110/B	Early Árpád Period cemetery	Horváth (2022) 25.
111	Early Árpád Period cemetery	Horváth (2022) 25.
112	Early Árpád Period cemetery	Horváth (2022) 25.
113	Early Árpád Period cemetery	Horváth (2022) 25–26.
114	Early Árpád Period cemetery	Horváth (2022) 26.
115	Early Árpád Period cemetery	Horváth (2022) 26.

(continued)

Table 1. Continued

Grave No.	Periodization	Literature
116	Early Árpád Period cemetery	Horváth (2022) 26.
117	Carolingian Period cemetery	Tomka (2010) 211.
118	Early Árpád Period cemetery	Horváth (2022) 27.
119	Early Árpád Period cemetery	Horváth (2022) 27.
120	Early Árpád Period cemetery	Horváth (2022) 27.
121	Early Árpád Period cemetery	Horváth (2022) 28.
122	Early Árpád Period cemetery	Horváth (2022) 28.
123	Early Árpád Period cemetery	Horváth (2022) 28.
124	Early Árpád Period cemetery	Horváth (2022) 28.
125	Early Árpád Period cemetery	Horváth (2022) 28.
126	Early Árpád Period cemetery	Horváth (2022) 28–29.
127	Carolingian Period cemetery	Tomka (2010) 211.
128	Carolingian Period cemetery	Tomka (2010) 211–213.
129	Carolingian Period cemetery	Tomka (2010) 211.
130	Early Árpád Period cemetery	Horváth (2022) 29.
131	Early Árpád Period cemetery	Horváth (2022) 29.
132	Early Árpád Period cemetery	Horváth (2022) 29.
133	Early Árpád Period cemetery	Horváth (2022) 29.
134	Early Árpád Period cemetery	Horváth (2022) 29–31.
135	Carolingian Period cemetery	Tomka (2010) 213.
136/A	Early Árpád Period cemetery	Horváth (2022) 30.
136/B	Carolingian Period cemetery	Tomka (2010) 213.
137	Carolingian Period cemetery	Tomka (2010) 213.
138	Early Árpád Period cemetery	Horváth (2022) 30.
139	Early Árpád Period cemetery	Horváth (2022) 30.
140	Carolingian Period cemetery	Tomka (2010) 213–214.
141	Carolingian Period cemetery	Tomka (2010) 214.
142	Carolingian Period cemetery	Tomka (2010) 217–218.
143	Carolingian Period cemetery	Tomka (2010) 218.
144	Carolingian Period cemetery	Tomka (2010) 218–220.
145	Carolingian Period cemetery	Tomka (2010) 220.
146	Carolingian Period cemetery	Tomka (2010) 220.
147	Carolingian Period cemetery	Tomka (2010) 221.
148	Early Árpád Period cemetery	Horváth (2022) 32.
149	Carolingian Period cemetery	Tomka (2010) 222.
150	Carolingian Period cemetery	Tomka (2010) 222.
151	Carolingian Period cemetery	Tomka (2010) 218.
152	Carolingian Period cemetery	Tomka (2010) 222.
153	Carolingian Period cemetery	Tomka (2010) 222–223.
154	Early Árpád Period cemetery	Horváth (2022) 32.
155	Carolingian Period cemetery	Tomka (2010) 223.

Fig. 2. Himod-Káposztás. Photo of Grave 72/A

the data and information regarding the state of publication of the various graves in a summary table (Table 1).

The special nature of the site is highlighted by the fact that the ninth century cemetery burials were followed by tenth–eleventh century burials. Despite the fact that only a fraction of the entire funerary complex is known, this succession of periods naturally raised the possibility of potential population continuity, something also illustrated by numerous other examples. The best analysed such cemetery was discovered at the site of Čakajovce-Templom-dűlő, Slovakia, where ninth to eleventh century population continuity is evident.[17] Based on the preliminary reports, a similar possibility arose in the case of the Ducóvé cemetery.[18] There are many other cemeteries in today's Slovakia where similar phenomena could be observed.[19] The same phenomenon may be found in former Transylvania, in present-day northwest Romania.[20] This idea has also arisen in connection with several sites in Transdanubia, the western side of Hungary defined by the right bank of the Danube River. It should suffice to refer here to the much-discussed intepretation of the cemeteries at Győr-Téglavető-dűlő,[21] or mention the studies dealing with the Vörs-Papkert B cemetery.[22] The continued survival of the ninth century population into the tenth century in this region has also been confirmed, an idea that is also supported by the salvaged cemetery in the Esztergályhorváti-Alsóbárándpuszta area, discovered by Róbert Müller and described in preliminary reports.[23] Genetic research exploring links between eighth–ninth and tenth century finds brought up new arguments in favor of the fact that (as logic would dictate) the ninth century population did not disappear. It merged with the Hungarian population arriving from the east in search of a new homeland. Having been assimilated by the newcomers, the ninth century population became constituent in the Kingdom of Hungary, established in the eleventh century.[24] These research results naturally gave new impetus to studying such surviving populations, as evidenced by the new volume prepared on the graves excavated at the site of Hortobágy-Árkushalom.[25] However, the momentum, which assumes population continuity at all sites where both eighth–ninth and tenth–eleventh century graves have been found is substantially tempered by the statement of László Kovács regarding the Magyarhomorog cemetery. This cemetery, found in the area of Magyarhomorog-Kónyadomb, contained a large number of graves. It was continuously used by the local community until the beginning of the twelfth century, as supported by the evidence of coins found in the graves. The question in this case, was when the cemetery began to be used. The first graves, which were excavated by István Dienes (a charismatic researcher of the tenth-century find materials in the Carpathian Basin), indicated that the community settled here may have started using the cemetery as early as the tenth century.[26] Subsequently, however, careful analysis by László Kovács revealed that there had actually been two seperate cemeteries. One of them, represented by a small number of burials, was established in the tenth century. This community subsequently abandoned the cemetery (it must have moved elsewhere) and a new group opened another, new burial ground here in the eleventh century.[27] This seemed unusual in the light of the research of the time, since everyone assumed that, in this case, the phenomenon could be interpreted as a sign of continuity, while it turned out that continuity could have occurred in a given area even within half a century. Continuity, did not (necessarily) mean population continuity, but in some cases only continuity in using the same location! The latter means that a given area is equally suitable for the establishment of a settlement or cemetery for two (or several) culturally (or only structurally) different communities. At the time, environmental conditions and the locational perception of the people must have greatly influenced, and in some cases could have restricted, the area that these communities

[17] Hanuliak and Rejholcová (1999).

[18] Ruttkay (2005).

[19] Langó (2012) 253–256.

[20] Gáll (2013) 804–811; Révész (2020) 86–89, with additional references to the literature.

[21] For an overview of the background of the question and a detailed presentation of the previous literature, as well as an up-to-date analysis of the tenth century part of the cemetery, see: Horváth (2014) 50–53. The question is also discussed in: Langó (2005) 254.

[22] Költő et al. (1992); Költő (1996); Költő and Szentpéteri (1996).

[23] Müller (2004). Regarding the evaluation of the site see also: Kovács (2013) 516–517, 553–554.

[24] Szécsényi-Nagy et al. (2021).

[25] Szenthe and Gáll (2022).

[26] Dienes (1969).

[27] Kovács (2019) 211–263, 487–496.

considered suitable for settlement or as the final resting place for their dead. If this scenario could take place within half a century, could it not have happened with a slightly longer time lag? Evidently, if prehistoric or – as can be seen in Himod – Early Modern Age burials are found in an area that was also used as a cemetery in the Early Middle Ages, no one thinks of continuity between different periods that are far apart in time. But the question in this particular case is, whether the Carolingian Period and the Early Árpád Period were continuous at the site. A similar question motivated Ciprián Horváth, who carried out the study of the Árpád Period cemetery, and carefully considered the complex problem in his publication describing the finds. To investigate the possibility of continuity, the starting point for this specialist was an iron knife, fitted with a "bone" handle, decorated using a dot-and-circle design (Fig. 3) and its position within the grave.[28] This knife was found in an early Árpád Period burial (Grave 68). As the researcher emphasised, this artifact "fits well within the set of similar objects used by the communities of the Sopronkőhida-Pitten-Pottenbrunn group".[29] This artifact type – as highlighted by Ciprián Horváth in his analysis of the parallels to the find material – does not necessarily mean there was a direct relationship between the populations who used the two parts of the cemetery. However, he emphasized that this knife is an "object rooted in Carolingian tradition". On the other hand, he also pointed out that "naturally, it is not yet possible to infer the existence of a surviving person/group from this [at the site], although its placement in the burial is also thought-provoking."[30] This cautious statement, therefore, definitely involves the possibility of continuity. The traditional physical anthropological analysis of early graves at the site can potentially represent another contribution to the multi-faceted evaluation of this question.

THE HUMAN OSTEOLOGICAL MATERIAL AND THE RESEARCH METHODOLOGY

The remains of 112 individuals were available for study from Carolingian and tenth–eleventh century graves. The basic data are provided in Table 2. The finds are kept in the Rómer Flóris Museum of Art and History in Győr. As of today, they have not yet been inventorized. The preservation of the remains is poor, the skulls have often become naturally deformed.

In the case of children and young individuals, the age of death was established using the development and eruption patterns of teeth,[31] the length of long bones,[32] and the degree of ossification of various skeletal elements.[33] For adults, age determination was based on the closure of cranial sutures,[34] as well as changes in the articular surfaces of the pelvis in the pubic region *(facies symphysealis)*[35] and at the iliosacral joint *(facies auricularis)*, respectively.[36] The degree of toothwear[37] and general state of dentition have also been taken into consideration. For the demographic analysis, we used Zsolt Bernert's palaeoanthropological program package.[38] The biological sex of the deceased was identified using the method developed by Kinga Éry, Alán Kralovánszky and János Nemeskéri,[39] relying on 17 characters. (The characteristics taken into account are the following: the development of the frontal *(tuber frontale)* and parietal eminences *(tuber parietale)*, the development of the glabella and the supraorbital ridge, the size of the mastoid process, the development of the *protuberantia occipitalis externa* and the occipital surface, the upper edge of the orbit, the thickness of the zygomatic arch, the surface and height of the *facies zygomaticus*, the thickness of the body of the jaw *(corpus mandibulae)*, the development of the mentum, the shape of the angle of the mandible, the size of the head of mandible *(condylus mandibulae)*, the angle formed by the pubic bones, the shape of the greater sciatic notch *(incisura ischiadica major)* and the *sulcus preauricularis* of the ilium, the diameter of the head of the femur and the development of the *linea aspera*.) The skull and skeleton were measured according to guide published by Rudolf Martin and Karl Saller.[40] Cranial dimensions were evaluated using the classification method of Valery P. Alekseyev and Georgy F. Debeč.[41] Stature was estimated using measurements of the humerus, radius, femur and tibia based on the formulae developed by Torstein Sjøvold[42] and was evaluated using the classification system of Rudolph Martin and Karl Saller.[43] Some parenthesized values in the individual measurement tables indicate that the skeletal element either

[28] We believe that the handle of the knife found in the grave was made of antler rather than bone. The reason for the misunderstanding was obviously the use of terminology in an earlier period that was less sensitive to this difference (Török 1973, 49–50), but was never-the-less adopted by researchers for decades (Cf.: Szőke 1982; Kiss ed. 2000, 245; Müller 2004, 14). Recently, however, it has been clarified that in a significant part of the cases, it is reasonable to talk about antler use, as was also clarified by a recent analysis by Béla Miklós Szőke. Cf.: Szőke (2010) 35, n. 113. However, the possibility of knives with bone handles cannot be ruled out for this period either, since knives with bone handles were actually in use during the later stages of the Middle Ages. Cf.: Gere (2003) 70–72. For an international review see: Cowgill et al. (1987).

[29] Horváth (2022) 44.

[30] Horváth (2022) 45.

[31] Schour and Massler (1941); Ubelaker (1978).

[32] Stloukal and Hanáková (1978).

[33] Schinz et al. (1952); Ferembach et al. (1979).

[34] Meindl and Lovejoy (1985).

[35] Meindl et al. (1985).

[36] Lovejoy et al. (1985).

[37] Perizonius (1981).

[38] Bernert (2005).

[39] Éry et al. (1963).

[40] Martin and Saller (1957).

[41] Alekseyev and Debeč (1964).

[42] Sjøvold (1990).

[43] Martin and Saller (1957).

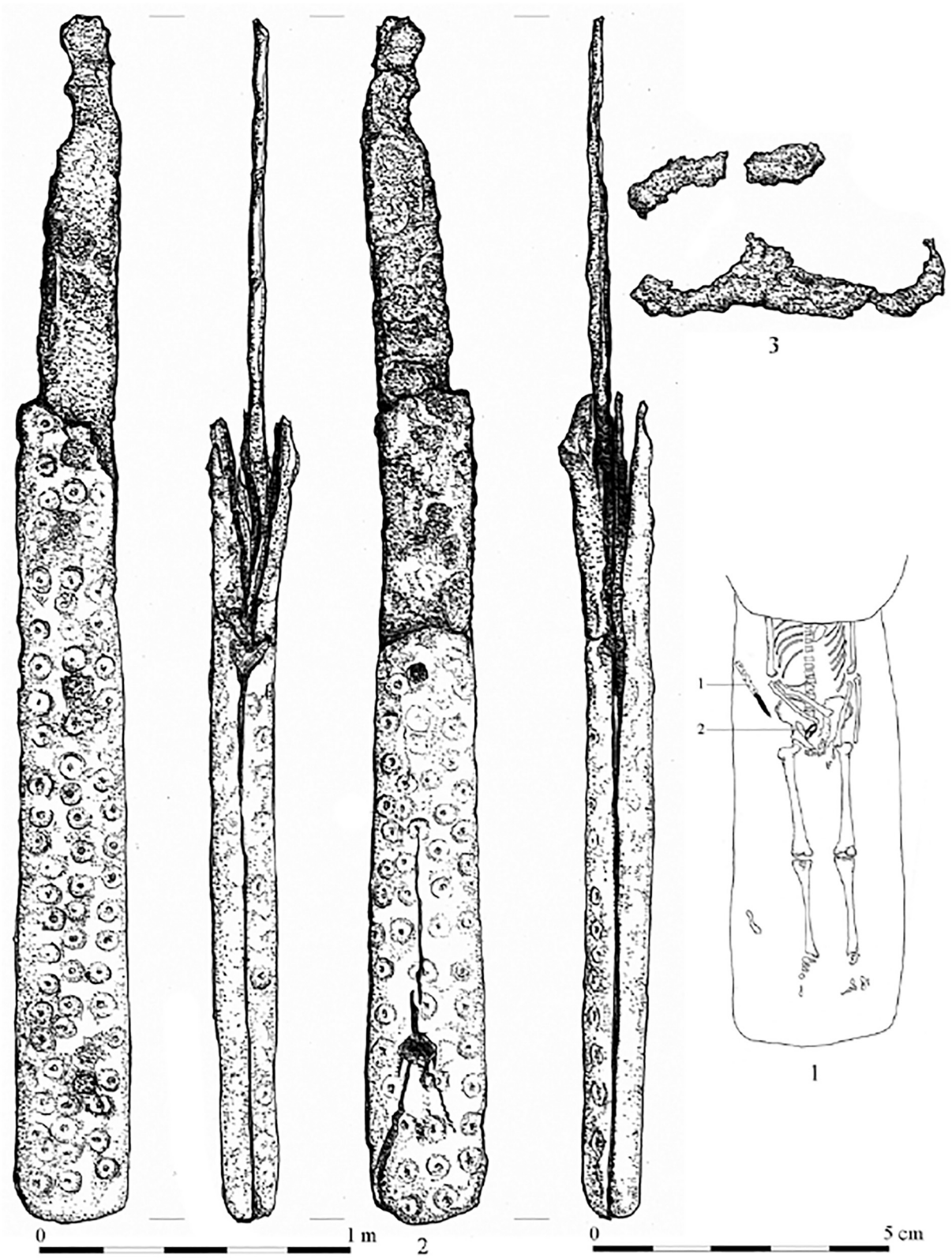

Fig. 3. Himod-Káposztás. Drawing of the knife found in Grave 68

Table 2. Individual data of early medieval finds from the Himod-Káposztáskertek site

