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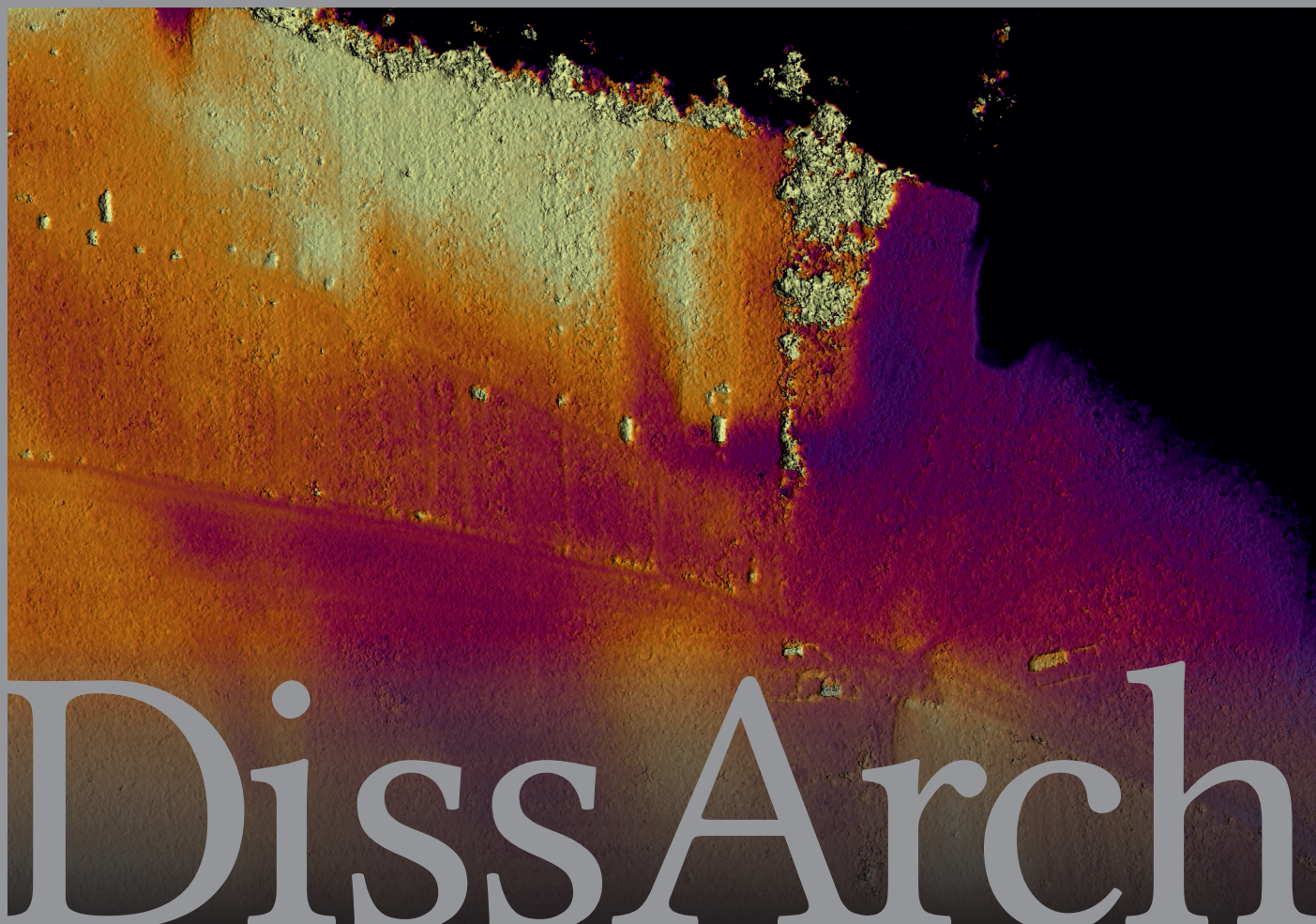

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Tiszakürt-Zsilke-tanya

An interdisciplinary analysis of an Early Avar Period cemetery

Bence Gulyás
Hungarian National Museum, Budapest, Hungary
gbence567@gmail.com

Eszter Pásztor
National Institute of Archaeology, Hungarian National Museum, Budapest, Hungary
pasztor.esz@gmail.com

Kristóf Fehér
National Institute of Archaeology, Hungarian National Museum, Budapest, Hungary
feher.kristof@mnm.hu

Csilla Libor
National Institute of Archaeology, Hungarian National Museum, Budapest, Hungary
csillalibor1992@gmail.com

Tamás Szeniczey
Department of Anthropology, ELTE Eötvös Loránd University, Budapest, Hungary
szeniczey.t@gmail.com

László Előd Aradi
National Institute of Archaeology, Hungarian National Museum, Budapest, Hungary
aradi.laszlo@hnm.hu

Réka Fülöp
National Institute of Archaeology, Hungarian National Museum, Budapest, Hungary
fulop.reka@mnm.hu

Kyra Lyublyanovics
National Institute of Archaeology, Hungarian National Museum, Budapest, Hungary
lyublyanovics.kira@hnm.hu

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Abstract: A cemetery section comprising 35 burials was excavated at the site of Tiszakürt-Zsilke-tanya. The burial rites suggest that the community who interred their dead here was of East European steppe origin, settled primarily east of the Tisza River. The graves were poorly furnished; the main chronological indicators are melon seed-shaped beads and two pairs of earrings with big bead pendants. Based on these, the cemetery section can be dated between the 640s and the 680s. The archaeological analysis is complemented by an anthropological, archaeozoological, and pottery analysis, as well as a study of metal and glass composition.

Keywords: Early Avar Period, Trans-Tisza Region, burial rites, beads, XRF analysis, SEM analysis, bioarchaeology, archaeozoology

1. Introduction

In the last decade, attempts have been made to conduct a more complex analysis of archaeological finds from the Avar Period; anthropological and archaeozoological methods were introduced to broaden the scope of traditional archaeological analyses.[1] However, these additional methods and findings have often remained unintegral to the archaeological study, relegated into additional datasets in the appendix.

The present paper focuses on the cemetery brought to light at Tiszakürt-Zsilke-tanya. The cemetery comprised 35 Early Avar Period graves with burial rites typical of the Trans-Tisza region in the 6th–7th centuries AD.[2] The studies bring together the results of archaeology and natural sciences, and the comprehensive archaeological interpretation yields a complex picture of the examined community by integrating the results of the anthropological, zoological, and pottery analyses, as well as the study of metal and glass composition. However, while scope limitations make it impossible to address all the questions that may arise, the conclusions clearly set out directions for future research.

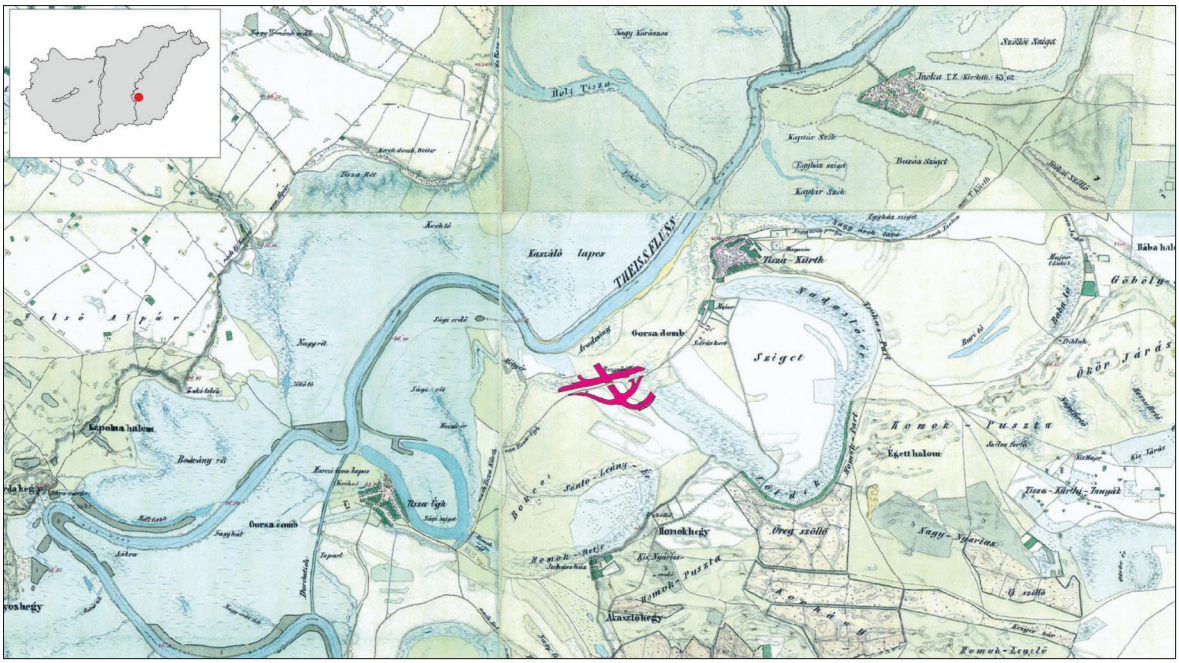

Fig. 1. Location of the site (after Fülöp et al. 2018)

2. Material and methods

The site Zsilke-tanya is located west of Tiszakürt village (Jász-Nagykun-Szolnok County), in the vicinity of the sand hill called Nagysziget (Fig. 1). To the north, the east, and the west, the area is bordered by the former floodplain of the Tisza.[3] There are two hills on the sides of a northwest-southeast oriented sandbank. The western hill was inhabited in the Middle Neolithic and Late

1 Among others, the publications about Pitvaros-Víztározó, Szegvár-Oromdűlő and the cemeteries of Nădlac can be mentioned here (Bende 2017; Gáll 2017; Lőrinczy et al. 2022). However, the first work with a similar conception was about the cemetery in Leobersdorf focusing a different region (Daim 1987).

2 In this paper, the name Trans-Tisza refers to the part of the Great Hungarian Plain east of the Tisza river, as well as parts of the Banat region in Serbia and Romania.

3 Fülöp et al. 2018, 499.

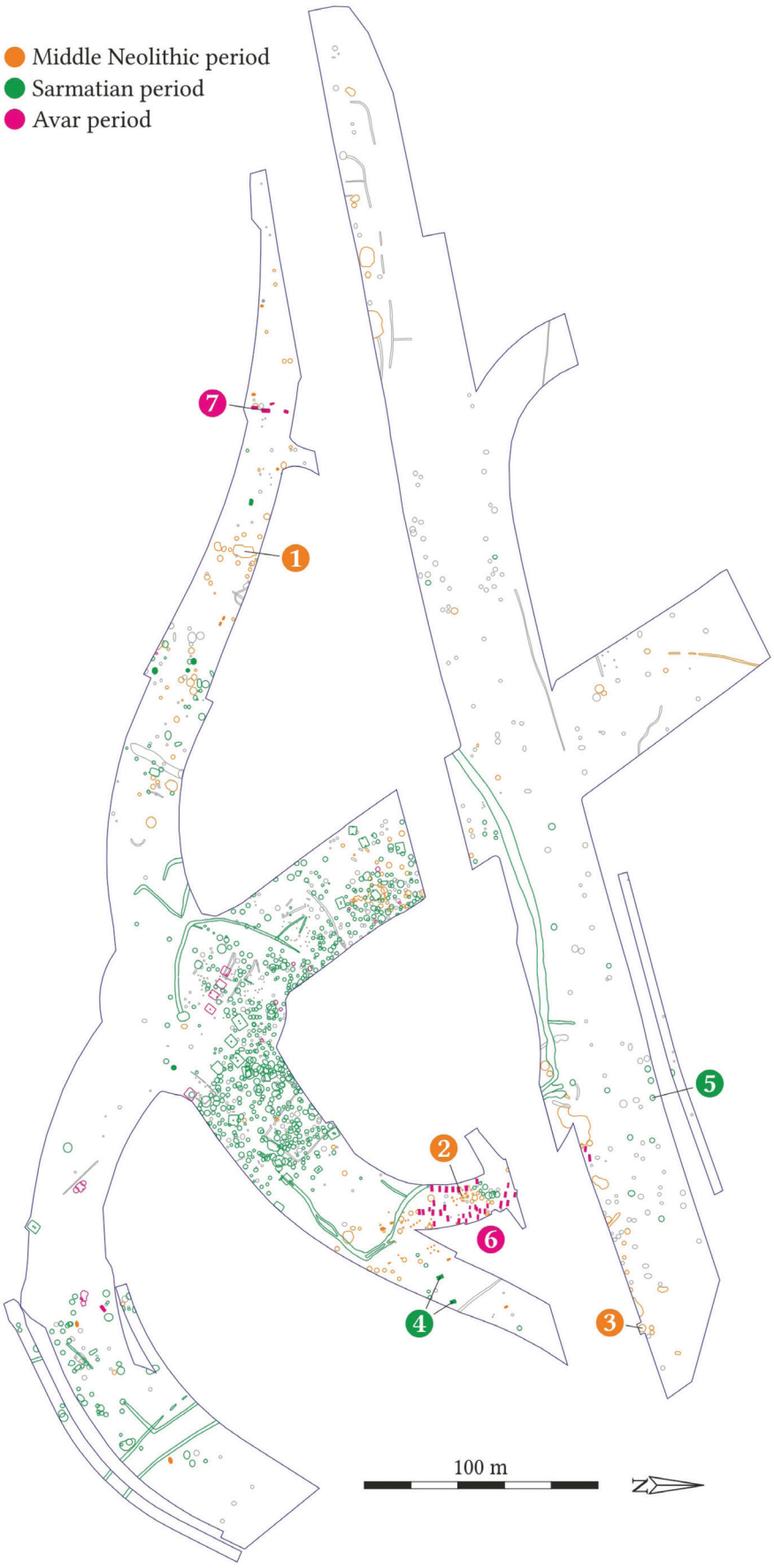

Fig. 2. Site plan (after Fülöp et al. 2018)

Sarmatian Periods, with some Late Avar burials located here as well. On the eastern hill, there are Neolithic, Sarmatian and Late Avar settlement features, as well as the Early Avar Period cemetery (Fig. 2).[4] The M44 motorway cuts through the area and its construction made an excavation necessary. In 2017, Salisbury Ltd. carried out a test excavation under the direction of Zoltán Farkas, and an Early Avar Period burial (Grave 40/53) was unearthed. In the following year, the Institute of Archaeology at Eötvös Loránd University conducted a rescue excavation under the direction of Gábor Váczi, Kristóf Fülöp, and Nóra Szabó. At that time, 34 graves dated to the 7th century were discovered in the southeastern part of the site, on the track of a service route.[5] In total, 35 Early Avar Period burials were unearthed. However, more graves may lie hidden under the shallow foundation of the service road, as the construction probably destroyed only the infant graves lying closer to the surface (Fig. 3).

After excavation, the finds were taken to the National Institute of Archaeology of the Hungarian National Museum, only the material of the test excavation is kept in Szolnok. The anthropological analysis was conducted by Tamás Szeniczey and Csilla Libor. The archaeozoological study of the animal remains was carried out by Kyra Lyublyanovics. László Előd Aradi and Kristóf Fehér analysed the pottery fragments, glass, and metal objects, respectively. The methodologies of these examinations are discussed in detail in the relevant subchapters.

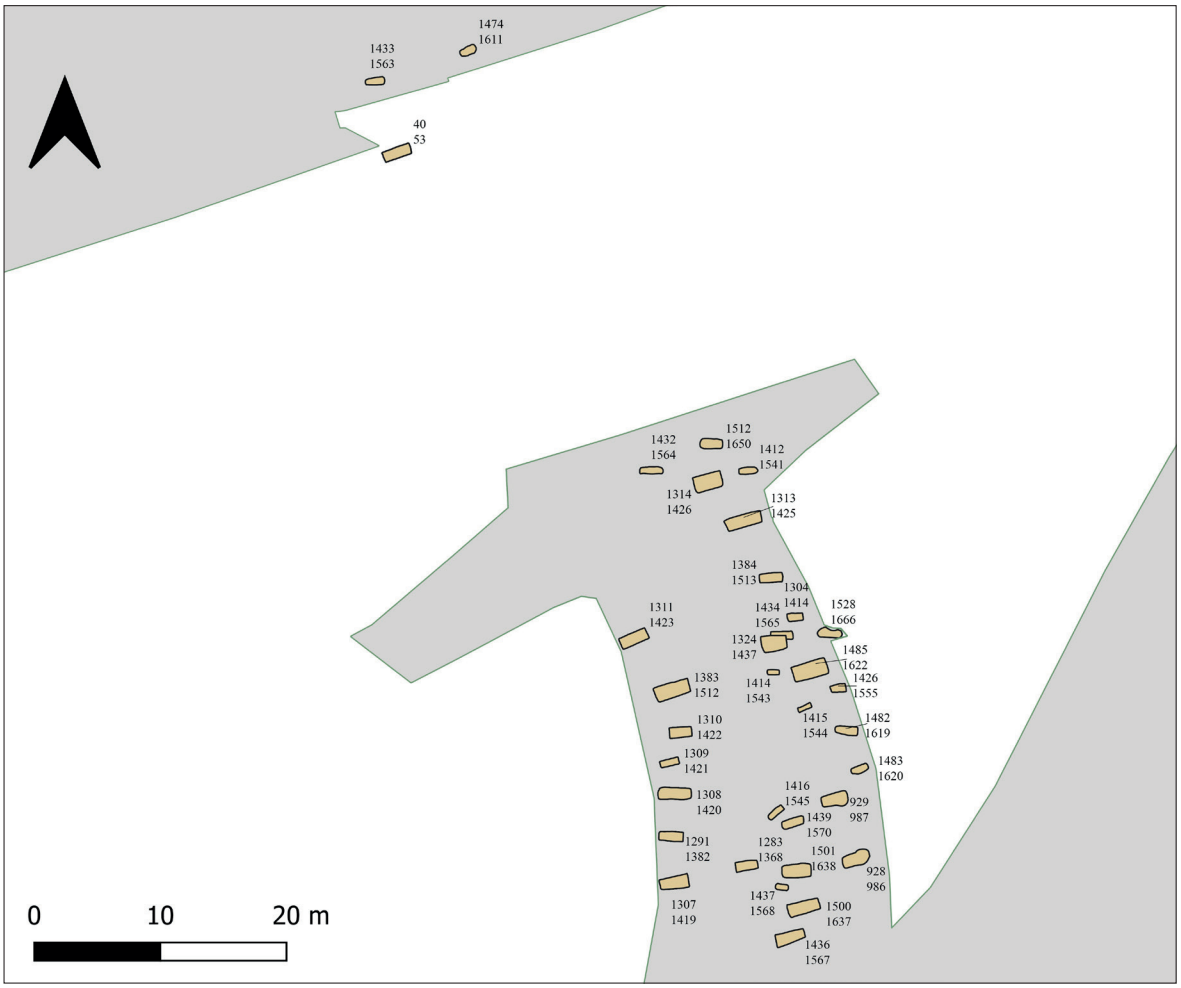

Fig. 3. Cemetery plan of Tiszakürt-Zsilke-tanya

4 Fülöp et al. 2018, 500.

5 Fülöp et al. 2018, 499, 510.

3. Description of the graves

Grave 40/53

Shaft grave (Fig. 4.A).[6] Orientation: NE–SW. L: 192 cm; W: 74 cm; D: 83 cm. The grave was dug into the northeastern part of house No. 40/40. It appeared as a barely visible, brownish stain in the soil. The grave pit was rectangular with rounded corners. The walls were slightly tapered towards the flat bottom. The pit had an infill of brown soil, containing clay and pieces of white chalk. A woman was found at the bottom of the pit in a supine position. The skull was slightly tilted to the right and the jaw was open. The arms were stretched along the rib cage, the right hand was under the pelvis. The legs were parallel.

Anthropological characteristics: well-preserved remains of a 24–26-year-old female. Mild degenerative alterations were observed on the lower thoracal and the lumbar spine. In addition, multiple Schmorl's nodes occur in these spinal regions. The cranium is long (hyperdolichocrane).

Animal remains: 1. The left partial foreleg (radius and ulna) of an infantile or neonate piglet. The remains were recovered from among the human bones, their original position in the grave is unknown.

Grave inventory: 2. Small, single-edged iron knife on the outer side of the left forearm (Fig. 4.2). It was pointed at the skull. L: 3.2 cm; W: 1.3 cm; Thickness: 0.4 cm. 3. Disc-shaped spindle-whorl between the body and the left elbow. Now lost.

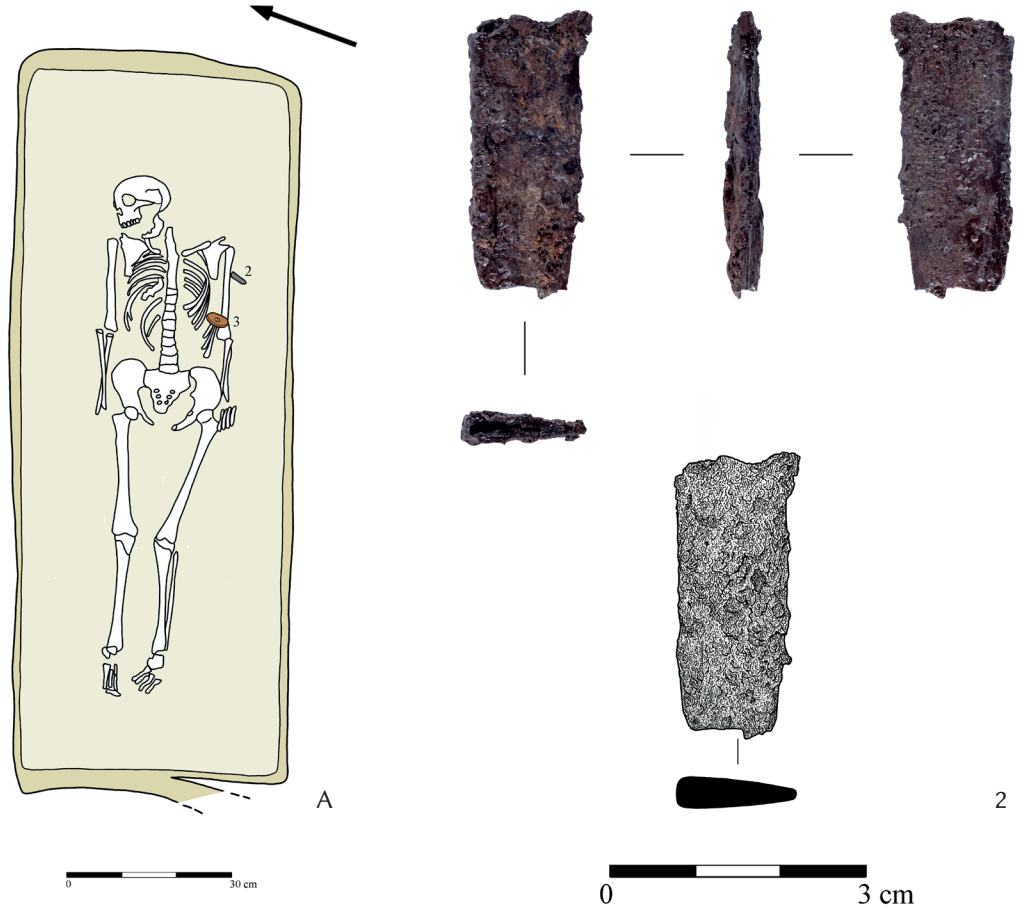

Fig. 4. Grave 40/50

6 The numbers in the catalogue are the same as the numbers on the grave drawings and the numbering of object drawings and photos. For this reason, the numbering in the Figures is not continuous. Apart from the Sarmatian pottery fragments and the lost objects, photos and/or drawings of all objects have been published.

Grave 928/986

Shaft grave (Fig. 5.A). Orientation: NE–SW. L: 220 cm; W: 91 cm; D: 82 cm. It appeared as an oval greyish soil stain. The disturbed grave pit was rectangular, with walls slightly tapered towards the bottom. The bottom was even. Its infill consisted of dark grey earth, with spots of yellow loam. A child was found at the bottom of the grave pit, lying in a supine position. The bones were poorly preserved. Only the cervical vertebrae, the bones of the left upper arm, a few ribs, and the extended legs in parallel position were preserved *in situ*. The position of the animal bones and the soil discoloration observed under the legs indicate that the body was in a coffin.

Anthropological characteristics: Highly fragmented and incomplete remains of a 4–6-year-old child.

Animal remains: 1. Skull, mandibles and incomplete lower limbs of a juvenile (18 months old), polled cattle, deposited in the top segment of the grave, right under the surface, at a depth of about 38 cm. The bone fragments near the grave walls were found 8–18 cm higher than the rest of the remains. The cattle skull was found in the east corner of the grave pit, to the left side of the human skull, oriented to the east. The partially preserved legs were located 45 cm to the west, deposited in a 40-cm-wide area across the grave. The left legs were located near the north grave wall, the right ones near the south wall. The original orientation of the disturbed remains could not be established. Based on the incomplete fusion of the metapodia, it was probably a cow, and must have been slaughtered in the autumn (September–October). 2. Partial hind legs (left tibia, astragalus, and os centrotarsale; both metatarsals) of an adult sheep in the upper layer of the grave, above the human remains; the bones may have belonged to the hide that was placed in the grave. The animal measured 59 cm at the withers. 3. Right humerus fragment of an adult swine, deposited in an uncertain location, probably next to the left upper arm of the deceased; probably a food offering.

Grave inventory: 4. A string of beads around the skull (Fig. 5.B; Fig. 5.4). 4/1. Ring-shaped light brown opaque glass bead. H: 1.8 mm; Diam: 4.3 mm. 4/2. White opaque two-piece truncated conical segmented glass bead with slightly corroded surfaces. H: 4.8 mm; Diam: 5 mm. 4/3. Spheroid white opaque glass bead. H: 4.5 mm; Diam: 3.2 mm. 4/4. Truncated conical light brown opaque glass bead with a gilded (?) surface. H: 4 mm; Diam: 7 mm. 4/5. Spheroid white opaque glass bead. H: 3.2 mm; Diam: 5.1 mm. 4/6. Spheroid yellowish-brown opaque glass bead with a damaged surface. H: 3.2 mm; Diam: 5.5 mm. 4/7. Truncated conical (?) white,

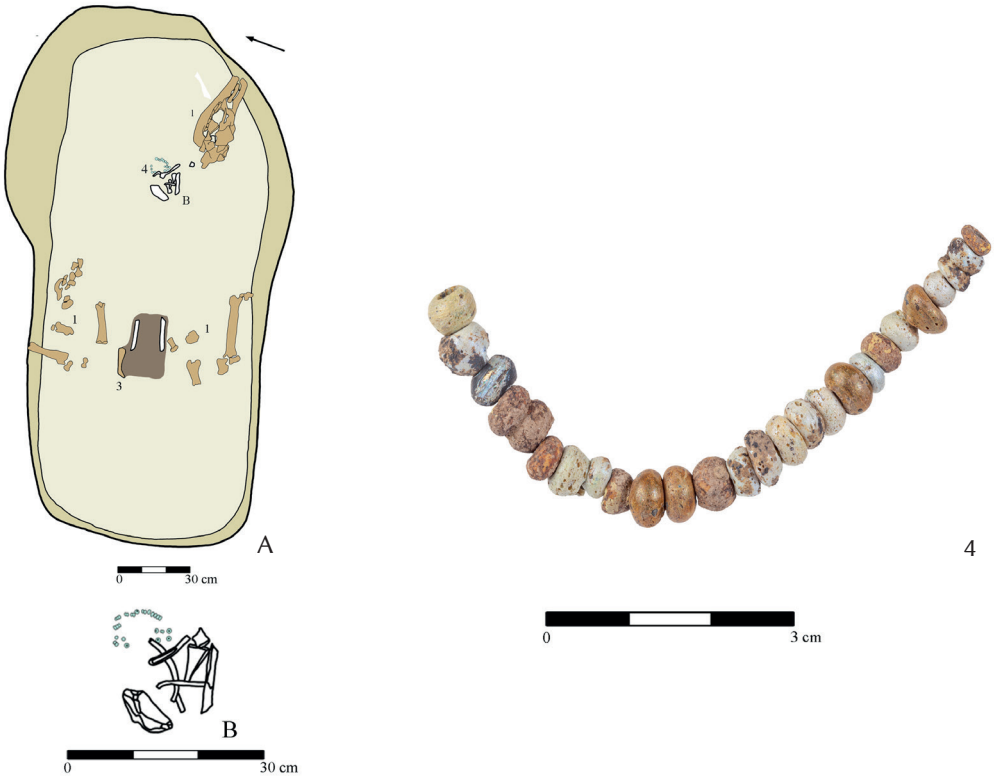

Fig. 5. Grave 928/986

pearlescent, opaque glass bead. H: 2.7 mm; Diam: 5.2 mm. 4/8. Spheroid brown opaque glass bead with a damaged surface. H: 4.2 mm; Diam: 6.7 mm. 4/9. Spheroid white opaque glass bead with a damaged surface. H: 3.7 mm; Diam: 6.1 mm. 4/10. Spheroid, white opaque glass bead with a damaged surface. H: 3.5 mm; Diam: 6.6 mm. 4/11. Spheroid white opaque glass bead with a damaged surface. H: 3.2 mm; Diam: 6.6 mm. 4/12. Truncated conical white opaque glass bead with a damaged surface. H: 3.2 mm; Diam: 6.4 mm. 4/13. Truncated conical white opaque glass bead, damaged, corroded surface with brown spots. H: 3.1 mm; Diam: 5.9 mm. 4/14. Spheroid yellow or light brown opaque glass bead with a damaged surface. H: 5 mm; Diam: 6.7 mm. 4/15. Spheroid light brown opaque glass bead with gilded (?) surfaces. H: 4 mm; Diam: 7.1 mm. 4/16. Spheroid light brown opaque glass bead with gilded surfaces. H: 4.7 mm; Diam: 6.8 mm. 4/17. Fragment of yellow opaque two-piece truncated conical segmented glass bead. Only one half survived. H: 4.1 mm; Diam: 5.4 mm. 4/18. Truncated conical white opaque glass bead. H: 3.1 mm; Diam: 4.6 mm. 4/19. Fragment of a white opaque two-piece conical segmented glass bead, only one half survived. H: 5.2 mm; Diam: 6 mm. 4/20. Spheroid yellow opaque glass bead with a damaged surface. H: 3.3 mm; Diam: 5.8 mm. 4/21. Light brown opaque two-piece spheroid segmented glass bead. H: 7.3 mm; Diam: 6.5 mm. 4/22. Spheroid pearlescent opaque glass bead. H: 4 mm; Diam: 6.1 mm. 4/23. Spherical white opaque glass bead with a damaged, corroded surface. H: 6.2 mm; Diam: 6.4 mm. 4/24. Spheroid yellowish-white pearlescent opaque glass bead. H: 4.6 mm; Diam: 6.3 mm. 4/25. Fragments of at least five spheroid white opaque glass beads. H: 3.7–5.3 mm; Diam: 4.9–6.6 mm.

Grave 929/987

Shaft grave (Fig. 6). Orientation: NE–SW. L: 213 cm; W: 92 cm; D: 58 cm. It appeared as an oval greyish soil stain. The disturbed grave was rectangular with rounded corners and the walls were tapered towards the bottom. Remains of a child were found at the bottom, in a supine position. The bones were preserved well. The skull was tilted forward, the arms were stretched closely beside the ribcage, and the legs were parallel. Traces of a wooden coffin were documented; the top planks extended beyond the longitudinal sides of the coffin. The coffin was placed in the pit slightly askew.

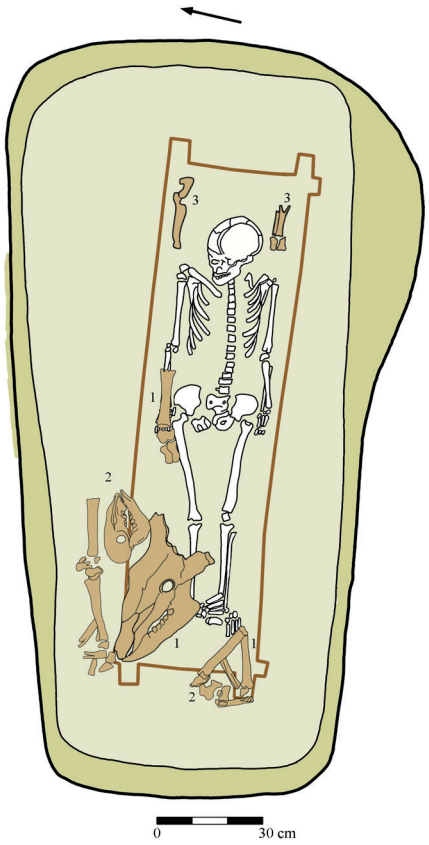

Fig. 6. Grave 929/987

Anthropological characteristics: incomplete remains of a 7.5–9.5-year-old child. Cribra femora is observed on both femoral necks. A shovel-shaped first incisor is visible in the permanent dentition.

Animal remains: The animal remains were 18 cm above the human bones. 1. Skull, mandibles and incomplete lower limbs of a juvenile (18 months old) cattle in the first quarter of the grave's north-west part. Based on the incompletely fused metapodia, it was probably a cow, and must have been slaughtered in the autumn (September–October). Its skull was oriented to the west. The left front leg was above the right ilium of the deceased, the left hind leg lay parallel to the north-west wall, and the right hind leg lay diagonally under the cattle skull. The right front leg was missing. The left front leg and hind leg were oriented to the southwest. 2. Skull, mandibles and incomplete lower limbs of an adult (mature), polled sheep, found next to the cattle skull and at the feet of the deceased. The sheep skull was oriented to the north-east. The remains must have belonged to the hide that was folded at the feet of the child. The animal measured 61.4 cm at the withers. Pathology: *intra vitam* tooth loss. 3. Hip bones and partial left hind leg (tibia, fibula, astragalus, calcaneus) of a juvenile (12 months old) pig. The hip was to the right side of the human skull, and the partial hind leg was on the left. The remains were probably placed in the grave as a food offering.

Grave 1283/1368

Shaft grave (Fig. 7). Orientation: E–W. L: 170 cm; W: 75 cm; D: 44 cm. It appeared as a square-shaped, greyish soil stain. The large pit was rectangular and tapered downwards. A child was found at the bottom of the grave in a supine position, placed slightly askew. The remains were poorly preserved. The left arm was probably bent at the elbow, the legs were parallel. The upper body was extremely disturbed; the skull was in a prone position, the mandible was found 15 cm away from the skull among the ribs, arm bones, and vertebrae. The bones in the lumbar region were undisturbed.

Anthropological characteristics: incomplete skeleton of a 4.5–6.5-year-old child. A shovel-shaped first incisor is visible in the permanent dentition.

Grave inventory: 1. Iron fragment between the ribs and arms. It is now lost. 2. Sarmatian pottery fragment from unknown provenance. Brick-red coloured, thrown pottery with finely wrought surface, tempered with micaceous sand. The surface is incised with haphazard lines and smoothed. Size: 4 × 2.7 cm; Thickness: 1.1 cm.

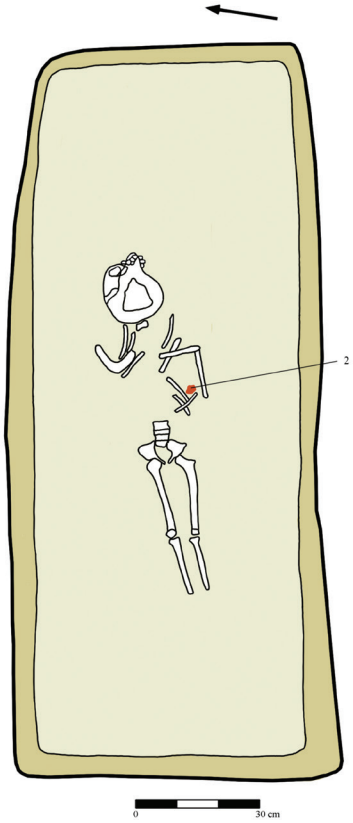

Fig. 7. Grave 1283/1368

Grave 1291/1382

Cenotaph (?) (Fig. 8). Orientation: NE–SW(?). L: 190 cm, W: 81 cm, D: 64 cm. It appeared as a dark, rectangular soil stain. The pit was rectangular, with walls tapered towards the flat bottom. No human remains were found.