Grave No.	Sex	Sex value	Estimated age (years)
Ninth century (Carolingian Period)			
97/A	–	-	7–9
100	female	−1.29 (14)	30–39
103	–	-	2–4
104	–	-	9–12
117	–	-	1–6
127	–	-	7–9
128	female	−0.40 (10)	30–39
129	–	-	8–12
135	–	-	3–5
136/B	female	−0.79 (14)	40–49
137	female?	−0.17 (6)	20–39
140	female	−0.87 (15)	25–29
141/A	–	-	2–4
141/B	–	-	1–3
142	male	+1.27 (11)	40–49
143	–	-	2–3
144	male	+0.67 (9)	40–59
145	–	– (0)	20-x
146	male	+1.25 (16)	35–44
147	–	-	7–13
149	male	+0.77 (13)	35–44
151	–	-	0.5–1.5
152	–	-	2–3
153	–	-	10–14
155	–	-	1.5–3
Tenth–eleventh century			
30	female	−0.5 (12)	40–59
31	–	-	2–4
32	–	-	0–0.5
33	male?	+0.5 (2)	20–39
41	male	+0.8 (10)	20–39
42	–	-	1.5–3
43	–	-	1–2
47	male	+0.62 (16)	20–29
48	male	+0.92 (13)	40–44
49	–	-	4–6
50	male	+1.20 (5)	50–59
51	–	-	7–13
52	–	-	3–5
53	female	−0.25 (12)	40–49
54	female	−1.20 (15)	25–29
55	female	−0.47 (15)	30–34
56	–	-	2–3
57	male	+1.07 (15)	20–39
58	male	+1.59 (17)	40–49
59	–	-	2–4
60	female?	−0.09 (11)	30–34
67	male	+1.25 (12)	40–49
68	male	+1.75 (4)	35–44
69	male	+1.12 (17)	40–49
70	female	−1.73 (11)	20–39
72/A	male?	-	20-x
73	female	−0.57 (14)	60-x
74	female	+1.40 (5)	40–59
75	–	-	11–14
76	female?	−1.00 (2)	40-x
77	(male?)	-	15–19
78	–	-	5–7
79	male?	+0.08 (13)	20–24
80	male	+1.19 (16)	40–44
81	male?	+0.06 (16)	20–24
82/A	female	−1.17 (12)	50–59
82/B	(female)	-	15–19
83	male	+1.69 (16)	50–59
84	female	−0.33 (15)	40–44
85	male	+0.76 (17)	40–44
86	male	+0.60 (5)	40–44
87	female	−1.6 (5)	20–24
88	male	+0.44 (16)	25–29
89	female	−0.79 (14)	40–59
90	–	-	5–7
91	male	+1.42 (12)	40–49
92	–	-	0–1
93	–	-	15–19
94	–	-	1.5–3
95	female	−1.33 (3)	20-x
96	–	-	2–4
97/B	(female)	-	15–19

(continued)

Table 2. Continued

(continued)

Table 2. Continued

Grave No.	Sex	Sex value	Estimated age (years)
99	male	+0.33 (12)	50–59
102	female	−1.00 (5)	35–39
105	–	-	8–12
106	female	−0.13 (15)	60-x
107	male	+1.50 (16)	50–59
108	(female)	-	15–19
109	female	−0.86 (7)	40–49
110/A	male	+1.50 (16)	45–54
110/B	female	−0.36 (14)	40–44
111	male	+1.40 (15)	35–39
112	male	+1.22 (9)	30–39
113	female	−1.08 (13)	25–34
114	–	-	0–0.5
115	female	−1.78 (9)	20–24
116	male	+1.44 (16)	40–49
118	female	−1.33 (3)	20–24
119	male	+1.29 (17)	25–34
120	–	-	1.5–2
121	–	-	8–13
122	female	−0.92 (12)	30–34
123	female	−1.06 (17)	30–39
124	–	-	1–2
125	male	+1.14 (14)	40–49
126	–	-	8–14
130	–	-	2–4
131	female	−1.06 (16)	20–24
132	–	-	7–11
133	male	+1.06 (16)	40–49
134	female?	−0.25 (4)	0-x
136/A	–	-	5–7
138	female	−1.14 (14)	40–59
139	male	+0.53 (15)	40–49
148	–	-	3–5
154	female	−1.00	35–39
156	female?	- (0)	20-x

could not be measured precisely, or was deformed by a pathological condition. We did not carry out any further calculations using these unreliable values (they were not included in statistics and the estimation of stature); they are published only for the purpose of general information. On the other hand, the diameter of the head of the femur was taken into account when determining the individual's sex even when it could not be measured along the transverse plane.

The study of the pathological changes was carried out using simple visual (macromorphological) examination, which in many cases did not allow for a more accurate identification. The pathological phenomena are presented according to the following categories: traumas, infections, diseases of the hematopoietic system, lesions caused by metabolic and hormonal disorders, joint diseases, neoplastic diseases, other changes. Developmental disorders, enthesopathies, and cases with uncertain classification were encompassed by the term "other changes". Detailed descriptions are given for traumas and rare or unusually severe pathological cases.

Sampling for aDNA analysis at the site was carried within the framework of a research program devoted to the study of the medieval Árpád Dynasty *(Árpád-ház Program)*. Bone samples were collected from both parts of the cemetery. Not all skeletons, but a representative number of cases, were sampled for aDNA studies. From this point of view, it is important to note that the macromorphological analysis revealed that the skulls from Graves 80 and 115 had been inadvertently exchanged,– perhaps during cleaning or packaging – because their sex and age characteristics strongly contradicted the postcranial skeletals they were packed with. However, the confusion could be unambiguously clarified based on the grave photos.

EXAMINATION RESULTS OF THE CAROLINGIAN SECTION OF THE CEMETERY

Distribution by sex and age

The remains of a total of 25 individuals were found in the ninth century graves.[44] Their distribution by age and sex is summarized in Table 3. There are 15 children's graves (60%) and out of 10 adults (40%), 4 are male, 5 are female. The sex of one skeleton could not be determined on a purely morphological basis. The juvenile age group is not represented by any of the skeletons. The proportion of children is very high, although the age group of neonates is completely absent. Among children, the proportion of the infant I age group is higher. The four men belong to older age groups (they died at the border of the adultus-maturus category, or during the maturus age interval). Four of the five women are adultus and one of them reached the age of maturity. The identification of the individual in Grave 144 was included in the work of Péter Tomka as an uncertain female skeleton.[45] The remains recovered from the grave are incomplete and fragmentary, the pelvis is missing. The morphology of the retrieved skull and skeletal elements display male characteristics. However, the female nature of the deceased could

[44] In the case of Grave 150, only the end of the foot fell into the excavated width of the road while the bones from two children could be distinguished in Grave 141.

[45] Tomka (2010) 218.

Table 3. Age and sex distribution in the ninth century graves

Age group	Indeterminate sex	Males	Females	Total
Infans I (from which neonatal)	9 (0)	–	–	15
Infans II	6	–	–	
Juvenis	–	–	–	–
Adultus	–	–	4	4
Adultus-maturus	–	2	–	2
Maturus	–	2	1	3
Senilis	–	–	–	–
Adultus (20-x)	1	–	–	1
Total	**16**	**4**	**5**	**25**

be clearly established based on aDNA testing.[46] This observation only partially influenced previous assumptions, because due to the small number of cases, the metric data of the Carolingian period are not suitable for drawing far-reaching conclusions anyway. Moreover, only three cranial measurements could be recorded on the skeleton in question. The physical anthropological sex determination of the individuals in Graves 128 and 149 also differs from previous assumptions. The deceased in Grave 128 was listed by Péter Tomka as an uncertain male, while the individual in Grave 149 as an uncertain female. However, no aDNA data are available for these skeletons.

Results of cranial and long bone measurements

Individual measurements are listed in Table 4. Among men, cranial length (M 1) in two cases falls into the "long" and "very long" category; for women, two out of three of the same measurement into the "medium" and one into the "very long" category. Forehead width (M 9) could be measured on four male and four female skulls each. Those measurements suggest that wide foreheads were more characteristic in both sexes.[47] The maximum width (M 8), the height of the cranium (M 17), as well as the width–height index (M 17:8) on all three measurable female skulls fall into the "medium" class; no measurements were available for men.

Long bones could be measured in two men and five women. The estimated stature for men is "small-medium" in one case and "tall" in the other; in women stature is "tall" in four cases while the category "very tall" applies to one individual.

Pathological changes

Traumas. Healed fractures of the IV and V left metatarsal bone could be observed on the adultus female buried in Grave 128. As a result of this lesion, the bones of the left foot underwent varying degrees of deformation and the periosteum was inflamed.

Joint diseases. Degenerative changes (attributable to the "wear and tear" of joints) of the vertebral column occurred in 4 individuals (Grave 100: adultus female, Grave 136/B: maturus female, Grave 142: maturus male, Grave 146: adultus-maturus male). In Grave 142, in addition to the degenerative changes, a joint disease affecting the spine was found. The latter can probably be classified among the seronegative spondylarthropathies (for example reactive arthritis or ankylosing spondylitis). On the superior endplate of cervical vertebra 6, and adjacent endplates between the bodies of cervical vertebrae 6 and 7, traces of inflammation can be seen that made the articular surfaces extremely uneven. The calcification of ligaments is also visible on cervical vertebrae 6–7, as well as on thoracic vertebrae 1, 6–8, and 10. As a result, blocks of vertebrae developed (the 6–7 cervical and 6–7 dorsal vertebrae were connected by bone) (Figs 4–5). Degenerative spondylitis further complicates the appearance of these vertebral disorders. Although 3 cervical, 10 dorsal and 5 lumbar vertebrae remained from the spinal column in Grave 142, most of the vertebral arches are missing. Even the surviving vertebral bodies are fragmentary, and in some places their edges are also damaged. No pathological changes can be detected in the few remaining small articulations. The entire skeleton is incomplete and fragmentary. The possible involvement of other joints and skeletal parts (e.g. the sacroiliac joint) therefore cannot be examined. Based on the symptoms and the skeletal parts available for study, diffuse idiopathic skeletal hyperostosis (DISH henceforth) cannot be ruled out either. However, in that case, the inflammatory process observed on the cervical vertebrae cannot be considered part of the DISH syndrome.

Other lesions. Enthesopathies occurred in four individuals in the ninth century section of the cemetery (Grave 136/B: maturus woman, Grave 137: adultus woman?, Grave 146: adultus-maturus man, Grave 149: adultus-maturus man). They could be observed mostly on the lower limb bones. This sub-pathological change results in the strengthening of surfaces of muscle attachment and origin on the bones, most often in response to increased strain. Although it may also be an accompanying symptom of certain diseases, enthesopathy in itself cannot be considered a pathological deformation.[48]

[46]Unpublished data kindly provided by Veronika Csáky.

[47]Taking into account that, according to the aDNA test, the deceased found in Grave 144 was female, the frontal width could be measured in three men and five women. Among the tabulated measurements, however, Grave 144 was listed alongside the burials of males, based on its sex determination using morphological criteria only.

[48]Nikita (2017) 274–275.

Table 4. Individual measurements and indices in the Carolingian Period section of the cemetery

Martin No.		Grave No.								
		Males				Females				
		142	144	146	149	100	128	136/B	137	140
1		–	–	190	191	174	–	173	–	188
5		–	–	–	–	93	107	93	–	–
8		–	–	–	–	137	137	138	–	–
9		97	102	100	103	97	98	95	–	99
17		–	–	–	–	128	130	129	–	–
40		–	–	–	–	88	102	93	–	–
45		–	–	–	–	122	–	–	–	–
47		–	114	–	–	109	–	–	–	–
48		–	–	–	70	66	72	68	–	–
51		–	–	–	–	42	43	40	–	–
52		–	–	–	–	32	32	32	–	–
54		25	–	–	27	25	–	–	–	–
55		48	–	–	53	49	–	50	–	–
65		–	–	–	–	–	–	–	–	114
66		102	102	–	–	–	–	99	–	–
8:1		–	–	–	–	78.74	–	79.77	–	–
17:1		–	–	–	–	73.56	–	74.57	–	–
17:8		–	–	–	–	93.43	94.89	93.48	–	–
9:8		–	–	–	–	70.80	71.53	68.84	–	–
47:45		–	–	–	–	89.34	–	–	–	–
48:45		–	–	–	–	54.10	–	–	–	–
52:51		–	–	–	–	76.19	74.42	80.00	–	–
54:55		52.08	–	–	50.94	51.02	–	–	–	–
Humerus 1	dex.	–	–	–	320	–	–	–	–	310
	sin.	–	–	–	313	307	–	–	–	–
Radius 1	dex.	–	–	–	236	–	–	–	–	–
	sin.	–	–	–	232	–	–	–	–	235
Ulna 1	dex.	–	–	–	258	–	–	–	–	–
	sin.	–	–	–	–	250	–	–	–	–
Femur 1	dex.	–	–	483	428	424	471	431	437	424
	sin.	–	–	495	432	427	472	430	–	429
Femur 19	dex.	–	–	–	46	–	–	–	45	43
	sin.	–	–		–	–	(46)	41	–	42
Tibia 1	dex.	–	–	–	–	354	–	–	356	343
	sin.	–	–	–	–	352	–	354	356	–
Fibula 1	dex.	–	–	–	–	–	–	–	–	–
	sin.	–	–	–	–	–	–	–	–	–
Stature (cm) (From Hu, Ra, Fe, Ti)		–	–	178.38	163.59	161.83	173.63	163.16	164.37	161.84
Stature (cm) (from all long bones)		–	–	178.38	165.77	161.89	173.63	163.16	164.37	161.84

Fig. 4–5. Presumed ankylosing spondylitis. Showing vertebrae C6 to T1 and T6 to T8 (Grave 142: maturus male)

EXAMINATION RESULTS OF THE TENTH–ELEVENTH CENTURY SECTION OF THE CEMETERY

Distribution by sex and age

The remains of 87 individuals came to light from the tenth–eleventh century section of the cemetery. Of these, 25 are children (28.74%), 5 are young people (5.75%), and 57 are adultus (65.52%). Among the adults, 29 were men (50.88%), 28 were women (49.12%). The sex and age distribution is summarized in Table 5.

In comparison with the "East 5" model developed by Ansley J. Coale and Paul Demeny,[49] the number of children falls short of the expected ratio of nearly 50%, which is primarily attributable to the small proportion of neonates. The infant I age group contributes more to child mortality. For men, mortality is highest in the first half of the maturus age, between the ages of 40 and 49, and then declines. There are three small peaks in the mortality curve for women, whose mortality is overall higher in the adultus than in the maturus age cohort (see Fig. 6 for the mortality curves).

In Graves 80 and 99, the excavation log mentions females (although Grave 80 carries a question mark). According to the osteomorphological criteria, however, both individuals could be men. According to the aDNA analysis, the deceased in Grave 80 is indeed a man (although due to the aforementioned skull mix-up, he was sampled under the number of Grave 115). There is no genetic information regarding the sex of the deceased in Grave 99.

Results of cranial and long bone measurements

Individual measurements are shown in Tables 6 and 7, the distribution of cranial dimensions and indices are listed in Table 8. The distribution of stature estimates is shown in Table 9. The statistical parameters of cranial and post-cranial skeletal dimensions are summarized in Tables 10 and 11. The small number of measurements does not offer an opportunity for detailed analysis of the osteometrical data. We would like to highlight, however, the main characteristics of the neurocranium and some features of the facial skeleton that have emerged even from the small body of data. They characterize our assemblage based on the mean values and their dispersion, not necessarily the entire population. In the tenth–eleventh century section of the cemetery, the men's skulls are "long" (M 1), "medium-long-long" (M 8:1), "medium-wide-wide" (M 8), "medium-high-high" (M 17), and their foreheads are "wide" (M 9). They are characterized by "wide" faces (M 45), "wide" orbits (M 51, 52:51) as well as a "wide" mandible (M 65, 66). In the case of women, the measurements also point in the direction of long-headedness, the skull is "long" or "very long" (M 1) in four out of five cases.

The mean value of stature estimated from the measurements of the long bones (humerus, radius, femur, and tibia) is 168.1 cm for men and 157.8 cm for women, which values fall within the "large-medium" category for both sexes. Looking at the size distribution of stature, the majority of men are found in "medium" to "tall" categories. In the meantime, a large proportion women belonged to both the "large-medium" and "tall" categories by stature; the greatest incidence for both sexes falls within "tall" category.

Both women and men can be classified in the Europid morphological group, within which medium-length and long-skull types predominate. Using traditional terminology, features of the Cromagnoid-A and Nordoid types can be observed on the better-preserved skulls of men. (Such typical male skulls can be seen in Figs 7–20). Smaller numbers of short-headed individuals of both sexes also occurred. Features characteristic of the so-called Pamir type (primarily a very short skull according to the 8:1 index, a steep forehead, a slight flattening of the lambda region) are displayed on the skulls of men in Graves 85 (Figs 21–22) and 123 (Figs 23–24), as well as on the female skull from Grave 131.

[49] Coale and Demeny (1983).

Table 5. Age and sex distribution of the tenth–eleventh century graves

Age group	Indeterminate sex	Males	Females	Total
Infans I (from which neonatal)	19 (3)	–	–	**25**
Infans II	6			
Juvenis	1	1	3	**5**
Adultus	–	10	13	**23**
Adultus-maturus	–	1	–	**1**
Maturus	–	17	10	**27**
Senilis	–	–	2	**2**
Adultus (20-x)	–	1	3	**4**
Total	**26**	**30**	**31**	**87**

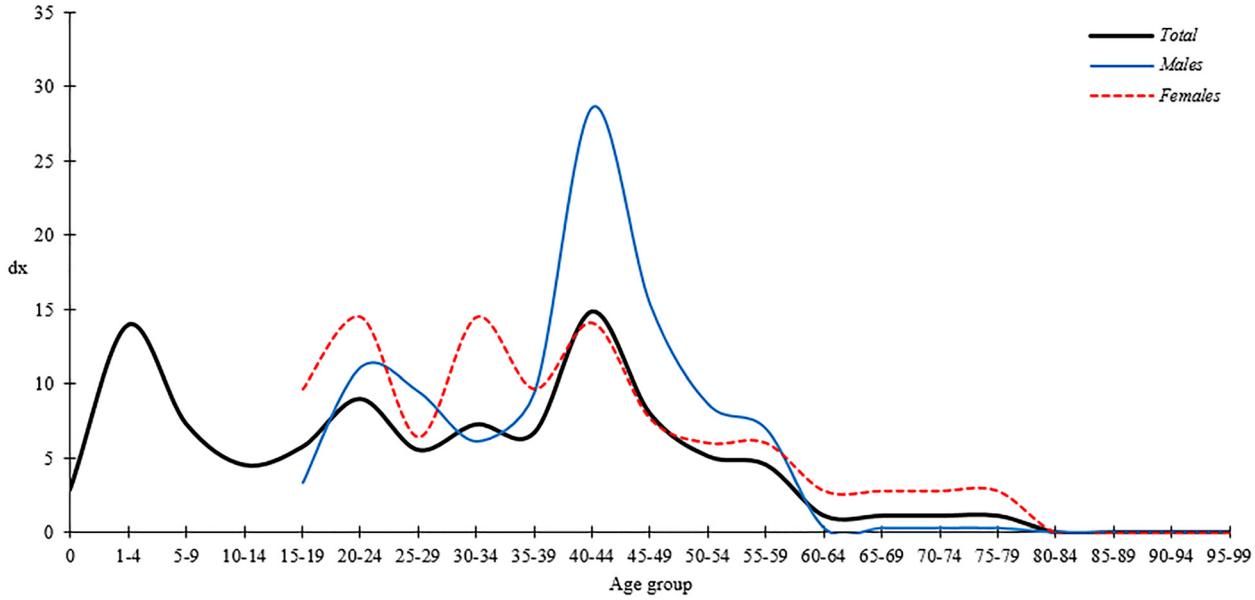

Fig. 6. Mortality curves of the tenth–eleventh century section of the cemetery of the Himod-Káposztáskertek site

Pathological changes

Numerous pathological phenomena of various kinds could be observed in the tenth–eleventh century graves. Due to limitations of space, it is not possible to publish an all-inclusive photo documentation here.

Traumas. The incidence of trauma is presented by anatomical region. Cranial injuries could be observed in four individuals: in Grave 67, a maturus man had a healed fracture on the nasal bones; in Grave 106, a healed fracture was identified on the jaw of a senilis woman (perhaps a trace of a crack or a bruise); in Grave 57, a healed fracture (cut?) occurred on the left side of the jaw of an adultus man; in Grave 69, a bruise mark was found on the right side of the frontal bone of a maturus man.

The left clavicle of an adultus man healed with minimal deformation was found in Grave 119; the left clavicle of the deceased man in Grave 57 shows a fracture (cut?) that healed with significant dislocation.

The fourth lumbar vertebra of the man in Grave 80 had a ruptured vertebral arch *(spondylolysis)*, and the vertebral body had slipped forward *(spondylolysthesis)* and fused with the fifth lumbar vertebra, forming block vertebrae. This process was accompanied by inflammation and the disappearance of the gap between the vertebral bodies (Figs 25 and 26).

Rib fractures occurred in two individuals, and healed in both cases: on the fourth left rib of the maturus man in Grave 50 and on two ribs of a maturus man in Grave 99 (the siding of these latter bones is uncertain due to fragmentation).

In Grave 60, a curve attributable to a so-called green stick fracture can be seen on the left humerus of an adultus woman.

Fractures of the forearm bones occurred in three individuals, in all cases at the distal end of the radius: Grave 76

Table 6. Measurements and indices of males in the tenth–eleventh century graves

Martin No.		Grave No.								
		47	48	50	57	58	67	68	69	79
1		187	–	–	–	187	190	–	193	–
5		105	–	–	–	105	–	–	108	–
8		140	–	–	–	151	149	–	152	–
9		96	–	–	–	103	101	–	111	–
17		137	–	–	–	137	–	–	–	–
40		101	–	–	–	102	–	–	99	–
45		–	–	–	–	146	–	–	149	–
47		121	–	–	–	124	–	–	122	–
48		74	–	–	–	74	77	–	74	–
51		42	–	–	–	44	42	–	48	–
52		33	–	–	–	34	33	–	36	–
54		–	–	–	–	28	26	–	30	–
55		55	–	–	–	54	57	–	57	–
65		–	–	–	–	138	–	–	–	–
66		104	–	–	102	116	–	–	110	–
8:1		74.87	–	–	–	80.75	78.42	–	78.76	–
17:1		73.26	–	–	–	73.26	–	–	–	–
17:8		97.86	–	–	–	90.73	–	–	–	–
9:8		68.57	–	–	–	68.21	67.79	–	73.03	–
47:45		–	–	–	–	84.93	–	–	81.88	–
48:45		–	–	–	–	50.68	–	–	49.66	–
52:51		78.57	–	–	–	77.27	78.57	–	75.00	–
54:55		–	–	–	–	51.85	45.61	–	52.63	–
Humerus 1	dex.	309	344	–	–	324	–	–	314	–
	sin.	315	339	–	–	–	335	–	306	–
Radius 1	dex.	249	256	–	–	249	–	–	240	–
	sin.	246	251	–	–	–	248	247	239	–
Ulna 1	dex.	270	–	–	–	–	–	–	264	–
	sin.	265	279	–	272	–	263	–	263	–
Femur 1	dex.	430	473	447	–	455	468	463	425	453
	sin.	429	475	455	–	–	476	461	435	456
Femur 19	dex.	44	48	50	47	51	52	(50)	46	49
	sin.	–	49	49	–	–	53	(49)	47	–
Tibia 1	dex.	349	381	352	–	346	362	371	345	–
	sin.	352	379	359	–	344	364	374	–	371
Fibula 1	dex.	351	–	355	–	–	–	367	–	–
	sin.	350	–	360	–	–	–	–	–	–
Stature (cm) (From Hu, Ra, Fe, Ti)		164.08	173.49	166.19	–	166.88	170.69	169.67	162.67	169.21
Stature (cm) (from all long bones)		164.77	173.88	165.68	172.22	166.88	170.16	168.06	163.80	169.21

(continued)

Table 6. Continued

Martin No.		Grave No.								
		80	81	83	85	86	88	89	99	107
1		–	181	184	172	–	–	189	190	190
5		–	101	102	101	–	–	102	105	108
8		–	–	145	152	–	–	140	140	148
9		–	101	106	102	–	–	105	100	105
17		–	133	143	138	–	–	128	136	138
40		–	98	95	98	–	–	97	–	105
45		–	132	–	140	–	–	–	137	145
47		–	126	113	120	–	–	–	–	(123)
48		–	–	68	70	–	73	68	–	75
51		–	41	45	44	–	43	43	42	44
52		–	33	33	34	–	34	32	36	34
54		–	23	23	25	–	25	28	–	27
55		–	54	52	54	–	54	49	54	56
65		–	121	127	128	–	–	–	131	–
66		115	106	–	106	–	106	–	112	112
8:1		–	–	78.80	88.37	–	–	74.07	73.68	77.89
17:1		–	73.48	77.72	80.23	–	–	67.72	71.58	72.63
17:8		–	–	98.62	90.79	–	–	91.43	97.14	93.24
9:8		–	–	73.10	67.11	–	–	75.00	71.43	70.95
47:45		–	95.45	–	85.71	–	–	–	–	(84.83)
48:45		–	–	–	50.00	–	–	–	–	51.72
52:51		–	80.49	73.33	77.27	–	79.07	74.42	85.71	72.27
54:55		–	42.59	44.23	46.30	–	46.30	57.14	–	48.21
Humerus 1	dex.	315	328	337	294	325	321	–	–	–
	sin.	314	327	338	296	–	321	–	–	337
Radius 1	dex.	237	247	263	221	245	–	–	–	266
	sin.	236	–	267	223	–	244	–	–	–
Ulna 1	dex.	257	263	284	242	266	264	–	–	–
	sin.	257	263	–	242	–	262	–	–	285
Femur 1	dex.	432	–	460	409	455	439	–	(430)	477
	sin.	430	452	462	405	453	443	–	(446)	480
Femur 19	dex.	47	48	50	48	49	51	–	(56)	50
	sin.	47	50	50	49	–	51	–	(51)	49
Tibia 1	dex.	353	352	359	313	365	335	–	–	–
	sin.	353	352	361	317	367	334	–	–	–
Fibula 1	dex.	342	–	–	322	–	–	–	–	–
	sin.	343	–	–	327	–	–	–	–	–
Stature (cm) (From Hu, Ra, Fe, Ti)		163.63	167.47	171.59	155.26	168.28	164.25	–	–	175.16
Stature (cm) (from all long bones)		163.19	167.59	172.82	155.37	168.51	165.01	–	–	175.92

(continued)

Table 6. Continued

Martin No.		Grave No.					
		110/A	111	116	119	133	139
1		–	188	197	185	185	182
5		–	106	–	105	104	108
8		–	143	142	137	143	–
9		–	97	104	99	100	93
17		–	143	–	136	126	134
40		–	101	–	106	–	106
45		–	140	–	138	–	–
47		–	127	–	134	–	–
48		–	77	–	77	–	67
51		–	45	–	43	–	43
52		–	37	–	32	–	32
54		–	29	–	25	–	25
55		–	56	–	53	–	50
65		–	–	131	–	–	–
66		–	117	105	107	108	–
8:1		–	76.06	72.08	74.05	77.30	–
17:1		–	76.06	–	73.51	68.11	73.63
17:8		–	100.00	–	99.27	88.11	–
9:8		–	67.83	73.24	72.26	69.93	–
47:45		–	90.71	–	97.10	–	–
48:45		–	55.00	–	55.80	–	–
52:51		–	82.22	–	74.42	–	74.42
54:55		–	51.79	–	47.17	–	50.00
Humerus 1	dex.	306	–	327	348	340	312
	sin.	304	–	–	–	331	309
Radius 1	dex.	–	257	249	–	–	–
	sin.	–	–	248	269	259	–
Ulna 1	dex.	–	274	266	291	287	–
	sin.	–	–	–	–	284	–
Femur 1	dex.	433	475	462	483	470	–
	sin.	441	478	467	489	463	438
Femur 19	dex.	–	–	–	53	49	(46)
	sin.	46	–	49	52	48	(45)
Tibia 1	dex.	365	385	381	386	–	343
	sin.	370	–	382	386	380	–
Fibula 1	dex.	363	–	380	–	–	–
	sin.	–	–	384	–	–	–
Stature (cm) (From Hu, Ra, Fe, Ti)		164.15	173.62	170.82	177.01	172.81	162.40
Stature (cm) (from all long bones)		164.77	173.50	171.03	177.81	173.94	162.40

Table 7. Measurements and indices of females in the tenth–eleventh century graves

Martin No.		Grave No.								
		30	53	54	55	60	70	73	74	82/A
1		178	–	–	–	–	–	183	–	–
5		100	–	–	–	–	–	99	–	–
8		135	–	–	–	–	–	135	–	–
9		91	–	–	–	–	–	97	–	–
17		–	–	–	–	–	–	130	–	–
40		93	–	–	–	–	–	–	–	–
45		–	–	–	–	–	–	–	–	–
47		–	–	–	–	–	–	–	–	–
48		70	–	–	–	–	–	–	–	–
51		43	–	–	–	–	–	–	–	–
52		34	–	–	–	–	–	–	–	–
54		–	–	–	–	–	–	–	–	–
55		55	–	–	–	–	–	–	–	–
65		–	–	–	–	–	–	–	–	–
66		–	90	–	–	–	–	–	–	–
8:1		75.84	–	–	–	–	–	73.77	–	–
17:1		–	–	–	–	–	–	71.04	–	–
17:8		–	–	–	–	–	–	96.30	–	–
9:8		67.41	–	–	–	–	–	71.85	–	–
47:45		–	–	–	–	–	–	–	–	–
48:45		–	–	–	–	–	–	–	–	–
52:51		79.07	–	–	–	–	–	–	–	–
54:55		–	–	–	–	–	–	–	–	–
Humerus 1	dex.	–	–	289	–	–	263	–	305	–
	sin.	–	–	287	–	–	–	282	–	–
Radius 1	dex.	–	–	230	–	245	–	–	234	–
	sin.	–	–	–	–	239	–	–	–	–
Ulna 1	dex.	–	–	–	–	263	–	–	–	–
	sin.	–	–	–	–	260	–	–	–	–
Femur 1	dex.	–	–	414	422	439	–	399	428	421
	sin.	–	416	412	–	445	366	398	434	421
Femur 19	dex.	–	–		45		–	42	39	43
	sin.	–	–		45		–	41	38	43
Tibia 1	dex.	–	336	332	–	356	–	320	350	344
	sin.	–	338	328	–	356	–	318	–	342
Fibula 1	dex.	–	–	–	–	351	–	321	–	–
	sin.	–	–	–	–	–	–	320	–	–
Stature (cm) (From Hu, Ra, Fe, Ti)		–	158.40	156.84	160.22	165.42	142.78	151.81	162.05	160.07
Stature (cm) (from all long bones)		–	158.40	156.84	160.22	165.19	142.78	151.70	162.05	160.07

(continued)

Table 7. Continued

Martin No.		Grave No.								
		84	87	89	95	102	106	110/B	113	115
1		–	–	–	–	–	182	–	–	–
5		–	–	–	–	–	101	–	–	–
8		–	–	–	–	–	138	–	–	–
9		–	–	–	–	–	98	101	105	–
17		–	–	–	–	–	138	–	–	–
40		–	–	–	–	–	–	–	–	–
45		–	–	–	–	–	129	–	–	–
47		–	–	–	–	–	–	–	–	–
48		–	–	–	–	–	–	71	65	–
51		–	–	–	–	–	46	40	–	–
52		–	–	–	–	–	34	31	–	–
54		–	–	–	–	–	25	26	–	–
55		–	–	–	–	–	52	49	50	–
65		–	–	–	–	–	–	–	–	–
66		99	–	–	–	–	97	–	–	–
8:1		–	–	–	–	–	75.82	–	–	–
17:1		–	–	–	–	–	75.82	–	–	–
17:8		–	–	–	–	–	100.00	–	–	–
9:8		–	–	–	–	–	71.01	–	–	–
47:45		–	–	–	–	–	–	–	–	–
48:45		–	–	–	–	–	–	–	–	–
52:51		–	–	–	–	–	73.91	77.50	–	–
54:55		–	–	–	–	–	48.08	53.06	–	–
Humerus 1	dex.	–	309	302	–	301	–	–	–	301
	sin.	298	314	–	–	–	317	290	–	298
Radius 1	dex.	231	232	230	–	–	–	–	–	233
	sin.	234	228	229	–	–	236	–	–	230
Ulna 1	dex.	–	256	–	–	–	–	–	–	251
	sin.	–	251	–	–	–	235	–	–	248
Femur 1	dex.	415	413	427	416	425	457	400	410	411
	sin.	417	416	426	–	424	461	393	408	414
Femur 19	dex.	–	41	42	–	43	–	43	–	45
	sin.	41	42	42	–	43	45	–	–	44
Tibia 1	dex.	339	341	342	–	332	–	320	–	351
	sin.	343	341	341	321	335	–	321	–	350
Fibula 1	dex.	–	337	326	–	–	–	–	–	344
	sin.	–	–	329	–	–	–	–	–	346
Stature (cm) (From Hu, Ra, Fe, Ti)		159.35	160.57	160.27	155.78	158.67	166.54	153.02	156.70	159.96
Stature (cm) (from all long bones)		159.35	160.54	159.00	155.78	158.67	166.54	153.02	156.70	160.31

(continued)

Table 7. Continued

Martin No.		Grave No.						
		118	122	123	131	134	138	154
1		–	–	177	169	–	–	–
5		–	–	96	102	–	–	–
8		–	–	149	137	–	–	–
9		–	–	101	95	–	–	–
17		–	–	136	131	–	–	–
40		–	–	87	93	–	–	–
45		–	–	–	–	–	–	–
47		–	–	116	117	–	–	–
48		–	63	71	68	–	–	–
51		–	38	41	42	–	–	–
52		–	34	34	35	–	–	–
54		–	–	23	22	–	–	–
55		–	45	51	51	–	–	–
65		–	–	113	123	–	–	–
66		–	–	91	106	–	–	–
8:1		–	–	84.18	81.06	–	–	–
17:1		–	–	76.84	77.51	–	–	–
17:8		–	–	91.28	95.62	–	–	–
9:8		–	–	67.79	69.34	–	–	–
47:45		–	–	–	–	–	–	–
48:45		–	–	–	–	–	–	–
52:51		–	89.47	82.93	83.33	–	–	–
54:55		–	–	45.10	43.14	–	–	–
Humerus 1	dex.	–	–	–	299	–	–	–
	sin.	–	–	310	299	–	–	–
Radius 1	dex.	–	222	236	224	–	–	–
	sin.	–	–	232	223	–	–	–
Ulna 1	dex.	–	–	255	241	–	–	–
	sin.	–	–	250	243	–	–	–
Femur 1	dex.	411	406	436	423	–	391	412
	sin.	413	405	437	420	409	392	417
Femur 19	dex.	–	40	43	41	–	39	44
	sin.	–	40	42	41	–	39	44
Tibia 1	dex.	327	329	351	341	–	308	–
	sin.	325	329	–	341	–	307	–
Fibula 1	dex.	–	–	–	–	–	–	–
	sin.	–	–	347	333	–	–	–
Stature (cm) (From Hu, Ra, Fe, Ti)		156.05	156.65	163.09	158.98	156.70	150.22	158.19
Stature (cm) (from all long bones)		156.05	156.65	162.74	158.36	156.70	150.22	158.19