Animal remains: **1**. Skull, mandibles, and incomplete lower limbs of an adult, polled sheep. The skull was deposited on the bottom of the east section of the pit, facing to the northeast. The remains of the incomplete lower limbs were found in a higher layer, near the south wall. The animal measured 63 cm at the withers. Pathology: lesions on the metatarsals and on one proximal phalanx.

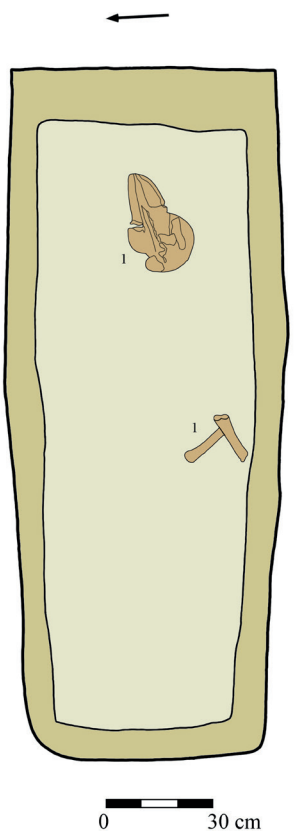

Fig. 8. Grave 1291/1382

Grave 1304/1414

Shaft grave (Fig. 9). Orientation: E–W. L: 120 cm, W: 55 cm, D: 25 cm. It appeared as a dark grey, oval-shaped soil stain. The grave pit was irregularly rectangular with rounded corners. Its walls were slightly tapered towards the flat bottom; the dense infill consisted of dark grey loam. The poorly preserved bones of a child were found at the bottom of the grave, in a supine position.

Only the skull and parts of the left arm and hand were found. The skull was tilted to the left. No grave goods.

Anthropological characteristics: highly fragmented and incomplete remains of a 2.5–3.5-year-old child.

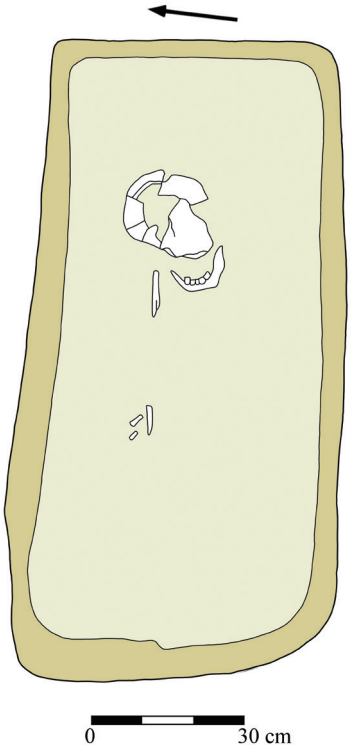

Fig. 9. Grave 1304/1404

Grave 1307/1419

Grave with longitudinal ledges (Fig. 10.A). Orientation: NE–SW. L: 233 cm; W: 78 cm; D: 53 cm. It appeared as a long, rectangular soil stain. The grave pit was rectangular, with walls slightly tapered downwards. The well-preserved remains of a woman were found at the bottom of the grave, in a supine position. The upper body was severely disturbed; the vertebrae and feet were missing.

Anthropological characteristics: moderately preserved skeleton of a 25–40-year-old female (probability calculated with the DSP2 method: 0.98). Discoloration caused by copper is observed on the left upper second incisor. The left humerus and sacrum also show stains from iron objects. Early osteoarthritic changes are present in both knee joints, involving the distal end of the femora and the proximal end of the tibiae. Multiple enamel linear hypoplasia are observed on several teeth. The rASUDAS application assigned the individual to Western Eurasian and East Asian ancestry groups with posterior probabilities of 99.49% and 0.51%, respectively.

Animal remains: 1. Skull, mandibles, and incomplete lower legs of an adult (mature) sheep. The skull was found at the southwest end of the grave, located between the woman's left tibia and the grave wall, oriented in a southwest direction, 4–5 cm above the human bones. The fore extremities were found above the human ilium and femur, while the hind legs were positioned around the right shoulder. The animal measured 62 cm at the withers. Pathology: heavily worn teeth and ossified ligament on the left metacarpal.

Grave inventory: 2. A string of beads around the original position of the skull (Fig. 10.2). 2/1. Blue opaque two-piece ring-shaped segmented glass bead. Its surface is porous and damaged. H: 4 mm; Diam: 5 mm. 2/2. Yellow opaque two-piece spheroid segmented glass bead with brown surface discoloration. H: 5.5 mm; Diam: 5 mm. 2/3. Biconical white iridescent, slightly translucent glass bead. H: 2 mm; Diam: 6 mm. 2/4. Spheroid white iridescent opaque glass bead. H: 4 mm; Diam: 8 mm. 2/5. Ring-shaped blue opaque glass bead with a porous and damaged surface. W: 1.7 mm; Diam: 5 mm. 2/6. Spheroid blue opaque glass bead with a porous and damaged surface. H: 3 mm; Diam: 5.5 mm. 2/7. Spheroid blue opaque glass bead with a porous and damaged surface. H: 3 mm; Diam: 5.7 mm. 2/8. Spherical brown opaque glass bead with a damaged surface. H: 4 mm; Diam: 5 mm. 2/9. Spheroid yellow opaque glass bead with brown surface discoloration. H: 3.6 mm; Diam: 6 mm. 2/10. Ring-shaped white pearlescent opaque glass bead. H: 2.3 mm; Diam: 5.6 mm. 2/11. Barrel-shaped blue opaque glass bead with a porous and damaged surface. H: 4 mm; Diam: 6 mm. 2/12. Truncated conical blue opaque glass bead with a porous and damaged surface. H: 3.5 mm; Diam: 5.5 mm. 2/13. Spheroid dark green opaque glass bead with red wavy lines. H: 4 mm; Diam: 7 mm. 2/14. Prismatic translucent blue glass bead with cut corners. H: 9.4 mm; Diam: 6 mm. 2/15. Spheroid brown opaque glass bead with a damaged surface. H: 3 mm; Diam: 4.7 mm. 2/16. Spheroid yellow opaque glass bead with brown surface discoloration. H: 2.3 mm; Diam: 5 mm. 2/17. Truncated conical blue opaque glass bead with a porous and damaged surface. H: 4 mm; Diam: 6 mm. 2/18. Spheroid dark blue pearlescent, opaque glass bead with a porous surface. H: 4 mm; Diam: 6 mm. 2/19. Truncated conical blue opaque glass bead with a porous and damaged surface. H: 4 mm; Diam: 6 mm. 2/20. Ring-shaped blue opaque glass bead with a porous and damaged surface. H: 3 mm; Diam: 4 mm. 2/21. Ring-shaped blue opaque glass bead with a damaged surface. H: 4 mm; Diam: 5 mm. 2/22. Spheroid blue opaque glass bead with a damaged surface. H: 4 mm; Diam: 5 mm. 2/23. Spheroid blue opaque glass bead with a damaged surface. H: 4 mm; Diam: 5.6 mm. 2/24. Blue opaque two-piece spheroid segmented

Fig. 10. Grave 1307/1419

glass bead with a damaged surface. H: 6 mm; Diam: 5 mm. 2/25. Ring-shaped blue opaque glass bead with a porous and damaged surface. H: 1 mm; Diam: 5.6 mm. 2/26. Ring-shaped blue opaque glass bead with a porous and damaged surface. H: 1 mm; Diam: 5 mm. 2/27. Barrel-shaped yellow opaque glass bead with a brownish surface. H: 3.8 mm; Diam: 4.5 mm. 2/28. Spheroid light yellow opaque glass bead with brownish surface discoloration. H: 2 mm; Diam: 6 mm. 2/29. Spheroid light yellow opaque glass bead with brown surface discoloration. H: 3 mm; Diam: 6 mm. 2/30. Truncated conical (?) blue opaque glass bead with a damaged surface. H: 2.8 mm; Diam: 5 mm. 2/31. Truncated conical (?) blue opaque glass bead with a porous and damaged surface. H: 3 mm; Diam: 5.6 mm. 2/32. Spheroid (?) blue opaque glass bead, heavily damaged. H: 3 mm; Diam: 5.6 mm. 2/33. Spherical dark brown opaque glass bead. H: 4 mm; Diam: 4.6 mm. 2/34. Truncated conical light yellow opaque glass bead with a damaged surface. H: 3.5 mm; Diam: 5.7 mm. 2/35. Spherical dark brown opaque glass bead. H: 3.7 mm; Diam: 4 mm. 2/36. Spheroid (?) blue opaque glass bead with a porous and heavily damaged surface. H: 2.6 mm; Diam: 4 mm. 2/37. Spheroid light yellow opaque glass bead. H: 3 mm; Diam: 5.8 mm. 2/38. Blue opaque two-piece spheroid segmented glass bead. The surface is damaged, part of the artefact is missing. H: 4.6 mm; Diam: 5.8 mm. 2/39. Truncated conical blue opaque glass bead with a porous and damaged surface. H: 3 mm; Diam: 5.3 mm. 2/40. Spherical shaped yellow opaque glass bead with brown surface discoloration. H: 3.6 mm; Diam: 4.7 mm. 2/41. Irregular ring-shaped dark brown opaque glass bead with a damaged surface. H: 2.8 mm; Diam: 4.6 mm. 2/42. Blue opaque two-piece spheroid segmented glass bead, with a porous and damaged surface. H: 4.8 mm; Diam: 5.3 mm. 2/43. Spheroid blue opaque glass bead with a porous and damaged surface. H: 3.3 mm; Diam: 5 mm. 2/44. 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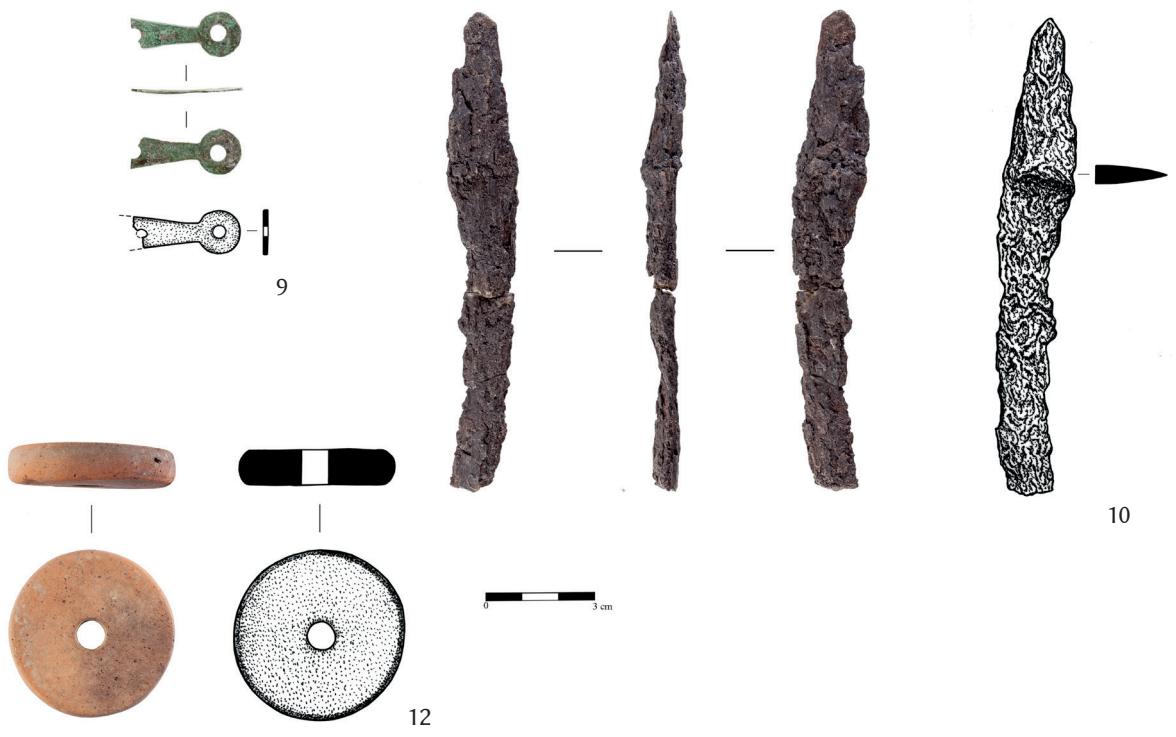

Fig. 11. Grave 1307/1419

2/114. Truncated conical dark blue opaque glass bead with a porous, damaged surface. H: 3.3 mm; Diam: 6.8 mm. 2/115. Spheroid yellow opaque glass bead. H: 3.2 mm; Diam: 5.8 mm. 2/116. Spheroid blue opaque glass bead with a porous, damaged surface. H: 3.5 mm; Diam: 6 mm. 2/117. Ring-shaped blue opaque glass bead with a porous, damaged surface. H: 2.5 mm; Diam: 5.2 mm. 2/118. Spheroid dark blue opaque glass bead with a porous surface. H: 3.7 mm; Diam: 6 mm. 2/119. Fragmented spherical blue iridescent opaque glass bead. H: 12 mm; Diam: 12 mm. 2/120. Fragmented spherical light blue iridescent glass bead. H: 11 mm; Diam: 11 mm. 2/121. Fragments of spheroid yellow opaque glass beads. 2/122. Fragments of barrel-shaped dark brown opaque glass beads with porous surfaces. 2/123. Fragments of ring-shaped blue opaque glass beads with porous surfaces. 2/124. Fragments of spheroid blue opaque glass beads with porous surfaces. 2/125. Fragments of truncated conical blue opaque glass beads with porous surfaces. 3. Copper-alloy earring with a big bead pendant to the right of the skull (Fig. 10.3). The ring is open. A cylindrical connecting part is attached to its lower segment. The pendant is missing. $Diam_{ring}$: 1.9 cm; Thickness: 1.6 mm. 4. Copper-alloy earring with a big bead pendant, found south of the fragmented skull (Fig. 10.4). The ring is open and has a protrusion on it opposite the pendant. The pendant is missing. $Diam_{ring}$: 1.9 cm; Thickness: 1.7 mm. 5. Fragment of an irregular spherical black opaque glass bead with a damaged surface, collected from an unknown location (Fig. 10.5). H: 7 mm; Diam: 9 mm. 6. A slightly pointed spherical black opaque glass bead with a damaged surface, collected from an unknown location (Fig. 10.6). H: 11 mm; Diam: 10 mm. 7. Slightly pointed spherical black opaque glass bead, collected from an unknown location (Fig. 10.7). A copper-alloy wire ending in a loop is threaded through the hole. Diam: 12 mm. 8. Slightly pointed spherical black opaque glass bead with a heavily damaged surface, collected from an unknown location (Fig. 10.8). Diam: 12 mm. 9. Copper-alloy pouch fastener in the eastern part of the grave, found 7–8 cm east of the earring (Fig. 11.9). It is made of a thin plate. The central part was originally rhombic, with two disc-shaped extensions connected to its ends. It was perforated in the middle and at both ends. It is broken in half; one half is now lost. L: 2.8 cm; W_{max}: 1.1 cm; Thickness: 0.1 cm. 10. Single-edged iron knife, found in two fragments by the medial aspect of the left upper arm (Fig. 11.10). It has a straight spine. The tip of the knife points towards the skull. L_{total}: 12.8 cm; L_{tang}: 4 cm; $W_{max:}$ 1.9 cm; W_{tang}: 1 cm. 11. Fragment of an iron object (belt buckle?) on the right ilium. Lost. 12. Disc-shaped spindle-whorl at the lateral side of the left knee, made from a fragment of a wheel-thrown pot (Fig. 11.12). It is flat and of a brownish-orange color. Diam: 4.5 cm; $Diam_{hole}$: 0.7 cm; Thickness: 0.9 cm; Weight: 26 gr.

Grave 1308/1420

Cenotaph (?) (Fig. 12). Orientation: E–W (?). L: 270 cm; W: 93 cm; D: unknown. It appeared as a rectangular, mixed, hardly recognizable soil stain. The corners of the grave pit were rounded, the walls were slightly tapered towards the flat bottom. The west part of the grave was overexcavated. No human remains were found in the pit.

Animal remains: 1. Skull, mandibles, and incomplete lower limbs of a juvenile (18–20-month-old) cattle. Based on the incompletely fused metapodia, it was probably a cow; it must have been slaughtered in the autumn or winter (September–November). It has small, rudimentary horn cores (ca. 7 cm in length). The skull lay on its left side in the center of the grave, oriented to the northwest. The position of the extremities contradicts their anatomical position, probably because the hide that contained them was folded. The right front leg was partly next to and partly under the skull, at a 45-degree angle to the grave's axis; the left hind leg was 10 cm away from it, in a parallel position. The left front leg was at the eastern end of the grave, in its middle, roughly parallel to the axis of the grave, next to the right hind leg. 2. Skull, mandibles, and incomplete lower limbs of a juvenile (18–24-month-old) sheep. Its position is unclear, but it was probably deposited in the west part of the grave. It was probably slaughtered sometime between September and March.

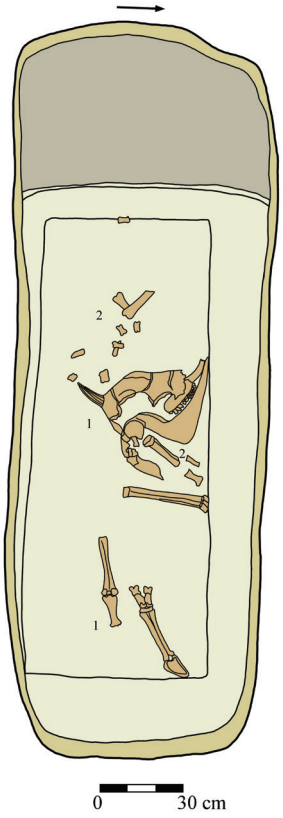

Fig. 12. Grave 1308/1420

Grave 1309/1421

Shaft grave (Fig. 13). Orientation: NE–SW. L: 164 cm; W: 54 cm; D: 23 cm. It appeared as a barely recognizable rectangular soil stain. Rectangular pit with straight walls that were slightly tapered towards the bottom. The grave was short for the height of the deceased. A woman's well-preserved bones were found at the bottom of the pit, in a supine position. The skull tilted to the right. The left arm was stretched alongside the ribcage, while the right arm was positioned slightly farther from the ribs, with the right hand placed on the right pelvis and thighbone. The bones of the rib cage were tilted to the right. The legs were parallel, the bones of the left foot were missing. Without inventory.

Anthropological characteristics: moderately preserved skeleton of a 35–40-year-old female. Degenerative changes are evident in all sections of the spinal column, with the cervical section being the most severely affected, showing early signs of spondyloarthropathy. Additionally, multiple Schmorl's nodes are present in the lower thoracic and upper lumbar sections. Two cases of *antemortem* fractures were identified on the rib fragments.

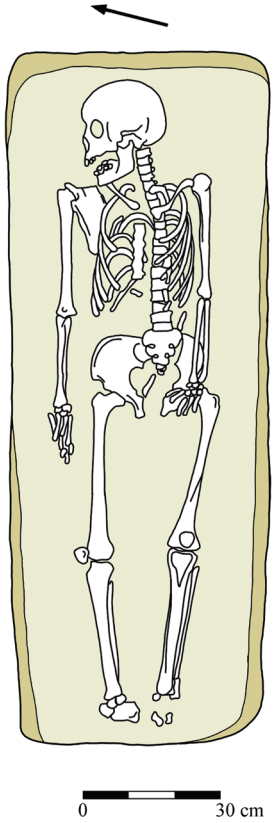

Fig. 13. Grave 1309/1421

Grave 1310/1422

Shaft grave (Fig. 14.A). Orientation: NE–SW. L: 177 cm; W: 87 cm; D: 78 cm. It appeared as a barely recognizable rectangular soil stain. The walls were straight. The poorly preserved remains of a child were found at the flat bottom, in a supine position. The skull was smashed, the arms were stretched alongside the upper body, and the legs were parallel. The right arm, a few vertebrae, a few ribs, and the left foot were missing. Only a few tiny fragments were preserved from the ilium. The soil discoloration observed under the legs indicate that the body was in a coffin.

Anthropological characteristics: highly fragmented cranial remains of a 2.5–3.5-year-old child. Signs of linear enamel hypoplasia are visible on two teeth.

Animal remains: 1. Skull, mandibles, and incomplete lower limbs of an adult, polled sheep on the bottom in the west part of the grave pit. The truncated extremities were placed between the child's feet and the grave wall, more-or-less vertical to the axis of the grave pit. The right foreleg was stretched, the other three legs were bent. The skull was oriented to the northeast. The animal measured 60 cm at the withers.

Grave inventory: The following objects were found at the end of the left collarbone, at the shoulder (Fig. 14.B): 2. Rounded copper-alloy pendant (Fig. 14.2). Made from an irregular circle-shaped copper-alloy sheet, with 11 perforations. The suspension loop is missing. Diam: 3.1 cm; W_{sheet}: 0.05 cm. 3. Copper-alloy ring (Fig. 14.3). It is made from a wire with a circular cross-section. It is broken and deformed. Diam: 1.4 cm; Thickness: 0.1 cm. 4. Brick-red two-piece spheroid segmented glass bead (Fig. 14.4). It is decorated with intersecting wavy yellow lines and eight eye-shaped white inlays. H: 16 mm; Diam: 11 mm. 5. Perforated circular copper-alloy sheet (Fig. 14.5). Made of two thin convex sheets, with a mass of lead between them. They were presumably attached to each other by a rivet, but the rivet hole is missing. The artifact is broken. $Diam_{outer}$: 1.7 cm; $Diam_{inner}$: 0.9 cm; Thickness: 0.2–0.4 cm. 6. Spheroid red glass bead (Fig. 14.6). It is decorated with white intersecting wavy lines and five turquoise eye-shaped inlays on a white base. H: 7 mm; Diam: 13 mm. 7. Trapezoid iron buckle on the right (?) ilium (Fig. 14.7). The corners of the buckle are rounded, and the body is slightly flattened along its longitudinal sides. It is heavily corroded, and the prong is broken. Diam: 3.6 × 4.3 cm; Thickness: 0.7–1.3 cm. 8. Fragment of an iron chain, heavily corroded (Fig. 14.8). Its exact position is unknown. Several amorphous iron fragments are corroded onto the two-chain links. Diam: 1.1 × 1.5 cm; Thickness: 0.8 cm.

Fig. 14. Grave 1310/1422

Grave 1311/1423

Shaft grave (Fig. 15.A). Orientation: SW–NE. L: 228 cm; W: 93 cm; D: 98 cm. It appeared as a hardly perceptible, circular soil stain. Rectangular pit with straight walls. The well-preserved bones of a woman were found at the flat bottom of the grave in a supine position. The skull was tilted to the right and slightly backwards. The right arm was stretched close to the rib cage, and the left arm was placed on the left ilium. The legs are parallel, close to each other. A few small bones were dislocated, probably by the activity of rodents: one of the finger bones was found above the skull, to the west, while the patella was deposited near the ankle.

Anthropological characteristics: moderately preserved skeleton of a 50+-year-old female (probability calculated by the DSP2 method: 0.99). Severe degenerative changes, such as spinal osteophytosis and spondyloarthropathies, are evident in the thoracic and lumbar sections of the spine (the cervical vertebrae are missing). In addition to the osteophytes, excessive syndesmophyte formations are observed between the 2nd and 3rd, and the 3rd and 4th lumbar vertebrae. Arthritic alterations are present in the elbow, left wrist, right hip, and both knees, as well as on many costovertebral joints. A well-healed fracture of the right second metacarpal bone is also noted.

Grave inventory: 1. Silver earring with open ends at the west corner of the grave (Fig. 15.1). The wire has a round cross-section, its two ends bent over each other. Diam: 2–2.1 cm; Thickness: 0.2 cm. 2. Riveted small copper-alloy sheet on the bones of the right foot (Fig. 15.2). At least two hollow rivets were soldered to one side; one of them is broken. The item is fragmented; the original edges are unidentifiable. Size: 2.6 × 1.4 cm; Thickness: 0.04 cm, L_{rivet}: 0.95 cm, $Diam_{rivet}$: 0.2 cm. 3. Iron object on the right foot (Fig. 15.3). Heavily corroded and crumbled fragments. 4. Silver earring with a small spherical pendant, collected from an unknown part of the grave (Fig. 15.4). The open ring has a round, thick cross-section. The ends are close together. The globular pendant is made of two soldered hemispheres. Diam: 2.2 cm; Thickness: 0.3 cm; Diam: 0.7 cm. 5. Three thin, bent copper-alloy clasps. Their original position is unknown. Size: 0.5–0.9 × 0.8–1.1 cm; W.: 0.05 cm.

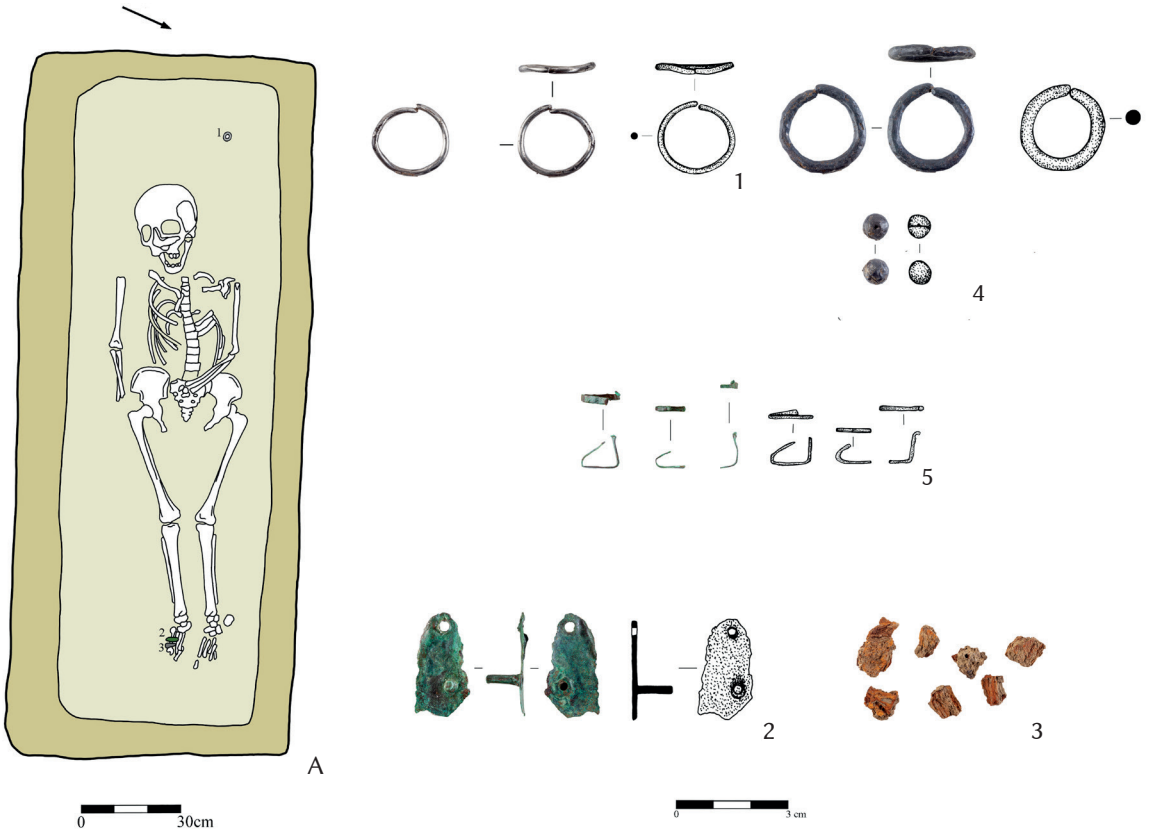

Fig. 15. Grave 1311/1423

Grave 1313/1425

Shaft grave (Fig. 16.A). Orientation: SW–NE. L: 292 cm; W: 98 cm; D: 125 cm. It appeared as a rectangular, mixed, barely recognizable soil stain. It is a rectangular pit with straight walls slightly tapered towards the bottom. The poorly preserved remains of a man in a supine position were found at the flat bottom of the grave. The arms are bent at the elbows, with the hands resting on the pelvis. The legs are parallel and close together. The skull is smashed, and the bones of the upper arms, most of the ribs, the ilium, and the small bones of the feet and hands have perished.

Anthropological characteristics: poorly preserved remains of a 35–50-year-old male individual. Linear enamel hypoplasia was observed on a tooth.

Grave inventory: 1. Fragments of two copper-alloy rivets at the left ilium (Fig. 16.1). Only the spikes were preserved. L: 0.8–1 cm. 2. Trapezoid iron buckle with rounded corners and slightly inverted sides at the left ilium (Fig. 16.2). It is heavily corroded. Diam: 3.5 × 3.1 cm; Thickness: 0.5–0.7 cm. 3. At least three copper-alloy rivets found at the lower section of the thoracic spine (Fig. 16.3). The rivets have a slightly convex head and a small spike. One is intact; the others are fragments. $Diam_{head}$: 0.8–1 cm; L: 1.1 cm. 4. Fragments of copper-alloy rivets (?) at the right elbow (Fig. 16.4). Only two small, amorphous fragments remained. 5. A brownish-yellow,

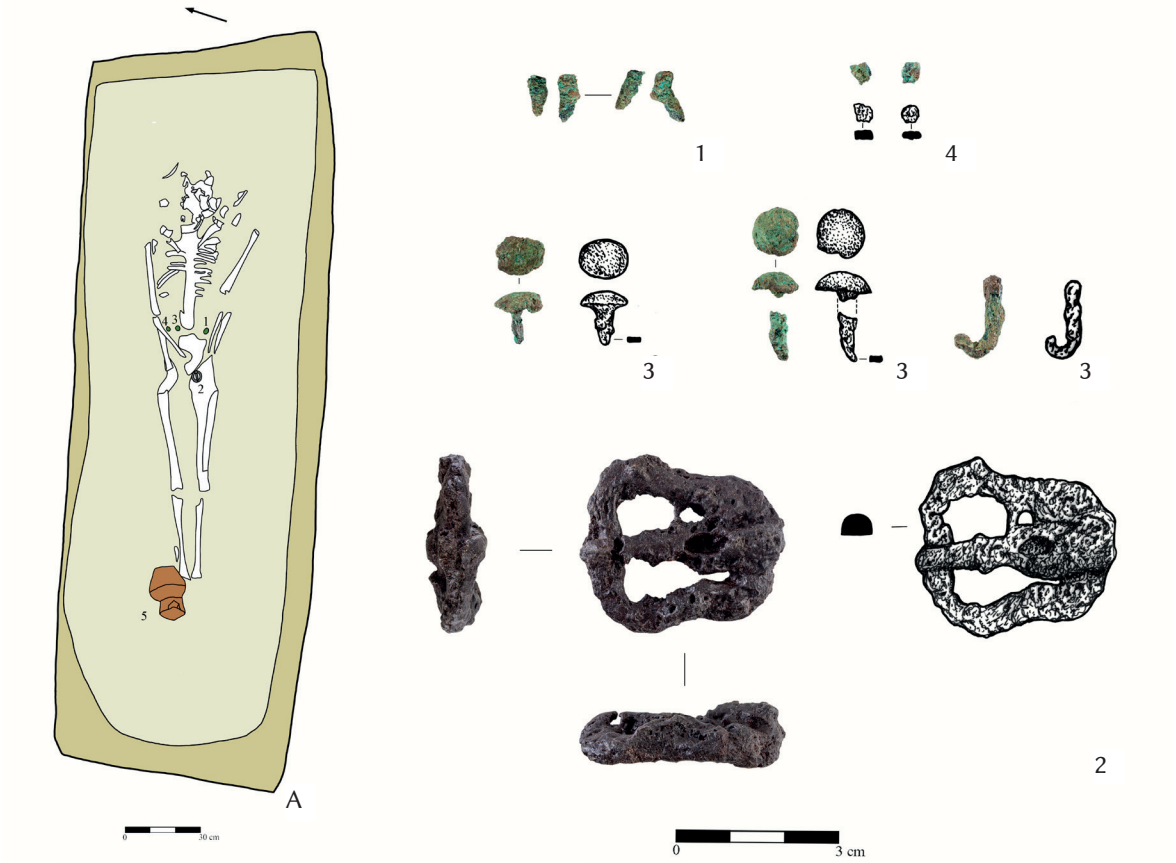

Fig. 16. Grave 1313/1425

handmade jug with grey discoloration, placed on the outer side of the right foot, with its mouth oriented towards the grave's end (Fig. 17). The jug was roughly worked, tempered with organic material and grog. The surface was probably glossed with black paint-run patterns. The jug was of a medium height, widening at the rounded shoulder; it has a funnel neck with an applied spout. The vertical handle is thick, has an oval cross-section, and attaches to the rim and the shoulder. The rim is curved and vertical, the base is flat. Fragmentary and incomplete artefact. H: 18.9 cm; $Diam_{rim}$: 10.9–11.1 cm; $Thickness_{rim:}$ 0.7 cm; $Diam_{bottom}$: 8.9 cm; W_{handle}: 2.6 cm; $Thickness_{handle}$: 1.9 cm.

Grave 1314/1426

Shaft grave (Fig. 18.A). Orientation: ENE–WSW. L: 225 cm; W: 102 cm; D: 65 cm. It appeared as a barely recognizable, mixed, rectangular soil stain with rounded corners. The pit had narrow walls tapered towards the flat bottom. On the north side, the wall was overexcavated. The grave was too long for the height of the deceased. The well-preserved bones of a woman were found at the bottom of the pit, in a supine position. The skull was turned to the left, the shoulders were in a raised position, and the arms were close to the rib cage. The legs were parallel, and the feet were pressed down. Some of the thoracic vertebrae were missing.

Anthropological characteristics: well-preserved remains of a 25–30-year-old female. The lumbar section of the spine indicates mild marginal osteophytes and a Schmorl's node. The cranium is long (hyperdolichocrane). The rASUDAS application assigned the individual to Western Eurasian and East Asian ancestry groups with respective posterior probabilities of 8.05% and 91.95%. In contrast to the dentition, the non-metric features of the cranium showed more Western Eurasian features.

Grave inventory: 1. Trapezoid iron buckle with rounded corners and slightly inverted longitudinal sides, found at the medial side of the right knee (Fig. 18.1). The prong is thin, and does not extend over the frame. Heavily corroded object, the body is fragmentary, the prong is broken. L: 3 cm; W: 2.4–2.7 cm; Thickness: 0.4 cm; $Thickness_{prong}$: 0.4 cm. 2. Sarmatian pottery shards in the grave's infill; now lost.