Table 8. Distribution of the cranial measurements and indices in the tenth–eleventh century graves

Martin No.	Class	Males		Females	
		Intervall	N	Intervall	N
1		x–160	–	x–152	–
	very short	161–171	–	153–163	–
	short	172–177	1	164–169	1
	medium	178–184	3	170–175	–
	long	185–190	9	176–181	2
	very long	191–201	2	182–192	2
		202–x	–	193–x	–
		total:	15		5
5		x–87	–	x–83	–
	very short	88–95	–	84–90	–
	short	96–99	–	91–94	–
	medium	100–103	4	95–98	1
	long	104–107	6	99–102	4
	very long	108–115	3	103–109	–
		116–x	–	110–x	–
		total:	13		5
8		x–124	–	x–119	–
	very narrow	125–133	–	120–128	–
	narrow	134–138	1	129–133	–
	medium	139–144	6	134–139	4
	broad	145–149	3	140–144	–
	very broad	150–158	3	145–153	1
		159–x	–	154–x	–
		total:	13		5
9		x–81	–	x–78	–
	very narrow	82–89	–	79–86	–
	narrow	90–93	1	87–90	–
	medium	94–98	2	91–95	2
	broad	99–102	6	96–99	2
	very broad	103–110	5	100–107	3
		111–x	1	108–x	–
		total:	15		7
17		x–117	–	x–112	–
	very low	118–126	1	113–120	–
	low	127–131	1	121–125	–
	medium	132–136	4	126–130	1
	tall	137–141	4	131–135	1
	very tall	142–150	2	136–143	2

(continued)

Table 8. Continued

Martin No.	Class	Males		Females	
		Intervall	N	Intervall	N
		151–x	–	144–x	–
		total:	12		4
40		x–82	–	x–79	–
	very short	83–91	–	80–87	1
	short	92–96	1	88–92	–
	medium	97–101	6	93–97	2
	long	102–106	4	98–102	–
	very long	107–115	–	103–110	–
		116–x	–	111–x	–
		total:	11		3
45		x–116	–	x–108	–
	very narrow	117–125	–	109–116	–
	narrow	126–130	–	117–121	–
	medium	131–136	1	122–127	–
	broad	137–141	4	128–132	1
	very broad	142–150	3	133–140	–
		151–x	–	141–x	–
		total:	8		1
47		x–95	–	x–88	–
	very low	96–107	–	89–99	–
	low	108–114	1	100–106	–
	medium	115–122	3	107–113	–
	tall	123–129	3	114–120	2
	very tall	130–141	1	121–131	–
		142–x	–	132–x	–
		total:	8		2
48		x–57	–	x–53	–
	very low	58–64	–	54–59	–
	low	65–68	3	60–63	1
	medium	69–73	2	64–68	2
	tall	74–77	7	69–72	3
	very tall	78–84	–	73–78	–
		85–x	–	79–x	–
		total:	12		6

(continued)

Table 8. Continued

Martin No.	Class	Males		Females	
		Intervall	N	Intervall	N
51		x–35	–	x–33	–
	very narrow	36–38	–	34–36	–
	narrow	39–40	–	37–38	1
	medium	41–42	4	39–40	1
	broad	43–44	7	41–42	2
	very broad	45–47	2	43–45	1
		48–x	1	46–x	1
		total:	14		6
52		x–27	–	x–27	–
	very low	28–30	–	28–30	–
	low	31–32	3	31–32	1
	medium	33–34	8	33–34	4
	tall	35–36	2	35–36	1
	very tall	37–39	1	37–39	–
		40–x	–	40–x	–
		total:	14		6
54		x–18	–	x–18	–
	very narrow	19–21	–	19–21	–
	narrow	22–23	2	22–23	2
	medium	24–25	4	24–25	1
	broad	26–27	2	26–27	1
	very broad	28–30	4	28–30	–
		31–x	–	31–x	–
		total:	12		4
55		x–42	–	x–39	–
	very low	43–47	–	40–44	–
	low	48–50	2	45–47	1
	medium	51–53	2	48–50	2
	tall	54–56	8	51–53	3
	very tall	57–61	2	54–58	1
		62–x	–	59–x	–
		total:	14		7
65		x–100	–	x–93	–
	very narrow	101–110	–	94–104	–
	narrow	111–116	–	105–109	–
	medium	117–122	1	110–115	1
	broad	123–128	2	116–120	–
	very broad	129–138	3	121–131	1

(continued)

Table 8. Continued

Martin No.	Class	Males		Females	
		Intervall	N	Intervall	N
		139–x	–	132–x	–
		total:	6		2
66		x–78	–	x–73	–
	very narrow	79–90	–	74–85	–
	narrow	91–96	–	86–90	1
	medium	97–103	1	91–97	2
	broad	104–109	7	98–102	1
	very broad	110–121	6	103–114	1
		122–x	–	115–x	–
		total:	14		5
8 : 1		x–67.6	–	x–68.4	–
	very long	67.7–73.2	1	68.5–74.1	1
	long	73.3–76.4	5	74.2–77.3	2
	medium	76.5–79.9	5	77.4–80.8	–
	short	80.0–83.1	1	80.9–84.0	1
	very short	83.2–88.7	1	84.1–89.7	1
		88.8–x	–	89.8–x	–
		total:	13		5
17 : 1		x–63.7	–	x–63.8	–
	very low	63.8–69.2	2	63.9–69.4	–
	low	69.3–72.3	1	69.5–72.5	1
	medium	72.4–75.6	6	72.6–75.8	1
	tall	75.7–78.7	2	75.9–78.9	2
	very tall	78.8–84.2	1	79.0–84.5	–
		84.3–x	–	84.6–x	–
		total:	12		4
17 : 8		x–80.1	–	x–79.3	–
	very low	80.2–87.9	–	79.4–87.1	–
	low	88.0–92.3	4	87.2–91.4	1
	medium	92.4–97.0	1	91.5–96.1	1
	tall	97.1–101.4	5	96.2–100.4	2
	very tall	101.5–109.2	–	100.5–108.2	–
		109.3–x	–	108.3–x	–
		total:	10		4

(continued)

Table 8. Continued

Martin No.	Class	Males		Females	
		Intervall	N	Intervall	N
9 : 8		x–56.9	–	x–57.2	–
	very narrow	57.0–62.7	–	57.3–63.0	–
	narrow	62.8–66.0	–	63.1–66.3	–
	medium	66.1–69.6	5	66.4–69.9	3
	broad	69.7–72.9	4	70.0–73.2	2
	very broad	73.0–78.7	4	73.3–79.0	–
		78.8–x	–	79.1–x	–
		total:	13		5
47 : 45		x–71.2	–	x–70.9	–
	very broad	71.3–80.5	–	71.0–80.1	–
	broad	80.6–85.8	3	80.2–85.4	–
	medium	85.9–91.6	1	85.5–91.1	–
	narrow	91.7–96.9	1	91.2–96.4	–
	very narrow	97.0–106.2	1	96.5–105.6	–
		106.3–x	–	105.7–x	–
		total:	6		–
48 : 45		x–42.7	–	x–42.5	–
	very broad	42.8–48.3	–	42.6–48.1	–
	broad	48.4–51.4	3	48.2–51.2	–
	medium	51.5–54.9	1	51.3–54.7	–
	narrow	55.0–58.0	2	54.8–57.8	–
	very narrow	58.1–63.6	–	57.9–63.4	–
		63.7–x	–	63.5–x	–
		total:	6		–
52 : 51		x–65.0	–	x–67.3	–
	very low	65.1–73.8	2	67.4–76.4	1
	low	73.9–78.7	8	76.5–81.5	2
	medium	78.8–84.3	3	81.6–87.3	2
	tall	84.4–89.2	1	87.4–92.4	1
	very tall	89.3–98.0	–	92.5–101.5	–
		98.1–x	–	101.6–x	–
		total:	14		6
54 : 55		x–35.3	–	x–36.0	–
	very narrow	35.4–42.5	–	36.1–43.3	1
	narrow	42.6–46.6	5	43.4–47.5	1
	medium	46.7–51.1	3	47.6–52.1	1
	broad	51.2–55.2	3	52.2–56.3	1
	very broad	55.3–62.4	1	56.4–63.6	–
		62.5–x	–	63.7–x	–
		total:	12		4

Table 9. Distribution of stature in the tenth–eleventh century graves

Class	Stature (cm)	N	%
Males			
	x–129.9	–	–
very small	130.0–149.9	–	–
small	150.0–159.9	1	4.76
small medium	160.0–163.9	3	14.29
medium	164.0–166.9	5	23.81
tall medium	167.0–169.9	4	19.05
tall	170.0–179.9	8	38.10
very tall	180.0–199.9	–	–
	200.0–x	–	–
	total:	21	100
Females			
	x–120.9	–	–
very small	121.0–139.0	–	–
small	140.0–148.9	1	4.17
small medium	149.0–152.9	2	8.33
medium	153.0–155.9	2	8.33
tall medium	156.0–158.9	8	33.33
tall	159.0–167.9	11	45.83
very tall	168.0–186.9	–	–
	187.0–x	–	–
	total:	24	100

(maturus female?, right side), Grave 111 (adultus male, left side), Grave 154 (adultus female, right side).

Healed fractures (possible cuts) were observed on the hand bones of the deceased, a man in Grave 57. They occurred on the right III and IV metacarpal bones, and also on a phalanx.

Lower leg fractures were found in one individual: the left tibia of the man buried in Grave 111 was broken at the distal third and the left fibula at its proximal quarter. Both fractures healed but caused dislocation of broken ends resulting in shortening of the two bones.

The injuries listed are mostly fractures or cracks. Their occurrence is more common on the bones of the post-cranial skeleton than on the skull. Fractures were identified in a total of ten individuals (17.54% of adults); they are more frequent in men than in women, both in terms of the number of individuals (6/29 men: 20.69%, 4/28 women: 14.29%), and the number of fractures. Multiple fractures were observed in men (Graves 50, 57, 99, and 111). The aforementioned injuries (on the left side of the mandible, on the left clavicle, and on the bones of the right hand) of the deceased, a man in Grave 57 may be "simple" fractures or even cuts. (The damage to the clavicle and mandible can be seen in Figs 27 and 28). In any case, the fractures also indicate that the weapons buried alongside men were placed there deliberately. In Grave 57, an iron arrowhead found next to the knife with a 'bone' handle, indicated that the deceased may once have been a soldier.[50]

Infections. The inflammation of the periosteum covering bones *(periostitis)* is discussed here, even if this lesion cannot be considered a disease itself, but may be an accompanying symptom of various pathological conditions,[51] other than infection. These conditions include, among others, trauma and excess strain. Periostitis was observed in seven individuals. It was usually manifested in a milder form. Periostitis could be observed on both femora and tibiae of the maturus man in Grave 83, as well as on his left metatarsal bones; it also affected the distal end of the right fibula of the maturus woman in Grave 89. In the rest of the cases (Graves 57, 76, 111, 119, and 154) periostitis developed as a consequence of a fracture.

In Grave 73 (senilis woman), round-shaped cysts with rounded edges and a diameter of a few mm are visible on the

[50] Horváth (2022) 13–14.

[51] White et al. (2012) 443, 446.

Table 10. Statistical parameters of cranial measurements and indices in the tenth–eleventh century graves

Martin No.	*N*	Mean	Min.	Max.	Standard deviation	Class of mean value
Males						
1	15	186.67	172	197	5.79	long
5	13	104.62	101	108	2.53	long
8	13	144.77	137	152	5.12	broad
9	15	101.53	93	111	4.45	broad
17	12	135.75	126	143	5.08	medium
40	11	100.73	95	106	3.74	medium
45	8	140.88	132	149	5.51	broad
47	8	123.38	113	134	6.09	tall
48	12	72.83	67	77	3.69	medium
51	14	43.50	41	48	1.74	broad
52	14	33.79	32	37	1.58	medium
54	12	26.17	23	30	2.25	medium
55	14	53.93	49	57	2.37	tall
65	6	129.33	121	138	5.61	very broad
66	14	109.00	102	117	4.72	broad
8:1	13	77.32	72.08	88.37	4.18	medium
17:1	12	73.43	67.72	80.23	3.52	medium
17:8	10	94.72	88.11	100	4.32	medium
9:8	13	70.65	67.11	75	2.58	broad
47:45	6	89.30	81.88	97.1	6.13	medium
48:45	6	52.14	49.66	55.8	2.63	medium
52:51	14	77.36	72.27	85.71	3.75	low
54:55	12	48.65	42.59	57.14	4.14	medium
Females						
1	5	177.80	169	183	5.54	long
5	5	99.60	96	102	2.30	long
8	5	138.80	135	149	5.85	medium
9	7	98.29	91	105	4.57	broad
17	4	(133.75)	(130)	(138)	(3.86)	(tall)
40	3	(91.00)	87	93	(3.46)	short
45	1	(129.00)	–	–	–	(broad)
47	2	(116.50)	(116)	(117)	(0.71)	(tall)
48	6	68.00	63	71	3.35	medium
51	6	41.67	38	46	2.73	broad
52	6	33.67	31	35	1.37	medium
54	4	(24.00)	(22)	(26)	(1.83)	(medium)
55	7	50.43	45	55	3.05	medium
65	2	(118.00)	(113)	(123)	(7.07)	(broad)
66	5	96.60	90	106	6.50	medium
8:1	5	78.13	73.77	84.18	4.32	medium

(continued)

Table 10. Continued

Martin No.	*N*	Mean	Min.	Max.	Standard deviation	Class of mean value
17:1	4	(75.30)	(71.04)	(77.51)	(2.93)	(medium)
17:8	4	(95.80)	(91.28)	(100)	(3.58)	medium
9:8	5	69.48	67.41	71.85	1.94	medium
47:45	0	–	–	–	–	–
48:45	0	–	–	–	–	–
52:51	6	81.04	73.91	89.47	5.42	low
54:55	4	(47.35)	(43.14)	(53.06)	(4.32)	(narrow)

Table 11. Statistical parameters of postcranial measurements in the tenth–eleventh century graves

Martin No.		N	Mean	Min.	Max.	Standard deviation
Males						
Humerus 1	dex.	15	322.9	294	348	15.10
	sin.	13	320.9	296	339	14.63
Radius 1	dex.	12	248.3	221	266	12.14
	sin.	12	248.1	223	269	12.80
Ulna 1	dex.	12	269.0	242	291	13.60
	sin.	11	266.8	242	285	12.58
Femur 1	dex.	19	453.1	409	483	20.32
	sin.	20	454.4	405	489	20.88
Femur 19	dex.	17	48.9	44	53	2.25
	sin.	14	49.2	46	53	1.93
Tibia 1	dex.	18	357.9	313	386	18.98
	sin.	17	361.5	317	386	18.25
Fibula 1	dex.	7	354.3	322	380	18.72
	sin.	5	352.8	327	384	21.18
Stature (cm) (From Hu, Ra, Fe, Ti)		21	168.1	155.26	177.01	5.20
Females						
Humerus 1	dex.	8	296.1	263	309	14.55
	sin.	9	299.4	282	317	12.17
Radius 1	dex.	10	231.7	222	245	6.34
	sin.	8	231.4	223	239	5.01
Ulna 1	dex.	5	253.2	241	263	8.07
	sin.	6	247.8	235	260	8.38
Femur 1	dex.	21	417.9	391	457	14.79
	sin.	22	415.6	366	461	19.55
Femur 19	dex.	14	42.1	39	45	1.96
	sin.	15	42.0	38	45	2.07
Tibia 1	dex.	17	336.4	308	356	12.89
	sin.	16	333.5	307	356	12.94
Fibula 1	dex.	5	335.8	321	351	12.40
	sin.	5	335.0	320	347	11.51
Stature (cm) (From Hu, Ra, Fe, Ti)		24	157.8	142.78	166.54	4.97

Fig. 25–26. Spondylolysthesis with consecutive inflammation and L4–L5 block vertebra (Grave 80: maturus male)

Fig. 27–28. Healed fracture (cutting?) on the left clavicle and on the left side of the mandible. The premortem loss of the lower left canine and first premolar may have been a consequence of the mandibular injury (Grave 57: adultus male)

surfaces of the sacroiliac joints, as well as new bone formation manifested as coarse granular structures. The left ilium even became attached to the sacrum in the retroauricular area *(ankylosis)*. In this case, the lesions are probably caused by an infection (Fig. 29). In Grave 87, a woman in the early years of adulthood, had her first and second lumbar vertebrae fused into a block. This may also have been caused by some kind of infection (such as tuberculosis) (Fig. 30). In the two cases presented here, it is impossible to confirm the infection with complete certainty using only macromorphological methods.