Fig. 17. Grave 1313/1425

Grave 1324/1437

Grave with a sidewall niche (Fig. 19.A). Orientation: E–W. L: 189 cm; W: 113 cm; D: 70 cm. It appeared as a barely recognizable rectangular soil stain. The shape of the entrance pit was irregularly rectangular; the walls were straight, slightly tapered towards the roughly flat bottom. The walls of the niche are curved; they are 10 cm deeper than the bottom of the entrance pit. The poorly preserved and disturbed remains of a child were discovered at the bottom of the niche, in a supine

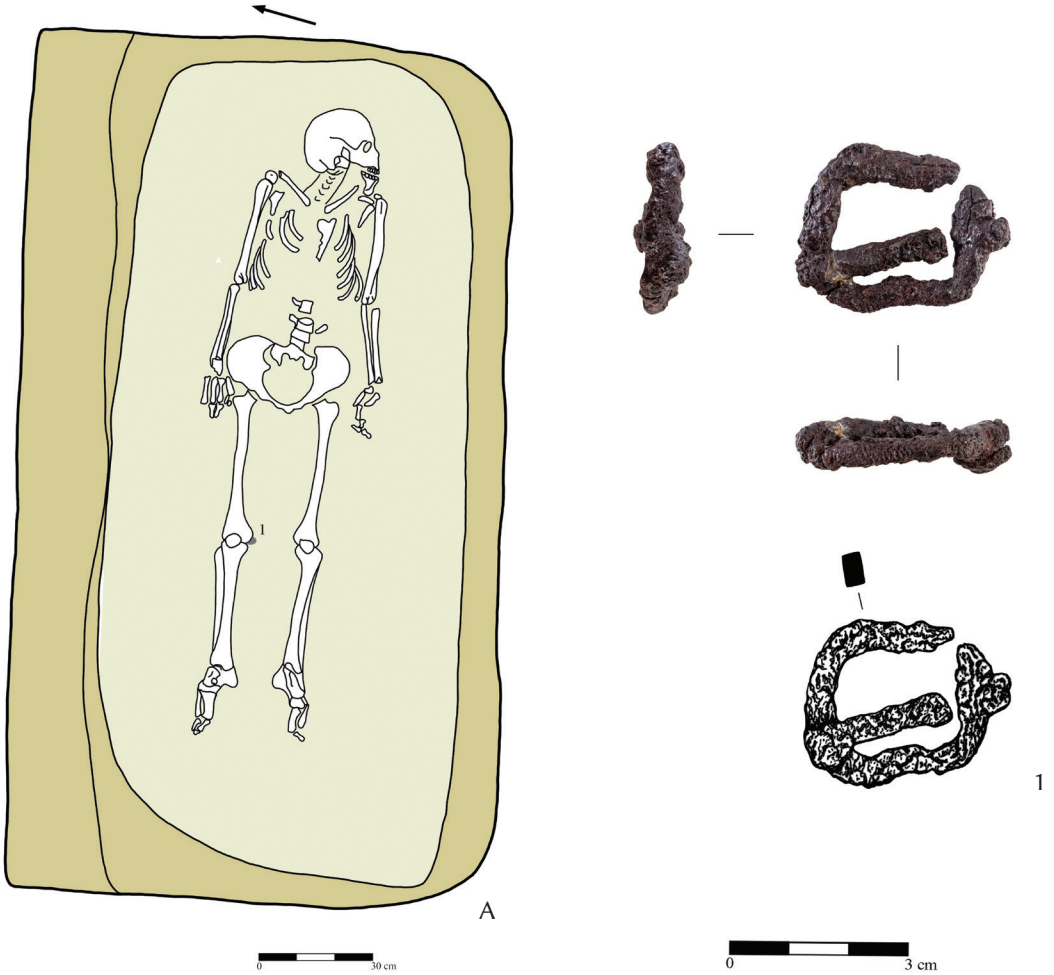

Fig. 18. Grave 1314/1426

position, with the knees up. Only the skull, the mandibles, and a few limb bones were preserved. The niche cuts Grave 1434/1565.

Anthropological characteristics: poorly preserved remains of a 9.5–10.5-year-old child. The rASUDAS application assigned the individual to Western Eurasian and East Asian ancestry groups with respective posterior probabilities of 96.49% and 3.51%.

Animal remains: 1. Skull, mandibles, and incomplete lower limbs of a subadult, 4–4.5-year-old horse at the bottom of the entrance pit. The absence of the dens caninus suggests that it was a mare; based on the only preserved metacarpal, the animal measured 131 cm at the withers. The horse skull was found at the eastern end of the pit, oriented the same way as the deceased. The incomplete lower limbs were placed along the central axis of the entrance pit, suggesting that the remains belonged to a folded hide. 2. Skull, mandibles and incomplete lower limbs of a juvenile, 16–20-month-old sheep, perhaps at the western end of the grave.[7] The remains are heavily fragmented and very poorly preserved. Based on its calculated age at death, the animal must have been slaughtered in the summer or autumn (July–November).

Grave inventory: 3. Handmade light grey cooking pot with dark grey discoloration, found at the right side of the human skull (Fig. 19.3). The vessel was found in a tilted position, its mouth was oriented towards the legs. Its material was tempered with sand and grog, some of which are exposed on the surface. The surface is untreated. The rim is small and slants outward. The pot is small, with a rounded carination and a flat base. The artefact is fragmented and incomplete. H: 14.4 cm; $Diam_{edge}$: 9.6–9.9 cm; $Thickness_{edge}$: 0.6 cm; $Diam_{bottom}$: 8.3 cm; $Diam_{max}$: 12.4 cm. 4. Unidentified iron object found beside the pelvis, presumably at the proximal end of the femur (Fig. 19.4). It has a rectangular cross-section. Heavily corroded, fragmented object. L: 2.6 cm; Thickness: 0.5–0.6 cm.

7 It was not documented; only small bones are visible in the photos.

Fig. 19. Grave 1324/1437

Grave 1383/1512

Grave with longitudinal ledges (Fig. 20.A). Orientation: SW–NE. L: 272 cm; W: 139 cm; D: 104 cm. It appeared as a small, round soil stain, and the edges of the grave were difficult to identify. On the two longitudinal sides of the rectangular burial pit, there were two narrow ledges at depths of 46 and 97 cm, respectively. These were barely perceptible at the northern and southern ends of the grave. The walls of the pit were tapered towards the flat bottom. The well-preserved remains of a woman were found in the pit, in a supine position. The skull was tilted to the right side. The shoulders were in a raised position, the arms were stretched beside the ribcage, and the legs were parallel. The cervical and thoracic vertebrae were missing, the remains must have been disturbed by rodents. The left scapula was fragmentary, and the ribs were displaced.

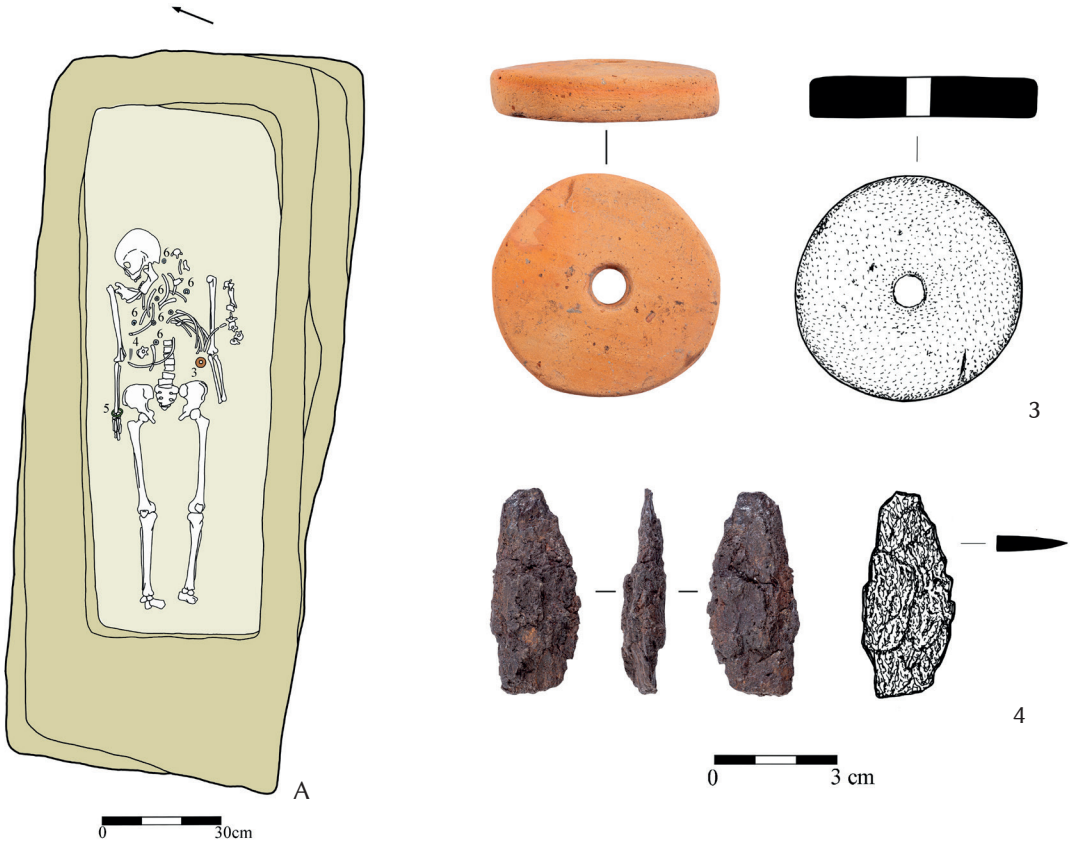

Fig. 20. Grave 1383/1512

Anthropological characteristics: well-preserved remains of a 25–30-year-old female (probability calculated by the DSP2 method: 1). The lumbar section of the spine indicates mild marginal osteophytosis. Multiple Schmorl's nodes can be observed on the thoracic and lumbar spine. A perimortem cutmark is visible on the medial edge of the left clavicle's shaft. Perimortem cutmarks can be detected on the edge of the radius, 1 cm beyond the styloid process, which resulted in a small portion of bone missing. The cutmark extends onto the dorsal surface, almost parallel to another cut in a similar direction. The cranium is short (brachycrane) and low (chamaecrane, tapeinocrane). The rASUDAS application assigned the individual to Western Eurasian and East Asian ancestry groups with posterior probabilities of 99.51% and 0.49%, respectively.

Grave inventory: 1. Open silver earring at the right side of the skull (Fig. 21.1). It is made from a wire with a circular cross-section; one end was tapered and the other rounded. Diam: 1.1–1.4 cm; Thickness: 0.16 cm. 2. Closed silver earring under the right scapula (Fig. 21.2). It is made from a wire with a circular cross-section; one end of the wire is bent onto the other. Diam: 1.2–1.4 cm; Thickness: 0.1 cm. 3. Spindle-whorl at the medial side of the left upper arm, made from an orange/red colored pot fragment (Fig. 20.3). It has an irregular disc shape, its surface is slightly convex. Diam: 5.3 × 5.4 cm; $Diam_{hole}$: 0.8 cm; Thickness: 1.1 cm; Weight: 44 gr.

Fig. 21. Grave 1383/1512

4. Fragment of a single-edged iron knife with a straight spine, found on the inner side of the right elbow (Fig. 20.4). Only parts of the tang and the blade were preserved. L: 4.9 cm; W_{tang}: 1 cm; W_{blade}: 2.1 cm. 5. Copper-alloy bracelet on the right wrist (Fig. 21.5). It is made of a thin copper-alloy plate; its two triangular ends are rolled back. Heavily deformed. Diam: 5.8 cm; W: 0.49 cm; Thickness: 0.07 cm. 6. Glass beads scattered throughout the grave pit; their original location is unknown (Fig. 21.6). 6/1. Elongated biconical dark blue opaque glass bead. H: 16 mm; Diam: 5 mm. 6/2. Ring-shaped dark blue opaque glass bead. H: 2 mm; Diam: 6 mm; $Diam_{hole}$: 4 mm. 6/3. Truncated conical light green pearlescent glass bead. H: 5.7 mm; Diam: 8.8 mm. 6/4. Spheroid yellow opaque glass bead with brown surface discoloration. H: 3.6 mm; Diam: 6 mm. 6/5. Spheroid yellow opaque glass bead with brown surface discoloration. H: 3.9 mm; Diam: 5.7 mm. 6/6. Spheroid yellow opaque glass bead with brown surface discoloration. H: 2.9 mm; Diam: 6.2 mm. 6/7. Spheroid yellow opaque glass bead with brown surface discoloration. H: 3.2 mm; Diam: 5.4 mm. 6/8. Spheroid light yellow opaque glass bead with brown surface discoloration. H: 3 mm; Diam: 4.9 mm. 6/9. Spheroid light yellow opaque glass bead with brown surface discoloration. H: 3 mm; Diam: 4.2 mm. 6/10. Spheroid light yellow opaque glass bead with brown surface discoloration. H: 2.6 mm; Diam: 4.1 mm. 6/11. Spheroid light yellow opaque glass bead with brown surface discoloration. H: 2.6 mm; Diam: 4.3 mm. 6/12. Fragment of a spherical orange opaque glass bead. H: 3.2 mm; Diam: 5.4 mm. 6/13. Ring-shaped blue glass bead. H: 3 mm; Diam: 5.4 mm. 6/14. Ring-shaped blue glass bead. H: 2.3 mm; Diam: 4.3 mm. 6/15. Ring-shaped blue glass bead. H: 1.9 mm; Diam: 4.8 mm. 6/16. Ring-shaped blue glass bead with a damaged, porous surface. H: 2.4 mm; Diam: 4.4 mm. 6/17. Spheroid blue pearlescent glass bead with a damaged, porous surface. H: 3.7 mm; Diam: 5.7 mm. 6/18. Spheroid blue pearlescent glass bead with a damaged, porous surface. H: 3 mm; Diam: 5.6 mm. 6/19. Fragments of at least three melon seed-shaped translucent glass beads with copper-alloy tubes. H: 10–13 mm. 6/20. Fragments of at least four melon seed-shaped translucent glass beads. H: 11–13 mm. 6/21. Fragments of at least three melon seed-shaped light green iridescent glass beads. H: 9–11 mm. 7. Fragments of an iron chain found at different locations in the grave (Fig. 21.7). The find consists of several heavily corroded links, only one of them is well-preserved. Diam: 1 cm.

Grave 1384/1513

Shaft grave (Fig. 22.A). Orientation: E–W. L: 190 cm; W: 66 cm; D: 41 cm. It appeared as a trapezoid soil stain with rounded corners and sides narrowing towards the legs of the deceased. The walls were straight and tapered towards the flat bottom. The well-preserved bones of a man were discovered at the bottom in a supine position. The skull was tilted to the right, the shoulders were in a raised position, and the arms were stretched closely beside the rib cage. The left arm is bent towards the pelvis.

Anthropological characteristics: well-preserved remains of a 25–30-year-old male (probability calculated by the DSP2 method: 0.81). At the distal end of the right humerus, traces of a well-healed *antemortem* fracture can be seen, which is indicated by a slight axis deviation. The cranium is long (hyperdolichicrane) and low (chamaecrane, tapeinocrane). The face is wide (hypereuryen, euryprosop). The rASUDAS application assigned the individual to Western Eurasian and East Asian ancestry groups with posterior probabilities of 86.62% and 13.38%, respectively. Similarly, in the dentition, the non-metric traits of the cranium showed Western Eurasian features.

Animal remains: 1. Skull of a small ruminant in the northeastern part of the grave, ca. 10–15 cm above the human skull. The skull was tilted to its left side, with the nose oriented to the north-east. The legs were missing. The finds are now lost; the excavation photos suggest that it was probably a polled sheep, but this remains speculative without detailed archaeozoological examination. 2. Fragmented skull, mandibles, and incomplete lower limbs of an adult sheep in the southwest corner of the grave, at the feet of the deceased. The jaws were oriented to the south. One metatarsal was found between the right tibia of the deceased and the grave wall; the other leg bones were deposited in a pile next to the skull. The position of the remains suggests that they belonged to a folded hide. The horn cores are small and rudimentary, ca. 12 cm long. The animal measured 64.5 cm at the withers; its long and slender metatarsals suggest that it was a wether (castrated ram).

Grave inventory: 3. Single-edged iron knife with a straight spine, found on the left ilium, under the left hand (Fig. 23.3). It was found in four fragments. L: approx. 21.1 cm; W: 1.2–2.8 cm. 4. Tang of an iron knife (Fig. 23.4). L: 5.6 cm; W: 1.9 cm; Thickness: 0.8 cm. 5. Flints under the left femur (Fig. 22.5). 5/1. Light brown flint. L: 2.5 cm; W: 1 cm. 5/2. White flint with reddish-orange colors and a triangular cross-section. L: 1.8 cm; W: 0.8 cm. 6. Trilobated iron arrowhead with tang (Fig. 22.6). It was found together with the iron knife at the left ilium, under the left hand. L: 5.3 cm; W: 1.7 cm.

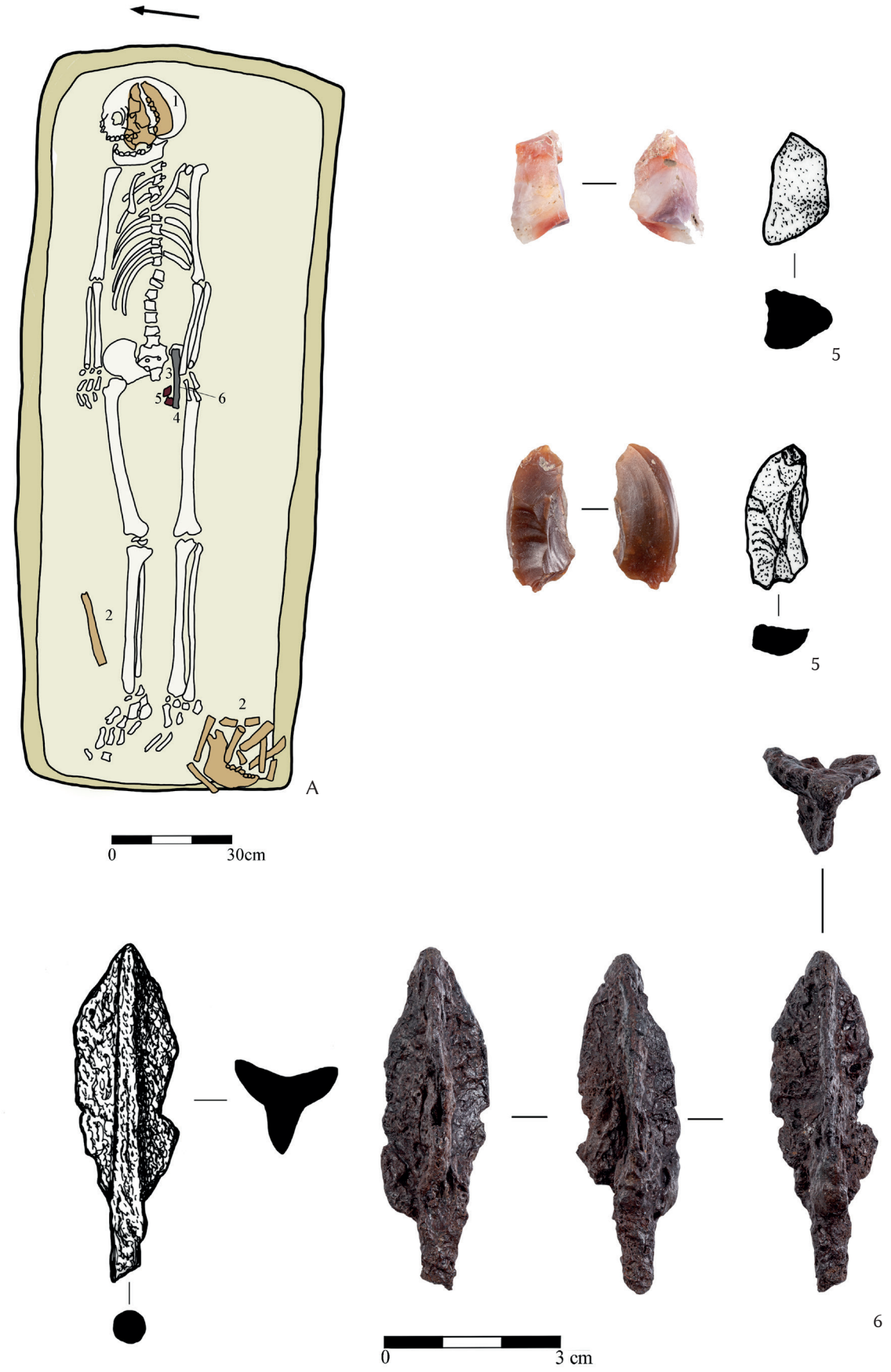

Fig. 22. Grave 1384/1513

Fig. 23. Grave 1384/1513

Grave 1412/1541

Shaft grave (Fig. 24.A). Orientation: NE–SW. L: 148 cm; W: 60 cm; D: 15 cm. The irregular, oval-shaped burial pit appeared as an elongated, narrow soil stain. The walls of the grave were slightly tapered towards the bottom; its two ends semicircular, and the bottom uneven. The burial pit is much too long for the deceased. The poorly preserved remains of a child were found in a supine position. Only the humerus and a few cranial fragments were present.

Anthropological characteristics: poorly preserved cranial remains of a child aged between 10 and 18 months.

Animal remains: 1. Skull, mandibles, and incomplete lower limbs of an adult sheep at the west end of the grave. The skull was oriented to the northwest and was found on top of an 8–10 cm thick infill layer. The left metatarsal was found on top of the human skull, while the right metacarpal was to the right of the sheep skull. Only a fragment of the left astragalus, calcaneus and metatarsal, the right metacarpal and tibia, and fragmented phalanges are preserved from the legs. The hide may have been spread out on the child's body. Based on the metapodia, the animal measured 58.5 cm at the withers. 2. Fragmented shell of a painter's mussel (*Unio pictorum*) in the middle of the grave (Fig. 24.2). It was found in four fragments. 3. Fragments of the sternum and ulna from a juvenile hen, found among the bones of the human skull. Probably a food offering. 4. Mandible of a European water vole (*Arvicola amphibius*), probably a secondary deposition.

Grave 1414/1543

Shaft grave (Fig. 25.A). Orientation: E–W. L: 95 cm; W: 40 cm; D: 18 cm. It appeared as an oval-shaped, elongated, narrow soil stain. The grave filling consisted of mixed, dark brown loam. The grave pit was rectangular with straight walls tapered towards the flat bottom. The poorly preserved bones of a child were found, in a supine position. The skull was slightly tilted to the right, the arms were stretched beside the ribcage. The legs were disturbed in the west part of the grave. Only the skull, the left arm, and some of the ribs were preserved; the rest of the bones were only perceptible as an imprint in the soil.

Anthropological characteristics: poorly preserved cranial remains of a 1.5–2.5-year-old child. On the right maxilla, next to the aperture, there is a sign of intense periosteal apposition that extends to the infraorbital foramen and the alveolar process. The deciduous first upper incisors are medium-size and pronouncedly shovel-shaped.

Animal remains: 1. Skull, mandibles, and incomplete lower limbs of a (newborn?) calf, deposited 13 cm above the deceased. One of the forelegs was placed partly on top of the child's left pelvis. The position of the skull and the other leg bones is unknown. The remains are heavily fragmented and poorly preserved. Based on its age at death, the animal was probably killed in the spring.

Grave inventory: 2. Handmade, light brown cooking pot with grey dots, found at the southeast corner of the grave, to the left side of the skull of the child (Fig. 25.2). The material is roughly worked, tempered with sand, organic material and grog, some of which is exposed on the surface in the form of inclusions. Its surface is coarse. The fragmented rim thickens towards the outside with an outward sloping slant. It is globular with a straight, flat bottom. H: 15.2 cm; $Diam_{rim}$: 12.6 cm; $Diam_{max}$: 13.2 cm; $Diam_{bottom}$: 9.5 cm.

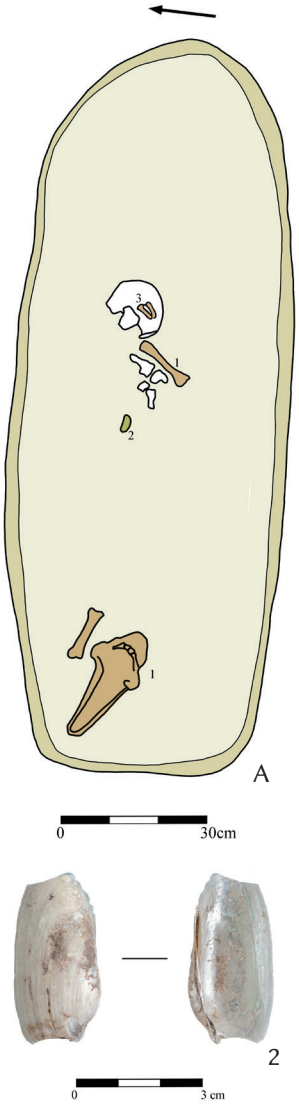

Fig. 24. Grave 1412/1541

Grave 1415/1544

Shaft grave (Fig. 26). Orientation: NE–SW. L: 123 cm; W: 45 cm; D: 8 cm. It appeared as a narrow, elongated, oval-shaped soil stain. The corners were rounded, the walls tapered towards the bottom. The north end was not properly excavated. The fairly preserved remains of a child were found at the bottom, in a supine position. The skull was tilted forward, and the arms stretched beside the ribcage. The left hand was placed on the left pelvis. The feet were close to each other at the ankles. The skull was crushed during the excavation of the infill. Without inventory.

Anthropological characteristics: moderately preserved remains of a 1.5–2.5-year-old child. Both parietal bones exhibit porous alterations, diagnosed as cribra cranii.

Grave 1416/1545

Shaft grave (Fig. 27.A). Orientation: NE–SW. L: 141 cm; W: 52 cm; D: 21 cm. It appeared as an oval-shaped, elongated, but narrow soil stain. The pit was rectangular with rounded corners and straight, slightly tapered walls. The south and west parts of the grave were overexcavated. The poorly preserved remains of a child were found in a supine position. Only the skull was preserved *in situ*, the mandible and the rest of the skeleton is missing.

Fig. 25. Grave 1414/1543

Anthropological characteristics: poorly preserved cranial remains of a 1.5–2.5-year-old child.

Animal remains: 1. Skull, mandibles and incomplete lower limbs of an adult sheep in the west end of the grave, 18 cm above the bottom. The bones are heavily fragmented. Based on a relatively well-preserved metacarpal, the animal measured 59.8 cm at the withers. The skull is placed along the axis of the grave, facing west; the legs were positioned partly under the sheep skull and partly between the skull and the northern wall of the pit, suggesting that a folded hide was placed in the grave.

Grave inventory: 2. Handmade, light grey cooking pot with dark grey discoloration to the right of the child's skull (Fig. 27.2). Its material is roughly worked and tempered with grog, some of which is exposed on the surface in the form of inclusions. The surface is coarse. The rim is incomplete and slopes outward, the body is barrel-shaped. The rugged base has a footring. H: 10 cm; $Diam_{max}$: 8 cm; $Diam_{bottom}$: 6.5 cm.

Grave 1426/1555

Shaft grave (Fig. 28.A). Orientation: E–W. L: 129 cm; W: 56 cm; D: 44 cm. Its soil stain was easily detectable. The burial pit was rectangular with rounded ends and had straight walls that were tapered towards the flat bottom. The burial pit was long for the height of the deceased. In the eastern half of the grave, the moderately preserved remains of a child were found in a supine position. The skull was not tilted, the right elbow was bent and the arm placed on the stomach, and the right leg was extended. The vertebrae, part of the ribs, the bones of the left arm and left leg, the pelvis, the hands, and the feet are missing.

Anthropological characteristics: moderately preserved remains of a 10–18-month-old child.

Animal remains: 1. Skull, mandibles, and incomplete lower legs of an adult, polled sheep at the east end of the grave. The skull was found 2 cm below the modern floor level, placed along the central axis of the grave,

facing east; the leg bones were found under the skull. Based on the metapodia, the animal measured 61.4 cm at the withers. The position of the bones suggests that they belonged to a folded hide. 2. Skull, mandibles, and incomplete lower legs of a 3–6-month-old lamb, found next to the adult sheep. The skull was placed along the central axis of the grave, beside the skull of the adult sheep, facing east. The bones of the left foreleg were found on the west side of the skull, while the right foreleg was discovered between the skull and the grave wall. The position of the bones suggests that they belonged to a folded hide. Based on its age at death, the lamb was probably slaughtered in the summer of early autumn. 3. Egg of a domestic goose (?) at the right side of the child's skull, 6–7 cm from it (Fig. 28.3). Its taxonomic identification is uncertain. 4. Wing bone (right radius) of a hen, found in the pot. Probably a food offering. 5. Lumbar vertebrae of a subadult sheep, placed under the pot at the child's feet. Probably a food offering.

Grave inventory: 6. Handmade, light brown cooking pot with grey dots, located west of the feet, 18 cm below the modern floor level (Fig. 28.6). Its mouth was oriented to the north. The material was roughly worked and tempered with organic material and grog, some of which is exposed on the surface in the form of inclusions. The rim is turned outward and decorated with deep fingerprints. The body is barrel-shaped but lopsided. The bottom is straight. H: 12.1 cm; $Diam_{rim}$: 10.7 cm; $Diam_{body}$: 9.5 cm; $Diam_{base}$: 6.6 cm. 7. Three fragments of a bronze sheet in the grave's infill (Fig. 28.7). The largest piece was found 6–8 cm from the right side of the skull; the exact location of the other fragments is unknown. 7/1. Copper-alloy sheet. Slightly curved. L: 1.6 cm; W: 1.6 cm; Thickness: 0.3 mm. 7/2. Copper-alloy sheet. Holes for rivets on the fragmented edge. L: 1.6 cm; W: 1.2 cm; Thickness: 0.4 mm. 7/3. Copper-alloy sheet. Reconstructed from several parts. L: 1.8 cm; W: 1 cm; Thickness: 0.3 mm.

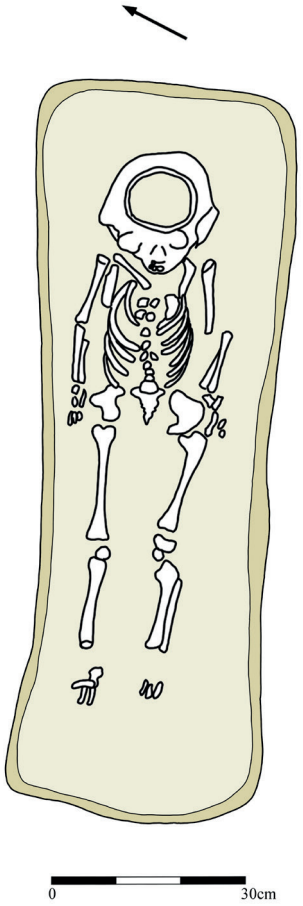

Fig. 26. Grave 1415/1544

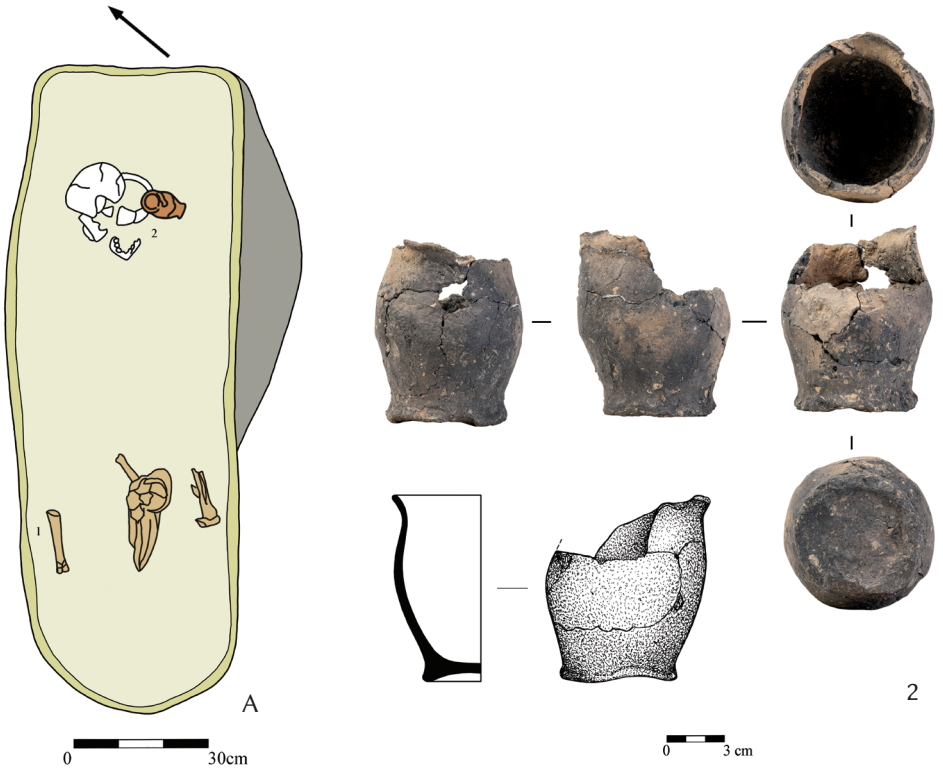

Fig. 27. Grave 1416/1545

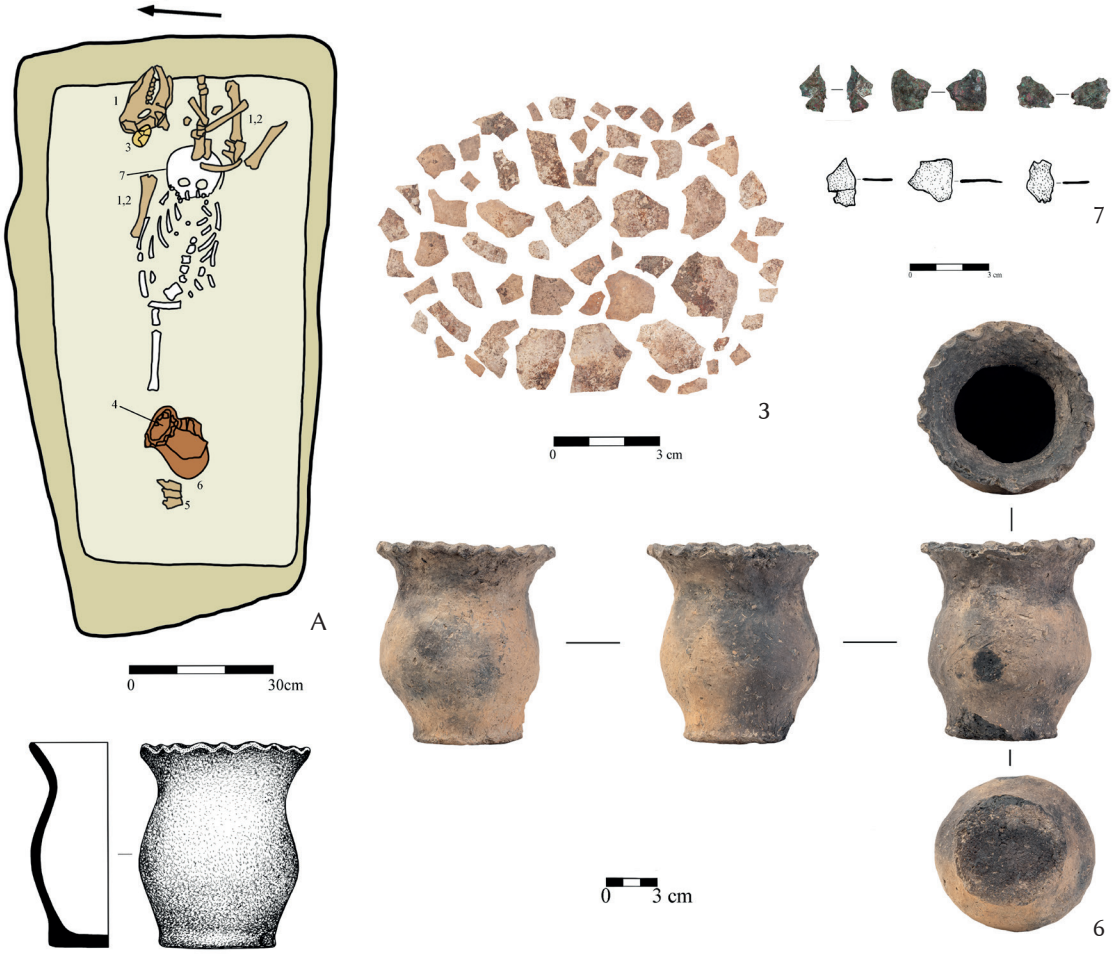

Fig. 28. Grave 1426/1555

Grave 1432/1564

Shaft grave (Fig. 29). Orientation: E–W. L: 180 cm; W: 58 cm; D: 4 cm. The grave appeared as an oval-shaped soil stain and contained homogeneous black infill. The pit had an irregular oval shape, the bottom was horizontal, and the western end was overexcavated. The moderately well-preserved remains of a woman were found at the bottom, in a supine position. The shallow grave was damaged by the machines during soil removal. The skull, the left humerus and most of the ribs were missing. The arms were stretched beside the rib cage, the legs were parallel, with the ankles closely beside each other. Without inventory.

Anthropological characteristics: moderately fragmented and incomplete remains of a 50+-year-old female. Iron stains were observed on the distal end of the right radius and ulna. Traces of degenerative changes are visible on the thoracic and lumbar sections of the spine. There is a fracture on the talar neck, probably associated with ankle dislocation, as indicated by the formation of false joints (pseudoarthrosis) between the talus and the distal end of the tibia on the right side.