Disorders of the hematopoietic system. The development of a porous bone surface on the orbital roof and the cranial vault (which is formed as a result of the thinning of the outer layer, the *tabula externa* of the frontal bone caused by the hypertrophy of the spongy *diploë* underneath) is called porotic hyperostosis. As the cause of this lesion, the literature usually refers to iron deficiency anemia, which can develop as a result of infectious diseases, insufficient nutrition, or malabsorption of nutrients.[52] This type of lesion occurred in four individuals: in Grave 47 (adultus male), Grave 48 (maturus male), Grave 49 (4–6-year-old child), and Grave 70 (adultus female). Each of these people displayed only a mild form of porotic hyperostosis.

Metabolic and hormonal diseases. Osteoporosis (the loss of bone mass) could be observed in three individuals (Grave 99: maturus man, Grave 106: senilis woman, Grave 110/B: maturus woman). Osteoporosis can primarily be recognized in archaeological material by the fact that the bones of the affected individual are much lighter in comparison with the corresponding skeletal elements of other individuals from the same site.[53] (Assuming that the decomposition of the bones took place under comparable taphonomic conditions at the given site.) The decrease in bone density affects spongiosa-rich bones to the greatest extent (vertebrae, pelvis, sternum, ribs) and, among the long bones, the trabecular structure of the neck of the femur. Susceptibility to fractures increases due to a decline in bone density. As a consequence of micro-fractures in the vertebral end plates, characteristically biconcave, so-called "fish vertebrae", as

[52] White et al. (2012) 448–450; Nikita (2017) 308–310.

[53] Ortner (2003) 410.

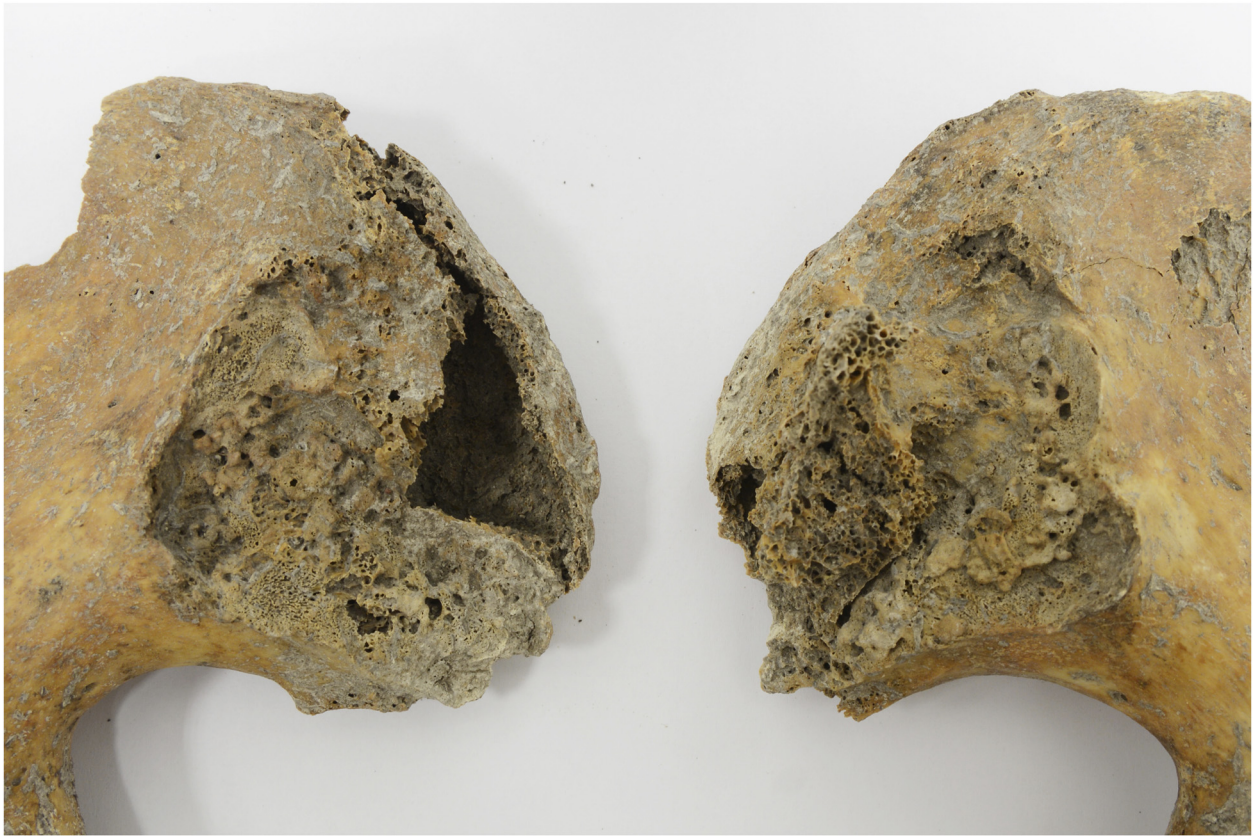

Fig. 29. Inflammation of the sacroiliac joints (infection?), bony ankylosis between the sacrum and left ilium (only the fragmentary evidence of the ankylosis can be seen in the picture) (Grave 73: senile female)

Fig. 30. Presumed tuberculosis-infection, L1–L2 block vertebra (L1 collapsed) (Grave 87: adultus female)

well as collapsed, wedge-shaped vertebral bodies may develop.[54] Osteoporosis in the Himod material was recognizable by the light weight of the bones (especially the vertebrae). It was advanced in the case of the senilis woman found in Grave 106. As a consequence of osteoporosis, she also suffered from degenerative arthrosis affecting many of her joints.

It is suggested here, that the gracile bones of a juvenile individual found in Grave 108 may have been caused by some metabolic disorder. The surviving skeletal elements are particularly slender. (The number of such remains is small. Only the incomplete bones of the upper torso, as well as the fragmentary pelvis and sacrum were excavated as they fell into the excavated width of the road's future track.) The epiphyses of the humeri have already fused to the diaphysis. Thus, a stature of 147.2 cm could be estimated from their lengths. The vertebrae and the skull of this individual were quite small.

Joint diseases. Degenerative changes of the spine were commonly recognized. They could be observed in a total of 34 individuals, nearly 60% of all adults (Graves 30, 47, 48, 50, 53, 54, 57, 58, 67, 68, 69, 73, 74, 80, 81, 83, 84, 85, 86, 87, 88, 99, 102, 106, 107, 110/A, 110/B, 111, 116, 119, 122, 133, 138, and 144). These changes were more common among males (22 men: 75.86% of adult men, 12 women: 42.86% of adult women). They occurred often (at least twice as frequently) in the older, maturus and senior age cohorts, than in adultus. In the vast majority of cases, the changes affected the entire vertebral column.

[54] Ortner (2003) 411.

Degenerative arthrosis of the extravertebral joints occurred in 13 burials (22.81% of adults). The list of the affected individuals and joints is as follows: Grave 48 (maturus male): both elbow joints (particularly severe in the right elbow), the left wrist and the left knee. Grave 50 (maturus male): the left shoulder joint and both elbow joints. Grave 73 (senilis female): the sternoclavicular joints, the joints between the sternum and the first ribs, and the glenohumeral (shoulder) joints. Grave 80 (maturus male): hip joints, elbow joints and the sacroiliac joints. Grave 83 (maturus male): the right temporomandibular joint, both shoulder joints, the joints between the sternum and the ribs, both elbow joints (more severe on the right side), both sacroiliac joints (inflammation can also be observed here). Grave 85 (maturus male): both wrist joints. Grave 86 (maturus male): hip joints and the right elbow joint. Grave 89 (maturus female): in the sacroiliac joints and at the symphysis; extremely severe abrasion and erosion are visible (Fig. 31) on the right pubic bone. Grave 99 (maturus man): degenerative arthrosis of the hip joints as a result of Legg-Calvé-Perthes disease, a childhood hip disorder. Grave 102 (adultus female): left elbow joint, both wrist joints. Grave 106 (senilis woman): developed due to advanced osteoporosis, the right mandibular joint, both shoulder joints, both ends of the clavicles, both hip joints, both sacroiliac joints, and both knee joints are affected. Grave 107 (maturus male): in the shoulder joints, both ends of the clavicles, the handle of the sternum *(manubrium sterni)*, the distal ends of the forearm bones (but especially on the left side), and the carpal bones. Grave 119 (adultus male): in the elbow joints. It is clear from the list that arthrosis of the extravertebral joints also occurred in the majority of cases in the older age cohorts. In terms of localization, it is most common in the elbow joint, where it could be observed in 7 individuals (6 men, 1 woman). Examining the distribution by sex, degenerative arthrosis is approximately twice as common in males as in females (9 men: 31.03% of adult men, 4 women: 14.29% of adult women), which indicates a greater physical load on men, as well as the difference between the sexes in the incidence of changes observed on the vertebral column.

Other changes. Developmental abnormalities include mild vertebral malformation, sacralisatio, seen on the skeleton in Grave 68 (adultus-maturus male). This can be observed both in the lumbar and coccyx directions in this individual. The coccyx is ossified to the sacrum; furthermore, the transversal processes of the fifth lumbar vertebra are broadened, thereby looking similar to the sacral vertebral segments (due to high fragmentation, it is impossible to examine whether ossification took place between these two bones). The maturus

Fig. 31. Severe degenerative arthrosis on the right pubic symphysis (Grave 89: maturus female)

woman in Grave 74 had a severe congenital scoliosis resulting from a developmental disorder in several vertebrae. This condition is caused by various vertebral abnormalities occurring during the first four weeks of fetal development, the two main types of which are disorders of segmentation and morphological anomalies.[55] In the case under discussion here, a form of shape deviation, so-called contralateral hypoplasia and segmentation disorder are present together with multiple block vertebrae. In the case of lateral hypoplasia, one side of the vertebra lags behind in development, resulting in a laterally wedge-shaped vertebral body. In the case of contralateral hypoplasia, the developmental disorder affects several vertebrae, some of which are hypoplastic on the right side and others on the left side, so the spine develops an S-shaped curvature in the medio-lateral plane. Vertebrae and even ribs may fuse.[56] For the woman in Grave 74, the right side of the 1–2 thoracic vertebrae, the left side of the 4–8 thoracic vertebrae, and again the right side of the 10–11 thoracic vertebrae were hypoplastic. Severe curvature is visible in the middle section, at the 4–8 thoracic vertebrae. The right side of the vertebral bodies (in a small part), the right articular processes, and the right side as well as the central part of the vertebral arch that was ankylosed between the 1–2 thoracic vertebrae. The bodies of the 4–7 thoracic vertebrae are completely fused so that the intervertebral gaps became invisible. Moreover, the articular processes and spinous processes also grew together and the transversal processes are fused alternately on the right and on the left side (Figs 32 and 33). As a result of this spinal deformity, the shape of the ribs and sternum also changed and

Fig. 32–33. Congenital scoliosis, contralateral hypoplasia and multiple block vertebrae on the thoracic spine. The pictures are showing the complete thoracic section from ventral and from dorsal view (Grave 74: maturus female)

[55] Kilgore and van Gerven (2010) 633.

[56] Barnes (2012) 81, 92.

Fig. 34. Warped and asymmetric sternum due to congenital scoliosis (Grave 74: maturus female)

developed a torsion (Fig. 34). No anomaly can be detected on the surviving four lumbar vertebrae of the same woman, but the shape of the pelvic bones is asymmetric. There is a striking difference between the right and left *incisura ischiadica major* and *facies auricularis*. The two facies auricularis are anyway abnormal in size and shape, the one on the left side is especially small (Fig. 35). The sacrum is missing.[57]

In Grave 99 (maturus male), an ossification disorder of the left patella *(patella bipartite)*, occurred, while the right patella showed normal development. Various malformations of the sternum could be detected in four individuals: in Grave 123 (adultus female), the forward bulging deformity of the sternum, a mild form of the hen's breast *(pectus carinatum)* could be observed; in Grave 54 (adultus woman) a perforated sternum (a developmental anomaly, *fenesratio sterni*) could be identified. Osseous fusion between the corpus and manubrium sterni occurred in Graves 73 (senilis woman) and 138 (maturus woman).

Here the Legg-Calvé-Perthes disease is worth discussing. This condition can be traced back to a blood supply disorders of the epiphysis of the head of the growing femur which causes necrosis of the epiphysis (the cause is unclear, but traumatic effect may be assumed). As a result of a consequential compression fracture and in the absence of enchondral growth, the head of the femur develops a flattened form, its rim widens and becomes mushroom-shaped.[58] This disease is much more frequent in males, about four times more common than in females.[59] The lesion observed in our material occurred in the maturus man found in Grave 99. Both femoral heads were flattened and widened, but the deformation is more obvious on the right side, and even pronounced rim formation can be detected on the joint's outline. The diameter of the right *caput femoris* is 56 mm, which is 5 mm larger than measured on the left one, while the maximum length of the right femur is 430 mm, which is 16 mm less than on the left side. The articular surfaces of both capita show porosity (this is especially pronounced in the right femur), the attachment site of the *ligamentum teres,* the depression of the *fovea capitis femoris*, was filled with new bone on both sides. In Perthes' disease, the femoral neck is often shortened and widened,[60] which in this skeleton can be seen better on the left side, only because the right femur is fragmentary and incomplete (Figs 36 and 37). Bilateral involvement in Perthes' disease is rare, it occurs in approximately 10% of the cases. Hypothyroidism (underperformance of the thyroid gland) and epiphyseal dysplasia (developmental disorder of the long bone epiphyses), where femoral heads are abnormally shaped bilaterally, can be ruled out in this case, because those conditions also affect other skeletal parts. Consequential arthrosis can be observed in both hip joints, the acetabula have widened and became shallower and a characteristic rim has formed on their edges (Figs 38 and 39).

The ossification of ligaments in various places was found in four individuals. These lesions may have been caused by different factors although in the majority of cases the most likely cause is trauma. In Grave 67 (maturus male), the osseous ankylosis of the 1–2 cervical vertebrae can be observed. This is the consequence of the ossification of the *ligamentum transversum* and *ligamentum interspinale* (Figs 40–42). Complex deformations were identified in the cervical vertebrae of the senilis woman in Grave 73. The shapes of both the *foramen magnum* and the first cervical vertebra are asymmetrical, and the small section on the left side of the *ligamentum transversum atlantis* is ossified (Fig. 43). An abnormal depression can be seen at the edge of the opening of the *foramen magnum*, right behind the right occipital condyle (Fig. 44). The bodies of the 5–6 cervical vertebrae were fused in the back and on both sides. Their articular processes have also grown together on the right side (through the ossification of the joint capsule). However, the articular gap between the bodies of the two vertebrae was preserved (Figs 45–47).

Ligament ossification can be seen on the anterior surface of the left mandibular head of the maturus man found in Grave 99. This is the attachment point of the lateral pterygoideus muscle. The caput and the articular surface are intact. There is an approximately 15 by 15 mm exostosis on the occipital bone at the inferior level of the *linea nuchae* of the maturus man identified in Grave 133. Enthesopathy

[57]We thank Andrea Hegyi for her observations regarding these anomalies.

[58]Ortner (2003) 346–349.

[59]Aufderheide and Rodríguez-Martin (1998) 84.

[60]Aufderheide and Rodríguez-Martin (1998) 84.

Fig. 35. Small and asymmetric facies auricularis on both ilia (the sacrum is missing) (Grave 74: maturus female)

Fig. 36–37. Legg–Calvé–Perthes-disease with bilateral involvement, the left and right femur, dorsal view (Grave 99: maturus male)

occurred in 29 individuals (Graves 41, 47, 48, 50, 58, 67, 68, 69, 73, 80, 81, 85, 86, 88, 99, 102, 106, 107, 110/A, 110/B, 111, 116, 119, 122, 123, 125, 133, 138, and 139). This anomaly is more common in males: it occurred in 22 men (75.86% of adult men) and only 7 women (25.00% of adult women). In 15 individuals, enthesopathies were observed on the bones of both the lower and upper extremities. In 14 cases, they occurred only on the bones of the lower limbs.