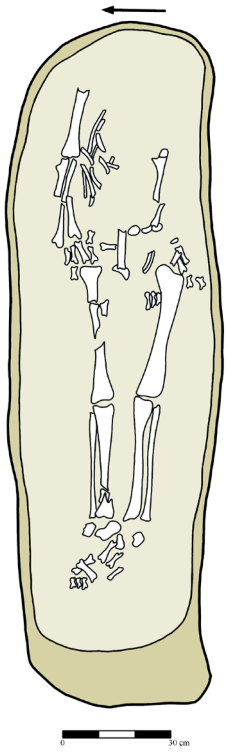

Fig. 29. Grave 1432/1564

Grave 1433/1563

Shaft grave (Fig. 30.A). Orientation: NE–SW. L: 153 cm; W: 50–60 cm; D: 15 cm. It appeared as a rectangular-shaped, dark brown soil stain. There were pottery fragments in the northeast end of the pit. The grave was slightly trapezoidal with rounded ends; the walls were curved; the bottom horizontal. The poorly preserved remains of a woman (?) were found in a supine position.[8] The skull was slightly tilted forward, the arms were stretched beside the rib cage, and the legs were parallel. The shoulder and the chest were disturbed, several ribs were missing.

Anthropological characteristics: highly fragmented and incomplete remains of a 25–35-year-old, presumably male individual.

Animal remains: 1. Partial skeleton of an adult hen in the pot on the right side. The head and the vertebrae are missing, the extremities were fragmented; only pieces of the sternum and synsacrum were preserved. Probably a food offering.

Grave inventory: 2. Handmade, yellow-brown cooking pot with dark grey discoloration, found to the left of the skull, tilted towards it (Fig. 31.2). The material was moderately worked, tempered with organic material, sand and grog, pieces of which are visible on the surface as inclusions. The small rim slopes outward. The object is globular, the base is flat. The rim and the walls are incomplete. H: 12.4 cm; $Diam_{rim}$: 10.5 cm; $Diam_{base}$: 10 cm; $Thickness_{rim}$: 0.5 cm. 3. Turquoise iridescent melon-shaped glass bead under the pot on the left side (Fig. 30.3). Broken into two. H: 13 mm; Diam: 10 mm; Thickness: 4 mm. 4. Handmade, light brown cooking pot with grey discoloration, found to the right of the skull, and was tilted towards it (Fig. 31.4). The material was roughly worked, tempered with organic material and grog, pieces of which are exposed on the surface

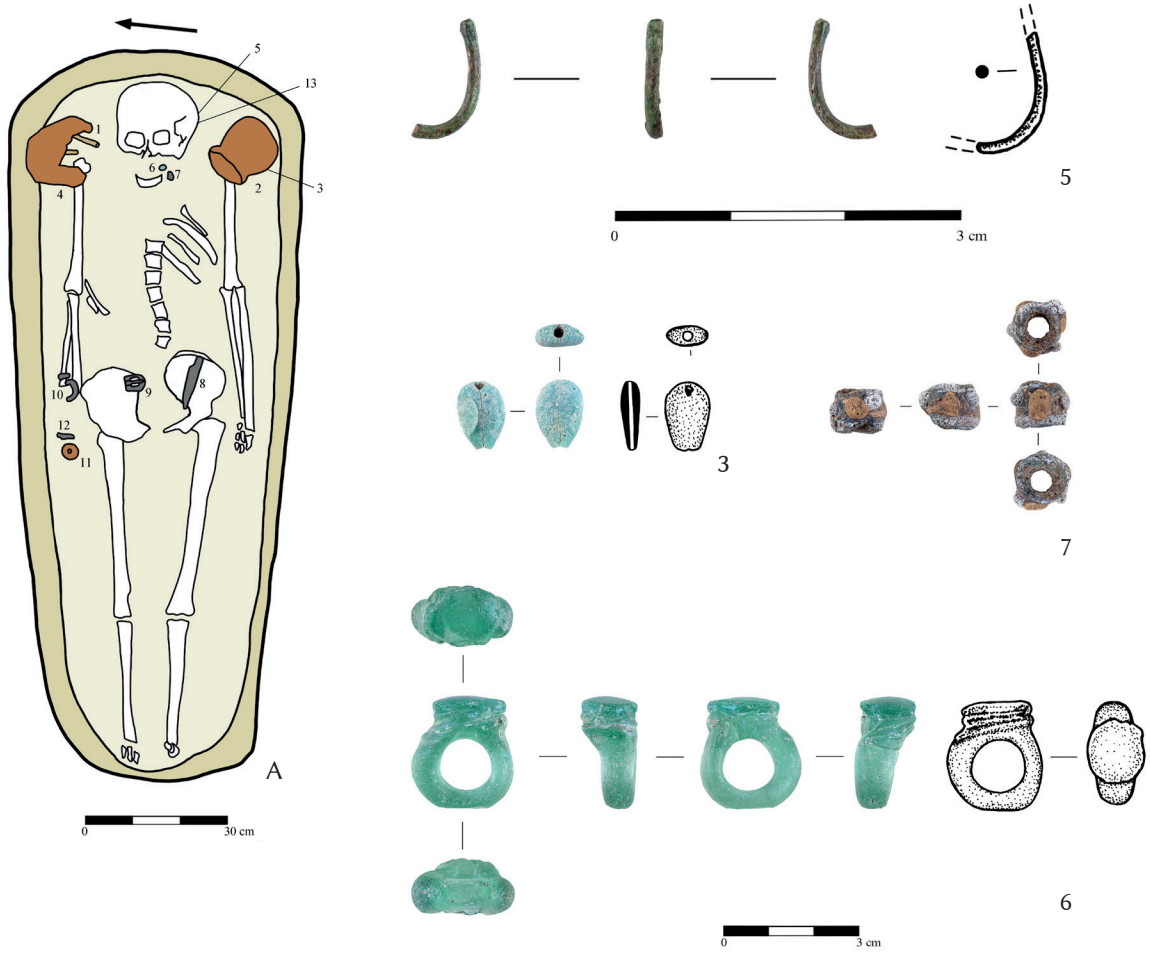

Fig. 30. Grave 1433/1563

8 Anthropologically, the skeletal remains were uncertainly defined as male.

as inclusions. The surface is smoothed and decorated with parallel scratched lines. The rim is short and sloping outward. The fabric has a spherical body and a flat base. Incomplete, fragmentary. H: 12.7 cm; $Diam_{rim}$: min. 14.5 cm; $Diam_{base}$: 8.1 cm; $Thickness_{rim}$: 6.8 mm. 5. Copper-alloy ring under the skull (Fig. 30.5). The exact finding location is unknown. The wire has a round cross-section; the object is fragmentary; its shape can no longer be reconstructed. L: 1.1 cm; Thickness: 0.1 cm. 6. Glass pendant under the skull (Fig. 30.6). The exact find

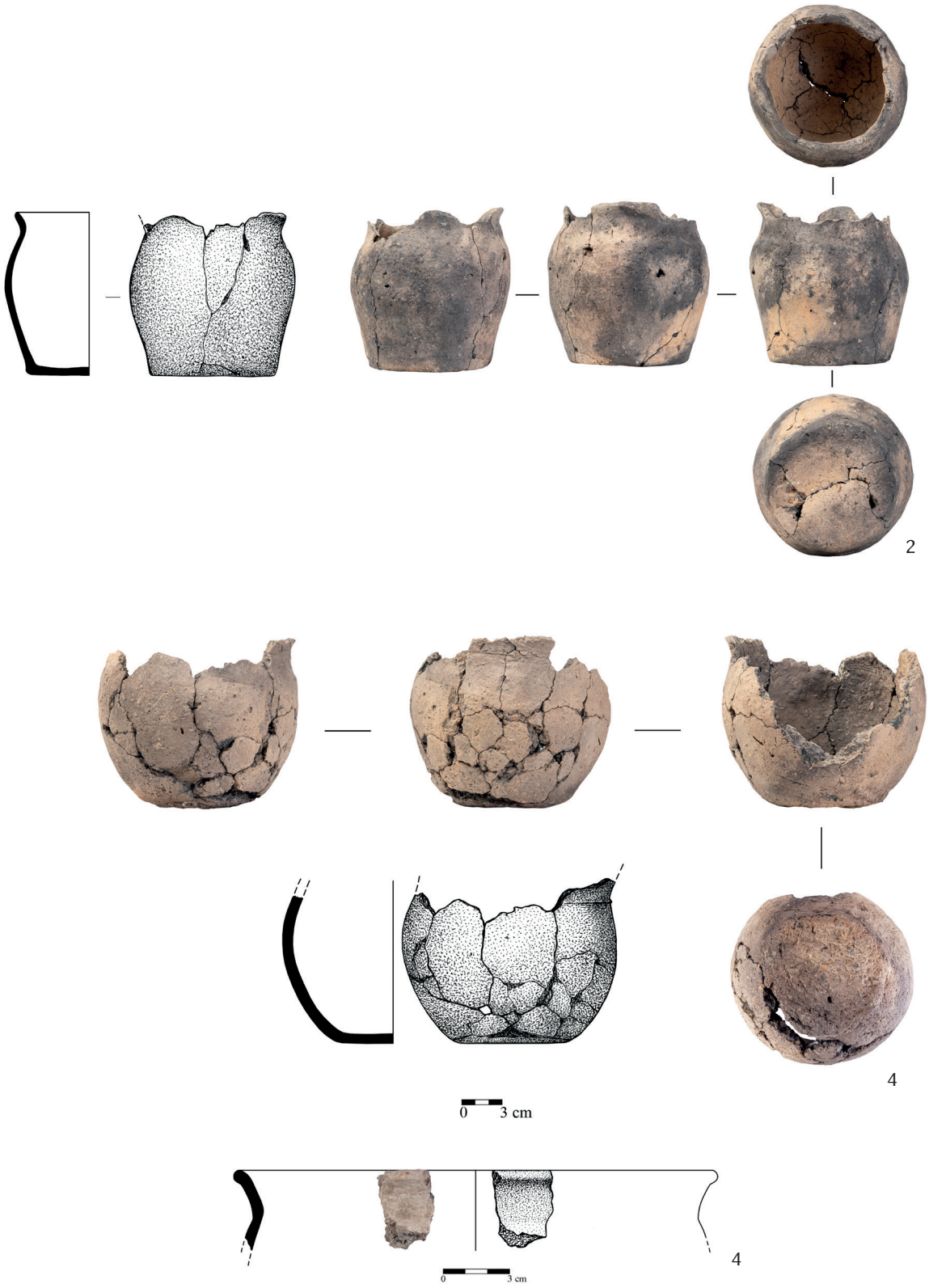

Fig. 31. Grave 1433/1563

location is unknown. It was recycled from a greenish-blue, ring-shaped handle of a Roman (?) glass vessel: the pendant was composed of the handle and the thick vessel wall. Its sides were strongly smoothed and rounded. $Diam_{loop}$: 2.1–2.5 cm; Thickness: 0.9 cm; Diam: 1.2 × 1.6 cm. 7. Cylindrical black glass bead from an unknown location under the skull (Fig. 30.7). It is decorated with three white and three yellow eye-shaped inlays as well as white lines at each end. Its surface is heavily damaged and porous. H: 9 mm; Diam: 11 mm; $Diam_{bore}$: 4 mm. 8. Single-edged iron knife with a slightly curved spine, found under the right pelvic bone (Fig. 32.8). The tip pointed towards the northeast. Heavily corroded object, the tip of the blade is broken. L_{total}: 12.1 cm; L_{tang}: 5.3 cm; W_{blade}: 2.1 cm; W_{tang}: 0.5–1.8 cm. 9. Trapezoid-shaped iron buckle at the left pelvis (Fig. 32.9). The edges are rounded, and the longitudinal sides are slightly dented. Heavily corroded object, the tip of the prong is broken. Diam: 3.4 × 4 cm; Thickness: 0.5–0.8 cm; L_{prong}: 2.7 cm; $Thickness_{prong}$: 0.6 cm. 10. Fragments of an iron ring under the right wrist, on the lateral side of the pelvis (Fig. 32.10). Only three fragments were preserved; their diameter is unknown. L: 1.5–2.3 cm; Thickness: 0.48–0.5 cm. 11. Spheroid spindle-whorl on the outer side of the femur (Fig. 32.11). It was made of light brown clay, the surface has slight grey discolorations. The perforation is relatively big and regular. Diam: 3.9 cm; H: 2.6 cm; $Diam_{perforation}$: 0.7 cm; Weight: 40 gr. 12. Two fragments of a narrow iron object with a round cross-section, found near the left femur (Fig. 32.12). L: 1.1–2.1 cm; Thickness: 0.5 cm. 13. Iron chain link under the skull (Fig. 32.13). It has an irregular circular shape and is heavily corroded. Diam: 1.6 cm; Thickness: 0.3 cm.

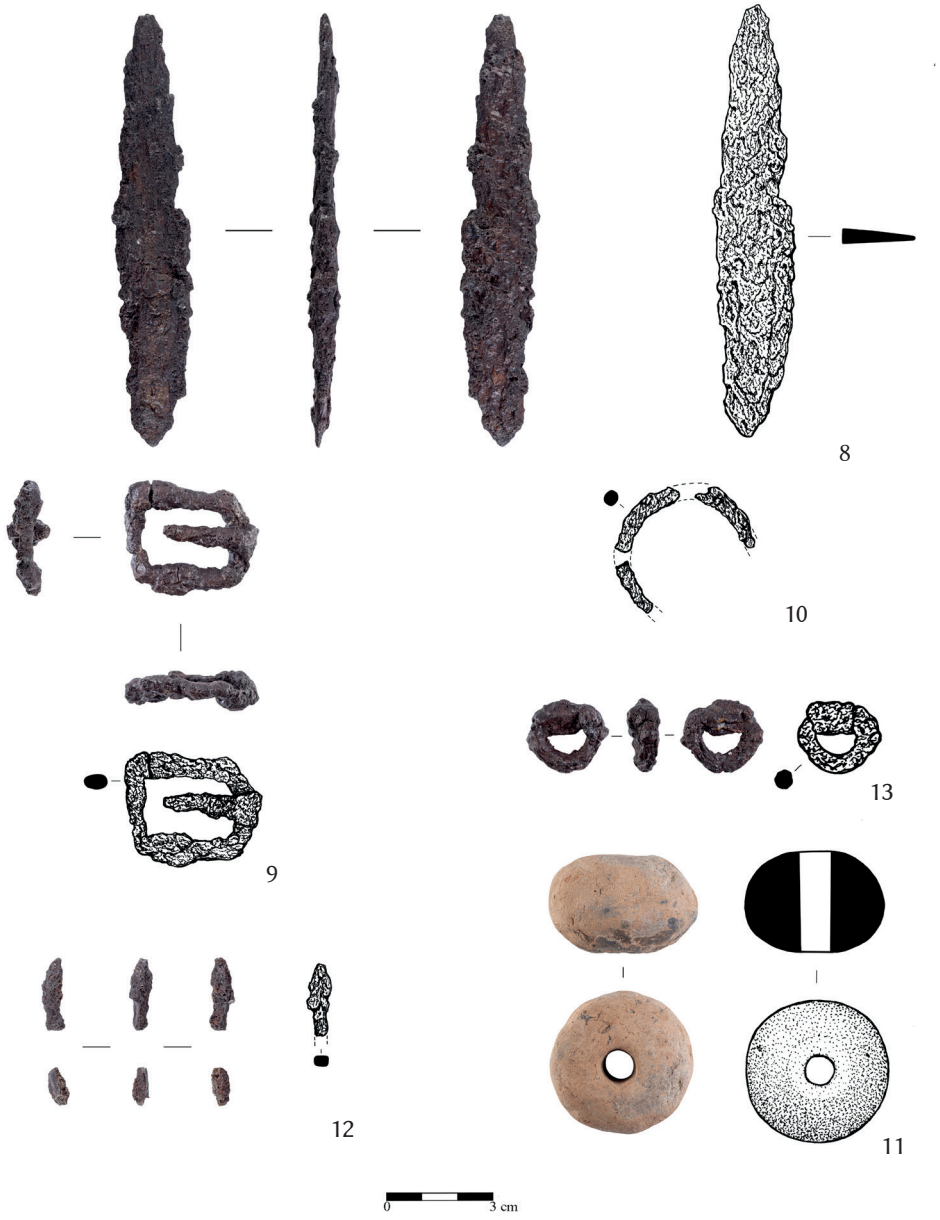

Fig. 32. Grave 1433/1563

Grave 1434/1565

Shaft grave (Fig. 33.A). Orientation: E–W. L: 178 cm; W: 60 cm; D: 25 cm. It appeared as a dark, rectangular soil stain. The grave pit was rectangular with rounded corners, and its walls were slightly tapered downwards the flat bottom. The pit was much longer than the body of the deceased. The southwest part was disturbed by Grave 1324/1437. In the east part of the grave, there were the moderately preserved remains of a child in a supine position. The skull was tilted to the left, the arms were stretched closely beside the rib cage, and the legs were parallel. The bones of the lower arm, the lower legs, the hands, and the feet were missing.

Anthropological characteristics: fragmented and considerably incomplete remains of a 5.5–6.5-year-old child.

Grave inventory: 1. Beads near the skull (Fig. 33.1). 1/1. Spheroid light green opaque iridescent glass bead. H: 8 mm; Diam: 10 mm. 1/2. Spherical white opaque glass bead. H: 6 mm; Diam: 7.8 mm.

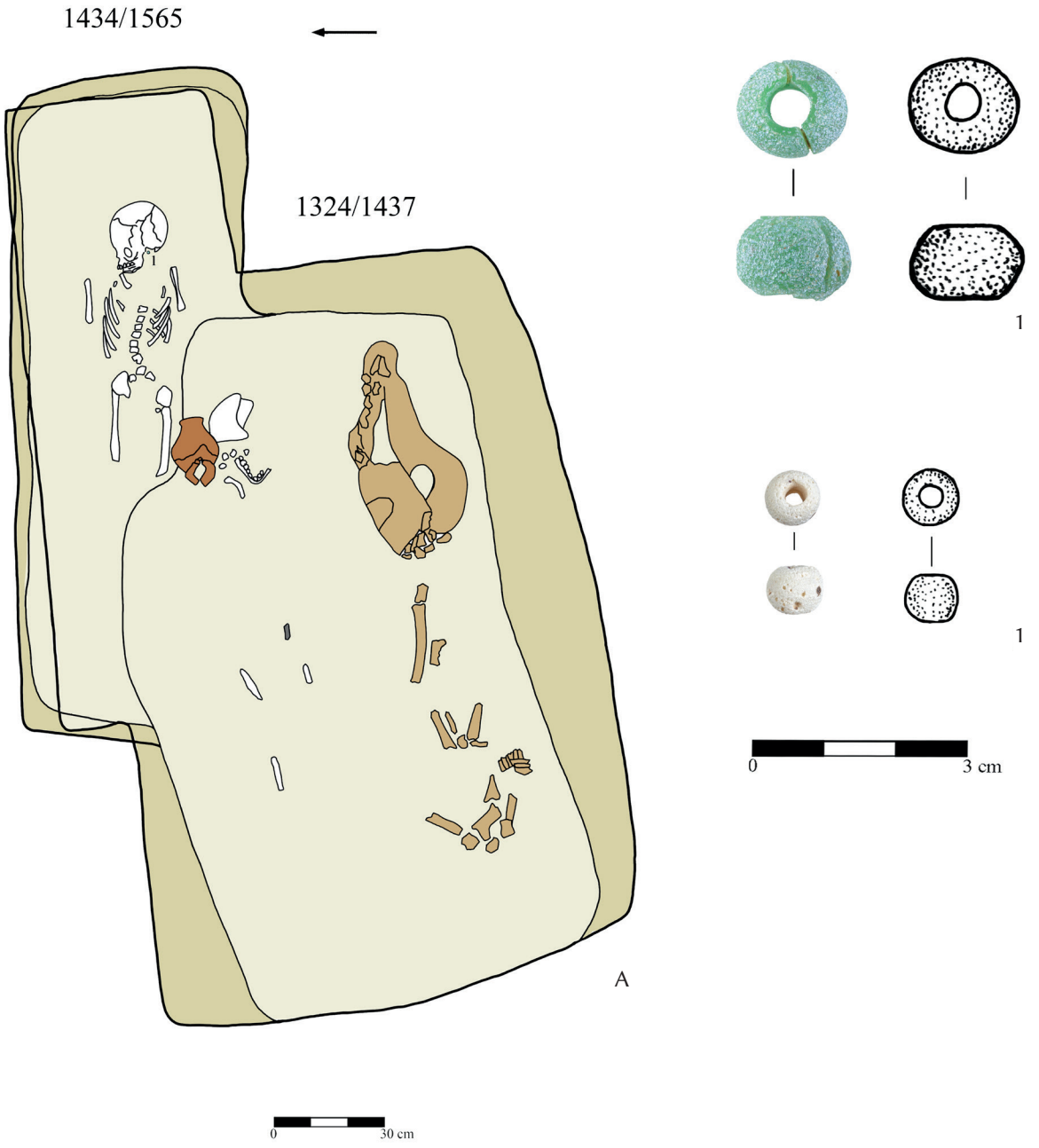

Fig. 33. Grave 1434/1565

Grave 1436/1567

Shaft grave (Fig. 34.A). Orientation: NE–SW. L: 210 cm; W: 75 cm; D: 97 cm. It was discovered when the Neolithic pit No. 1435/1566 was excavated; the soil stain was observed at a depth of 80 cm. The grave pit was rectangular, its northeast corner was rounded. Its northern wall is slightly tapered towards the bottom, the other walls were vertical, the bottom was flat. The moderately preserved remains of a woman were found at the bottom of the grave pit, in a supine position. The skull was tilted to the right, but the mandible remained in its original position. The arms were stretched closely along the rib cage, the legs were parallel. The bones of the right lower arm, the hands and the feet were missing.

Fig. 34. Grave 1436/1567

Anthropological characteristics: moderately fragmented and incomplete remains of a 35–45-year-old female (probability calculated by the DSP2 method: 0.62). The cranium is short (brachycrane) and tall (hyperhypsicrane, akrocrane). The non-metric characters of the skull are more indicative of East Asian ancestry.

Animal remains: 1. Skull, mandibles, and incomplete lower limbs of a juvenile, 18–24-month-old cattle, deposited 13 cm above the human skeleton with the same orientation as the deceased. The skull was oriented northeast and was placed on top of the right pelvis of the woman, along with the leg bones. The left metacarpal was found at the right foot of the deceased in the southwest corner of the pit. The fact that this is the only bone found outside the bone heap beneath/around the skull suggests that it may have been displaced by burrowing rodents. Only a few bones of the extremities were preserved, they are heavily fragmented. The frontal part of the skull is slightly concave, the horn cores are fragmented and very small (they measure 22.7 × 22.7 mm at the base). Based on the age at death, the animal must have been slaughtered during the autumn or winter (September–February). 2. Tibia fragment of an adult cattle, deposited next to the right knee of the deceased. This fragment has a different bone density and size, and certainly comes from a different individual than the rest of the cattle remains. It may be hypothetically interpreted as a food offering.

Grave inventory: 3. Copper-alloy earring with a large bead pendant, found at the left temporal bone of the woman (Fig. 34.3). The pendant was linked to a bronze wire. The bluish-light green, iridescent, spherical bead had a tubular base. The linking element was a ribbed copper-alloy cylinder. L: 2.7 cm; $Diam_{ring}$: 1.5 cm; $Diam_{pearl}$: 0.8 cm; $Thickness_{ring}$: 0.1 cm; $Diam_{connecting\ link}$: 0.3 cm. 4. Copper-alloy earring with large bead pendant, found at the right temporal bone (Fig. 34.4). The pendant was linked to a copper-alloy wire ending in a loop. The bead was light green, iridescent, spherical, and had a tubular base. The connecting link was a ribbed copper-alloy cylinder. L: 2.9 cm; $Diam_{ring}$: 1.5 cm; $Diam_{bead}$: 0.8 cm; $Thickness_{ring}$: 0.1 cm; $Diam_{connecting\ link}$: 0.4 cm. 5. Spindle-whorl under the left side of the skull; made from the side wall of a light grey, wheel-thrown vessel (Fig. 34.5). It has a regular disc shape. Diam: 4.9 cm; $Diam_{hole}$: 0.7 cm; Thickness: 1.1 cm; Weight: 36 gr. 6. A prismatic, slightly transluscent dark blue glass bead with cut corners, found at the left collarbone (Fig. 34.6). H: 6.6 mm; Diam: 5.1 mm. 7. Trapezoid iron buckle, found at the head of the right femur (Fig. 34.7). It was heavily corroded, and the short side was broken. L: 5.5 cm; W: 3.5–4.3 cm; $Thickness_{prong}$: 0.4 cm; $Thickness_{frame}$: 0.5 cm.

Grave 1437/1568

Shaft grave (Fig. 35.A). Orientation: WNW–ESE. L: 100 cm; W: 44 cm; D: 20 cm. It appeared as a rectangular-shaped dark soil stain. The grave pit was rectangular with rounded corners, its walls were tapered towards the flat bottom. The poorly preserved and disturbed remains of a child were found in the pit, in a supine position. The leg bones were up, turned slightly to the right. The skull was displaced, the arms remained parallel to the body. Some of the ribs, the pelvis, and the bones of the feet were displaced or missing. Without inventory.

Anthropological characteristics: highly fragmented and incomplete remains of a neonate.

Animal remains: 1. Skull, mandibles, and incomplete lower limbs of a juvenile, max. 13–16-month-old sheep, deposited 12–16 cm above the human skeleton. The exact find location of the skull fragments is unknown. The bones of the left foreleg were deposited in the southwest corner of the grave, the right foreleg was placed above the right arm of the child. The left hind leg was between the left arm of the child and the grave wall, while the right hind leg was found in the northeast corner of the pit. Only one molar fragment of the dentition was preserved and so the exact age of the animal cannot be established. Based on the hypothesized age at death, the sheep was likely slaughtered in the spring or summer, between April and July. 2. Metatarsal bone fragments

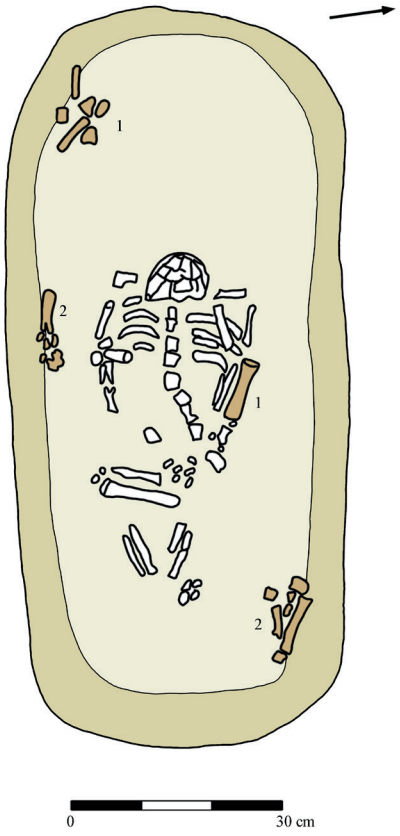

Fig. 35. Grave 1437/1568

of an adult sheep, deposited probably 12–16 cm above the remains of the child, in the north-east corner of the burial pit.[9] It is uncertain if this comes from a second animal sacrifice; if so, this is the only preserved fragment.

Grave 1439/1570

Shaft grave (Fig. 36.A). Orientation: NE–SW. L: 175 cm; W: 77 cm; D: 53 cm. The grave pit was rectangular, its walls slightly tapered towards the flat bottom. The south side was overexcavated. The poorly preserved remains of a child were found in the pit, in a supine position. The skull was tilted to the right, and the arms were stretched closely beside the rib cage. The knees were positioned close together.

Anthropological characteristics: moderately fragmented and incomplete remains of a 2.5–3.5-year-old child. Porotic alterations are present on the roof of the orbits and on the right parietal bone.

Animal remains: 1. Skull, mandibles, and incomplete lower limbs of an adult (mature) sheep. The skull was oriented to the west. Based on the excavation photos, the hind legs were deposited underneath a pot placed at the feet of the deceased, while the forelegs were on top of the pot. This suggests that the pot was either covered with the hide or wrapped in it. The horn cores are small, their length is ca. 28 mm, with an oval base and a slight twist. The estimated withers height is 61 cm. 2. Skull and incomplete lower limbs of a juvenile, ca. 9–12-month-old sheep, found at the southern end of the grave, above the human skeleton. The remains are poorly preserved. Based on the estimated age at death, the animal was slaughtered in the winter or spring, between December and April. 3. Limb bones (partial left foreleg and right hind leg) of a max. 12-month-old piglet, deposited next to the left tibia of the deceased. Probably a food offering.

Grave inventory: 4. Handmade, light brown cooking pot with grey discoloration, placed on top of the right lower leg, tilted towards the skull (Fig. 36.4). The material was roughly worked and tempered mainly with grog. The surface is coarse. The outturned rim is decorated with deep fingerprints. The artefact is lopsided; the diameter is widest at the shoulders. The bottom is concave on one side. Incomplete, fragmentary object. H: 13.6 cm; $Diam_{rim}$: 8.9 cm; $Diam_{shoulder}$: 9.8 cm; $Diam_{bottom}$: 6 cm.

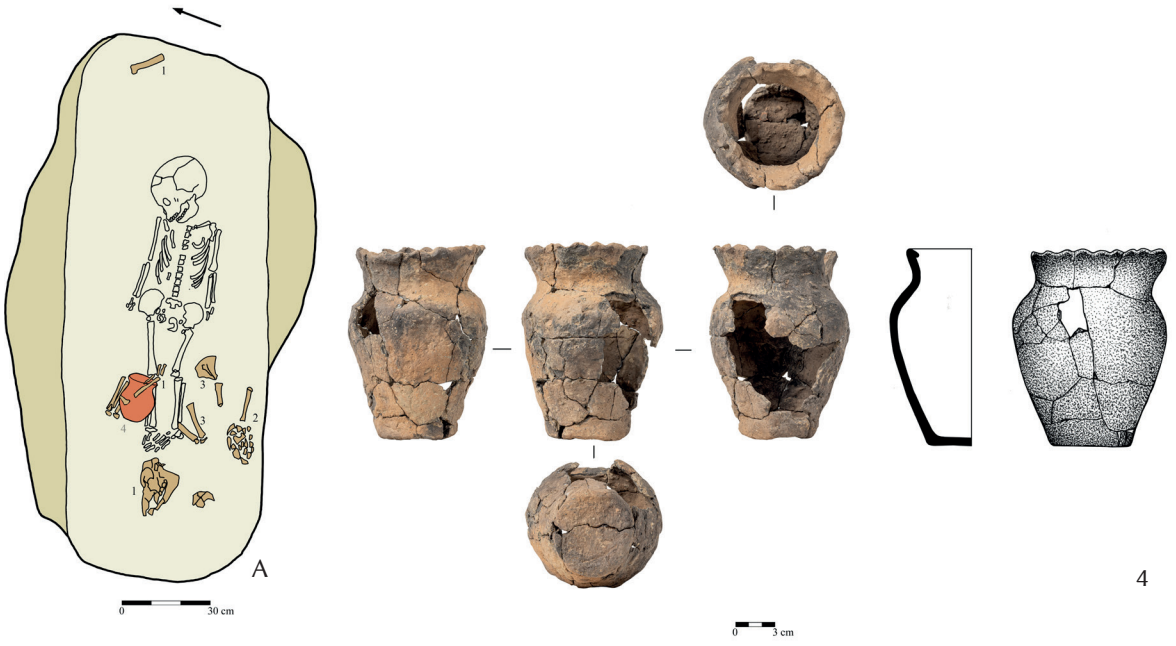

Fig. 36. Grave 1439/1576

9 The exact position was not documented, it was reconstructed based on the photos.

Grave 1474/1611

Shaft grave (Fig. 37.A). Orientation: SW–NE (?). L: 134 cm; W: 67 cm; D: 4 cm. The soil stain associated with the pit was difficult to see; only the human bones scattered on the surface indicated the presence of a grave. It was an irregular, oval-shaped, shallow burial pit. The disturbed remains of a woman and leg bones of a second individual were found at the bottom. The woman's skull, her ribs, and the bones of her arms were deposited in the western half of the grave, while the legs were found in the eastern half. The bones of the woman's upper body and arms were found more or less in anatomical order. The eastern part of the grave yielded bones from the left leg of another individual. Without inventory.[10] Based on its orientation and its position in relation to other graves, the grave was classified as belonging to the cemetery. Without inventory.

Anthropological characteristics: considerably fragmented, disturbed, and incomplete remains of two people. The majority of the skeletal elements belong to a 25–35-year-old, presumably female individual. On the right orbital roof, porotic hyperostosis is observed. In addition to these remains, a right tibia, humerus, and distal end of a right fibula were identified as belonging to another adult individual of indeterminate sex.

Animal remains: 1. Snail shell in the infill (Fig. 37.1).

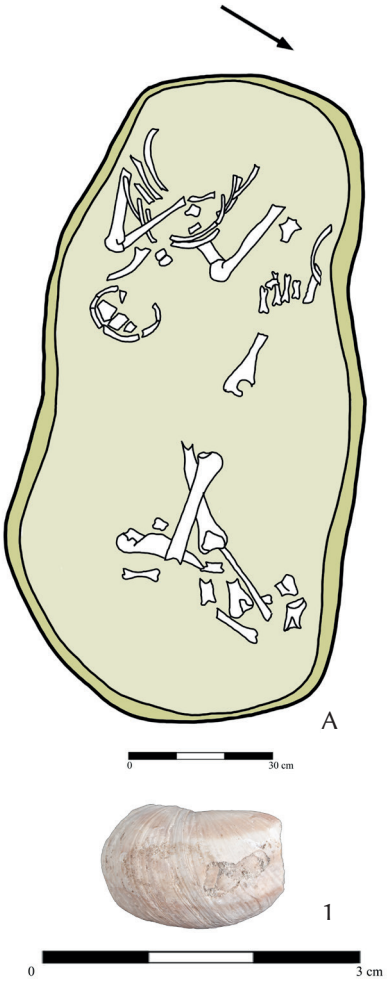

Fig. 37. Grave 1474/1611

Grave 1482/1619

Grave with longitudinal ledges (Fig. 38.A). Orientation: ESE–WNW. L: 188 cm; W: 70 cm; D: 26 cm. Cut by Grave 1383/1621. It appeared as a dark, oval-shaped soil stain. The grave was rectangular, its walls were tapered towards the flat bottom. A narrow, ca. 7 cm wide ledge was observed at the northwestern end, along the short side of the grave. The infill was dark and homogeneous. The poorly preserved bones of a child were found at the bottom of the pit, in a supine position. The skull was tilted forward, the arms were stretched closely beside the rib cage, the legs were parallel. The cranial bones were crushed; the facial bones, the right arm, and the pelvis were missing. The ribs were displaced. The soil discoloration observed under the legs indicates that the body was in a coffin.

Anthropological characteristics: highly fragmented and incomplete remains of a 6.5–7.5-year-old child.

Animal remains: 1. Skull, mandibles, and incomplete hindlegs of a juvenile, ca. 15–18-month-old cattle, deposited 5–15 cm above the deceased. The skull was at the western end of the grave, oriented to the northwest. The left hind limb was in the southeastern corner, the find location of the other leg is unknown. The proportion of the metatarsals suggests that it was a cow. The horn cores are small and rudimentary, ca. 26 mm long, measuring 21.2 × 17.7 mm at the base. Based on the age at death, the animal must have been slaughtered during the summer or autumn, between May and October. 2. Skull, mandibles, and incomplete lower limbs of an adult

10 Fragments of a gastropod shell, identified as the snail *Helix lutescens*, was also found; it was probably deposited secondarily and does not belong to the grave's context.

(old?), polled sheep, deposited 5–15 cm above the deceased. The skull was found at the west end of the grave. The bones of the right hind leg were to the left side of the human skull, the exact find location of the rest of the bones is unknown. The teeth are heavily abraded, the upper third molar (M^3) shows irregular wear, with a hook-like projection on the aboral side. The estimated withers height is 62 cm. 3. Poorly preserved fragments of the right pelvis of an adult swine, deposited to the right of the human skull. Probably food offering.

Grave inventory: 4. Reddish-brown, handmade bowl with grey discoloration, found on the left of the skull (Fig. 39.4). It was tilted towards the skull. The clay was roughly worked and tempered with organic material and grog. A thin layer of slip was applied on the surface; the vessel was poorly fired. The rim is curved and slopes outward. The object has a bucket-like shape with a flat base. H: 8.2 cm; $Diam_{rim}$: 17.7 cm; $Thickness_{rim}$: 0.4–0.7 cm; $Diam_{bottom}$: 8.6 cm. 5. Glass beads around the neck and under the skull (Fig. 38.5). 5/1. Disc-shaped white iridescent opaque glass bead with a copper-alloy tube. Diam: 11 mm. 5/2. Disc-shaped white iridescent opaque glass bead with a copper-alloy tube. Diam: 12 × 13 mm. 5/3. Spheroid white opaque glass bead. H: 4.7 mm; Diam: 7.7 mm. 5/4. White opaque two-piece ring-shaped segmented glass bead with brown surface discoloration. H: 5 mm; Diam: 5 mm. 5/5. Spheroid white iridescent opaque glass bead. H: 3 mm; Diam: 6.5 mm. 5/6. Spheroid white iridescent opaque glass bead. H: 3 mm; Diam: 6 mm. 5/7. Spheroid white iridescent opaque glass bead. H: 3 mm; Diam: 6 mm. 5/8. Cylindrical white iridescent opaque glass bead. H: 5 mm; Diam: 5 mm. 5/9. Spheroid yellow opaque glass bead with brown surface discoloration. H: 2.8 mm; Diam: 4.4 mm. 5/10. Spheroid white opaque glass bead with brown surface discoloration. H: 4 mm; Diam: 5 mm. 5/11. Spheroid iridescent white opaque glass bead in two fragments. H: 2.8 mm; Diam: 4.2 mm. 5/12. Spheroid iridescent white opaque glass bead. H: 3 mm; Diam: 6 mm. 5/13. Spheroid white opaque glass bead with brown surface discoloration. H: 3 mm; Diam: 4 mm. 5/14. Fragments of a melon-shaped iridescent light blue glass bead with a copper-alloy tube. H: 11 mm; Diam: 1.6 mm. 5/15. Spheroid white opaque glass bead with brown surface discoloration. H: 5 mm; Diam: 7 mm. 5/16. Spheroid blue opaque glass bead. H: 3.5 mm; Diam: 5 mm. 5/17. Fragments of a white iridescent glass bead with a copper-alloy tube. 5/18. Fragments of a spheroid white glass bead. 5/19. Fragments of a white iridescent opaque glass bead with a copper-alloy tube. 5/20. Fragments

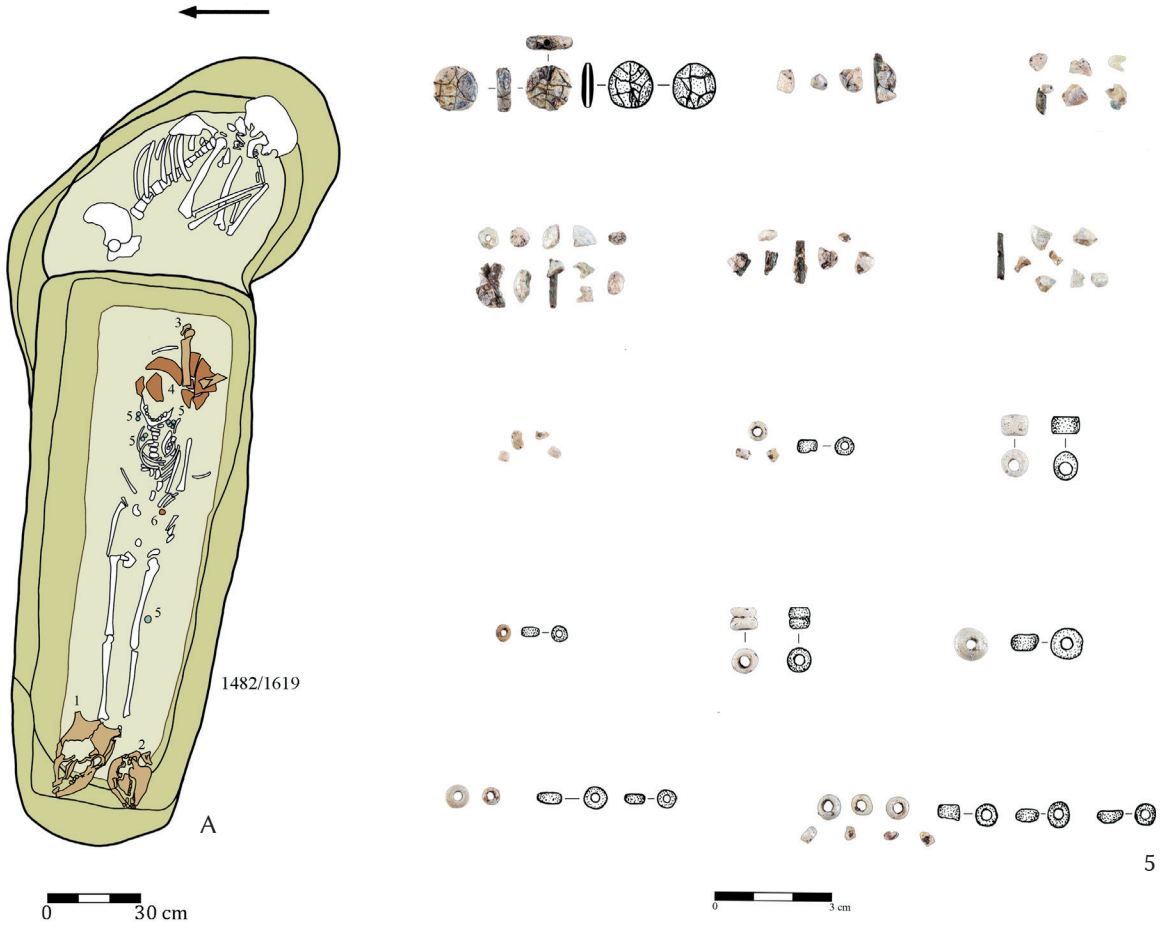

Fig. 38. Grave 1482/1619

of a melon seed-shaped white iridescent glass bead with a copper-alloy tube. 6. Dark grey pottery sherd, deposited on the left pelvis of the deceased (Fig. 39.6). The clay was roughly worked, tempered with sand. The surface was coarse. Only an approximately round fragment of the vessel was found. Diam: 1.4 cm; Thickness: 0.6 cm. 7. Fragment of a disc-shaped spindle-whorl, probably deposited on the pelvis (Fig. 39.7). It was made of brownish-gray clay, the surface was damaged and irregular. The object was broken into two, only one piece was preserved. Diam: 5.2 cm; Thickness: 1.1 cm; Weight: 16 gr.

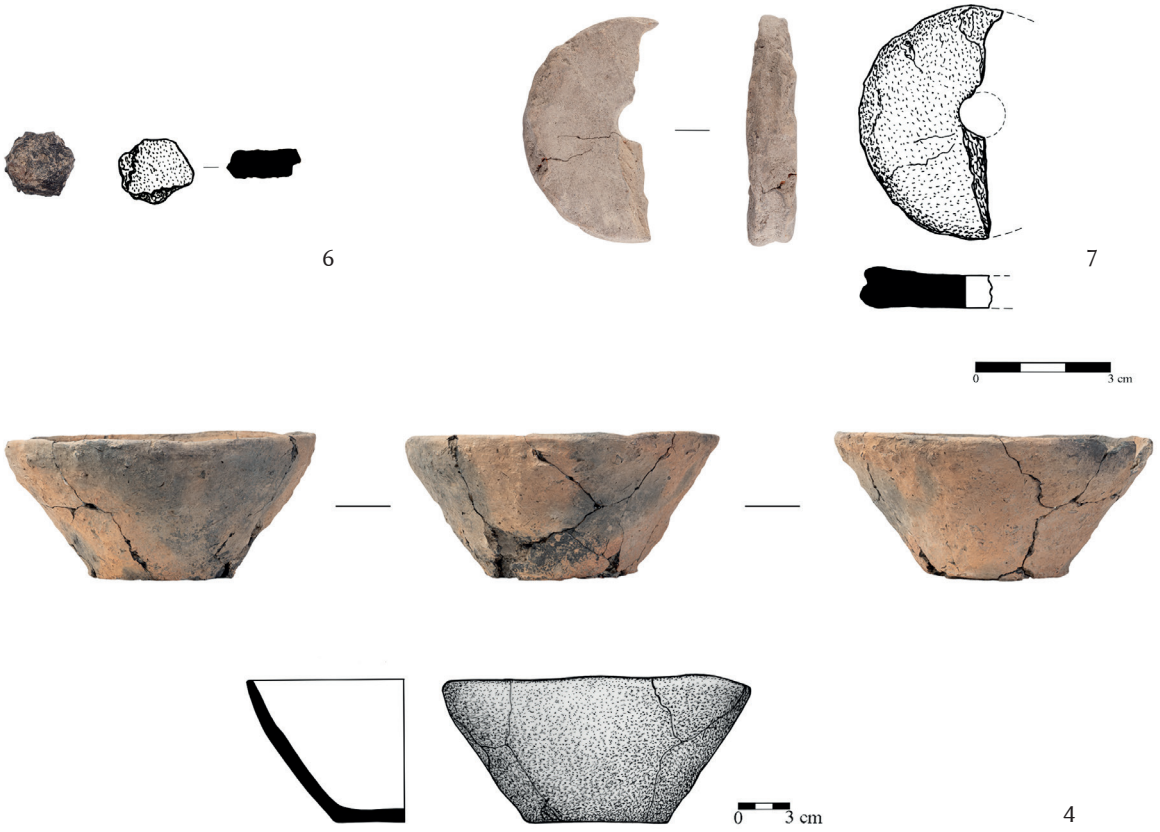

Fig. 39. Grave 1482/1619

Grave 1483/1620

Shaft grave (Fig. 40.A). Orientation: SW–NE. L: 138 cm; W: 51 cm; S: 17 cm. The grave pit was rectangular with strongly rounded corners. Its curved walls were tapered towards the bottom. The grave pit was much longer than the body of the deceased. The poorly preserved remains of a child were found in a supine position. The skull may have been facing forward, the arms were stretched closely beside the rib cage, the legs were parallel. The skull was crushed, the ribs were displaced; the left arm, the right leg, the left lower leg, and the hand and feet bones were decomposed.

Anthropological characteristics: moderately fragmented and incomplete remains of a neonate.

Animal remains: 1. Third phalanx of an adult sheep, found among the human bones.

Grave inventory: 2. Fragment of a trapezoid lead object (Fig. 40.2). It has three large holes at the wider end and two rows of probably punched decoration around the edges. The surface is damaged, the edges are broken. H: 1.6 cm; W: 1.2 cm; Thickness: 0.1 cm.

Grave 1485/1622

Cenotaph (?) with longitudinal ledges (Fig. 41.A). Orientation: NE–SW (?). L: 212 cm; W: 125 cm; D: 117 cm. The grave was wide and rectangular; the ledge was observed along the longitudinal sides at a depth of 75–80 cm. The infill consisted of black soil that yielded a large amount of Sarmatian

pottery fragments, animal bones, and stones. There were no human bones in the grave, but based on its position and orientation, it can be related to the early Avar graves.

Grave inventory: 1. Wall fragment of a Sarmatian pot. Brick-red, wheel-thrown pottery, made of well-levigated, good quality material, finely worked, tempered with grog. The surface is smoothened and finely worked. Dimensions: 3.5 × 4.4 cm, Thickness: 0.85 cm. 2. Foot-ringed base fragment of a Sarmatian pot. Brick-red wheel-thrown pottery, made of well-levigated, good quality material, finely worked, tempered with grog. The surface is heavily damaged. $Diam_{base}$: 9 cm; $Thickness_{wall}$: 0.95 cm; $Thickness_{base}$: 1.7 cm; W_{base}: 1.3 cm. 3. Rim fragments of Sarmatian pots. One brownish-red and two brick-red wheel-thrown pottery fragments, finely worked and smoothened. The rims thicken towards the outside and are rounded. Greatest dimensions: 3.6 × 5 cm; $Thickness_{rim}$: 1.6 cm; $Thickness_{wall}$: 1.1 cm; Smallest dimensions: 2.9 × 3 cm; $Thickness_{rim}$: 0.9 cm; $Thickness_{wall}$: 0.5 cm. 4. 16 pieces of wall fragments of Sarmatian pots. Brick-red wheel-thrown pottery fragments, finely worked and smoothened. Two pieces are profiled. Smallest dimensions: 1.7 × 3.3 cm; W: 1 cm. Largest dimensions: 5.6 × 6.2 cm; W: 0.95 cm; 5. Base fragment of a Sarmatian pot. Brick-red wheel-thrown pottery fragments, finely worked and smoothened. $Diam_{base}$: 7 cm, 9.8 × 8.7 cm; $Thickness_{wall}$: 0.8 cm; $Thickness_{footring}$: 1.2 cm. 6. Two wall fragments of a Sarmatian pot. Grey wheel-thrown pottery fragments, finely worked, tempered with micaceous sand. The rim thickens and curves to the outside. Fragment No. 1: 3.1 × 3.1 cm; $Thickness_{rim}$: 1.5 cm; $Thickness_{wall}$: 0.6 cm; Fragment No. 2: 2.6 × 3.1 cm; $Thickness_{rim}$: 1 cm; $Thickness_{wall}$: 0.7 cm. 7. Decorated wall fragment of a Sarmatian pot. Dark grey wheel-thrown pottery fragments, finely worked, smoothened, decorated with wavy lines. Size: 6.9 × 7.1 cm; $Thickness_{wall}$: 1.2 cm. 8. 29 pieces of wall fragments of Sarmatian pots. Light grey to dark grey wheel-thrown pottery fragments, finely worked and smoothened. Largest dimensions: 10 × 9 cm; $Thickness_{wall}$: 1.2 cm; Smallest dimensions: 1.9 × 2.5 cm; $Thickness_{wall}$: 0.9 cm. 9. Wall fragment of a Sarmatian pot. Dark grey wheel-thrown pottery fragment, finely worked and tempered with glossy graphite. Size: 5.3 × 4.7 cm; Thickness: 1.1 cm. 10. Base fragment of a Sarmatian pot. Light grey wheel-thrown pottery fragment, finely worked and tempered with micaceous sand. The base is flat. $Diam_{base}$: 10 cm; Size: 5.5 × 6.1 cm; Thickness: 1.4–2.1 cm. 11. Base fragment of a Sarmatian pot. Dark grey wheel-thrown pottery fragments, finely worked, with grog inclusions on the bottom, and tempered with micaceous sand. The

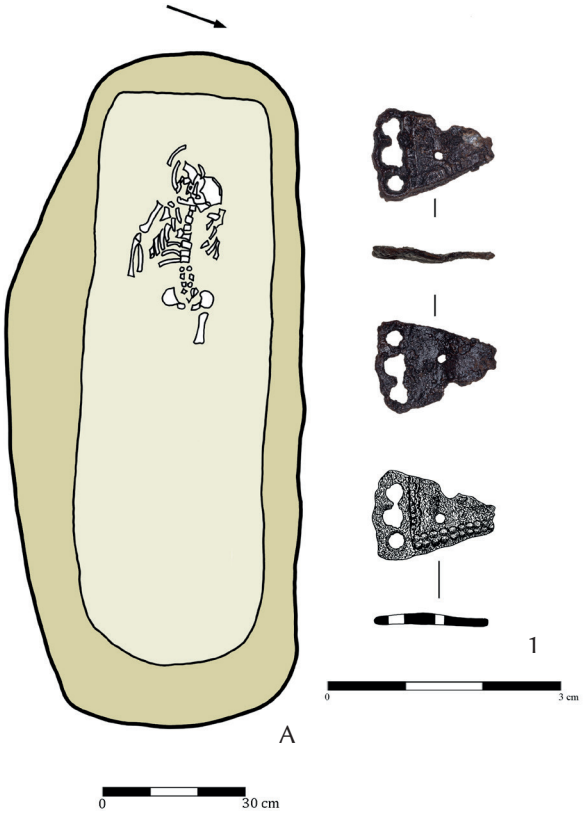

Fig. 40. Grave 1483/1620

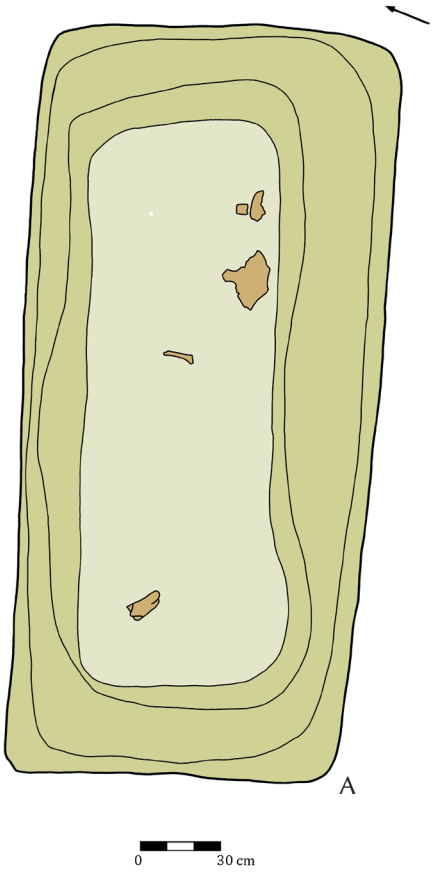

Fig. 41. Grave 1485/1622

base is flat. Diam$_{base}$: 11 cm; Size: 5 × 9 cm; H: 3.4 cm; Thickness$_{wall}$: 0.7 cm. 12. Wall fragment of a Sarmatian pot. Handmade, brown with dark grey/black and red spots; roughly worked, tempered with grog. The rim is rounded and slopes outward. Size: 11.5 × 11.1 cm; Thickness: 1.4 cm. 13. Rim fragment of a Sarmatian pot. Red with brown and dark brown spots, handmade. Roughly worked and tempered with grog. The rim is rounded and slopes outward. Size: 5 × 5.6 cm; Thickness: 1 cm. 14. Seven wall fragments of a handmade Sarmatian pot. Brown with light brown and red dots; the clay is roughly worked and tempered with grog. There is a partial fingerprint on one fragment. Largest dimensions: 6.7 × 7.4 cm; Thickness: 1.1–1.4 cm; Smallest dimensions: 2.9 × 3.6 cm; Thickness: 1.3 cm. 15. Wall and base fragment of a Sarmatian pot. The clay is roughly worked, tempered with grog. The base is flat. Diam$_{base}$: 11 cm; H: 7.4 cm; Thickness$_{wall}$: 1.4 cm; Thickness$_{bottom}$: 1.6 cm.

Grave 1500/1637

Shaft grave (Fig. 42.A). Orientation: NE–SW. L: 252 cm; W: 102 cm; D: 107 cm. It appeared as a vague, rectangular, light grey soil stain. The grave was rectangular, its walls were tapered slightly towards the flat bottom. There was a small niche in the north-west corner. The west end of the grave cut into a Neolithic burial (Grave 1282/1367). The burial pit is disproportionately long compared to the size of the buried body. The poorly preserved bones of a child were found at the bottom in a supine position.[11] The skull was fragmentary; most of the ribs, the pelvis, the hands, and the lower leg bones were missing.

Anthropological characteristics: poorly preserved and incomplete remains of a 12.5–13.5-year-old child. The rASUDAS application assigned the individual to Western Eurasian and East Asian ancestry groups with respective posterior probabilities of 78.19% and 21.81%.

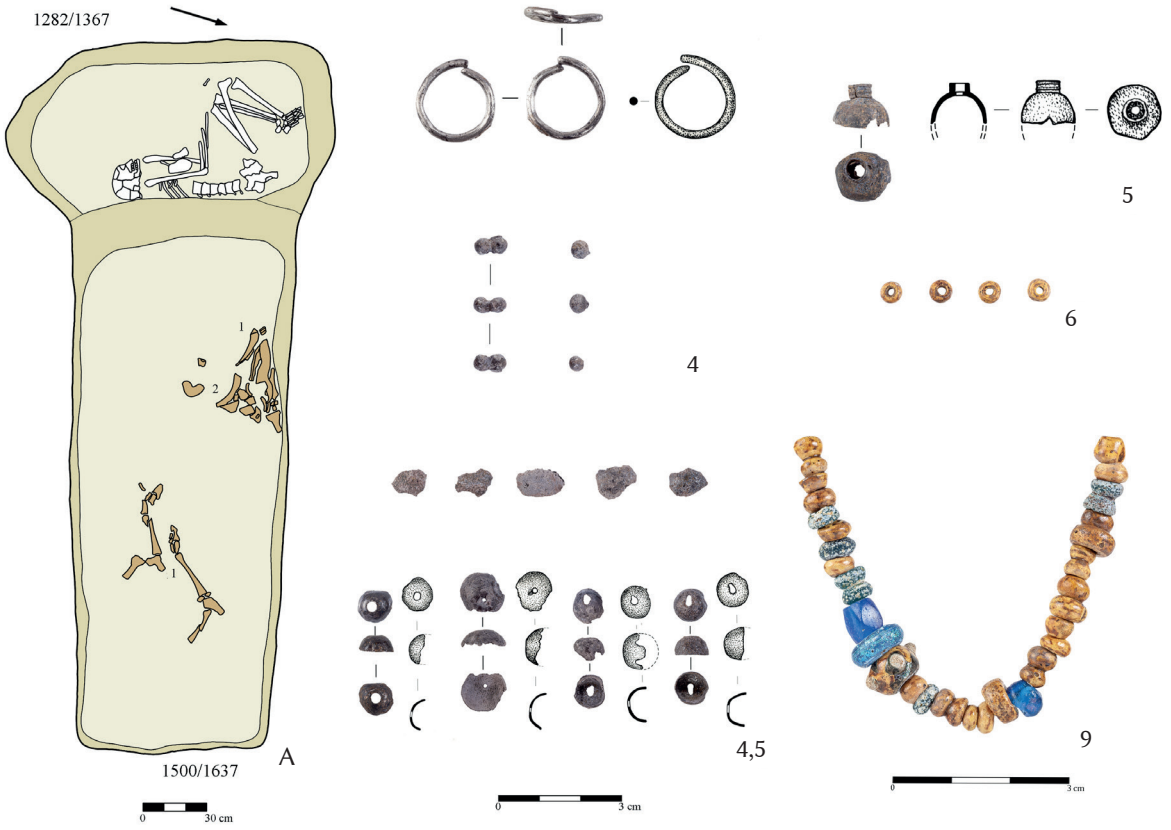

Fig. 42. Grave 1500/1637

11 No drawing was made of the level where the skeleton was found.

Animal remains: 1. Skull, mandibles, and incomplete lower limbs of a juvenile, 18–24-month-old cattle, deposited 20 cm above the human remains. The skull was in the northern half of the grave, oriented to the west; the first cervical vertebra (atlas) was deposited in the middle, at the axis of the grave pit. The bones of the forelegs came to light close to the skull, while the truncated hind legs were deposited on top of the remains of the child. The proportions of the metapodia suggest that it was a cow. Based on the age at death, the animal was probably slaughtered in the autumn or winter, between September and February. 2. Skull, mandibles, and leg bones of a subadult, approx. 3–4-year-old sheep, found in a recess in the north-west corner of the grave. The bones were deposited in a pile and were poorly preserved. The estimated withers height is 70 cm.

Grave inventory: 3. Handmade light brown cooking pot with grey discoloration, deposited to the right of the skull, slightly tilted towards it (Fig. 43.3). The clay was medium-well worked and tempered with organic material and grog. The surface is coarse; the neck is smoothened. The rim slopes outward, and it is rounded with unevenly thick walls. It was medium height with a wide body. The base is raised. Incomplete, fragmentary object. H: 18.9–19.8 cm; $Diam_{rim}$: 12.1 cm; $Diam_{bottom}$: 9.8 cm; $Thickness_{rim}$: 0.7 cm. 4. Silver earring with a spherical pendant under the skull, a few centimetres apart (Fig. 42.4–5). The earring had a round cross-section, with one end bent on the other. The pendant consists of two hemispherical plates, which were joined to the hoop with three granulations. It is extremely fragmented. $Diam_{ring1}$: 1.8–2 cm; $Diam_{ring2}$: 1.9–2.1 cm; $Diam_{pendant}$: 1.3–1.4 cm; $Diam_{granulation}$: 0.4 cm. 5. Fragments of silver beads on the right of the skull, made of two pressed hemispherical plates (Fig. 42.4,5).[12] One of the fragments was connected to a ring with a ribbed cylindrical part; only one half of its sphere remained, rest of them are fragmented. Diam: 1.4 cm; $Diam_{strap}$: 0.7 cm. 6. Glass beads under the jaw (Fig. 42.6). 6/1. Truncated conical yellow opaque glass bead with brown surface dis-

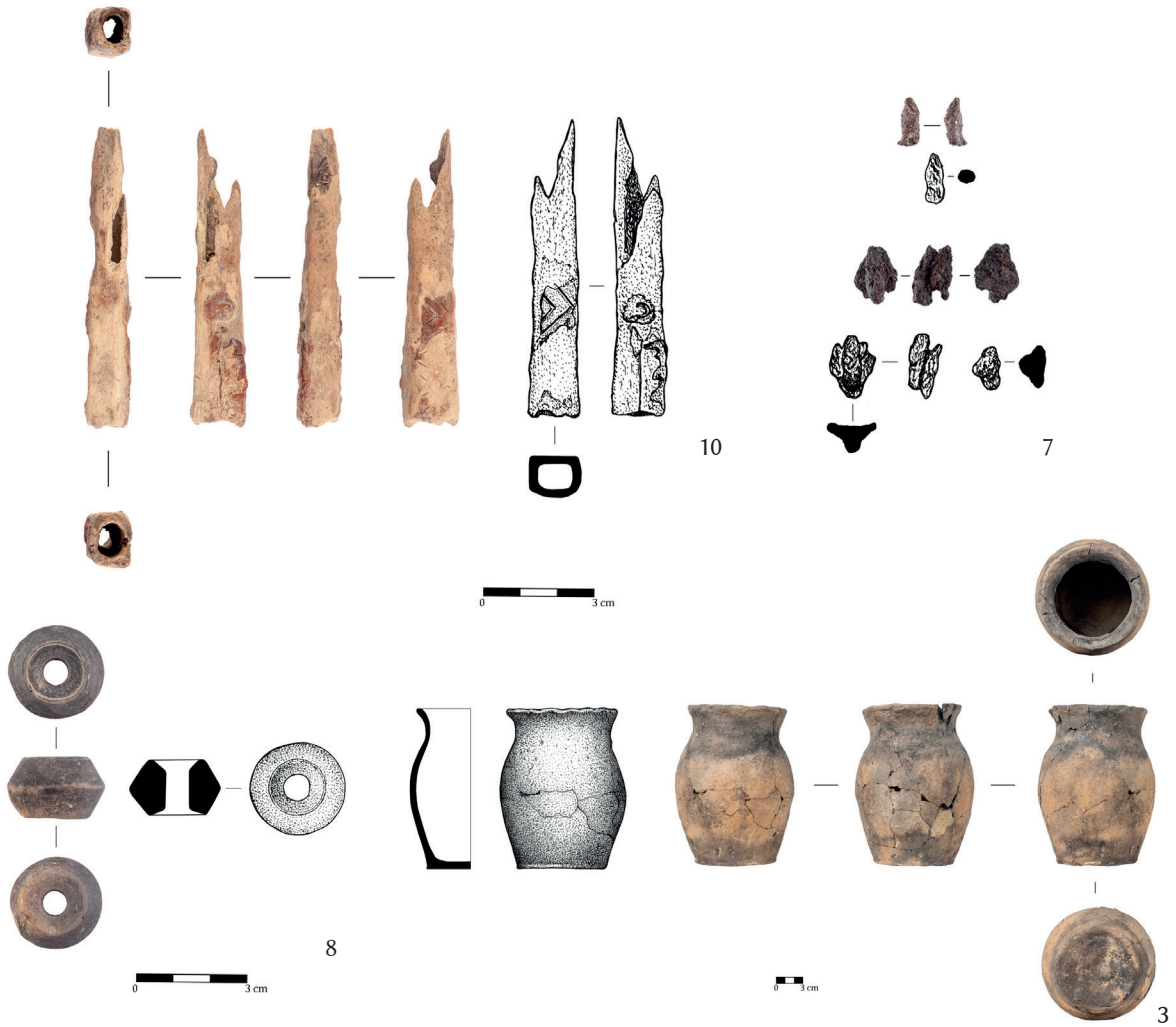

Fig. 43. Grave 1500/1637

12 It cannot be excluded that some of these fragments belong to the earrings.

coloration. H: 3 mm; Diam: 6 mm. 6/2. Spheroid yellow opaque glass bead with brown surface discoloration. H: 3 mm; Diam: 5 mm. 6/3. Spheroid yellow opaque glass bead with brown surface discoloration. H: 3 mm; Diam: 5 mm. 6/4. Truncated conical yellow opaque glass bead with brown surface discoloration. H: 2.5 mm; Diam: 5.7 mm. 7. Unidentified iron object next to the right femur (Fig. 43.7). Two small fragments remained. L_1: 1.5 × 1.1 cm; L_2: 0.7 × 0.9 cm. 8. Biconical spindle-whorl positioned at the level of the right knee, directly beside the grave wall (Fig. 43.8). Grey, worn to a light brown in some places. A narrow rim can be observed around the hole on both sides. H: 2 cm; Diam: 3.3 cm; $Diam_{hole}$: 0.85 cm; Weight: 24 gr. 9. Glass pearls from an unknown place appeared during the excavation (Fig. 42.9). 9/1. Opaque yellow segmented two-piece spheroid glass bead with brown surface discoloration. H: 7 mm; Diam: 4 mm. 9/2. Truncated conical yellow opaque glass bead. Its surface turned brown due to discoloration. H: 2.7 mm; Diam: 5 mm. 9/3. Spheroid yellow opaque glass bead with brown surface discoloration. H: 3.4 mm; Diam: 6 mm. 9/4. Spheroid (?) blue opaque glass bead. It has a damaged, porous surface. H: 3 mm; Diam: 5.8 mm. 9/5. Spheroid yellow opaque glass bead with brown surface discoloration. H: 3.6 mm; Diam: 6 cm. 9/6. Spheroid dark blue opaque glass bead with a damaged, porous surface. H: 3.5 mm; Diam: 6.8 mm. 9/7. Truncated conical yellow opaque glass bead with brown surface discoloration. H: 3.4 mm; Diam: 5.5 mm. 9/8. Blue opaque two-piece conical segmented glass bead with a damaged, porous surface. H: 5 mm; Diam: 5.8 mm. 9/9. Column-shaped, dark blue, slightly translucent glass bead with cut corners. H: 6 mm; Diam: 4 × 7 mm. 9/10. Large ring-shaped blue iridescent glass bead with a porous surface. H: 4 mm; Diam: 10 mm. 9/11. Dark green glass bead. It is decorated with yellow wavy lines and four white eye-shaped inlays. It has a damaged surface. H: 6.6 mm; Diam: 9–11 mm. 9/12. Spheroid yellow opaque glass bead with brown surface discoloration. H: 3 mm; Diam: 5 mm. 9/13. Spheroid blue opaque glass bead with a damaged, porous surface. H: 2.9 mm; Diam: 6 mm. 9/14. Yellow opaque two-piece spheroid segmented glass bead with brown surface discoloration. H: 5.8 mm; Diam: 5.5 mm. 9/15. Truncated conical yellow opaque glass bead with brown surface discoloration. H: 2.4 mm; Diam: 4 mm. 9/16. Spheroid yellow opaque glass bead with brown surface discoloration. H: 3 mm; Diam: 6 mm. 9/17. Large spheroid yellow opaque glass bead with brown surface discoloration. H: 4 mm; Diam: 8.5 mm. 9/18: Spheroid slightly transparent, iridescent blue glass bead with a damaged surface. H: 5 mm; Diam: 6 mm. 9/19. Yellow opaque glass bead. It is made of two spheroid parts, with brown surface discoloration. H: 6.6 mm; Diam: 5.5 mm. 9/20. Spheroid yellow opaque glass bead with brown surface discoloration. H: 3 mm; Diam: 5.6 mm. 9/21. Truncated conical yellow opaque glass bead with brown surface discoloration. H: 3 mm; Diam: 5 mm. 9/22. Spheroid yellow opaque glass bead with brown surface discoloration. H: 3.7 mm; Diam: 7 mm. 9/23. Spheroid yellow opaque glass bead with brown surface discoloration. H: 3 mm; Diam: 6 mm. 9/24. Yellow opaque two-piece spheroid segmented glass bead. It consists of two spheroid parts with brown surface discoloration. H: 5 mm; Diam: 5 mm. 9/25. Large spheroid yellow opaque glass bead with brown surface discoloration. H: 3.7 mm; Diam: 8 mm. 9/26. Spheroid yellow opaque glass bead. There is brown discoloration on its surface. H: 4 mm; Diam: 5.6 mm. 9/27. Blue opaque glass bead. It consists of two truncated conical parts with damaged, porous surfaces. H: 5.7 mm; Diam: 5.7 mm. 9/28. Truncated conical yellow opaque glass bead with brown surface discoloration. H: 3 mm; Diam: 6 mm. 9/29. Truncated conical yellow opaque glass bead with brown surface discoloration. H: 4 mm; Diam: 5.7 mm. 10. Decorated bone needle case next to the deceased. The exact position is unknown. It is column-shaped, made of a tubular bone. It is fragmented. The surface is damaged, and a zigzag motif is discernible in some parts. L: 7.9 cm; W: 1.1 × 1.4 cm.

Grave 1501/1638

Shaft grave (Fig. 44.A). Orientation: E–W (?). L: 230 cm; W: 106 cm; D: 112 cm. It appeared as a vague, grey, amorphous soil stain. The grave pit was rectangular with rounded corners; its walls were difficult to discern and were slightly tapered downwards the flat bottom. The infill consisted of mixed soil with light brown spots. The grave pit was much larger than the buried body. The human remains were heavily disturbed. The skull of a child was found in the center of the pit, ca. 50 cm above the bottom.

Anthropological characteristics: poorly preserved and incomplete cranial remains of a 1–2-year-old child.

Animal remains: 1. Skull, mandibles, and incomplete legs of an adult, polled sheep in the middle of the grave, approximately 50 cm below the modern surface. The skull came to light in the center of the grave pit, oriented to the west. Bones of the left foreleg were found south of the skull, ca. 20 cm from it. The position of the other limbs is unknown. The estimated withers height is 62 cm. The tibia was truncated in the middle as customary with animal hides, but the radius was left intact.

Grave inventory: 2. Handmade light brown cooking pot with grey discoloration, found on the right of the skull, at the same level as the animal remains (Fig. 44.2). The clay was roughly worked and tempered with organic material, sand, and grog, some of which is visible on the surface in the form of exposed inclusions. There are remains of slip on the surface. The rim is curved and overhanging. The body is cylindrical with a slight carination. The bottom is flat. H: 10.4 cm; $Diam_{rim}$: 8.7 cm; $Diam_{bottom}$: 8 cm; $Thickness_{rim}$: 0.5–0.6 cm.