COMPARISON WITH SOME CONTEMPORY ASSEMBLAGES

The data from the Carolingian period section of the Himod cemetery is insufficient for calculating Penrose distances. The tenth–eleventh century part is also at the lower limit of statistical applicability, but an attempt was made to compare it

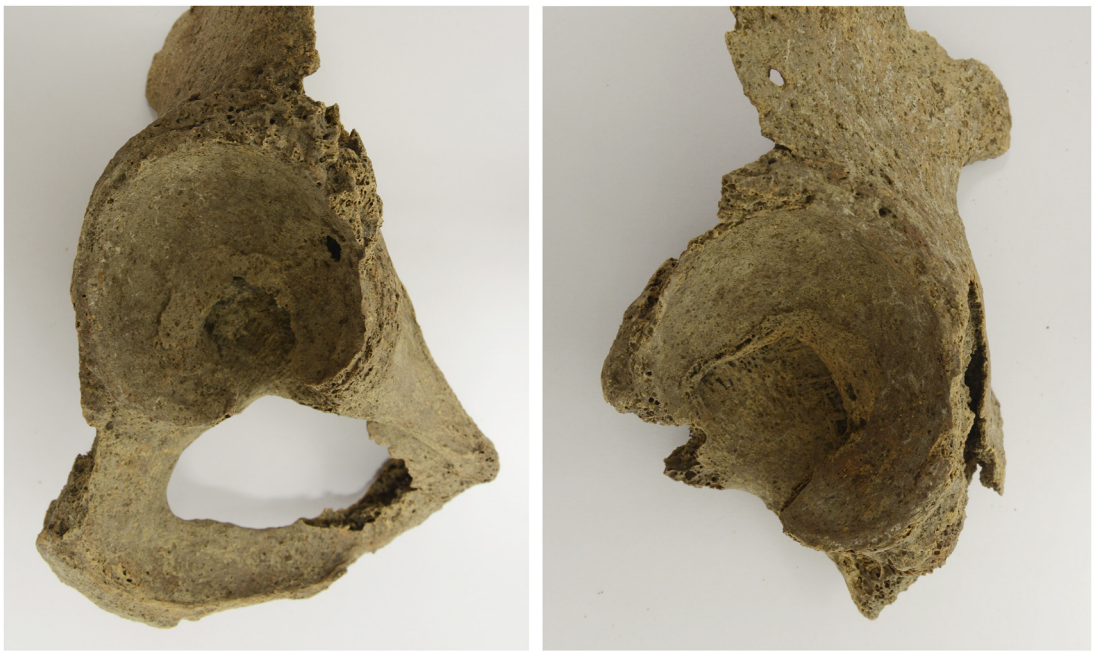

Fig. 38–39. Degenerative arthrosis of hip joints as a consequence of Legg–Calvé–Perthes-disease. Both acetabula are broader and shallower than normal (Grave 99: maturus male)

with other contemporaneous series of human remains from Transdanubia, bearing in mind the limitations of the validity of this multivariate method. The study was based on ten cranial measurements from male skeletons (M 1, 8, 9, 17, 40, 45, 48, 51, 52, 54). The following, tenth–eleventh century series were included in our comparison, within the framework of the *Árpád-ház Program*, also intended for aDNA analysis: Sárbogárd-Tringer-tanya,[61] Székesfehérvár-Rádiótelep (Bikasziget),[62] Székesfehérvár-Sóstó,[63] and Visegrád-Esperesi cemetery (listed as Visegrád-Várkert in the physical anthropology study[64]). Measurements from the eleventh century site of Zalavár-Vársziget were also compared.[65] In the case of these other assemblages, the selected cranial measurements are available, and the number of cases is also sufficiently large (although Székesfehérvár-Rádiótelep, like Himod, is considered a borderline case from the point of view of sampling bias). The Penrose test showed no similarity to either of the samples used in the comparison.[66] The eleventh-century specimen from Zalavár-Vársziget is closest to Himod with a distance value of $C_R^2 = 0.281$. The Himod men are distinguished from the other samples included in the comparison primarily by their broad foreheads and broad faces. However, their cranial dimensions tend to also be generally larger for most measurements. On the other hand, a significant similarity was found between the male crania from Sárbogárd and Székesfehérvár-Sóstó. The sample from the Visegrád-Esperesi cemetery is different from all the other examined assemblages. (The distance values between the individual series are listed in Table 12, the dendrogram constructed from the distance values is shown in Fig. 48).

BRIEF SUMMARY OF THE PHYSICAL ANTHROPOLOGY DATA

The small number of cases in the Himod assemblages, especially in the ninth century Carolingian series, does not allow for detailed demographic, metric and taxonomic analysis and comparison. Samples that do not fully conform to the criteria of statistical testing reflect reality within certain boundaries. The proportion of children in the graves dating to the Carolingian Period is higher than expected, while their contribution is much smaller in the burials from the tenth–eleventh century section of the Himod cemetery. In both sections, the proportion of women is higher than that of men in the adultus age cohort; the ratio of biological sexes is balanced. The osteological measurements taken in the two parts of the cemetery cannot be compared to each other. However, the long skull and the broad forehead apparently represent a shared morphological feature. In the tenth–eleventh century section of the cemetery, tall people represent the majority for both sexes; male skulls are characterized by large absolute dimensions, especially broad foreheads and broad faces. According to the traditional nomenclature of cranial morphology, the population belonged to the Europid form. Although a small contribution of

[61] Éry (1968).

[62] Éry (2008).

[63] Éry (2008).

[64] Pap and Susa (1986).

[65] Unpublished data kindly provided by Sándor Évinger.

[66] On the level of 1% probablity, series of measurements are considered similar in statistically significant terms when their distance equals or is less than 0.197.

Fig. 40–42. C1–C2 block vertebra from above, ventral and dorsal views (Grave 67: maturus male)

individuals with short skulls can also be observed in both sexes, most of the crania examined are of the Nordoid and Cromagnoid-A types.

There was an abundance of pathological cases in the skeletal material from the tenth–eleventh century section of the cemetery. Fractures, degenerative changes of the spine and extravertebral joints (especially the elbow joint) should be highlighted due to their high frequencies. The occurrence of these pathological phenomena also marks a difference between sexes and indicates that there was a greater physical strain on men. Another noteworthy condition is the congenital scoliosis, a rare developmental anomaly, observed on the vertebral column of the maturus woman in Grave 74.

The physical anthropological data could neither confirm nor refute the hypothesis that there may have been population continuity between the two early medieval periods represented in the excavated part of the cemetery. There were only a few adults in the 25 graves dated to the Carolingian period, which can be considered a small sample to begin with. Moreover, the preservation of these remains was also poor. Therefore not much can be said about the general physical characteristics of this population since there is only a few individual data, which are not sufficient for drawing far-reaching conclusions. In the future, the analysis of aDNA samples taken from the two sections of the cemetery may help to answer the question of whether there was population continuity. Results can also be expected from radiocarbon dating Grave 68 at the site. Based on its depth and size, the excavating archaeologist dated this grave to the early Árpád Period, although the knife with a "bone" handle with dot-and-circle decoration found near the man's body, as mentioned before, could also be associated with the Carolingian tradition by the analyst of the Árpád Period

Fig. 43. Asymmetrically shaped C1, a small part of the *ligamentum transversum atlantis* ossified on the left side (Grave 73: senile female)

Fig. 44. Asymmetrically shaped foramen magnum, anomalous hollow posterior to the right condylus occipitalis (grave 73: senile female)

section of the cemetery. Unfortunately, the head section of the grave was destroyed while excavating Feature 47 (a pit dated to the Early Modern Age).[67] As a result, it is impossible to examine how well the man's cranial morphology fit with those observed in the Árpád Period part of the cemetery, which otherwise does not display a completely homogeneous morphological picture. With his tall stature as estimated from the long bones, this man fits nicely into the general picture of the Árpád Period population observed here, but this similarity does not prove anything in itself. No parallels could be found when data was compared using Penrose analysis from the tenth–eleventh century section of the cemetery with some contemporary skeleton burials from Transdanubia. The men of Himod stand apart from the other assemblages due to their larger cranial measurements, especially their wide faces and broad foreheads.

THE QUESTION OF CONTINUITY, WITH REGARD TO RESULTS FROM PHYSICAL ANTHROPOLOGY AND ARCHAEOLOGY ANALYSIS

Studies of human osteology could neither prove nor disprove continuity. However, our observation, on the basis

[67] In Ciprián Horváth's work, Feature 47 is erroneously called Feature 48. Cf.: Horváth (2022) 15. However, based on the excavation log, it was possible to clarify the typographic error. According to Péter Tomka's diary, Feature 47 may have been a round storage pit, in which, in addition to fragmented prehistoric ceramics, small pot shards datable to the Early Modern Age were also found. At the bottom of the feature there was a large stone, which the excavator interpreted in his diary as a "cabbage fermenting stone weight". For the background of this latter term see: Szabó (1936).

Fig. 45–47. C5–C6 block vertebrae (grave 73: senile female)

Table 12. Penrose distance values (C_R^2) between the tenth–eleventh century male graves of Himod and some contemporaneous series of males. Hi: Himod-Káposztáskertek, Sá: Sárbogárd-Tringer-tanya, Rá: Székesfehérvár-Rádiótelep (Bikasziget), Só: Székesfehérvár-Sóstó, Vi: Visegrád-Esperesi temető (Várkert), Za: Zalavár-Városziget

	Hi	Sá	Rá	Só	Vi	Za
Hi	–	–	–	–	–	–
Sá	0.770	–	–	–	–	–
Rá	0.724	0.286	–	–	–	–
Só	0.629	0.168	0.305	–	–	–
Vi	2.539	1.390	1.800	1.290	–	–
Za	0.281	0.457	0.541	0.315	2.213	–

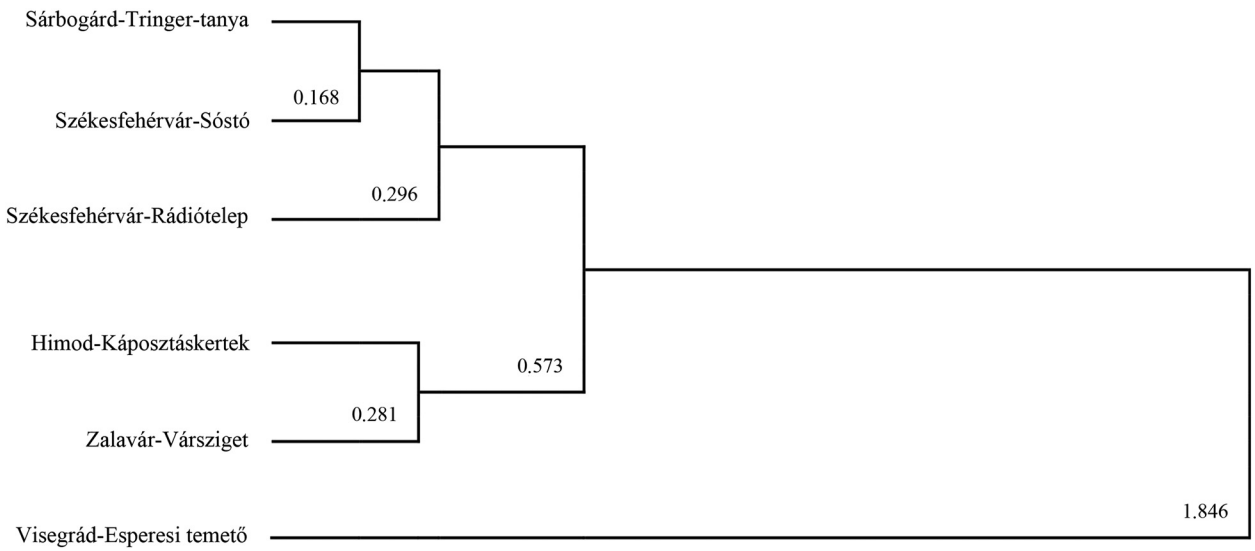

Fig. 48. Dendrogram constructed from Penrose-distances between some Transdanubian tenth–eleventh century male series

of which the measurable osteometric data of Grave 68 fits within the early Árpád Period skeletal finds, supports the assumption that this case represents site continuity rather than population continuity. In this regard, it is worth briefly considering again the type of knife presented by Ciprián Horváth, as well as its wider cultural context and chronological evaluation. As already pointed out by this eminent specialist, the object is typically found in ninth century contexts in the Carpathian Basin, where it was usually associated with women's graves.[68] In this case, however, the knife was found in a man's burial. Similar knives with straight-backed blades[69] and antler[70] as well as bone handles[71] are known from the tenth–eleventh century, although their handles are usually not decorated. The design of the knife found in the Himod grave is closely related to Group 1 of the typology established by Béla Miklós Szőke.[72] In a broader sense, the Hungarian researcher dated this type of object to the second half of the ninth century and the first half of the tenth century. Then, in his summary work – based on the data available – he placed this knife type at the turn of the ninth and tenth centuries (between the last third of the ninth century and the beginning of the tenth century).[73] However, he later refined his dating proposal in the light of new finds. He touched upon the issue again in connection with the grave remains discovered at the site of the Szombathely-Szent Márton-templom.[74] The remains of an early churchyard were found at this site.[75] A knife with a dot-and-circle decorated antler handle was also found in Grave 7 excavated at that site (Fig. 49).[76] Although the piece differed from the main type analyzed by Béla Miklós Szőke in terms of the design of the tang,[77] its attribution was accepted even by him.[78] The excavators unambiguously dated this burial to the ninth century.[79] Béla Miklós Szőke, however, disputed the typochronological dating, pointing out that the object type may have been present in the tenth century as well.[80] The grave is definitely close to the Himod find in that the knife was also found in a male burial.[81]

Regarding the analysis of the object type, several researchers later commented on the statement of Béla Miklós

[68] Szőke (1982) 24–25; Müller (2004) 14. This observation has been confirmed by contemporary research. Maja Petrinec mentions a case as an exception: Petrinec (2009) 298. According to the description of František Kalousek, Grave 174, a man's burial at the site Břeclav-Pohansko, Czech Republic, contained a knife with a wooden handle. Cf.: Kalousek (1971) 111, No. 3. The problems surrounding this issue are shown by the fact that Béla Miklós Szőke is also uncertain regarding the raw material of the handle. Cf.: Szőke (1982) 38; Kalousek (1971) 138 regarding the knife found in Grave 232 from that cemetery,.

[69] Ahrens Type 2.2 (Ahrens 1983, 57–59). Cf.: Szőke (1982) 23.

[70] According to observations by Blanka Kavánová these handles were made of antler in Mikulčie. Cf.: Kavánová (1995) 214.

[71] Szőke (1982); Catalogo Brescia (2001) 473, No. 81e.

[72] Szőke (1982) 24.

[73] Szőke (1982) 31–32.

[74] Szőke (2010) 35.

[75] Kiss (2005).

[76] Kiss (2000) 245. The knife handle in this case was certainly made of antler. We are indebted to Bertalan Zágorhidi Czigány for the visual study and identification of this object.

[77] The Central European occurrence of the knife type (analyzed by Béla Miklós Szőke) was evaluated in Austrian research as a typical sign of Carolingian and Bavarian influence, based on the design of the tang and the length of the blade. Cf.: Breibert (2005) 410. Erik Szameit also drew attention to the fact that the handle may have been made of wood for the simpler parallels to this type of knife. Szameit (1990) 117.

[78] Szőke (2010) 35, n. 113.

[79] This find was placed in "Period A" of the cemetery, dated to the ninth century: Kiss and Tóth (1993) 185; Kiss (2000) 252.

[80] Szőke (2021) 184, n. 1386.

[81] Kiss (2000) 245.

Fig. 49. The knife from Grave 7 of the Szombathely-Szent Márton-Church site

Szőke. In connection with his analysis of the Hainbuch cemetery, Erik Szameit drew attention to the fact that the knife type may have appeared in Lower Austria as early as the second half of the eighth century.[82] A similar opinion was expressed by Maja Petrinec, who placed the occurrence of the knife type at the end of the eighth century based on the age of the finds from the Auhof-Perg cemetery in Upper Austria.[83] Her opinion was also confirmed by Blanka Kavánová's analysis of similar antler knife handles found in the area of Mikulčice, Czech Republic, where among the finds, there were also objects connected to the era preceding the Moravian period.[84]

However, in light of recent finds in Croatia, Maja Petrinec also drew attention to the fact that this knife type was also been present in the middle of the tenth century artifactual material from Croatia.[85] The tenth century dating is even confirmed by additional finds. They include the fragment found (in all probability in a grave) in the area of the Church of the Virgin Mary in Libice, Czech Republic, highlighted by Béla Miklós Szőke and classified as part of the same group.[86] He also directed attention to the fact that the fragments found in Grave 70 from the ninth–eleventh century cemetery in Trnovec nad Váhom, Slovakia (Hungarian name: Tornóc) may be dated to the tenth century.[87] However, that female grave can be classified as belonging to the tenth century part of the cemetery, not only based on the flat edged arrowhead found in the burial context,[88] but also based on its wider find environment.[89] The dating to the middle and second half of the tenth century has recently been confirmed by data mentioned by Maja Petrinec. She referred to such an object having been found at the site of Šibenik-Sv Lovre, Croatia (Church of Saint Laurence), in a context that could be dated to the second half of the tenth century.[90] A similar piece which, in terms of design, partially shows similarities with Type 3 described by Béla Miklós Szőke, came to light in Kremsburg in Styria.[91] Austrian experts dated that assemblage to the end of the tenth century on the basis of the S-shaped lock rings found among the grave goods recovered from Grave 11.[92] However, it can be said that carved bone and antler knife handles were used in the northern Slavic areas in the tenth century. Their handles were also decorated. However, they were not made of plates fixed with rivets, but – as Béla Miklós Szőke also describes – the tang was embedded directly into the bone/antler handle.