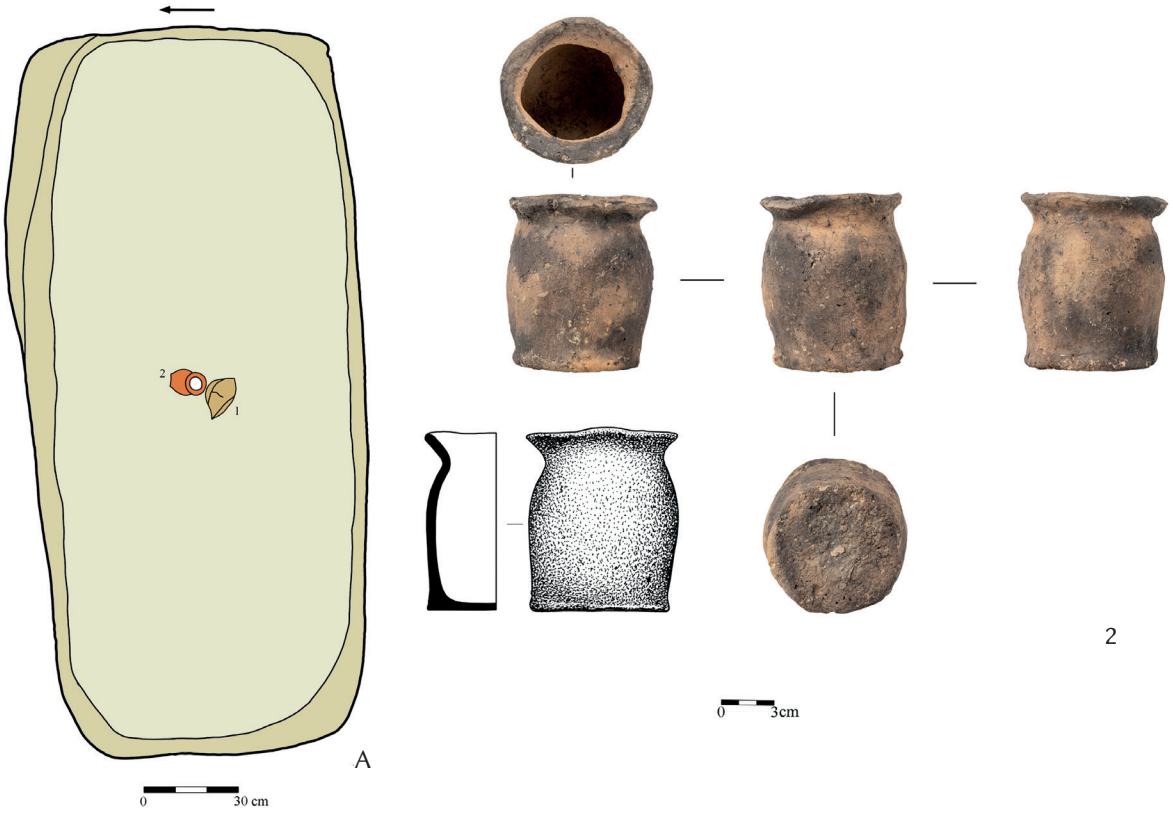

Fig. 44. Grave 1501/1638

Grave 1512/1650

Shaft grave with a single ledge (Fig. 45.A). Orientation: E–W. L: 180 cm; W: 70 cm; D: 65 cm. It appeared as a dark, rectangular soil stain. The grave pit was more or less rectangular, with rounded corners and walls that were tapered towards the flat bottom. There was a narrow ledge on the east side of the pit. The grave's infill consisted of brown clay that was mixed with yellow clay in some parts and yielded Neolithic pottery sherds. The moderately well-preserved remains of a child were found at the bottom of the grave, in a supine position. The skull was tilted to the right, the mandible was found south of it. The right forearm was placed on the pelvis. The arms were close to the rib cage, the legs were parallel, slightly bent at the knees and turned to the right. The arm and leg bones were disturbed by rodent activity; some of the phalanges were relocated to the northwest corner of the grave.

Anthropological characteristics: moderately fragmented and incomplete remains of a 2.5–3.5-year-old child. Signs of porotic hyperostosis are visible on the right orbital roof. On the inner surface of the parietal bones and the sulci of the occipital bone, extensive 'hair-on-end' endocranial lesions can be observed.

Animal remains: 1. Skull, mandibles, and incomplete left foreleg of an adult (mature) sheep. The skull was deposited on the west side of the grave, at the feet of the child, oriented to the southwest. The find location of the partial leg is uncertain.

Grave inventory: 2. Slow-wheel pottery deposited to the left side of the skull (Fig. 45.2). Finely worked material, brown, with dark grey and black spots of clay and sand inclusions. There are traces of slip and a few recesses on

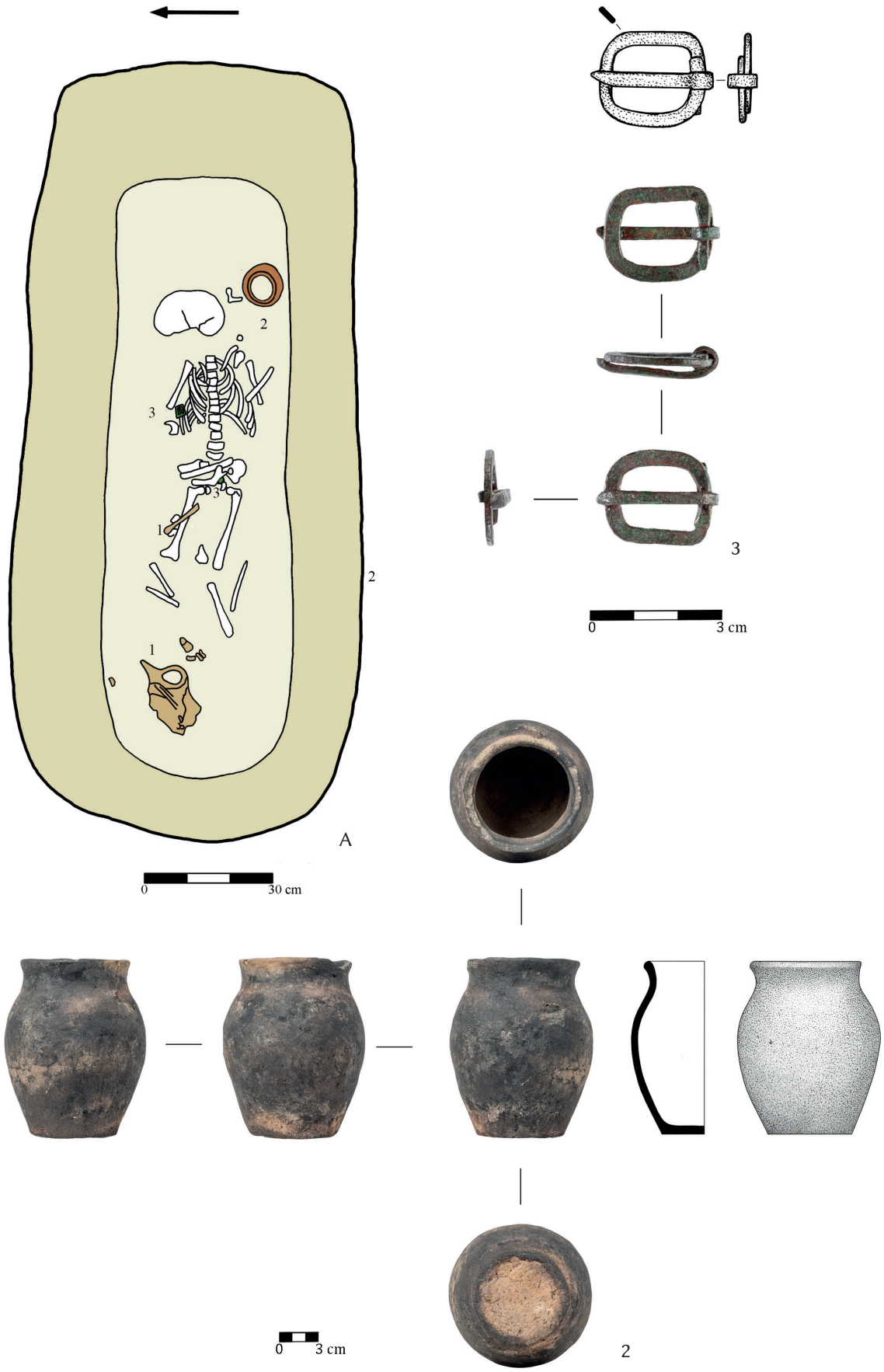

Fig. 45. Grave 1512/1650

the smoothened surface. The rim is small and slopes outwards. There is a carination on the body of the vessel. The base is concave and uneven. H: 14.4 cm; $Diam_{rim}$: 9 cm; $Diam_{base}$: 7.4 cm; $Thickness_{rim}$: 0.7 cm. 3. Rectangular copper-alloy buckle with rounded corners, found on the inner side of the right elbow (Fig. 45.3). It was made of wire with a flat cross-section. The prong is narrow, straight, and bends over to the external side of the frame. $Diam_{body}$: 2.3 × 2.1 cm; Thickness: 0.3 cm; L_{prong}: 2.7 cm; W_{prong}: 0.2 cm. 4. Stone, found under the pelvis.

Grave 1528/1666

Shaft grave (Fig. 46.A). Orientation: ESE–WNW. L: 215 cm; W: 88 cm; D: 61 cm. The grave pit was irregular with rounded ends, its walls were slightly tapered towards the flat bottom. Another pit was dug into its western side later. The remains of a young person were found at the bottom in a supine position. The skull was tilted to the left, and the arms were stretched closely beside the rib cage. The legs were parallel. The later pit disturbed the lower leg bones, some of them were displaced and came to light beside the left knee. One of the vertebrae was to the right of the skull.

Anthropological characteristics: well-preserved remains of a 14–15-year-old juvenile. Multiple Schmorl's nodes are visible on the thoracic and lumbar vertebrae.

Animal remains: 1. Section of the lumbar spine (six lumbar vertebrae and one caudal vertebra) of a subadult sheep, probably on the right side of the skull. Probably a food offering. 2. Incomplete left hind leg of juvenile pig, deposited along the right thigh. The animal was at most 12 months old when it was slaughtered. Probably a food offering. 3. Calcaneus bone of an adult cattle, deposited in an unknown location.[13]

Grave inventory: 4. Iron buckle, found east of the right shoulder, to the right of the skull (Fig. 46.4). Rectangular, wide, and thick object. One end was bent back at a square angle; the other was straight or broke off. L: 3.4 cm; W: 0.9 cm; Thickness: 0.2 cm. 5. Iron buckle (?), found on in the pelvic area, on top of the sacrum (Fig. 46.5). Heavily corroded object that broke into several pieces. Reconstruction of the frame is not feasible. L_{prong}: 3 cm; W_{prong}: 0.58 cm.

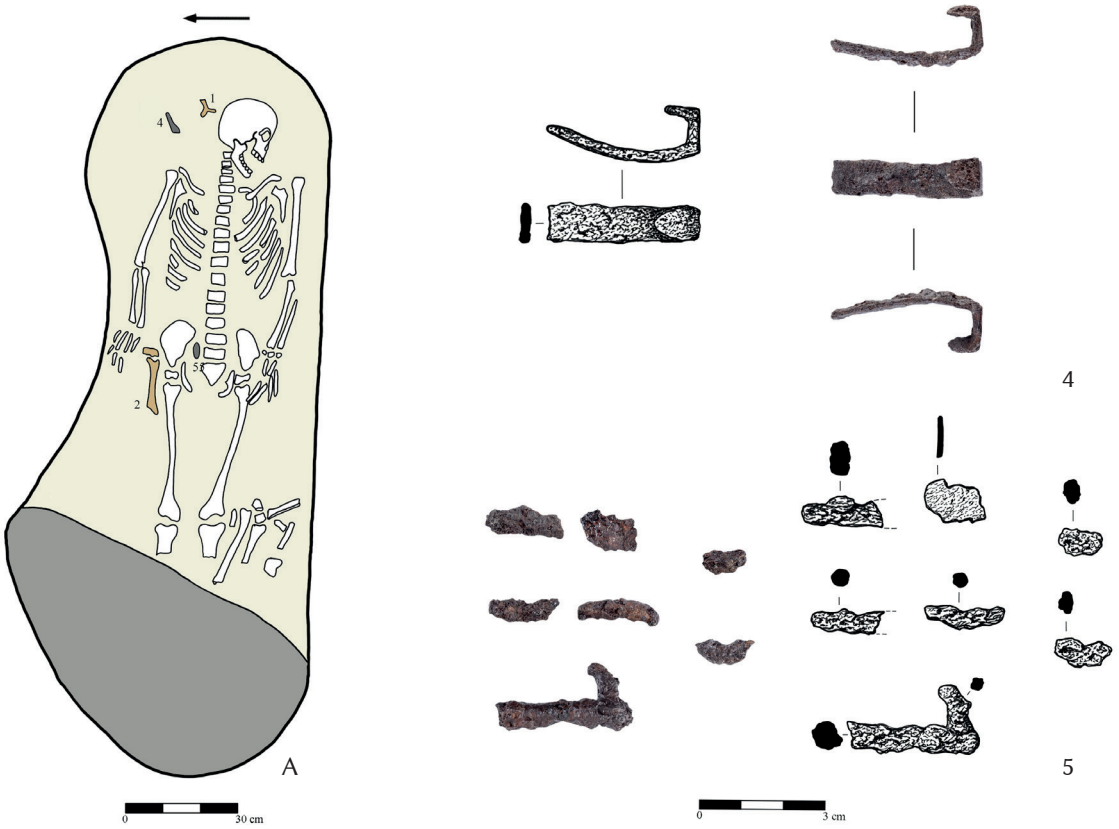

Fig. 46. Grave 1528/1666

13 It may have come from the former garbage pit that cuts the grave.

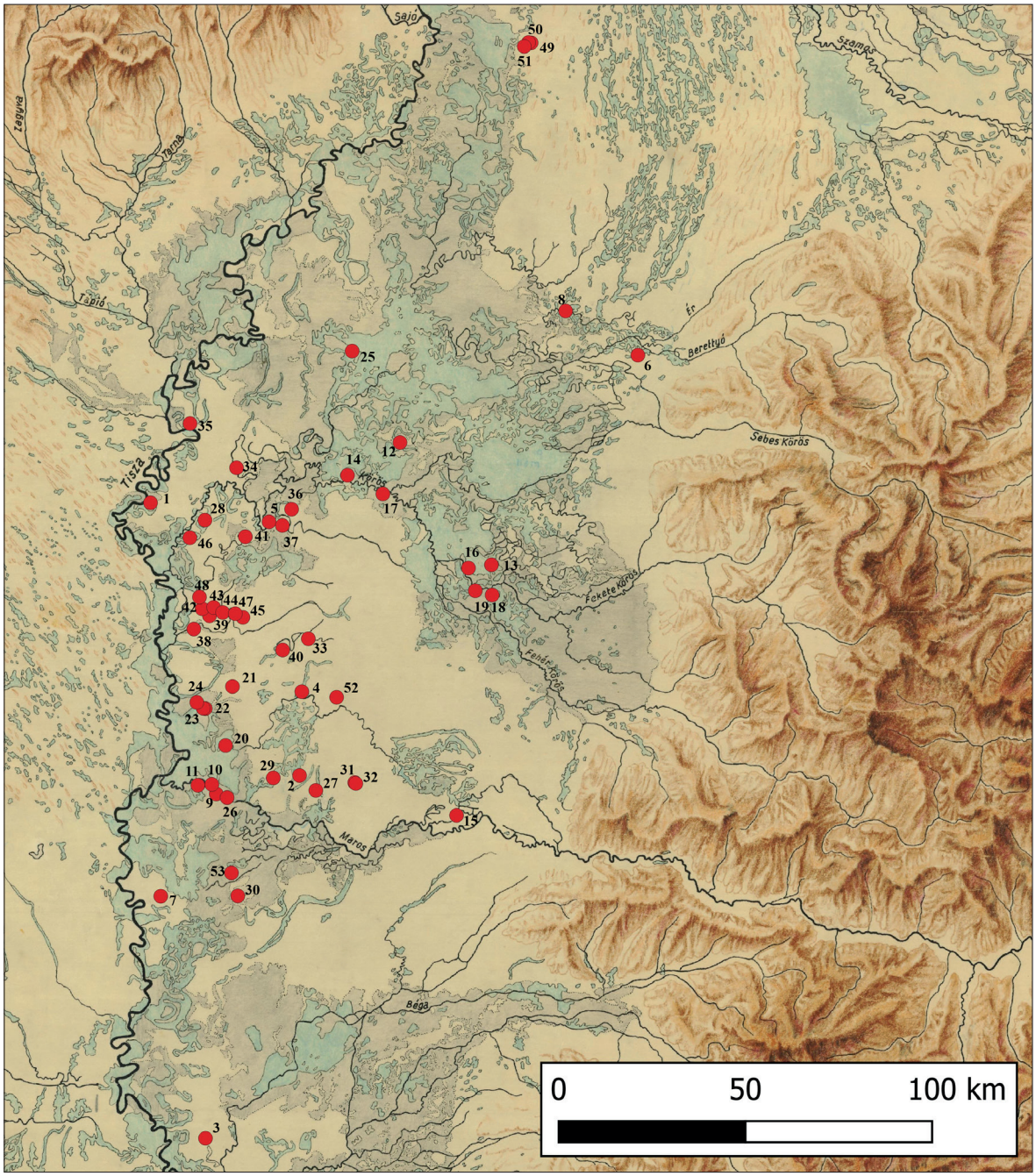

Fig. 47. Early Avar sites in the Trans-Tisza region mentioned in the text. 1 – Tiszakürt-Zsilke-tanya, 2 – Apátfalva-Nagyút-dűlő, 3 – Aradac-Mečka, 4 – Békéssámson-Móricz Zs. utca, 5 – Békésszentandrás-Benda-tanya, 6 – Bojt-Gulya-legelő, dél, 7 – Čoka-Kremenjak, 8 – Derecske-Bikás dűlő, 9 – Deszk-Site G/P, 10 – Deszk-Site Sz, 11 – Deszk-Site T, 12 – Dévaványa-Köleshalom, 13 – Doboz-Hajdúirtás, 14 – Endrőd-Doboskert, 15 – Felnac, 16 – Gerla-Szakácsföld, 17 – Gyoma-Ugari-tanyák-dűlő, 18 – Gyula-Dobos I. utca, 19 – Gyula-Site Nr. 511, 20 – Hódmezővásárhely-Batida, IX. homokbánya, 21 – Hódmezővásárhely-IV. téglagyár, 22 – Hódmezővásárhely-Kishomok, 23 – Hódmezővásárhely-Kopáncs II, 24 – Hódmezővásárhely-Solt-Palé, 25 – Kisújszállás, 26 – Kiszombor-Site O, 27 – Kövegy-Nagy-földek, 28 – Kunszentmárton-Habranyi-telep, 29 – Makó-Mikócsa-halom, 30 – Mokrin-Vodoplav, 31 – Nădlac-Site 3M-N, 32 – Nădlac-Site 9M, 33 – Orosháza-Bónum, 34 – Öcsöd-MRT Site 96a, 35 – Rákóczifalva-Bagi-földek, Site 8a. 36. Szarvas-Grexa-téglagyár, 37 – Szarvas-Ponyicky-tanya, 38 – Szegvár-Oromdűlő, 39 – Szegvár-Sápoldal, 40 – Székkutas-Kápolnadűlő, 41 – Szentes-Belsőecser, F9 tábla, 42 – Szentes-Berekhát, Farkas Imre földje, 43 – Szentes-Borbásföld, 44 – Szentes-Derekegyházi oldal, 45 – Szentes-Donát, Szentes-Jaksor No. 7, 48 – Szentes-Lapistó, 49 – Szentes-Lenin utca 13, 49 – Tiszavasvári-Kashalom-dűlő, 50 – Tiszavasvári-Koldusdomb, 51 – Tiszavasvári-Utasér-parti-dűlő, 52 – Tótkomlós-Békéssámsoni út 48, 53 – Vălcani.

4. Burial rites

4.1 Structure of the cemetery

Compared to Transdanubia, Early Avar cemeteries in the Trans-Tisza region tend to be smaller in terms of size.[14] The dimensions of the Szegvár-Oromdűlő and Makó-Mikócsa-halom cemeteries are known with certainty; in the case of the Mokrin-Vodoplav cemetery, however, it can only be speculated that the number of graves exceeded 100.[15] The region is known for its many isolated burials and small cemeteries.[16] Few burial grounds fall between these two size categories. The cemetery of Deszk-G/P stands out with the excavated 64 burials.[17] The partial graveyards brought to light at Koldus-domb and Utasér-part-dűlő in the vicinity of Tiszavasvári, comprised 24 and 26 graves, respectively.[18] Based on these data, Tiszakürt-Zsilke-tanya can be considered a middle-sized cemetery.

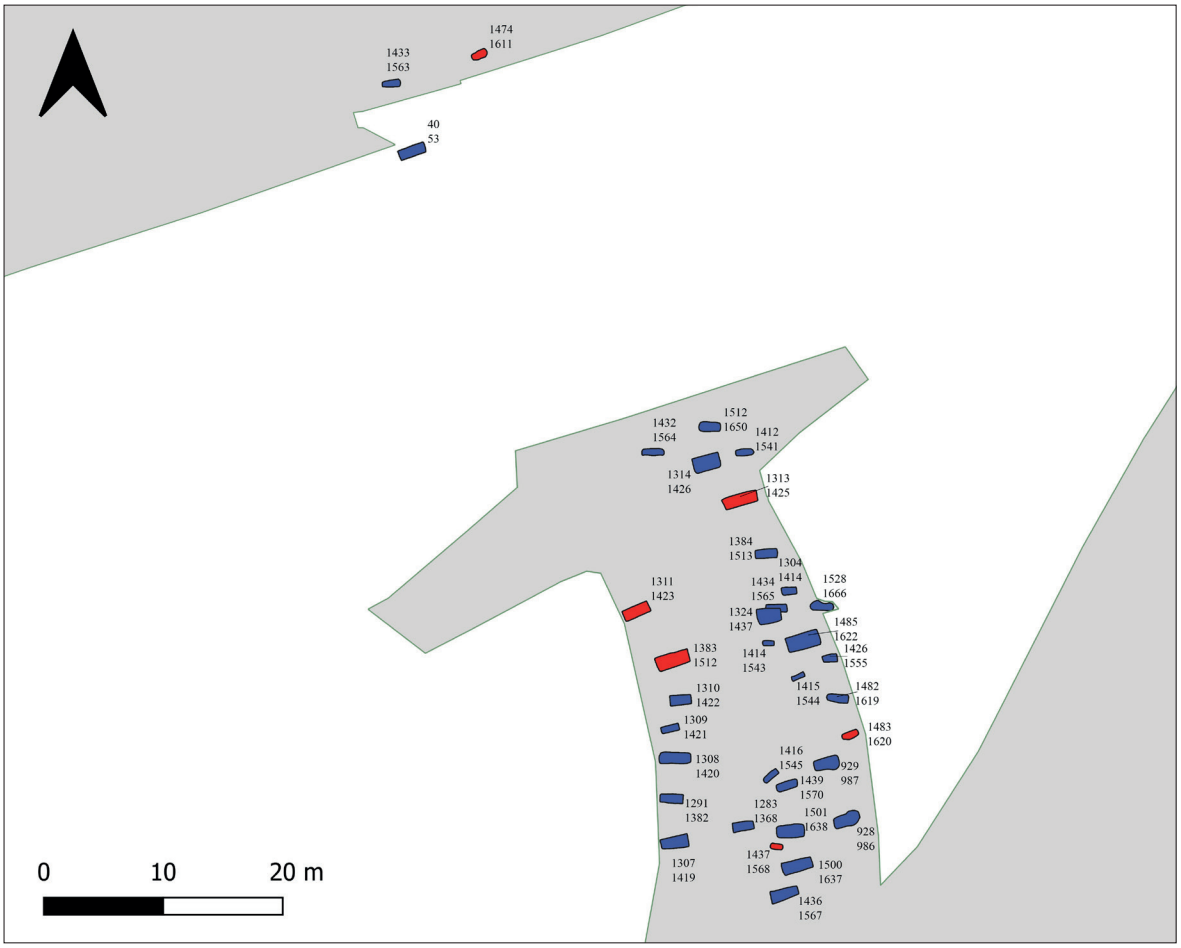

Fig. 48. Spatial distribution of the graves based on their orientation. Blue – E–W and its variations, red – W–E and its variations.

14 Due to the burial customs and partly the regional characteristics of the finds, it is primarily analysed in a micro-region covering the wider catchment area of the broader vicinity of Szarvas and Szentes cities and secondarily in a context of the Trans-Tisza region. For the sites mentioned in the text, see Fig. 47.

15 467 graves were excavated in Szegvár and 251 in Makó (Lőrinczy 2020, 13; Lőrinczy 2020, 130). For the research history of the Mokrin cemetery, see Balogh 2015, 39–41.

16 Lőrinczy 1996, 184–185; Lőrinczy 2016, 156.

17 According to B. Kürti, these are two parts of the same cemetery, with 58 and 6 graves, respectively (Kürti 2002a, 109–110; Kürti 2002b, 111).

18 Gulyás – Lőrinczy 2018, 529; Istvánovits – Lőrinczy 2017, 36–37.

In the Tiszakürt cemetery, the graves were arranged in three more or less regular rows (see Fig. 3). This arrangement was more typical of Transdanubia and the Danube–Tisza Interfluve region in the Early Avar Period, while the small cemeteries in the Trans-Tisza region usually have scattered groups of graves.[19] Only a few exceptions are known, such as Szegvár-Sápoldal and Öcsöd-MRT 96a.[20] The exact chronology of the Szarvas-Grexa-téglagyár cemetery is difficult to establish because of the large number of burials without any inventory or with grave goods not suitable for dating. However, the graves dated to the Early Avar Period with certainty, form rows of various sizes.[21]

4.2 Orientation

Two major types of orientation could be distinguished in the Tiszakürt cemetery: E–W and W–E (Fig. 48). The first group includes 15 NE–SW, 1 ENE–WSW, 11 E–W, and 2 ESE–WNW-oriented graves. The NE–SW and E–W orientations are typical of 6th–7th-century cemeteries belonging to a population with Eastern European origin, found mainly in the Trans-Tisza region.[22] According to recent estimates, this orientation was documented at more than 70 sites in the region.[23]

Five graves were oriented SW–NE, and one WNW–ESE; they represent about less than one-fifth of the burials. This may be interpreted as reverse orientation. This phenomenon is not unique in the region in an early Avar context; for example, 15 graves at Szegvár-Oromdűlő were oriented in a similar way.[24]

According to D. Csallány, the change in orientation primarily reveals chronological information: the initial E–W orientation was replaced by N–S and later W–E.[25] G. Lőrinczy, on the other hand, attributes the different orientations to different cultural groups.[26] His statement that the W–E orientation appeared sporadically in the Trans-Tisza region is, however, doubtful.[27] In the Körös valley, for example, this orientation is common; there are sites where the overwhelming majority of graves are oriented this way. The most important of these sites is Szarvas-Grexa-téglagyár, where the Early Avar Period graves are oriented NW–SE and WNW–ESE.[28] All of the graves excavated at the site of Öcsöd-MRT 96a are WNW–ESE-oriented.[29] The Kunszentmárton-Habranyi telep cemetery is also located along the Körös river; most of the burials here were also oriented W–E.[30] The isolated burials at Szarvas-Ponyiczky-tanya, Szentes-Belsőecser F9 tábla, Grave 1 at Szentes-Berekhát, Farkas Imre földje, Szentes-Jaksor, 7. sz. as well as the two graves at Békésszentandrás-Benda-tanya, also exhibit this orientation.[31]

19 Lőrinczy – Rácz 2014, 166–167; Cseh – Varga 2017, 459, Pl. 2.A; Gáll 2017, 230, Pl. 4.

20 Lőrinczy 2018, 65, Fig. 10; Madaras 2004, 355, Fig. 1.2.

21 Juhász 2004, 96–102. I. Juhász distinguished between early and late grave groups, including burials without any inventory. Therefore, this chronology needs to be revised.

22 Lőrinczy 1992b, 164–165.

23 Lőrinczy 2022, 19.

24 Lőrinczy 2022, 19.

25 Csallány 1968, 60.

26 Lőrinczy 1998, 351.

27 Lőrinczy 2022, 19.

28 Juhász 2004, 63.

29 Madaras 2004, 341–342.

30 Csallány 1933, 2–4.

31 Jankovich et al. 1989, 445; Lőrinczy – Szalontai 1993, 289; Madaras 1999, 320; Liska 1997, 158; Balogh et al. 2023, 256.

4.3 Grave forms

While the majority of the graves in Transdanubia are simple shaft graves, there are many so-called compound burials in the Early Avar cemeteries in the Trans-Tisza region. A common feature is the separation of the deceased and the entrance shaft. Several types can be distinguished according to the position of the entrance pit and the niche for the deceased. If the niche is located along the long side of the entrance shaft, it is called a grave with a sidewall niche; if it is on the short side, it is called an endwall shaft. The ledges on the longitudinal walls held the planks that separated the animal and human remains. From a functional point of view, this grave form is related to compound graves, rather than simple shaft graves. The Tiszakürt cemetery contained shaft graves, graves with longitudinal ledges, and one grave with a sidewall niche.

4.3.1 Shaft graves

Altogether 30 shaft graves were documented in the Tiszakürt cemetery. They were mainly rectangular with rounded corners, which can be considered common. The grave walls are usually tapered slightly towards the bottom, which is typically flat.[32] The characteristic feature of the burials in the Trans-Tisza region is that they are much narrower compared to the graves in Transdanubia. This can be expressed as the ratio of length to width of the graves; in the Trans-Tisza region, this ratio is typically 3.[33] Grave 21 at Tiszavasvári-Koldusdomb is particularly narrow, with a 3.7 length-to-width ratio.[34] In the Tiszakürt cemetery, this ratio varies between 2 and 3.1, the average being 2.5. This quotient is even higher for the six shaft graves in the neighbouring cemetery of Öcsöd-MRT 96a, where the average is 2.85.[35]

4.3.2 Graves with ledges

Four graves with ledges were documented in the Tiszakürt cemetery. In Graves 1307/1419, 1383/1512, and 1485/1622, ledges were along the longitudinal walls, while Grave 1482/1619 had a narrow ledge only at the foot end. However, it is possible that there were more such burials in the cemetery, as not all ledges may have been perceivable during the excavation. Since their documentation has been proven problematic at other sites as well, this grave form is rarer than others. In Szegvár-Oromdűlő, 21 graves had ledges and 30 had so-called "lobes"[36] on the longitudinal sides for the planks. These comprised almost 11% of all graves.[37] At Öcsöd-MRT 96a, there was only one ledge in Grave 3, and there were two in Graves 9 and 10.[38] Four of ten burials had a similar structure at Szegvár-Sápoldal.[39] Among the recently published burials, Grave 273 of Hódmezővásárhely-Batida, IX. homokbánya was of this shape.[40]

4.3.3 Grave with a sidewall niche

Although the excavators have described Grave 1324/1437 as a shaft grave, there are several indications that it is a grave with a sidewall niche. It was much wider than the other burials and the left side of the pit, which may be identified as the sidewall niche, is about 10 cm deeper than the entrance shaft. Moreover, the wall of the niche was curved, indicating that the cavity was dug horizontally into the soil.

32 At Szegvár-Oromdűlő, the grave walls were vertical (Lőrinczy 2022, 20).

33 Gulyás 2015, 503.

34 Gulyás – Lőrinczy 2018, 540.

35 Cf. Madaras 2004, 340–341.

36 Grooves dug into the end walls of the grave pit above the level of the coffin (Lőrinczy 2022, 283).

37 Lőrinczy 2022, 20.

38 Madaras 2004, 341.

39 Lőrinczy 2018, 73.

40 Lőrinczy – Varga 2022, 18.

Graves with a sidewall niche were common in the Trans-Tisza region in the Early Avar Period. About 80% of the graves in Makó-Mikócsa-halom and about a fifth of the graves in Szegvár-Oromdűlő belong to this type.[41] The graves with a sidewall niche in the Trans-Tisza region follow the same pattern in terms of their structure; the entrance shaft is rectangular with rounded edges, located on the south or south-eastern side of the grave; the bottom slopes gently towards the sidewall niche. In the vast majority of cases, the animal remains were placed in the shaft. The sidewall niches are on the northern or north-western side; their walls are curved, their bottom is typically deeper than the entrance shaft.[42] This standardized arrangement probably evolved in the eastern European steppe region.[43] In contrast, the sidewall niche and the entrance shaft of graves in the Danube–Tisza interfluve region are in an inverted arrangement with no animal remains in the entrance shaft.[44] In the wider area of the Tiszakürt cemetery, the largest number of graves with a sidewall niche were found at Szegvár-Oromdűlő, and the isolated burials of Szentes-Borbásföld and Szentes-Lapistó were probably of a similar design.[45]

4.4 Cenotaphs

Graves 1291/1382 and 1308/1420 did not contain human remains, but both their shape and orientation suggest that they were graves. Similarly to burials, the former feature contained the skull and extremities of a sheep, the latter those of cattle (Fig. 49). Grave 1485/1622 was a grave with longitudinal ledges. There were Sarmatian pottery fragments, pieces of wattle-and-daub, stones, animal bones, and, according to the documentation, human bones in the infill of the grave. However, these finds were not deposited in any structured way, therefore this grave, too, can be classified as a cenotaph.

Similar graves have been documented at other sites as well. The pit No. 10 at Kövegy-Nagyföldek was very shallow, only 5 cm deep. Bones were observed during the cleaning of the top layer, and there was a sheep tibia at the bottom. Although it is possible that only the sheep remains were interred in the grave, it cannot be ruled out that it was originally intended as a burial site for a small child, as indicated by the size of the pit.[46]

Several theories have been formulated concerning the interpretation of cenotaphs in the Avar Period. Examining empty graves in south-east-

Fig. 49. Hypothetical cenotaph of Grave 1308/1420

41 Balogh 2017, 56; Lőrinczy 2022, 21.
42 Lőrinczy – Straub 2006, 280–282.
43 Cf. Sokolov – Gulyás 2023, 38–40.
44 Balogh 2016, 43–44.
45 Lőrinczy 1996, 181.
46 Benedek – Marcsik 2017, 370.

ern Transdanubia, Á. Novotnik points out that their existence cannot be traced back to a single cause. Agricultural work, bone decay, and the abduction of the corpse can all be responsible for the absence of human remains. Therefore, each case should be examined separately.[47] G. Lőrinczy and P. Straub suggest that these may have been the entrance shafts of compound graves, in which the sidewall niche or the endwall shaft is no longer perceivable.[48] In our view, it cannot be completely excluded that Graves 1291/1382 and 1308/1420 were actual burials and the human bones were simply decomposed. The size of the hypothesized cenotaphs is similar to that of the adult graves, however, the bones in the adult graves were more-or-less well preserved. Therefore, it seems that these phenomena can indeed be considered as cenotaphs.

4.5 Coffins

Discoloration indicating the presence of a coffin was observed in Graves 928/986, 929/987, 1310/1422, and 1482/1619 (Fig. 50).[49] Grave 929/987 deserves more attention, as it was clearly documented that the ends of the longitudinal planks extended beyond the short sides. A similar technique was recorded in Grave 12 at Kövegy-Nagyföldek.[50] In the majority of cases, impressions of log coffins were documented in the burials of the Trans-Tisza region.[51]

Among other things, the presence of a coffin may be indicated by animal remains deposited above the human skeleton, but such an interpretation is not entirely unambiguous. In the case of graves with longitudinal ledges, the use of planks can also account for this arrangement. Additionally, the animals could have been deposited in the fill. In four graves,[52] the cattle remains were 13–20 cm above the deceased, while in Graves 1384/1513 and 1437/1568, there were bones of small ruminants 10–16 cm above the human remains.

Fig. 50. Discoloration left by the coffin in Grave 1482/1619

4.6 Position of the human remains

The skeletons brought to light in the cemetery were found in a supine position with the arms stretched along the body, except for those in the heavily disturbed grave of Grave 1474/1611. The arms were close to the body, and the hands were on or near the pelvis. The legs were in parallel position, often with the knees or ankles together. This arrangement is common in the region. In Grave 1437/1568, however, the knees of the deceased were pulled up but not in a typical crouched position

47 Novotnik 2011, 106.

48 Lőrinczy – Straub 2006, 292, Note 6.

49 The number of the coffins was probably higher than this, but discoloration indicative of coffins is difficult to document, even under favourable soil conditions (cf. Tomka 1978).

50 Benedek – Marcsik 2017, 419, Pl. 7.

51 Lőrinczy 2022, 37.

52 Graves 929/987, 1414/1543, 1436/1567, and 1500/1637.

because the body was not lying on its side. Atypical burials were rare in the examined period, only one skeleton was found in a crouched and another in a prone position, both in the cemetery of Szegvár-Oromdűlő.[53]

4.7 Disturbed graves

Minor to major bone displacement was documented in 13 graves (Fig. 51). Nine of these were infant burials with subpar grave goods, in which the disturbance was probably caused by rodents. This is also the case in Grave 1433/1563, where only the right part of the rib cage was not *in situ*. In Grave 1528/1666, the leg bones were destroyed by a later pit. In Grave 1307/1419, the body was destroyed from the pelvis upwards, and the grave goods were displaced accordingly. Considering that the burial was one of the richest in the cemetery, grave robbery is certainly a possibility. In Grave 1474/1611, the bones of the upper body were in anatomical order, but the leg bones were disturbed, which suggests that the soft tissues were holding the bones together when the upper part of the remains was pulled to the western end of the grave during the re-opening the burial.

Fig. 51. Disturbed human remains in Grave 1313/1425

Compared to the contemporaneous graves in Transdanubia, far fewer were disturbed in the Trans-Tisza region. In Szegvár-Oromdűlő, about 15% of the graves were looted: not only the shaft graves but also those with a sidewall niche or an endwall niche. This suggests that the robbers were well-aware of the grave forms used by the community. There was no sharp distinction between the infill of the graves and that of the robbers' pits, suggesting that the graves were robbed not long after the burials had taken place.[54] The typical disturbance at Szegvár-Oromdűlő targeted the upper body, similarly to Grave 1307/1419 at Tiszakürt.[55] The nine burials of Szegvár-Sápoldal, excavated in the 1980s, were also all robbed.[56] In Grave 4 at Öcsöd-MRT 96a, only the skull of the deceased was disturbed, while the rest of the skeleton remained intact.[57]

4.8 Hypothetical double burial

The interpretation of Grave 1474/1611 is unclear. The bones were disarticulated due to disturbance and were not found in anatomical position. The remains of two individuals could be identified by anthropological means; however, the excavation documents make no mention of a double burial, possibly because the skeletons were too fragmentary to be easily recognized as the remains of two

53 Lőrinczy 2022, 35.
54 Lőrinczy 2022, 38.
55 Lőrinczy 2022, 39.
56 Lőrinczy 2018, 53–63.
57 Madaras 2004, 343.

people. One individual was identified as a 25–35-year-old female, but the identification of the other is inconclusive. Only leg bones were found from the second individual, which makes the double burial interpretation doubtful. Similar cases were recorded in three graves at the site of Szarvas-Grexa-téglagyár, where additional skulls were found in disturbed burials.[58]

Double burials are widespread across major Avar cemeteries throughout the period; however, the majority can be dated to the Late Avar Period. They comprise only a small number of cases in the cemeteries.[59] Usually, double burials involve an adult and a child, with the adult generally oriented as was customary for the community, while the child's orientation may differ. A smaller number of cases involve double burials of two adults, occasionally with both individuals oriented in the same direction, regardless of their gender.[60] The burial of two adults of the same sex in one grave is also common. There are examples of two males or two females in the same grave in the Körös–Maros–Tisza interfluve region in the second half of the Avar Period.[61] Although assumptions about marriage or family relationships are made, they remain speculative. The DNA analysis conducted on the double burial of a woman and a child in Csákberény-Arató-szérű cemetery in Northeast Transdanubia revealed that they were related on the maternal side.[62] However, this evidence is limited to a single case, and general conclusions require further study.

Multiple burials were rare in the wider region of Tiszakürt. In Grave 935 at Szegvár-Oromdűlő, the remains of an adult woman and a fetus were found.[63] The remains of two children were laid in opposite orientation in Grave 5 at Orosháza-Bónum.[64] A mature woman and an infant child were buried together in Grave 8 at Székkutas-Kápolnadűlő;[65] this was one of the earliest graves in the cemetery.

The *in situ* documentation and photo of the hypothetical double grave of Tiszakürt, Grave 1474/1611, suggest that the deceased were lying on their sides with their knees up. This arrangement has not been documented elsewhere in the Trans-Tisza region. The closest analogy was recently found in Dunavarsány in Northeast Transdanubia, with two adults laid in the same position but oriented in opposite ways.[66] In the Tiszakürt case, however, this interpretation remains tentative due to the displacement and fragmentation of bones, and the presumable complete dislocation of the upper body of one individual.

4.9 Animal remains

Various forms of animal remains were recovered in Tiszakürt, including bones that suggest the presence of the skin of horse, cattle and sheep, food offerings, as well as suspected symbolic burials. Almost all animal remains recovered from the graves seem to have belonged to animal skins; the 23 graves that yielded animal bones contained the remains of altogether 44 animals. In the Trans-Tisza region, the early Avar population of Eastern European steppe origin typically buried their dead with partial animal carcasses. These included animal sacrifices, food offerings, and symbolic animal burials alike. Complete bodies of horses, and occasionally cattle, were rarely interred.[67]

58 Bende 2017, 283, Note 355.

59 Tomka 2003, 18.; Balogh 2006, 43; Bende 2017, 283–285; Szücsi et al. (in press).

60 Bende 2017, 284.

61 Bende 2017, 283–284.

62 Szücsi et al. (in press).

63 Lőrinczy 2020, 338.

64 Lichtenstein 2006, 131.

65 B. Nagy 2003, 17.

66 We are grateful to archaeologist Eszter Piroska for this information.

67 Gulyás et al. 2021; Gáll – Mărginean 2020, 385.

Typically only the flayed skin of the sacrificed animal was deposited in the grave, along with the skull, the terminal bones, and sometimes the first cervical and caudal vertebrae that were left in the skin during flaying (Fig. 52).

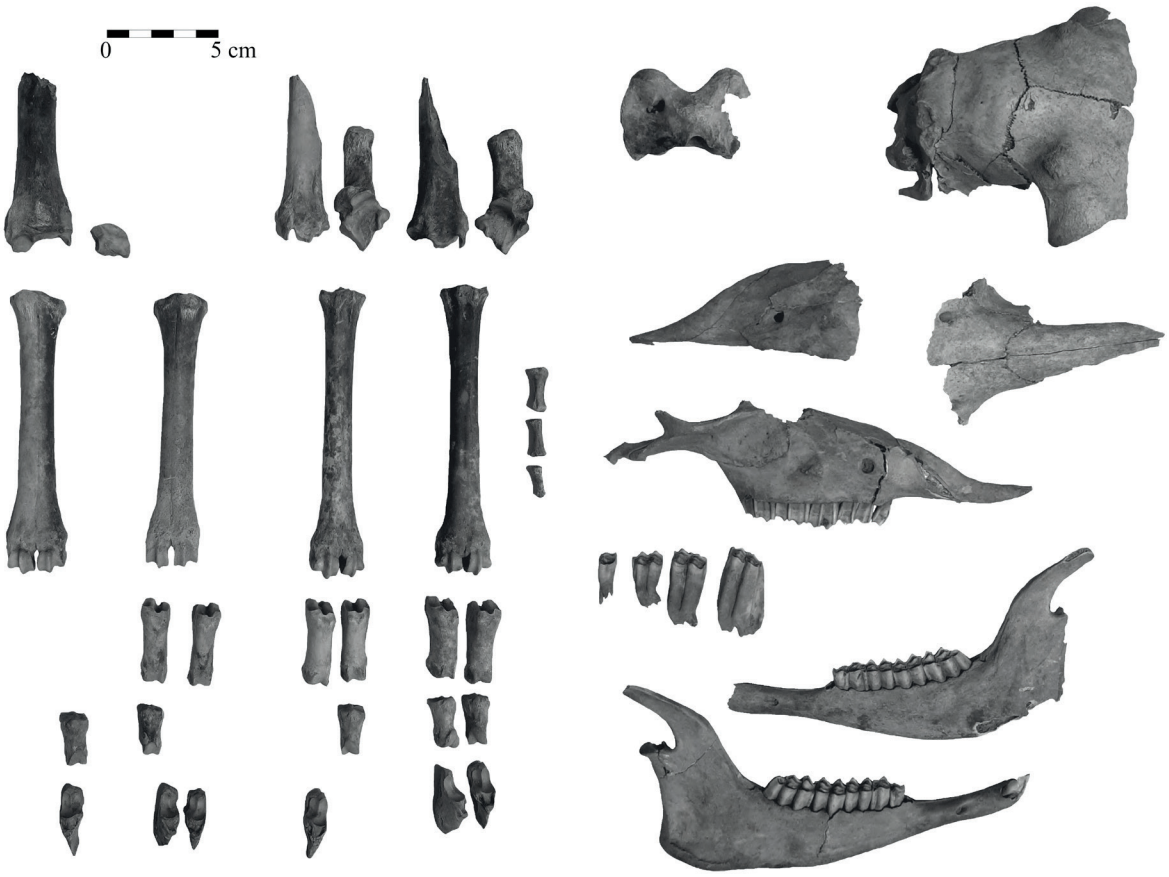

Fig. 52. Typical remains of a sheepskin, deposited in Grave 1310/1422. The skull is fragmented, some of the legbones are missing. The fist cervical vertebra (atlas) and three caudal vertebrae are present. (Photo: Kyra Lyublyanovics)

The animals' age was estimated on the basis of the epiphyseal fusions and the dentition, mainly following I. A. Silver's data.[68] Sexing and withers height estimation were based on G. Nobis and J. Matolcsi's methodology for cattle;[69] M. Teichert's for sheep withers height;[70] and by V. O. Vitt's for the withers height of horses.[71] Bone measurements were recorded according to the protocol by A. von den Driesch.[72] Animal remains are summarized in Tab.1; biometric measurements are available in Tab. 2.

Spring calving and lambing (typically taking place in the months between February and May, with the vast majority of births in March and April) were calculated for estimating the season of culling. It must be noted, however, that late calving / lambing in the autumn, associated with human

68 Silver 1963.

69 Nobis 1954; Matolcsi 1970.

70 Teichert 1975.

71 Vitt 1952.

72 von den Driesch 1976.

intervention and dairy production, has been documented from the Neolithic onwards.[73] Although there is no information confirming such practices among the Avars, it is not impossible that autumn calving was also common, which means that seasonality calculated from the animal remains must be considered a rough estimation. Keeping this in mind, the estimated times of culling cover the whole year, with the majority of slaughters taking place in the autumn and winter. This suggests that the cemetery was used for a longer period of time and in different seasons. Similar seasonality was recorded by A. Kőrösi in the Avar cemetery of Székkutas, although autumn and winter slaughter constituted a larger proportion there.[74]

The animal skins raise the question whether these were freshly flayed or somehow conserved for later use; the latter would discredit seasonality data. In the case of the Tiszakürt burials, conservation and later utilization of flayed skins can be excluded. Bacterial processes of decomposition normally begin shortly after flaying, and the continental climate is not warm and dry enough to conserve the skins solely by hanging them to dry.[75] Preservation by salt is possible, provided that the skin is cleansed of excess tissues (fat, connective tissue, membrane) so that the chemicals responsible for preservation can penetrate the skin.[76] This cannot be done without removing the bones and the tendons, ligaments, and muscles attached to them. Salting extracts moisture which prevents bacterial decomposition, but its effectiveness diminishes if bones and associated soft tissues remain in the skin-enclosed limb. In the case of the animals from Tiszakürt, not only the lower leg bones and the skull remained in the skin, but also the jaws and in many cases the hyoid bone and some cervical vertebrae, which rules out the possibility that the skins had been treated. These bones would have been removed or fallen out during the removal of the soft tissues. Thus, it is relatively certain that the skins placed in the graves had belonged to animals sacrificed at the time of burial and eaten at the funeral feast.

There was no clear clustering in terms of spatial distribution of the animal remains, but some patterns were observed (Fig. 53). Most graves with animal skins were in the southern part of the excavated cemetery section. Graves that contained cattle skins were concentrated in the southernmost part, with the five graves that yielded both cattle and sheep skins situated relatively close to each other, within a radius of ten meters, and in the eastern row of graves with one exception. The only grave that contained the skin of a horse was situated in the middle of the eastern row. The presence of food offerings followed the distribution of pots, showing a clear association between the two items, even if the food was not placed in the pot in all cases (Fig. 54). Interestingly, almost all graves with food offerings were situated in the southern part of the excavated area and in the eastern row of graves, similarly to the distribution of the animal skins. The graves with swine and domestic hen bones were scattered throughout the eastern row, while the two graves that contained the lumbar spine section of sheep were next to each other in the middle, close to the grave with the horse skin. All this may indicate similarities of the burial rites in this southeastern cluster and in the middle section; however, it must be kept in mind that the excavated area covers only a part of the Avar cemetery and so this hypothesis will have to be tested when more graves will come to light.

4.9.1 Horse skin

The skull and lower leg bones of a horse were only documented in one burial, Grave 1324/1437. Such assemblages are generally identified as remains of the horse's flayed skin. The horse bones were spread in the shaft of a grave with a sidewall niche, suggesting that the deposited animal skin was oriented the same way as the deceased. Horse hides were common in graves in the area east of the Tisza river in the

73 Balasse et al. 2017; Balasse et al. 2021; Tornero et al. 2020.

74 Kőrösi 2005.

75 Covington 2009, 76.

76 Reed 1972, 46–49; Covington 2009, 56.

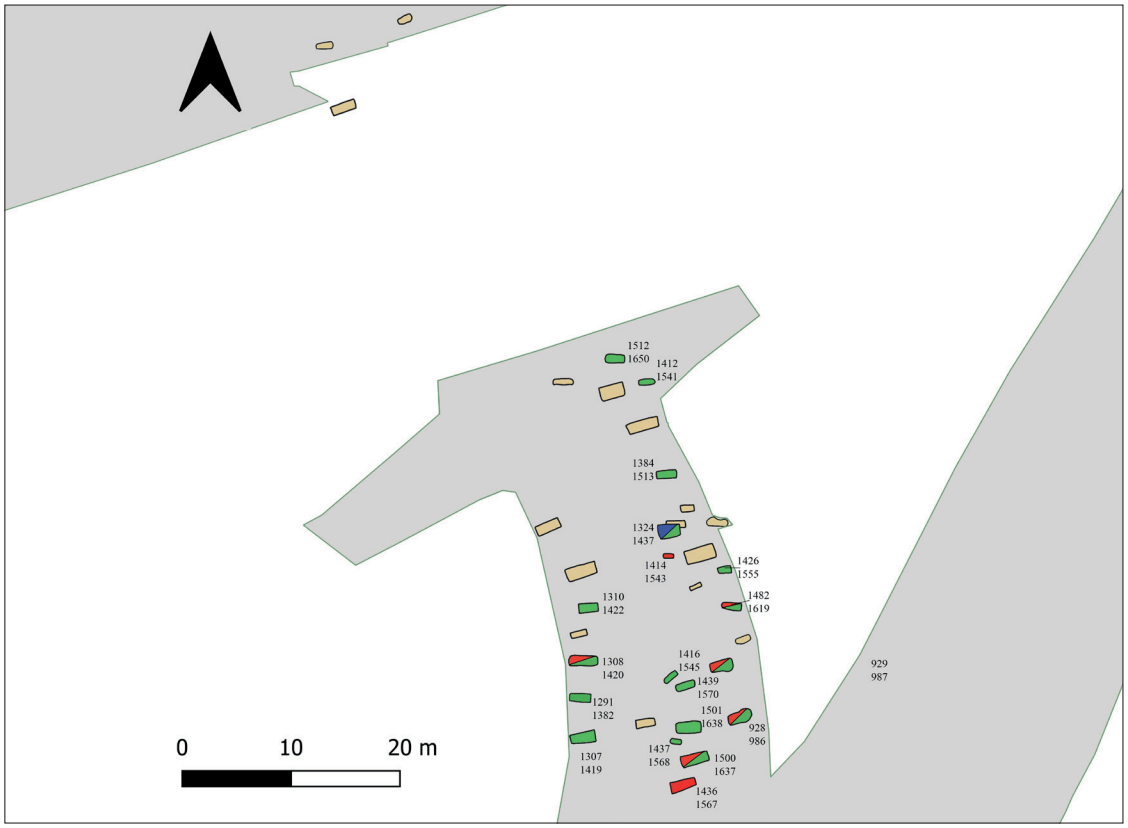

Fig. 53. Spatial distribution of the graves with animal skins. Blue – horse, red – cattle, green – sheep

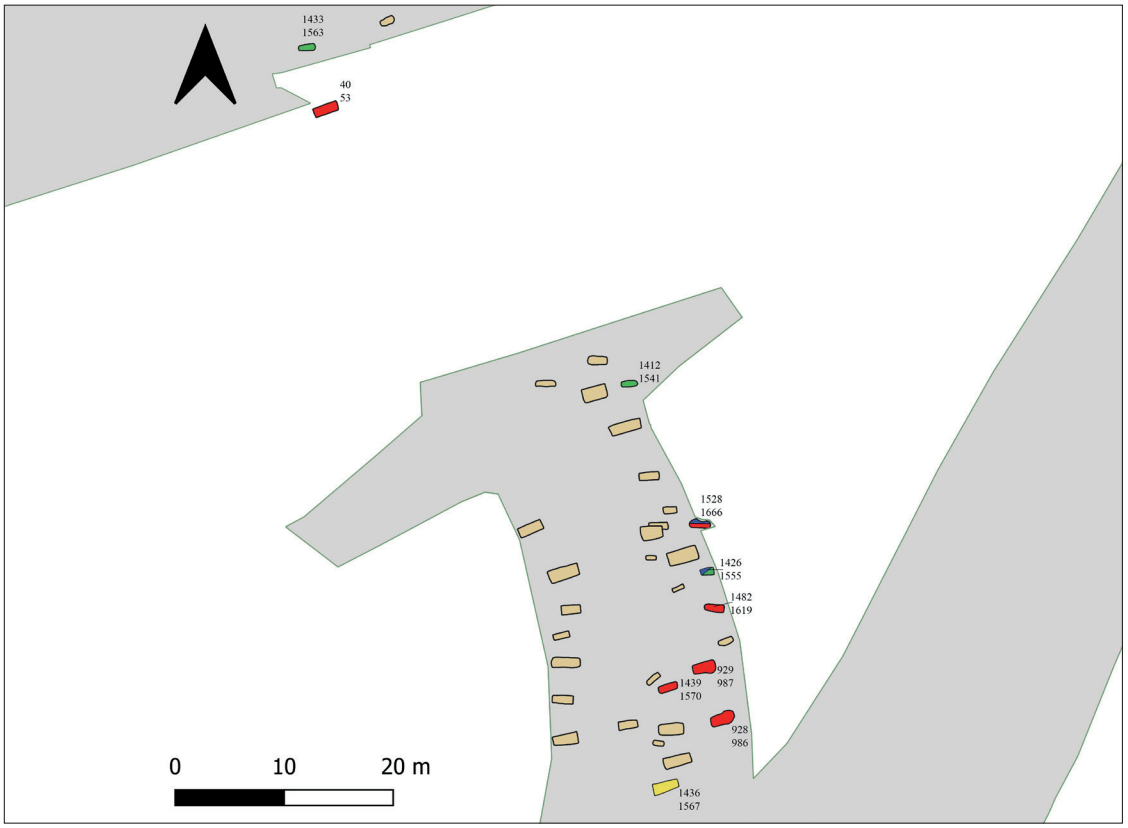

Fig. 54. Spatial distribution of the graves with food offerings. Blue – mutton, red – pork, green – poultry, yellow – beef

Early Avar Period;[77] the graves in Transdanubia that yielded horse skins also show cultural resemblances to those in Trans-Tisza.[78] Most such burials in the region were found in the cemetery of Szegvár-Oromdűlő; 103 horses were identified here through archaeozoological means.[79] In addition, the remains of horse skins were documented at small sites, such as Grave 1 at Szegvár-Sápoldal, from Szentes-Lapistó, -Derekegyházi-oldal and -Borbásföld.[80] Notably, burials containing horse harnesses, which appeared in the later 7th century in the Hármas-Körös area, are considered as a form of representation analogous to burials with horse skins.[81] This custom was mainly documented in the early graves at Szarvas-Grexa-téglagyár; similar burial rites were prevalent in the cemetery of Békésszentandrás-Bendatanya as well.[82] In the immediate vicinity of Tiszakürt, at Szegvár-Oromdűlő, however, only Grave 951 falls into this category,[83] while such graves are completely absent from the Tiszakürt cemetery.

The grave in Tiszakürt with horse remains, Grave 1324/1437, contained the body of a a 9.5–10.5-year-old child. People of Eastern European steppe origin typically buried horse skins with men, the phenomenon has only sporadically been documented in female graves, e.g. at Szegvár-Oromdűlő.[84] Children were very rarely buried with horses; in the Oromdűlő cemetery, 5 children in the *infans I* (younger children, 0–6 years of age) and 13 in the *infans II* (older children, 6–14 years) age group were interred this way.[85] Even though children were sometimes buried with multiple cattle or sheep, there is never more than a single horse in their graves.[86] There are a few sporadic examples in the Trans-Tisza region for horses in the graves of juveniles; a 12–14-year-old was interred with remains of a horse in Grave 34 of Tiszavasvári-Kashalom-dűlő, while a 14–15-year-old individual were found in a similar grave at Szentes-Borbásföld.[87]

In the Tiszakürt grave, the animal remains belonged to a young, 4–4.5-year-old mare. Few horse remains have been studied by archaeozoological means in the Trans-Tisza region, and so the zoological details of such graves are rarely known. In the above mentioned grave at Szentes-Borbásföld, the bones of a 17–18-year-old stallion were recorded.[88] In the cemetery of Tiszavasvári-Koldusdomb, all horses whose age and sex could be identified were young stallions.[89] Grave 3M-N 351 in Nădlac (Banat region, Romania) contained the skull and leg bones of a 8–10-year-old horse.[90] The most detailed study was conducted by I. Vörös in connection with the Szegvár-Oromdűlő cemetery, where out of the 103 horses the skins of which were interred, only 14 were found to be mares.[91] In terms of their age at death, 22 out of the 103 animals were 3.5–4 years old, which seems to be the typical age for culling.[92]

77 Némethi – Klima 1992, 177.

78 Gallina et al. 2022, 14–15; Gulyás 2023, 165, 168–170.

79 Vörös 2022, 772.

80 Bóna 1979, 5; Csallány 1934, 206; Csallány 1939, 116; Lőrinczy 1996, 177.

81 According to L. Bende, this custom appeared in the mid-7th century (Bende 2000, 254); however, it is most prevalent at sites that she herself dated to the later Avar period due to the absence of the standard burial rites known from Szegvár and Marosszög.

82 Juhász 2004, 71–74; Balogh et al. 2023, 258–259.

83 Lőrinczy 2020, 345.

84 Gulyás 2023, 166.

85 Lőrinczy 2022, 44, Tab. 9. Grave 720 contained the complete skeleton of a horse.

86 Lőrinczy 2022, 44–45.

87 Lőrinczy – Rácz 2014, 148; Lőrinczy 1996, 177, Note 3.

88 Vörös 1996, 192.

89 Gulyás – Lőrinczy 2018, 530–537.

90 Gáll 2017, 110.

91 Vörös 2022, 771.

92 Vörös 2022, 774, Tab. 5.

The estimated withers height of the Tiszakürt mare is 130 cm, calculated by Vitt's method.[93] This corresponds to the average size of horses in the period, although it is smaller than the size of horses sacrificed in the cemetery of Tiszavasvári-Koldusdomb (between 130.8 and 137.2 cm, with an average of 134.7 cm, respectively).[94] In their study on the Avar horses from the cemetery of Vörs-Papkert, L. Bartosiewicz, T. Somhegyi and I. Takáts note that "typical Avar horses," which had ca. 135 cm withers height and slender limbs, must have been the result of conscious breeding and may indicate the presence of a "military standard."[95] Similar animals were documented at Szegvár-Oromdűlő by I. Vörös, who describes this type of horses as small horses of Eastern origin, bred for use in forested and mountainous areas.[96] It is important to add that the horse herd reconstructed from the Szegvár dataset was not homogenous, as opposed to the horses in Vörs. Larger animals that deviate from the period's average were found sporadically in the Trans-Tisza region (Derecske-Bikás dűlő: 8–9-year-old stallion that measured 143 cm at the withers;[97] Békéssámson-Móricz Zs. utca: 11–12-year-old mare with a withers height of 142.4 cm[98]). Of course, one individual is insufficient for a comprehensive picture of the horses kept in Tiszakürt. No pathological phenomena were observed on the bones of the identified mare, the animal—based on its incomplete remains—was healthy.

No harness was found beside the remains of the Tiszakürt horse. G. Lőrinczy and P. Straub created a typology of horse burials according to the position of the harness; in their categorization, Group 2 included animals buried without harness or with one that decomposes completely, e.g. a halter made of rope.[99] Although earlier scholarship suggests that there are no burials with unharnessed horses in the Trans-Tisza area,[100] five of such graves were found in the cemetery of Szegvár-Oromdűlő. These unharnessed horses were mostly buried with women and children, and one was interred in the grave of a man.[101]

4.9.2 Cattle skins

In Tiszakürt, cattle skulls and leg bones indicating the presence of animal skins were collected from seven graves altogether (Fig. 55).[102] One of these, Grave 1308/1420 was a cenotaph. The cattle skin was deposited above the deceased, spread out on top of the coffin or planks. The cattle skins follow the same common pattern: the skull, the jaws, sometimes the hyoid bone and the first cervical vertebrae were found, along with the lower legs, truncated in the distal third of the radius and tibia, and occasionally parts of the tail.

During the Early Avar Period in the Trans-Tisza region, it was customary to inter cattle skins with the dead; 354 cases were documented in the cemetery of Szegvár-Oromdűlő, and 252 cattle were identified in Makó-Mikócsa-halom.[103] In the wider area of Tiszakürt, similar animal remains were

93 Vitt 1952. This formula is considered more reliable for horses in the Migration Period than the one established by L. Kiesewalter in the late 19th century. The most authoritative method for the size estimation of Avar horses was developed by L. Bartosiewicz; however, measurements on a more-or-less intact skeleton are needed for his formula. Measurements of only the skull and the partial legs are insufficient.

94 Gulyás – Lőrinczy 2018, 530–536.

95 Takáts et al. 1995.

96 Vörös 2022, 777.

97 Daróczi-Szabó 2021, 103.

98 Vörös 1998, 373.

99 Lőrinczy – Straub 2005a, 140.

100 Lőrinczy 1996, 185.

101 Lőrinczy 2022, 58–59.

102 Graves 928/986, 929/987, 1308/1420, 1414/1543, 1436/1567, 1482/1619 and 1500/1637.

103 Vörös 2022, 785; Balogh 2021, 133.

recorded in Grave 7 of Öcsöd-MRT 96a; however, due to the absence of a comprehensive archaeozoological study of these finds so far, the information necessitates cautious interpretation.[104] The grave brought to light in Szentes-Derekegyházi-oldal, as well as Graves 3 and 10 in Szegvár-Sápoldal all contained cattle skins.[105] In the immediate region of Hódmezővásárhely in southern Hungary, similar remains are known from Grave 272 of Batida IX; and it was also raised in connection with Grave 49 of Kishomok that it may have contained the remains of cattle instead of a horse.[106]

Fig. 55. Cattle remains in Grave 928/986

Burials with cattle skins usually belong to women or children. In the Tiszakürt cemetery, two of these graves contained the remains of younger children (0–6 years), and three others were graves of older children (7–14 years). If the size of cenotaphs can be taken as a reliable indicator of the deceased to whom the symbolic grave was dedicated, Grave 1308/1420 probably also belonged to a child. The only adult whose grave yielded the remains of a cattle skin was the mature woman interred in Grave 1436/1567. At sites associated with peoples of Eastern European steppe origin, cattle skins usually come to light from burials of women.[107] In Szegvár-Oromdűlő, 47.6% of all cattle remains were discovered in female graves, while 24.4% of them came from the graves of infants. At this site, altogether 44 cattle were buried with children under 6 years of age, and 37 were found in the graves of older children (6–14 years).[108] In the cemetery of Szegvár-Sápoldal, cattle remains came to light from the graves of a woman and a juvenile man.[109]

Among the cattle interred in the Tiszakürt graves, six were juveniles (heifers) and one infantile (calf). In the cemetery of Szegvár-Oromdűlő, perhaps the most suitable for comparison, calves were interred only in 15 cases,[110] while 87 animals were slaughtered between the age of one and two years, comprising 23.1% of all cattle remains.[111] The latter age at culling was typical for the Tiszakürt material as well: almost all cattle remains come from individuals of 1.5–2 years of age, and only one calf was identified. The incompletely developed metacarpal and metatarsal bones suggest that probably all slaughtered cattle were females. In the case of the Szegvár-Oromdűlő material, only 60% of the cattle remains could be sexed, the findings suggesting an overwhelming majority of cows and a small percentage of bulls.[112]

104 Madaras 2004, 340.
105 Csallány 1939, 116; Lőrinczy 2018, 73.
106 Lőrinczy – Varga 2022, 18, 22.
107 Gulyás 2023, 166.
108 Lőrinczy 2022, 44, Tab. 9.
109 Lőrinczy 2018, 55, 63.
110 Vörös 2022, 786, Tab. 16.
111 Vörös 2022, 786, Tab. 16.
112 Vörös 2022, 785.

In the case of the Tiszakürt cattle, withers height calculations can only be considered as a rough estimate, as these young animals had not yet reached their final size. Cattle usually reach 85–90% of their adult size by the age of one year, so the individuals from the Tiszakürt cemetery, typically slaughtered at 1.5–2 years of age, were presumably close to their adult size. Even if it is impossible to give exact size values on the basis of incompletely developed bones, it is certain that small cattle, commonly found at Avar sites, were found also in Tiszakürt. Withers height estimations range between 103 and 114 cm, respectively, with an average of 107.5 cm. Animals of similar stature were documented by I. Vörös in Szegvár-Oromdűlő. At the latter site, juvenile cattle, slaughtered typically at 18–24 months of age, had an average withers height of 118.1 cm, with an average of 110.9 cm for heifers.[113] The study of cattle excavated at Tiszavasvári-Koldusdomb yielded similar results: two cows were identified with the withers height of 113.5 cm (adult) and 116.5 cm (juvenile, 3 years old).[114] Animal remains brought to light at Szegvár-Szőlőkalja also suggest cattle of a similar size range.[115]

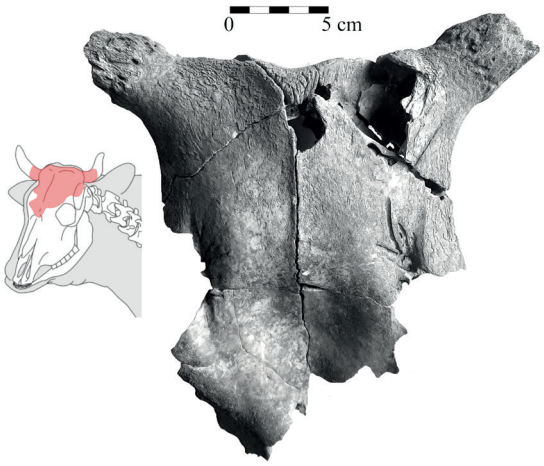

Fig. 56. Skull fragment of a juvenile cattle with small horn cores, a wavy frontal ridge, and a concave frontal bone, recovered from Grave 929/987. (The skeleton drawing is taken from Barone 1976, 22, Pl. 7, modified by the authors. Photo: Kyra Lyublyanovics)

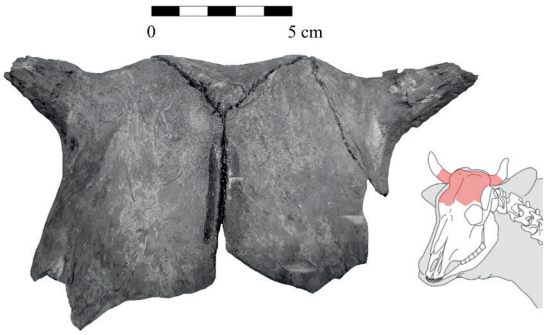

Fig. 57. Skull fragment of a juvenile cattle with small, rudimentary horn cores from Grave 1482/1619. (The skeleton drawing is taken from Barone 1976, 22, Pl. 7, modified by the authors. Photo: Kyra Lyublyanovics)

While polledness (hornlessness) was clearly evidenced in sheep, the extremely fragmented skulls of cattle made hardly any observations possible in terms of the presence and size of horns. Horn cores were seldom found among the fragments, which suggests that most individuals must have been polled. This is a common phenomenon in Avar cattle. A fragmented skull of a heifer from Grave 929/987 shows a concave frontal bone, a wavy frontal ridge, and small, rudimentary horn cores (Fig. 56). Small horn cores were observed in altogether four cases, with lengths varying between 26 and 70 mm, respectively. This suggests that the Tiszakürt cattle belonged to a short-horned cattle type (often referred to in the literature as *Bos taurus brachyceros* Rütimeyer 1861), with a high number of hornless individuals as a result of conscious breeding (Fig. 57).

4.9.3 Sheep skins

Sheep skulls and limb bones, associated with sheepskins, were recovered from altogether 15 early Avar graves (Fig. 58); the presence of a sheepskin can be hypothesized in two additional graves.[116] In

113 Vörös 2022, 786–787.

114 Gulyás – Lőrinczy 2018, 532–536.

115 Bartosiewicz 2018, 50.

116 Graves with sheepskin: Graves 929/987, 1291/1382, 1307/1419, 1308/1420, 1310/1422, 1324/1437, 1384/1513, 1412/1541, 1416/1545, 1426/1555, 1437/1568, 1439/1570, 1482/1619, 1500/1637, 1501/1638. Graves in which the presence of a sheepskin can be hypothesized on the basis of incomplete remains: 928/986, 1512/1650.

Graves 1426/1555 and 1439/1570, the remains of two skins each were identified; in Grave 1437/1568, probably two hides were interred but only a few bone fragments could be identified from one of them. Thus, the total number of certainly identified sheepskins is 17, plus there are three additional finds that may have been part of a sheepskin. In addition to these, sheep bones were also found as food offerings in some of the graves.

Fig. 58. Remains of a sheep in Grave 1384/1513

Skins of small ruminants are commonly deposited in graves associated with peoples of steppe origin, sometimes in great numbers; in Szegvár-Oromdűlő, 294 graves yielded altogether 460 individuals, and 103 burials contained more than one small ruminant.[117] Grave 187 of Szegvár is of special interest, as it contained the skin of ten animals.[118] In the cemetery of Makó-Mikócsa-halom, 42% of the burials yielded the remains of sheep or goat, amounting to 254 animals altogether.[119]

Quite a few burials with sheep skins are known in the wider region of Tiszakürt. Four graves at the site of Öcsöd-MRT 96a and eight at Szegvár-Sápoldal yielded such remains.[120] The 1930s excavation of the site of Szentes-Derekegyházi oldal also brought to light the remains of a sheepskin, but no archaeozoological examination of these bones has ever been conducted.[121] Single burials rarely contain more than one animal, but the grave of Szentes-Borbásföld contained the bones of four sheep.[122] Sheepskins were also documented in the cemetery of Szarvas-Grexa-téglagyár, but among these, only Grave 200 can be unambiguously dated to the Early Avar Period.[123]

The sheepskins can be divided into two groups based on their location in the grave (when the original position was possible to reconstruct). Twelve skins comprise the first group; these were laid on the coffin or on the planks above the ledges. In this type of burial, the deceased and the sacrificed animal were spatially separated; this was the most prevalent among people from the Eastern European steppe region. The second type involves animal remains placed right next to the human body. In Tiszakürt, the sheep bones were found at the feet of the deceased in six cases, while in one case they were placed beside the cranium, suggesting that the skins were folded. Similar arrangement was observed in 33 graves at Szegvár-Oromdűlő.[124] In Grave 1324/1437 only the excavation photos testify that the sheep bones were deposited in the western end of the entrance shaft. The original position of the younger of the two sheep in Grave 1426/1555 is unknown.