One should not forget the other reference made by Béla Miklós Szőke regarding the Szombathely knife. In connection with the find from the site of St. Martin's Church, the researcher also indicated that knives with antler (or bone) handles were found at tenth century sites on the Great Hungarian Plain (Eastern Hungary)[93] that fell within the habitation area occupied by Hungarians.[94] Despite the fact that the piece found by Attila Kiss in Majs differs from the type presented above,[95] it is possible that the specimen found in the Maroslele-Temető site,[96] included in the material he collected, likewise belonged to this group.[97] This attribution is indicated by the long handle and relatively short blade of that knife, as well as the fact that its handle comprised two pieces. Csanád Bálint even managed to

[82] Szameit (1990) 109–112, 117. Cf.: Breibert (2005) 410; Nowotny (2005) 220.

[83] Petrinec (2009) 298. Cf.: Szőke (1982) 35.

[84] Kavánová (1995) 215. For the periodization see: Klanica (1995).

[85] Petrinec (2009) 299.

[86] Turek (1969) 130. For interpretations of the site see also: Princová and Mařík (2006).

[87] Szőke (1982) 38.

[88] Točík (1971) 143.

[89] Točík (1971) 143–144, 146, 151, 155.

[90] Petrinec (2009) 299.

[91] Kühtreiber and Obenaus (2017) 165, Taf. 108.

[92] Kühtreiber and Obenaus (2017) 165.

[93] Szőke (2010) 35.

[94] Hermann (1985) 283.

[95] Majs-Udvari rétek Grave 532. Kiss (1983) 111, 207. (the latter page contains an erroneous grave number).

[96] Kiss (1983) 207. Attila Kiss linked this find to Grave 4. Based on the data in the Móra Ferenc Museum, the artifact was not found in Grave 4, this record must be wrong. Such information is not included in Csanád Bálint's work referring to the find either (Cf.: Bálint 1991, 239). The find was identified and inventoried by Attila Türk in 2000 (inventory number: MFM 2000.3.3.), and is currently on display in the exhibition of the Ópusztaszer Memorial Park. We would like to thank our colleagues Sándor Varga, Dénes Kristóf Szabó, and Andor Pataki for their kind help.

[97] Bálint (1991) 239.

observe carving on it.[98] In this case too, the S-shaped lock ring jewellery probably dates the artifact to the later decades of the tenth century or the eleventh century.[99] It may have been one of the latest knives of its kind that could be associated with the group of artifacts examined above. The other finds, almost the same age as the Maroslele specimen and following a similar design, was found in Graves 1 and 3 of the cemetery in Ibrány. There was one knife of this type in these burials. The knife handles were each fitted with two bone plates. The straight-backed blade was 7 cm in length, while the bone-covered handle itself was 17–18 cm long.[100] In the case of these pieces, however, it was no longer possible to observe any decoration, so the possibility arises that (perhaps together with the Maroslele knife) they were rather local copies of the finds presented above, or even that they were already the first examples of later medieval types.[101] However, what further connects these burials with the finds from Szombathely and Himod is that they were also found in men's graves. Unfortunately, the question cannot be answered today whether the knife from Grave 6 at Tuzsér, together with associated remains of a wooden and bone/antler plate, could have belonged to the same type in any respect.[102] The traditional long blade design of the knife suggests not.[103] In any case, based on the wooden remains mentioned by András Jósa, it is likely that it was similar to the knife defined by Béla Miklós Szőke as Type 3.[104] Such was the case in Grave 789 at Majs-Udvari-rétek,[105] Grave 417 at Vörs-Majori-dűlő,[106] or Grave 189 at the Deszk-Nádashalmi-dűlő/D cemetery[107] and Grave 36 in Úľany nad Žitavou (Zsitvafödémes), Slovakia.[108] In the case of these handles, diaphyses of long bones were unambiguously worked to produce the riveted plates of the knife handle. Thus, their design is similar to those placed in stylistic Group II by Béla Miklós Szőke (Fig. 50).[109]

Research by Béla Miklós Szőke already directed attention to the fact that the decoration of the antler handles of knives with short blades from the ninth century may have included numerous variants, which in part could have represented more complex patterns beyond the simple circle-and-dot decoration.[110] In his work, Ciprián Horváth also addressed the dot-and-circle parallels of the decoration on the Himod knife, including the aforementioned find from Szombathely within the scope of this investigation.[111] Blanka Kavánová, in connection with the discovery of the knife finds in Mikulčice, also drew attention to the fact that decorative motifs observed on the outer surface of the antler (both the simple and more complex patterns) can present side by side at the same site and the background to their creation may be mainly the care invested by the craftsperson who made the knife.[112] In this regard, it is also worth mentioning the "carved arched antler stick" from Grave 230 of the tenth–eleventh century cemetery excavated at the Wiesenacker vineyard site in Rusovce (Oroszvár), Slovakia.[113] In terms of the decoration and design the find is a unique specimen, to date lacking any exact parallel – as far as we know –in the material legacy of the tenth century Carpathian Basin.

The Bronze Age occurrence of similar objects, and their use in much later periods suggests that such decorative elements may have reached the population of the tenth century from many other sources.

This find, in our opinion, can also support the idea that the decorative structures existing in the various Moravian and Carolingian peripheral areas may also have occurred during the tenth century in the contact zone – in which the Himod site also falls.[114] Due to the simple nature of the dot-and-circle decoration itself, it was also present in the tenth century repertoire of antler and bone decorative motifs in the Carpathian Basin (although not necessarily on knife handles).[115]

On the other hand, despite the fact that we only know a fragment of the Himod cemetery, it is worth taking a broader look at the whole of the excavated sections. Grave 68 was further away from the excavated group of burials definitely dated to the ninth century, and a considerable distance can be seen between it and the most peripheral ninth century burial (Grave 97/A) toward the north. As far as is known today, no remains of the ninth century community have been found in this area. It is assumed that this part of the cemetery was probably in use during the tenth century based on the additional burials furnished with grave goods (Graves 47–48, 53, and 94) lying in the proximity of Grave 68.[116] Needless to say, one can only hope for a definitive answer from integrating results of investigations in natural science, or on the basis of an exploration that strives for completeness and the analysis of finds recovered in this way.

[98] We are indebted to Csanád Bálint for the data related to the evaluation of the knife. Currently, no trace of such decoration can be observed on the handle.

[99] László Révész dated the site to the eleventh century. Cf.: Révész (2020) 105, 113, 152–153.

[100] Istvánovits (2003) 71.

[101] Concerning finds relevant to the high Middle Ages see: Gere (2003) 70–72.

[102] Istvánovits (2003) 329.

[103] Jósa (1900) 219, Figure 11, 223.

[104] Révész (2000) 12; Istvánovits (2003) 237.

[105] Kiss (1983) 130, 167. The knife back also was not straight but rather beaten into a convex form, as was the case with the knife described by Béla Miklós Szőke.

[106] Hegyi and Költő (2017) 602.

[107] Kovács (2019) 477–478.

[108] Liptáková (1963) 228.

[109] Szőke (1982) 24.

[110] Szőke (1982) 24–34.

[111] Horváth (2022) 44.

[112] Kavánová (1995) 191–193, 212–217.

[113] Horváth (2014) 166–167.

[114] On the dating of the cemetery see: Horváth (2014) 181.

[115] Straub (1999) 414; M. Nepper (2002) I. 79, 97–98, 309. More recently about tenth century antler and bone carving see: Langó et al. (2023).

[116] Regarding the difficulties in interpreting the broader environment of a grave, see: Révész (2011) 538.

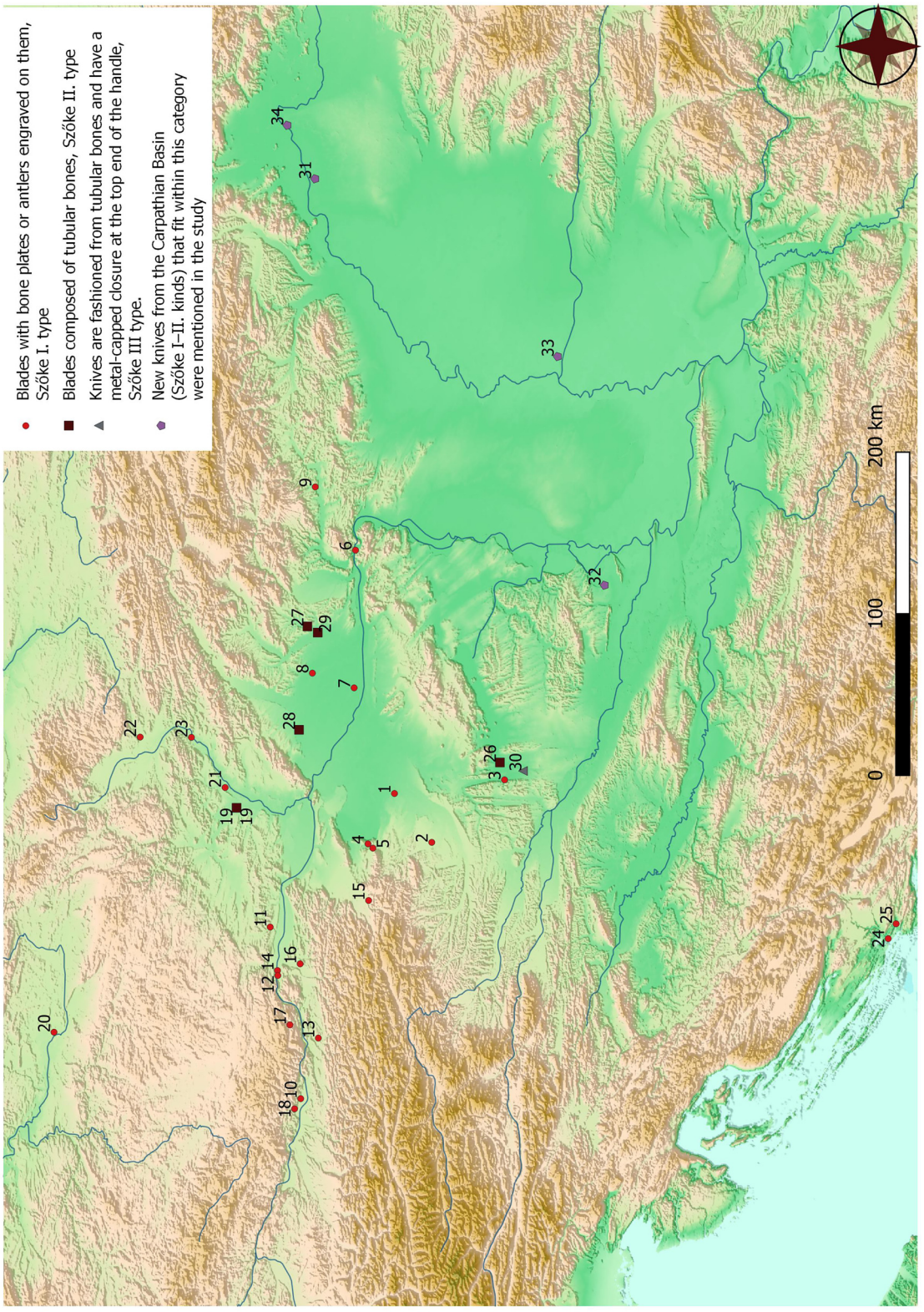

Fig. 50. The territorial distribution of knives with antler and bone handles in the Carpathian Basin

Until then, however, it seems that, as has been the case with the pendants from Grave 118 found near Grave 68, this part of the cemetery may have been influenced by the material culture legacy of the Eastern Alpine region.[117] In the event that additional research using methods of natural sciences or perhaps a new excavation at the site do not provide new, ground breaking results, the occurrence of the knife in the tenth-century section of the cemetery – based on our professional judgment – can also be explained by such an East-Alpine stylistic fashion arriving from the northwest, as seems to have been the case with the pendants with semi-lunar decoration.[118]

ACKNOWLEDGEMENTS

The research was realized as sub-project V.I. (Anthropological-genetic picture of Hungarians during the Árpád Period, project identification no. 39509/2018/KFSZ) within the framework of the project entitled "Árpád Dynasty Program" *(Árpád-ház Program)* and the NKFIH project "The Early Árpád Period settlements of the Moson plain, their lifestyle in the light of environmental conditions" (project identification no. K 132030). The site plan was prepared by Zsóka Varga, the distribution map by Róbert Lóki, and the dendrogram by Piroska Rácz. The drawing of the knife from Grave 68 at the Himod cemetery was taken from the work of Ciprián Horváth (2022). The mortality curves were made using Zsolt Bernert's (2005) paleoanthropological program package. The Szombathely knife was photographed by Péter Langó, and the photos of bones were taken by Piroska Rácz.

REFERENCES

Ahrens, C. (1983). Die eisernen Messer des spätsächsischen Gräberfeldes Ketzendorf. *Hammaburg*, 5(1978–1980): 51–64.

Alekseyev, V.P. and Debeč, G.F. (1964). Алексеев В.П. и Дебеч Г.Ф., *Краниометрия. Методика антропологических исследований* [Craniometry. Methodology of anthropological research]. Москва.

Aufderheide, A.C. and Rodríguez-Martin, C. (1998). *The Cambridge encyclopedia of human paleopathology*. Cambridge.

Bálint, Cs. (1991). *Südungarn im 10. Jahrhudert*. Studia archaeologica, 11. Budapest.

Barnes, E. (2012). *Atlas of developmental field anomalies of the human skeleton: a paleopathology perspective*. Hoboken, New Jersey.

Bernert, Zs. (2005). Paleoantropológiai programcsomag [Paleoanthropological software package]. *Folia Anthropologica*, 3: 71–74.

Breibert, W. (2005). Das karolingerzeitliche Hügelgräberfeld von Wimm, MG Maria Taferl, VB Melk, Niederösterreich. Untersuchungen zur Problematik frühmittelalterlicher Bestattungssitten im niederösterreichischen Donauraum. *Arheološki vestnik*, 56: 391–433.

Catalogo Brescia (2001). Bertelli, C., Brogiolo, G.P., Jurković, M., Matejčić, I., Milošević, A., and Stella, C. (Eds.), *Bizantini, croati, carolingi. Alba e tramonto di regni e imperi. Catalogo della mostra (Brescia, Santa Giulia – Museo della Città, 9 settembre 2001 – 6 gennaio 2002)*. Milano.

Coale, A.J. and Demeny, P. (1983). *Regional model life tables and stable populations*. Rev. with the help of Barbara Vaughan, 2nd ed. New York.

Cowgill, J., de Neergaard, M., and Griffiths, N. (1987). *Knives and scabbards. Medieval finds from excavations in London, 1*. London.

Dienes, I. (1969). Árpád fia Tarhos íjászainak nyomában [Following the archers of Árpád's son, Tarhos]. *Élet és Tudomány*, 24/13(28 March 1969): 610–615.

Egry, I. and Tomka, P. (2003). Himod, Káposztás-kertek. In: Kisfaludy, J (Ed.), *Régészeti kutatások Magyarországon, 2000 – Archaeological investigations in Hungary, 2000*. Budapest, pp. 147–148.

Éry, K. (1968). Reconstruction on the tenth century population of Sárbogárd on the basis of archaeological and anthropological data. *Alba Regia*, 8–9(1967–1968): 93–147.

Éry, K. (2008). Székesfehérvár kora Árpád-kori népességéről – ismét [On the Early Árpád Period population of Székesfehérvár – Again]. *Alba Regia*, 37(2008): 113–139.

Éry, K., Kralovánszky, A., and Nemeskéri, J. (1963). Történeti népességek rekonstrukciójának reprezentációja [Representing the reconstruction of historical populations]. *Anthropologiai Közlemények*, 7(1963)/1–2): 41–90.

Ferembach, D., Schwidetzky, I., and Stloukal, M. (1979). Empfehlungen für die Alters- und Geschlechtdiagnose am Skelett. *Homo*, 30(1979): 1–32.

Gáll, E. (2013). *Az Erdélyi-medence, a Partium és a Bánság 10–11. századi temetői, szórvány- és kincsleletei, 1–2* [Stray finds and hoards recovered from the tenth-eleventh century cemeteries of the Transylvanian Basin, the Partium and the Bánság region]. Magyarország honfoglalás kori és kora Árpád-kori sírleletei, 6. Szeged.

Gere, L. (2003). *Késő középkori és kora újkori fémleletek az ozorai várkastélyból* [Late medieval and early Modern Age metal artifacts from the Ozora castle]. Budapest.

Hanuliak, M. and Rejholcová, M. (1999). *Pohrebisko v Čakajovciach (9–12. storočie). Vyhodnotenie* [Burial ground in Čakajovce (9th–12th century). Evaluation]. Bratislava.

Hegyi, B. and Költő, L. (2017). Vörs-Majori dűlő 10–11. századi temetője [The 10th–11th century cemetery of Vörs-Majori

[117] A review of this question was provided by Langó (2021).

[118] Langó (2021). For a review of Eastern Alpine contacts see: Horváth (2014) 339–412. The reviewer of our manuscript, Béla Miklós Szőke raised the possibility that a possible solution in relation to the knives is that this type of an object "occurred in the Carpathian Basin during the ninth century, in a typically Carolingian cultural environment, and some generations continued to produce and use it after that" and thus it could remain in circulation and made it into the Himod cemetery. In our opinion, one indeed cannot rule out this possibility, however, it is difficult to verify. At present we know only one piece of this type of knife from the eleventh century, while in the ninth century it was much more widespread (as is also shown in Béla Miklós Szőke's summary cited several times here or by the relatively large number of such finds in the Sopronkőhida cemetery). Until now, however, we could not find any data on the continuous existence of this type of knife during the tenth century or on its later use, let alone the evidence of its local production.

dűlő]. In: Türk, A. (Ed.), *Hadak útján XXIV. A népvándorláskor fiatal kutatóinak XXIV. konferenciája, Esztergom, 2014. november 4–6, 2*. Budapest and Esztergom, pp. 597–626.

Herrmann, J. (1985). *Die Slawen in Deutschland. Geschichte und Kultur der slawischen Stämme westlich von Oder und Neiße vom 6. bis 12. Jahrhundert. Ein Handbuch*. Veröffentlichungen des Zentralinstituts für Alte Geschichte und Archäologie der Akademie der Wissenschaften der DDR, 14. Berlin.

Horváth, C. (2014). *Győr és Moson megyék honfoglalás és kora Árpád-kori temetői és sírleletei* [Cemeteries and grave finds from Győr an Moson Counties dated to the Period of the Hungarian Conquest and the Period of the Árpád Dynasty]. Magyarország honfoglalás kori és kora Árpád-kori sírleletei, 8. Szeged.

Horváth, C. (2022). *Honfoglalás és kora Árpád-kori sírok, temetők és szórványleletek a Nyugat-Dunántúlon, I* [Graves, cemeteries, and stray finds from western Hungary, dated to the Period of the Hungarian Conquest and Early Period of the Árpád Dynasty, I]. A Magyarságkutató Intézet kiadványai, 52. Budapest.

Istvánovits, E. (2003). *A Rétköz honfoglalás és Árpád- kori emlékanyaga* (Das landnahme- und arpadenzeitliche Nachlassmaterial des Rétköz). Magyarország honfoglalás kori és kora Árpád-kori sírleletei, 4. Régészeti gyűjtemények Nyíregyházán, 2. Nyíregyháza.

Jósa, A. (1900). Emlékek a honfoglalás korából. A tuzséri sírok [Finds from the Period of the Hungarian Conquest. The Tuzsér burials]. *Archaeologiai Értesítő*, 20: 214–224.

Kalousek, F. (1971). *Břeclav-Pohansko I. Velkomoravské pohřebiště u kostela: archeologické prameny z pohřebiště* [Břeclav-Pohansko I. Great Moravian cemetery near the church: archaeological sources from the necropolis]. Opera Universitatis Purkynianae Brunensis, Facultas philosophica, 169. Brno.

Kavánová, B. (1995). Knochen und Geweihindustrie in Mikulčice. In: Daim, F., and Poláček, L. (Hrsg.), *Studien zum Burgwall von Mikuľcice, I*. Spisy Archeologického ústavu AV ČR Brno, 2. Brno, pp. 113–378.

Kilgore, L. and van Gerven, D. (2010). Congenital scoliosis: possible causes and consequences in a skeleton from Nubia. *International Journal of Osteoarchaeology*, 20: 630–644.

Kiss, A. (1983). *Baranya megye X–XI. századi sírleletei* [Tenth–eleventh century grave finds from Baranya County]. Magyarország honfoglalás kori és kora Árpád-kori temetőinek leletenyaga, 1. Budapest.

Kiss, G. (Ed.) (2000). *Vas megye 10–12. századi sír- és kincsleletei* [Tenth–twelfth century grave finds and hoards from Vas county]. Magyarország honfoglalás kori és kora Árpád-kori sírleletei, 2. Budapest and Szombathely.

Kiss, G. (2005). Két szomszédos, kora Árpád-kori temető Szombathelyen [Two neighboring cemeteries in Szombathely from the Early Árpád Period]. In: Ritoók, Á., and Simonyi, E. (Eds.), *„…a halál árnyékának völgyében járok": A középkori templom körüli temetők kutatása*. Opuscula Hungarica, 6. Budapest, pp. 151–162.

Kiss, G. and Tóth, E. (1993). A szombathelyi Szent Márton templom régészeti kutatása 1984–1992. (Előzetes jelentés a feltárt 9–13. századi emlékekről) [Archaeological research at the Church of St. Martin in Szombathely (Preliminary report on the 9th–13th century finds)]. *Communicationes Archaeologicae Hungariae*, 1993: 175–199.

Klanica, Z. (1995). Zur Periodisierung vorgroßmährischer Funde aus Mikulčice. In: Daim, F., and Poláček, L. (Eds.), *Studien zum Burgwall von Mikulčice, I*. Spisy Archeologického ústavu AV ČR Brno, 2. Brno, pp. 379–469 1995.

Kovács, L. (2013). A Kárpát-medence honfoglalás és kora Árpád-kori szállási és falusi temetői. Kitekintéssel az előzményekre. Vázlat (Die Landnahmezeitlichen und Früharpadenzeitlichen Gräberfelder von Quartiere und Dörfer mit Hinblick auf die Vorgeschichte. Ein Abriss). In: Révész, L., and Wolf, M. (Eds.), *A honfoglalás kor kutatásának legújabb eredményei. Tanulmányok Kovács László 70. születésnapjára*. Monográfiák a Szegedi Tudományegyetem Régészeti Tanszékéről, 3. Szeged, pp. 511–604.

Kovács, L. (2019). *Magyarhomorog-Kónya-domb 10. századi szállási és 11–12. századi falusi temetője* (A 10th century cemetery belonging to a short-lived settlement and an 11–12th century village cemetery, both located on Magyarhomorog-Kónya-domb). Magyarország honfoglalás kori és kora Árpád-kori sírleletei, 12. Szeged and Budapest.

Költő, L. (1996). Vörs-Papkert B.. In: Fodor, I., Révész, L., Wolf, M., and M. Nepper, I. (Eds.), *„Őseinket felhozád…" A honfoglaló magyarság* ["You brought up our ancestors…" The Conquering Hungarians]. Budapest, pp. 378.

Költő, L., Lengyel, I., Pap, I., and Szentpéteri, J. (1992). Vorläufige Ergebnisse der Ausgrabungen am Gräberfeld Vörs aus dem 9–11. Jahrhundert. Ungarn, Komitat Somogy. Zur Problematik der Ethnika und archäologischen Kulturen im frühmittelalterlichen Pannonien. *Slovenská archeológia*, 40(2): 223–241.

Költő, L. and Szentpéteri, J. (1996). A Vörs-Papkert „B" lelőhely 8–9. századi temetője [The 8th-9th century cemetery of the Vörs-Papkert "B" site]. In: Költő, L., and Vándor, L. (Eds.), *Évezredek üzenete a láp világából (Régészeti kutatások a Kis-Balaton területén 1979–1992)*. Kaposvár and Zalaegerszeg, pp. 115–121.

Kühtreiber, K. and Obenaus, M. (2017). *Burgen des 9. bis zur Mitte des 11. Jahrhunderts in Niederösterreich – eine Bestandsaufnahme*. Monographien des Römisch-Germanischen Zentralmuseums, 132. Mainz.

Langó, P. (2005). Archaeological research on the Conquering Hungarians: A review. In: Mende, B.G. (Ed.), *Research on the Prehistory of the Hungarians: a review*. Varia archaeologica Hungarica, 18. Budapest, pp. 175–340.

Langó, P. (2012). Délszlávok Nyitrán? Megjegyzések az alsó ívükön tekercselt drótdíszes karikaékszerek klasszifikációja kapcsán [Southern Slavs in Nitra? Comments on classifying ring-shaped jewellery with lower arch ornaments with roundwound wire decoration]. In: Kiss, P.A., Piti, F., and Szabados, Gy. (Eds.), *Középkortörténeti tanulmányok, 7: A VII. Medievisztikai PhD-konferencia (Szeged, 2011. június 1–3.) előadásai*. Szeged, pp. 237–280.

Langó, P. (2021). Notes of the 10th-11th century relations of female jewellery found in the Carpathian Basin with South-Eastern Europe reflected by two types of jewellery. *Antaeus*, 37: 91–172.

Langó, P., Tóth, B., Török, B., Zágorhidi Czigány, B., Wilhelm, Á., Polónyi, E., Takács, M., and Harangi, F. (2023). *A 9–10. századi Magyar Fejedelemség kézműves hagyatéka* [The handicraft legacy of the 9th–10th century Hungarian Principality]. (Manuscript).

Liptáková, Z. (1963). Slovenské pohrebisko z X–XI storocia v Úľanoch nad Žitavou [Slovak cemetery from the X–XI century in Úľany nad Žitavou]. *Slovenská archeológia*, 11: 223–236.

Lovejoy, C.O., Meindl, R.S., Pryzbeck, T.R., and Mensforth, R.P. (1985). Chronological metamorphosis of the auricular surface of the ilium: a new method for the determination of adult skeletal age at death. *American Journal of Physical Anthropology*, 68: 15–28.

Martin, R. and Saller, K. (1957). *Lehrbuch der Anthropologie, I.* Stuttgart.

Meindl, R.S. and Lovejoy, C.O. (1985). Ectocranial suture closure: a revised method for the determination of skeletal age at death based on the lateral-anterior sutures. *American Journal of Physical Anthropology*, 68: 57–66.

Meindl, R.S., Lovejoy, C.O., Mensforth, R.P., and Walker, R.A. (1985). A revised method of age determination using the os pubis, with a review and tests of accuracy of other current methods of pubic symphyseal aging. *American Journal of Physical Anthropology*, 68: 29–45.

Müller, R. (2004). Régészeti összefoglaló az Esztergályhorváti-Alsóbárándpusztán feltárt Karoling-kori temetőről [Archaeological summary of the Carolingian Era cemetery excavated at Esztergályhorváti-Alsóbárándpuszta]. In: Tóth, G. (Ed.), *Karoling-kori emlékek. Régészet és antropológia (Esztergályhorváti-Alsóbárándpuszta 9–10. századi temetője)*. Szombathely, pp. 9–31.

M. Nepper, I. (2002). *Hajdú-Bihar megye 10–11. századi sírleletei* (Beschreibung und Auswertung der Grabfunde von 17 Fundorten des 10.–11. Jahrhundert im Komitat Hajdú-Bihar). Magyarország honfoglalás kori és kora Árpád-kori sírleletei, 3. Budapest and Debrecen.

Nikita, E. (2017). *Osteoarchaeology. A guide to the macroscopic study of human skeletal remains*. London.

Nowotny, E. (2005). Das frühmittelalterliche Gräberfeld von Hohenberg, Steiermark. Mit Exkursen zur historischen und archäologischen Situation im Ostalpenraum. *Archaeologia Austriaca*, 89: 177–250.

Ortner, D. (2003). *Identification of pathological conditions in human skeletal remains*. San Diego.

Pap, I. and Susa, É. (1986). Complex anthropological analysis of the cemetery of the comitat center at Visegrád. *Anthropologia Hungarica*, 19: 51–91.

Perizonius, W.R.K. (1981). Diachronic dental research on human skeletal remains excavated in The Netherlands, I. *Berichten van de Rijksdienst voor het Oudheidkundig Bodemonderzoek*, 31: 369–413.

Petrinec, M. (2009). *Gräberfelder aus dem 8. bis 11. Jahrhundert im Gebiet des frühmittelalterlichen kroatischen Staates*. Split.

Princová, J. and Mařík, J. (2006). Libice nad Cidlinou – stav a perspektívy výzkumu [Libice nad Cidlinou – status and perspectives of research]. *Archeologické rozhledy*, 58: 643–664.

Révész, L. (2000). Hitelesítő ásatás a tuzséri honfoglalás kori temető területén [Verifying excavations in the area of the cemetery of Tuzsér, Period of the Hungarian Conquest]. *Jósa András Múzeum Évkönyve*, 42: 7–32.

Révész, L. (2011). 11. századi temető Karcsa-Kormoskán [Eleventh century cemetery in Karcsa-Kormoska]. *A Móra Ferenc Múzeum Évkönyve – Studia Archaeologica*, 12: 529–558.

Révész, L. (2020). *A 10–11. századi temetők regionális jellemzői a Keleti-Kárpátoktól a Dunáig* [The regional characteristics of 10th–11th cemeteries between the Eastern Carpathians and the Danube river]. Magyarország honfoglalás kori és kora Árpád-kori sírleletei, 13. Szeged and Budapest.

Ruttkay, A. (2005). A szlovákiai templom körüli temetők régészeti kutatásáról [On the archaeological research carried out in churchyards in Slovakia]. In: Ritoók, Á., and Simonyi, E. (Eds.), *„…a halál árnyékának völgyében járok": A középkori templom körüli temetők kutatása*. Budapest, pp. 31–57.

Schintz, H., Baensch, W., Friedl, E., and Uehlinger, E. (1952). *Lehrbuch der Röntgendiagnostik*. Stuttgart.

Schour, I. and Massler, M. (1941). The development of the human dentition. *Journal of American Dental Association*, 28: 1153–1160.

Sjøvold, T. (1990). Estimation of stature from long bones utilizing the line of organic correlation. *Human Evolution*, 5: 431–447.

Stloukal, M. and Hanáková, H. (1978). Die Länge der Längsknochen altslawischer Bevölkerungen unter besonderer Berücksichtigung von Wachstumfragen. *Homo*, 29: 53–69.

Straub, P. (1999). A honfoglalás kori tegezcsontok időrendjéhez [On the chronology of quiver bones from the Period of the Hungarian Conquest]. *A Móra Ferenc Múzeum Évkönyve – Studia Archaeologica*, 5: 409–422.

Szabó, P. (1936). Nőnek a kövek [Stones are growing]. *Kelet Népe*, 2(2): 1–10.

Szameit, E. (1990). Das frühkarolingische Gräberfeld von Hainbuch, Niederösterreich. *Archaeologia Austriaca*, 74: 105–120.

Szécsényi-Nagy, A., Szeifert, B., Csáky, V., and Mende, B.G. (2021). Archeogenetika és magyar őstörténet: Hol tartunk 2021 elején? [Archaeogenetics and the ancient history of the Hungarians. Where are we at the beginning of 2021?]. *Magyar Tudomány*, 182(S1): 142–154.

Szenthe, G. and Gáll, E. (2022). *Hortobágy-Árkus kora középkori temetője. Egy elit csoport hagyatéka a 8–10. századi Észak-Tiszántúlról – The early medieval cemetery of Hortobágy-Árkus. The heritage of an elite group from the 8th–10th century northern Transtisza Region*. Archaeologica Hungarica, 52. Budapest.

Szőke, B.M. (1982). Ein charakteristischer Gebrauchsgegenstand des ostfränkischen Grenzgebietes: Das Eisenmesser mit Knochengriff. *Acta Archaeologica Academiae Scientiarum Hungaricae*, 34: 23–39.

Szőke, B.M. (2010). Mosaburg/Zalavár und Pannonien in der Karolingerzeit. *Antaeus*, 31–32: 9–52.

Szőke, B.M. (2021). *Die Karolingerzeit in Pannonien*. Monographien des Römisch-Germanischen Zentralmuseums, 145. Mainz.

Točík, A. (1971). Flachgräberfelder aus dem IX. und X. Jh. in der Südwestslowakei. *Slovenská archeológia*, 19: 135–276.

Tomka, P. (2010). Teil eines Gräberfeldes aus der Karolingerzeit von Himod, Flur Káposztás. *Antaeus*, 31–32: 199–223.

Török, Gy. (1973). *Sopronkőhida IX. századi temetője* [The 9th century cemetery of Sopronkőhida]. Fontes archaeologici Hungariae. Budapest.

Turek, R. (1969). Турек Р., *Либице: Княжеское городище X-го века* [Libice: Princely fortress of the 10th century]. Прага, pp. 1966–1969.

Ubelaker, D.H. (1978). *Human skeletal remains. Excavation, analysis, interpretation*. Aldine manuals on archeology. Chicago.

White, T.D., Black, M.T., and Folkens, P.A. (2012). *Human osteology*, 3rd ed. San Diego.

Fig. 7–8. The cranium from Grave 47, adultus male

Fig. 9–10. The cranium from Grave 58, maturus male

Fig. 11–12. The cranium from Grave 69, maturus male

Fig. 13–14. The cranium from Grave 81, adultus male (?)

Fig. 15–16. The cranium from Grave 91, maturus male

Fig. 17–18. The cranium from Grave 111, adultus male

Fig. 19–20. The cranium from Grave 119, adultus male

Fig. 21–22. The cranium from Grave 85, maturus male

Fig. 23–24. The cranium from Grave 123, adultus female