Only the skull of one of the two animals in Grave 1384/1513 was placed in the grave. Such cases were documented in Szegvár-Oromdűlő as well: in this cemetery, only the skull was found of 22 animals. I. Vörös interpreted these remains as attributes, where the skull represented the whole

117 Lőrinczy 2022, 41.
118 Lőrinczy 2022, 41.
119 Balogh 2021, 133.
120 Madaras 2004, 342; Lőrinczy 2018, 73.
121 Csallány 1939, 116.
122 Vörös 1996, 193.
123 Juhász 2004, 37. For the zoological analysis, see Bende 2017, 135.
124 Gulyás – Lőrinczy 2020, 179.

animal.[125] It is also possible that these belonged to animal skins without legs. Grave 75 of Dévaványa-Köves-halom may be seen as another analogy; here the mandible of a small ruminant was found at the feet of the deceased.[126]

In Tiszakürt, out of the 15 burials that certainly contained sheepskins, 9 graves belonged to children under 6 years of age (*infans I* age group) (Fig. 59), 4 to older children (6–14 years of age, *infans II* age group), one to an adult woman, and one to an adult man. Sheepskins were found in cenotaphs in two cases. In Szegvár-Oromdűlő, 41% of all sheep remains came to light from the graves of children;[127] at Szegvár-Sápoldal, five of the eight graves with sheep remains belonged to children.[128]

Fig. 59. Remains of a sheep in Grave 1310/1422

Juvenile sheep were present in moderate proportions. Of all sheepskins, only one lamb (3–6-months-old), four juvenile animals (two yearlings and two 16–20-month-old individuals), and one almost fully grown subadult sheep were identified. Ten sheep were slaughtered as adults, four were mature or old. This marks a difference from Szegvár-Oromdűlő, where less than half of the animals had reached adulthood at the time of slaughter.[129] Three of the four sheep found in the grave of Szentes-Borbásföld have been examined: one of them was a lamb, one juvenile, and one adult.[130]

Withers height estimation was possible for 14 individuals, based on their metapodia. Using Teichert's method,[131] their size ranges between 56.5 and 70 cm, with an average of 61.5 cm, which corresponds to the average size of sheep in the period. Withers height estimations for sheep excavated at nearby sites span the same size range: withers height was 63.5 cm at Tiszavasvári-Koldusdomb,[132] 60.6 and 65.7 cm at Szentes-Borbásföld,[133] and 63.5 cm at Tótkomlós-Békéssámsoni út 48,[134] respectively. The Tiszakürt sheep reflect a more or less homogenous herd, with only one individual standing out with its 70 cm height at the withers. 14 of the 15 animals range between 56.5 and 64.5 cm.

All the sheep had small, rudimentary horns or were polled, with only a small bump left in place of the horn cores (Figs 60–61). Fragments of horn cores were found only in a few cases, and these

125 Vörös 2022, 797.
126 Kovrig 1975, 136.
127 Lőrinczy 2022, 44, Tab. 9.
128 Lőrinczy 2018, 53–63, 68.
129 Vörös 2022, 798, Tab. 26.
130 Vörös 1996, 193.
131 Teichert 1975.
132 Gulyás – Lőrinczy 2018, 534.
133 Vörös 1996, 193.
134 Vörös 2002, 345.

were all tiny, 1–2-centimeters long, and slightly twisted. This is common in the Avar period. In the cemetery of Szegvár-Oromdűlő, 190 of the sheep were hornless and 56 had horns;[135] similar ratios were observed by J. Matolcsi in Gyenesdiás and by S. Bökönyi in Bóly.[136]

Sexing polled sheep is possible through the examination of the pelvis, but this skeletal element is missing from sheepskin burials. In most cases, the reliable identification of sex is impossible due to the heavily fragmented remains. Based on its long and slender leg bones, the individual interred in Grave 1384/1513 was probably a wether (castrated ram).

4.9.4 Skinning techniques

The know-how of skinning must have been handed down within communities; therefore, skinning techniques are sometimes interpreted as ethnic markers.[137] In the Trans-Tisza region in the Early Avar Period the so-called truncating method was used, by cutting the radius and the tibia of the animal in the distal third of the diaphysis.[138] Examining the animal remains from Szegvár-Oromdűlő, I. Vörös concluded that the animals had been laid on their backs to be flayed, and the cutmarks on the leg bones indicate that the persons handling the carcass were right-handed.[139] As flaying must have been an extremely bloody procedure, he speculated that it was done right before burial, close to the grave.[140]

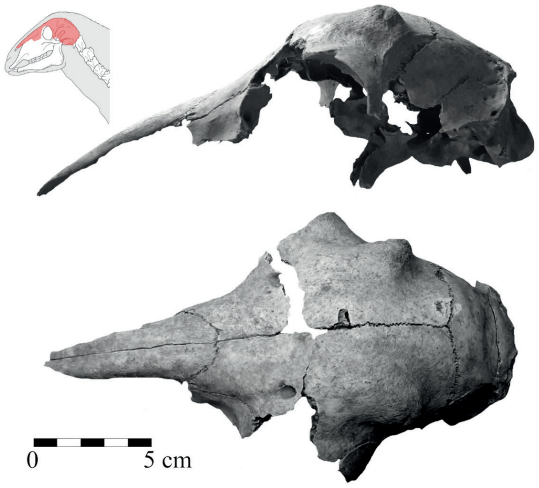

Fig. 60. Skull fragment of an adult polled sheep from Grave 1310/1422. (The skeleton drawing is taken from Barone 1976, 23. Pl. 8, modified by the authors. Photo: Kyra Lyublyanovics)

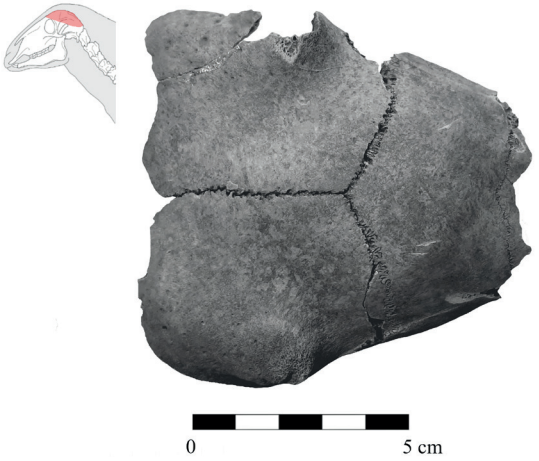

Fig. 61. Skull fragment of an adult polled sheep from Grave 929/987. (The skeleton drawing is taken from Barone 1976, 23. Pl. 8, modified by the authors. Photo: Kyra Lyublyanovics)

Earlier scholarship emphasized that only the skull and leg bones were left inside the skin; however, a detailed analysis shows that the process was more complex. According to the usual method of skinning in Tiszakürt, cervical and caudal vertebrae and hyoid bones were also left in the skin: cervical vertebrae were found in six cattle, three sheep and a horse, while the caudal vertebrae of two cattle, three sheep and a horse were also present. The hyoid bones of six cattle, seven sheep and a horse were found as well. As already discussed above, this precludes the possibility of using preserved hides. A similar pattern emerged in Szegvár-Oromdűlő, where 30 of the horses had a complete, and 18 had a fragmented first cervical vertebrae showing cutmarks.[141]

135 Vörös 2022, 800.

136 Bökönyi 1963, 109; Matolcsi 1968, 114.

137 Vörös 2013, 324; Atavin 1984.

138 Lőrinczy 1991, 131–132; Lőrinczy 1992a, 110; Vörös 2002, 346.

139 Vörös 2022, 772–773.

140 Vörös 2002, 345.

141 Vörös 2022, 772.

The skinning technique observed in Tiszakürt is unique in some respects. The legs were cut by using a dull tool; the bones were broken at the usual spot, but there are no unambiguous cutmarks, the bones broke spirally, indicating that they were still fresh and wet. The same is true for the skull and vertebrae; no cutmarks were observed on these elements either.

In Graves 1437/1568 and 1439/1570, the legs may have been truncated at the wrist and ankle joints, as no fragments of the radius and the tibia were present. This method is known from late Avar period graves in the Trans-Tisza region.[142] However, as both burials were disturbed, there may be other explanations for the absence of these skeletal elements.

4.9.5 Food offerings

Animal remains interpreted as food offerings were brought to light from 12 graves in Tiszakürt. These include the bones of sheep, domestic hen, swine and cattle. Eggshell fragments were brought to light from one burial.

J. Gy. Szabó pointed out in connection with Avar period burials that different communities preferred different types of meat and meaty parts, indicating differences in the cultural embeddedness of these grave goods.[143] Populations coming from the Eastern European steppe region usually preferred parts of the round meat cuts of sheep that contained some lumbar vertebrae and the sacrum.[144] In Tiszakürt, other types of food offerings were also found, which count as unusual in the Trans-Tisza region.

Estimating the amount of meat represented by the food offerings is challenging. It depends on a number of factors, including the age of the animal, the overall condition of its muscles, nutrition, and even the season of culling; and it is uncertain how much meat was actually left on the bones when they were deposited.[145]

4.9.5.1 Mutton

Lumbar vertebrae of sheep were found in Graves 1426/1555 and 1528/1666. In both cases, the 3rd and 4th lumbar vertebrae were deposited in the grave; these parts represent high quality meat and are often found in Avar graves, along with the sacrum. One of these graves (1426/1555) belonged to a 10–11-month-old child, while the other grave (1528/1666) contained the remains of a 14–15-year-old juvenile.

Earlier excavations rarely paid any attention to sheep remains in the graves, however, more recent studies suggest that these parts were frequently used as food offerings in the Trans-Tisza region.[146] Sheep lumbar vertebrae were also discovered in the cemetery of Szegvár-Oromdűlő, in altogether 76 graves;[147] similar remains were unearthed from Grave 3 at Szegvár-Sápoldal as well.[148] Grave 87 of Békésszentandrás-Benda-tanya also yielded the sacrum of a sheep.[149] In the Körös–Tisza–Maros interfluve, this type of food offering remained popular in the later Avar period as well; it was documented from cemeteries such as Pitvaros-Víztározó, Székkutas-Kápolnadűlő, Csárdaszállás,

142 Lőrinczy 2016, 166. The same method was observed in Grave 200 of Szarvas-Grexa-téglagyár (Bende 2017, 135), which, however, dates to the Early Avar Period.

143 Szabó 1981.

144 Gulyás et al. 2022.

145 Lyman 1979; Reitz et al. 1987; Needs-Howarth 1995.

146 Gulyás et al. 2022, 301–303.

147 Gulyás et al. 2022, 301.

148 Lőrinczy 2018, 74.

149 Balogh et al. 2023, 258.

Szarvas-Grexa-téglagyár and Nagykamarás. These sites are all associated with communities who, based on their reconstructed rituals, are regarded as descendants of early Avar people living in the Trans-Tisza area.[150]

This type of food offering is typically found behind the human skull.[151] Its position in Grave 1426/1555, under a pot placed beneath the feet of the deceased, is uncommon for the Early Avar Period.

This part of the body is known in gastronomy as the rump cup and the sirloin, considered to be of top-quality meat.[152] In sheep, the quality of meat is influenced also by the amount of suet, which partly depends on the age of the animal. According to modern data, the ratio of meat and bones starts decreasing from the age of 120 days, when the ratio of suet increases as a result of grazing, and the weight of viscera increases at the expense of muscles.[153] There is no information about how muscular these animals were and how they were fed. It is certain, however, that good quality food was given to the deceased, as in both cases the remains attest to young animals with incompletely fused vertebral plates (in sheep, these usually fuse at the age of two years).

4.9.5.2 Poultry

Remains of domestic hens were unearthed from three graves. Graves 1412/1541 and 1426/1555 of small children, and Grave 1433/1563 of an adult woman, yielded hen bones. The children were deposited with chicken breasts and wings, the woman had an almost complete hen. The head and feet of the latter were removed, and the rest of the body was put into a vessel that was deposited beside the head of the deceased. Analogies for this phenomenon are known from the cemetery of Pitvaros-víztározó, dated to the Later Avar Period.[154]

Six graves in the cemetery of Szegvár-Oromdűlő yielded hen bones that were certifiably identified as food offerings.[155] All were hens and the head was missing in all cases, and their trunk, wings and/or thighs were placed in the grave.[156] In the absence of archaeozoological processing, it is not clear how many graves at other sites contained hen remains. Most authors only mention wing bones, which could have belonged to other species.[157] There are a few exceptions: the leg of a hen was identified in Grave 377 of Apátfalva-Nagyút-dűlő,[158] and the single grave of a child found at Gyula-Site Nr. 511 yielded the thigh and wing of a hen.[159]

This type of food offering is typically associated with children and women. Similarly to the Tiszakürt graves, Grave 377 of Apátfalva-Nagyút-dűlő contained the remains of a young woman;[160] in Szegvár, the six graves that yielded hen remains belonged to children (two under 6, and three between the ages of 6 and 14) as well as one old woman.[161] The grave at Gyula-Site Nr. 511 has not been

150 Bende 2017, 318.

151 Gulyás et al. 2022, 301.

152 Tanács – Pinnyei 2018, 117.

153 Tanács – Pinnyei 2018, 117.

154 Vörös 2017, 544.

155 Lőrinczy 2022, 60. I. Vörös mentions 17 individuals from 14 graves (Vörös 2022, 808), however, these may contain remains that originate from the layers of the Sarmatian settlement (Cf. Lőrinczy 2022, 61).

156 Vörös 2022, 808.

157 Eight bone fragments of a waterfowl were found in Grave 4 of Tiszavasvári-Utasér-parti-dűlő (Istvánovits – Lőrinczy 2017, 42).

158 Cseh – Varga 2017, 447.

159 Rózsa – Vörös 2004, 37.

160 Cseh – Varga 2017, 447.

161 Lőrinczy 2022, 60.

studied anthropologically, however, the length of the skeleton indicates that it was a small child, probably younger than six years.[162]

In Tiszakürt, all domestic hen bones belonged to adult animals. Bone measurements correlate with the average size of Avar hens identified in Felgyő-Ürmös-tanya and Szegvár; they were probably all females.[163]

4.9.5.3 Pork

Bones of swine, interpreted as food offering, were present in six graves altogether.[164] In all cases, the meaty limb, typically the thigh was placed in the grave; in one case, parts of both the forelimb and the hind leg were found (Fig. 62). Pork was typically donated to children and young people: swine bones were recovered from the graves of four children (one small child, 2.5–3.5 years of age, and three older children), one juvenile individual, and one adult woman. The position of these offerings varies from one grave to the other, they were found next to the human skull, on the outer side of the leg or the arm. The original position of the food offering is unknown in Graves 50/43 and 1528/1666.

Fig. 62. Pig bones as food offering in Grave 929/987, placed beside the skull of the deceased

This type of food offering counts as unusual in the Trans-Tisza region, although there are a few analogies. In Szegvár-Oromdűlő, a swine scapula was found in Grave 111 and a tibia in Grave 326.[165] A rib and a scapula were brought to light from Grave 377 of Apátfalva. Grave 356 at the site of Nădlac 3M-N yielded the fragmented mandible, a metapodium, and a phalanx of a pig.[166] Based on these remains, E. Gáll interpreted the bones as a pigskin, which would be unique in the Carpathian Basin.[167]

Three of the swine were younger than one year when they were slaughtered. Culling of piglets is customary, as pigs reproduce rapidly and have multiple offspring at a time, which makes them suitable for culling at a young age. Since no measurements could be taken on the fragmented swine remains, the size of the animal cannot be estimated.

4.9.5.4 Beef

In Grave 1436/1567, a fragment of a cattle tibia was found next to the right knee of the buried adult female. It is questionable whether this can be interpreted as a food offering. This grave also contained the hide of a young cattle, but the tibia fragment belonged to another adult animal. This body part

162 Rózsa – Vörös 2004, 35.

163 Kőrösi 2010, 399–400; Vörös 2022, 808.

164 Graves 40/53, 928/986, 929/987, 1439/1570, 1482/1619, 1528/1666.

165 Lőrinczy 2022, 61.

166 Gáll 2017, 111.

167 Gáll 2017, 111.

is not particularly rich in meat, but its interpretation as a food offering cannot be excluded. In any case, beef was rarely placed in Avar graves in the Trans-Tisza region. At Szegvár-Oromdűlő, I. Vörös documented cattle ribs in four, sacrum in two, and femur in another two graves.[168] However, these may come from the Sarmatian settlement layer of the site instead of the Avar graves. Grave 379 in Nădlac 3M-N contained a cattle femur next to the skull of a juvenile/adult male;[169] Grave B 87 in Kölked-Feketekapu in Transdanubia yielded a cattle humerus next to the skull of a child.[170] This form of food offering was popular in eastern Transdanubia and partly on the Danube–Tisza Interfluve.[171]

4.9.5.5 Egg in the grave

Eggshell fragments were discovered in only one grave in Tiszakürt: in Grave 1426/1555, probably the egg of a domestic goose was placed beside the skull of the child. This type of offering has rarely been documented in the Trans-Tisza region in the Early Avar Period, but the absence of such findings may also be due to the limited methodology of old excavations. In five burials of Szegvár-Oromdűlő the remains of one egg were documented, and in two graves there were two eggs each. Six of these belonged to domestic hens, three to indeterminate species.[172] Similarly to Tiszakürt, in Szegvár this type of grave goods was associated with children, eggs being placed beside a mature female in only one burial.[173] Grave 10 in Szegvár-Sápoldal contained egg remains beside a juvenile male.[174] In the interfluve area of the Körös, Tisza and Maros rivers, altogether 151 Middle and Late Avar Period graves contained eggs, including some that can be attributed to the Eastern European steppe population.[175] According to L. Bende, this type of offering may have had two functions. The pieces found next to meat cuts may have been food offerings, while the pieces found in the graves of children and women, often around the pelvis, could have had a symbolic meaning, linked to fertility.[176]

4.9.5.6 Symbolic animal remains

Grave 1483/1620 contained the third phalanx (hoof bone) of a sheep, while Grave 1528/1666 yielded the calcaneus (heel bone) of cattle. As no other bones of these individuals were found in the graves, they are unlikely to be interpreted as animal skins. At the same time, since these bones have no meaty parts attached to them, they cannot be regarded as food offerings either. It is most likely that their burial was intended to be symbolic, possibly representing a slain animal. Cattle heel bones are also known from Graves 335 and 345 in the Szegvár cemetery.[177]

Such bones may be regarded as an attribute representing the whole animal on a *pars pro toto* basis. According to I. Vörös, by the Late Avar Period, bones of the hind leg and the patella became the most frequent attributes in certain cemeteries.[178] The use of such remains in funerary rites is interesting because they were present in everyday waste and available without killing sacrificial animals.

168 Vörös 2022, 786.

169 Gáll 2017, 117.

170 Based on the burial rites, this grave is associated with people of Eastern European steppe origins (Gulyás 2023, 168–170).

171 Kiss 1996, 183–184.

172 Lőrinczy 2022, 61.

173 Lőrinczy 2022, 61.

174 Lőrinczy 2018, 63.

175 Bende 2017, 321.

176 Bende 2017, 322.

177 Vörös 2022, 786.

178 Vörös 2022, 773.

4.9.5.7 Pathologies

Pathologies were observed in three cases only; all three animals were adult sheep. In Grave 929/987, the adult sheep showed signs of *intra vitam* tooth loss and periodontal disease (Figs 63–64): the second premolar (P_2) is missing from both mandibles, the alveoli fused. Irregular tooth wear was also observed on both lower fourth premolars and first molars (P_4-M_1), as well as moderate calculus on the lower tooth rows, both laterally and medially. There were signs of bone tissue resorption and remodelling on the lateral side of the left mandible. This lesion may have been caused by a bacterial infection of the soft tissue in the mouth, which is often detected in archaeological specimens, especially in mature and old domesticates. It causes severe pain at the stage when teeth start falling out, and then it may keep the animal from grazing properly, resulting in rapid weight loss and general physical deterioration. Inflammations in the oral cavity can have detrimental effects on the heart, the kidneys, or the liver as well.[179]

The adult sheep unearthed from Grave 1291/1382 showed lesions on its hind legs (Fig. 65). There are marginal osteophytes on the lateral side of the left metatarsal's proximal end; this hook-like formation extends in the direction of the central tarsal bone. The latter is missing, so it is uncertain if the whole joint was pathological. A similar, albeit less severe, lesion can be seen on the right metatarsal. On a proximal phalanx (probably from the left hind leg) there are exostoses on both sides of the diaphysis, extending onto the sides of the distal condyle. The newly formed bone tissue probably filled the space between the two proximal phalanges, but there is no sign of fusion. The woven bone formation seen on the lateral side of the diaphysis indicates an active inflammation at the time of culling. The distal end of the phalanx is distorted, and although the articular surface itself is normal, the missing second phalanx must have been pathological. This suggests a chronic inflammation of the tarsal and phalangeal joints, probably resulting in lameness or an altered gait.

The sheep in Grave 1307/1419 had minor pathologies that may be due to old age. The teeth are

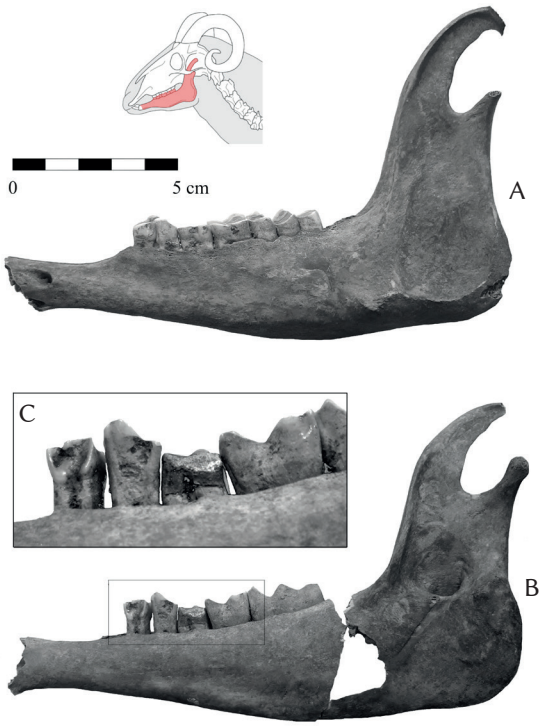

Fig. 63. Mandibles of an adult sheep from Grave 929/987, showing pathologies of the oral cavity. A – Lateral view of the left mandible. P_2 is missing, P_{3-4} are irregularly worn; bone remodeling is evident in the P_4–M_2 region, B – Medial view of the fragmented right mandible, with heavy calculus formation on M_1, C – Detail of the right lower tooth row, viewed from the medial side. (The skeleton drawing is taken from Barone 1976, 23. Pl. 8, modified by the authors. Photo: Kyra Lyublyanovics)

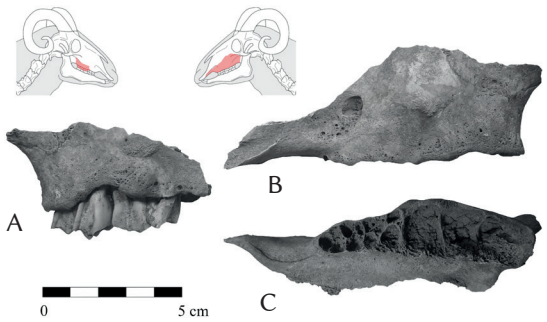

Fig. 64. Maxilla fragments of an adult sheep from Grave 929/987, showing the signs of periodontal disease. A – Lateral view of the right maxilla, B – Lateral view of the left maxilla, C – Ventral view of the left maxilla, the alveoli are widened and irregular. (The skeleton drawing is taken from Barone 1976, 23. Pl. 8, modified by the authors. Photo: Kyra Lyublyanovics)

179 Holmes et al. 2021.

heavily worn, and on the palmar side of the left metacarpal there is a solid, ledge-like bone formation on the medial side of the diaphysis, probably an ossified ligament.

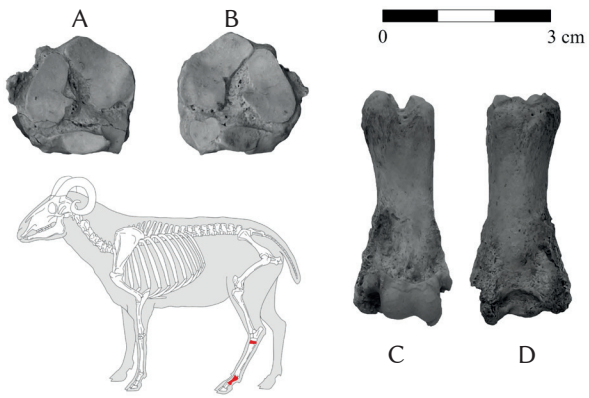

Fig. 65. Pathological metatarsals and proximal phalanx of an adult sheep from Grave 1291/1382. Osteophytes are visible on the proximal end of both metatarsals and on the phalanx. A: Dorsal view of the proximal end of the left metatarsal. B: Dorsal view of the proximal end of the right metatarsal. C: Caudal view of the proximal phalanx. D: Cranial view of the proximal phalanx. (The skeleton drawing is taken from Barone 1976, 23. Pl. 8, modified by the authors. Photo: Kyra Lyublyanovics)

4.10 Vessels associated with food offerings

There were 11 vessels in the graves of the Tiszakürt cemetery, which represents 32.4% of the total number of burials. The burials with vessels were located in the central and eastern rows of graves (Fig. 66). In the Trans-Tisza region, there is a great variation between micro-regions or even cemeteries in terms of the number of graves in which pottery was placed. For example, in the Nyíri-Mezőség region, about 60% of the burials contained pottery.[180] This proportion was close to 50% at the site of Makó-Mikócsa-halom.[181] Among the cemeteries of the Tiszazug region, three graves at the site of Öcsöd-MRT 96a contained complete pots, which is a quarter of all graves.[182] In the case of Kunszentmárton-Habranyi-telep, only two of the nine Early Avar graves contained vessels;[183] in Szegvár-Sápoldal, six of the ten burials contained such an offering.[184] In the cemetery of Szegvár-Oromdűlő 126 graves, i.e. about 27% of the burials, had a pot.[185]

In Tiszakürt, pottery is usually found in the graves of children; besides them, only one adult/mature man and an adult woman were buried with pottery. This type of grave goods was similarly gendered at other sites, such as Szegvár-Sápoldal and Tiszavasvári-Koldusdomb.[186] At Szegvár-Oromdűlő the distribution was more even, however, pottery was most frequently found in the graves of children too.[187]

In the Tiszakürt cemetery, 9 of the 12 vessels were found on either side of the skull (Fig. 67). In two cases, they were next to or behind the feet. In Grave 1439/1570 the cooking pot was on the lower right leg, with the mouth tilted towards the skull, which suggests that the pot may have been originally placed on top of the coffin and tipped over on its side after the wood had decayed. In cemeteries of steppe people of Eastern European origin, the vast majority of pottery is recovered from beside the skull.[188] There are only a few examples of cooking pots found around the feet. In an east-west oriented grave at Szentes-Lenin utca 13, the cooking pot was deposited at the feet.[189] In Grave 6 of Öcsöd-MRT 96a, the vessel was located between the left leg and the grave wall.[190]

180 Lőrinczy – Rácz 2014, 176.
181 Balogh 2021, 138.
182 Madaras 2004, 343.
183 Csallány 1933, 3.
184 Lőrinczy 2018, 74.
185 Lőrinczy 2022, 63.
186 Lőrinczy 2018, 74; Gulyás – Lőrinczy 2018, 542.
187 Lőrinczy 2022, 62.
188 Lőrinczy 2022, 62.
189 Lőrinczy – Szalontai 1993, 289.
190 Madaras 2004, 344.

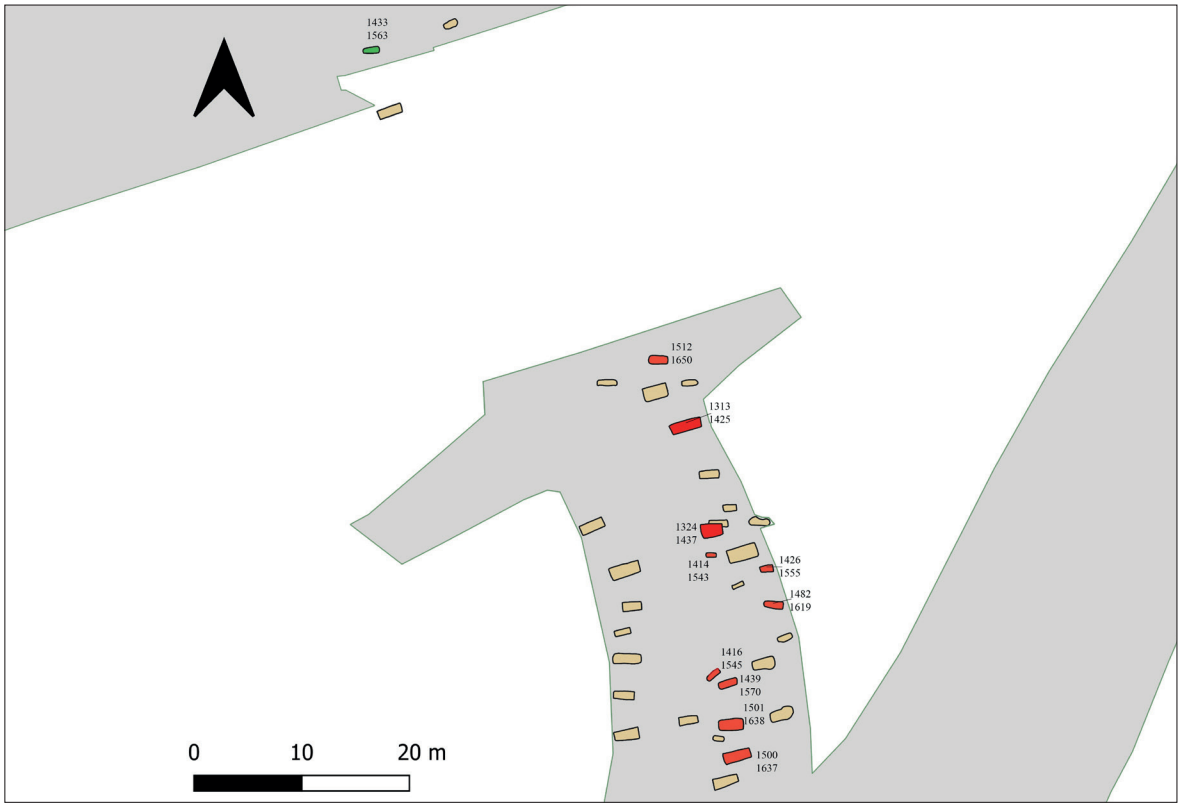

Fig. 66. Spatial distribution of graves with vessels. Red – grave with one vessel, green – grave with two vessels

In Grave 1433/1563, a vessel was found on both sides of the human skull. Depositing more than one vessel in a grave is extremely rare in the Early Avar Period in the Trans-Tisza region. Analogies have been documented from Grave 2 of Doboz-Hajduirtás, Graves 16 and 33 of Hódmezővásárhely-Kishomok, and Grave 299 of Szegvár-Oromdűlő.[191] In the yet unpublished site of Bojt-Gulya-legelő-dél, a male and a female burial contained two vessels each.[192] The maximum number of vessels in a grave was three, recorded behind the skull in Grave 3 of Kunszentmárton-Habranyi-telep.[193]

In Grave 1433/1563 of Tiszakürt, an almost complete hen was recovered from the cooking pot; in Grave 1426/1555 the wing (radius) of the hen may have also been originally placed in the pot. Animal bones associated with food offerings are rarely found in vessels; in Grave 214 of Makó-Mikócsa-halom a sheep scapula was found in this position.[194]

5. The anthropological analysis of the population

5.1 Material and methods

This chapter provides a detailed anthropological and palaeopathological analysis of the Early Avar Period cemetery at Tiszakürt-Zsilke-tanya. Altogether, the remains of 33 individuals were identified.

Age estimation of fetuses and newborns was carried out according to the method of G. Fazekas and F. Kósa.[195] The age at death of subadults was estimated based on their dentition, including tooth

191 Kovalovszki 1975, 210, 211, Fig. 8; Bóna – Nagy 2002, 44, 49; Lőrinczy 2020, 118.

192 Hága 2021, 245.

193 Csallány 1933, 3.

194 Balogh 2021, 134.

195 Fazekas – Kósa 1978.

formation and eruption,[196] along with measurement methods based on the longitudinal dimensions of limb bones.[197] The skeletal age of juveniles was assessed based on the timing of the fusion of ossification centres (primary and secondary), and on the changes in the size and shape of the bones with time.[198] In adults, age estimation involved a macromorphological analysis of the sternal end of the rib,[199] the obliteration of the ectocranial suture of the skull,[200] and the examination of age-related changes in the symphyseal surface of the pubic bone.[201]

In order to estimate the sex of the adult individuals, both macromorphological and metric analyses were conducted. The sexually dimorphic traits of the skull, pelvis, sacrum, and femora were analysed according to the method of K. Éry,[202] while the metric characterization of the coxal bones were evaluated using the DSP2 method.[203]

For craniometric and osteometric examinations, measurements defined by R. Martin and K. Saller were adopted.[204] The estimation of body height was carried out using the methods of T. Sjøvold.[205] Skull indices were classified according to the categorization by V. P. Alekseev and G. F. Debets.[206] Macromorphoscopical traits of the cranium and the dentition were used to assess the ancestry.[207]

Fig. 67. Vessel in Grave 1500/1637

In the palaeopathological analysis, we adhered to macroscopic observation methods in accordance with established standards in the literature.[208] In addition to macroscopic observations, X-rays were taken in cases where it was necessary for diagnosis, with a TW-110 portable X-ray device and SATURN8000 flat panel in the Szent István Király Museum in Székesfehérvár.

5.2 Demographic analysis

In total, the skeletal remains of 33 individuals were subjected to analysis (Fig. 68).[209] Altogether 20 of all buried individuals (60.6%) did not reach adulthood. Newborns comprised a substantial ratio of subadults (15%), while the proportion of younger children (1–6 years old) exceeded that of old-

196 AlQahtani et al. 2010.
197 Stloukal – Hanáková 1978; Bernert et al. 2007; Bernert et al. 2008.
198 Schaefer et al. 2009.
199 İşcan et al. 1984; İşcan et al. 1985; DiGangi et al. 2009.
200 Meindl – Lovejoy 1985.
201 Brooks – Suchey 1990.
202 Éry et al. 1963.
203 Brůžek et al. 2017.
204 Martin – Saller 1957.
205 Sjøvold 1990.
206 Alekseev – Debets 1964.
207 Lipták 1965; Hefner 2009; Scott et al. 2018.
208 Waldron 2009; Buiksta 2019.
209 For general information, see Tab. 3.

Tab. 3. Individual sex and age data of the Early Avar Period skeletal remains from Tiszakürt-Zsilke-tanya (*F= female; M= male; F?= probably female; M? probably male)

OBJ	SNR	Inventory number	Age	Sex*
40	53	1.72845.53.1	24–26	F
928	986	1.72845.986.1	4–6	?
929	987	1.72845.987.1	7.5–9.5	?
1283	1368	1.72845.1368.1	4.5–6.5	?
1304	1414	1.72845.1414.1	2.5–3.5	?
1307	1419	1.72845.1419.1	25–40	F
1309	1421	1.72845.1421.1	35–40	F
1310	1422	1.72845.1422.1	2.5–3.5	?
1311	1423	1.72845.1423.1	50+	F
1313	1425	1.72845.1425.1	35–50	M
1314	1426	1.72845.1426.1	25–30	F
1324	1437	1.72845.1437.1	9.5–10.5	?
1383	1512	1.72845.1512.1	25–30	F
1384	1513	1.72845.1513.1	25–30	M
1412	1541	1.72845.1541.1	0–1	?
1414	1543	1.72845.1543.1	0.9–1.5	?
1415	1544	1.72845.1544.1	1.5–2.5	?
1416	1545	1.72845.1545.1	1.5–2.5	?
1426	1555	1.72845.1555.1	0.9–1.5	?
1433	1563	1.72845.1563.1	25–35	M
1432	1564	1.72845.1564.1	50+	M?
1434	1565	1.72845.1565.1	5.5–6.5	?
1436	1567	1.72845.1567.1	35–45	F
1437	1568	1.72845.1568.1	0–0.5	?
1439	1570	1.72845.1570.1	2.5–3.5	?
1474	1611	1.72845.1611.1	25–35	F?
1474	1611	1.72845.1611.2	20+	?
1482	1619	1.72845.1619.1	6.5–7.5	?
1483	1620	1.72845.1620.1	0–0.5	?
1500	1637	1.72845.1637.1	12.5–13.5	?
1501	1638	1.72845.1638.1	1–2	?
1512	1650	1.72845.1650.1	2.5–3.5	?
1528	1664	1.72845.1664.1	14–15	?

er children (6–14 years old) and juveniles (14–20 years old), comprising 20% and 5%, respectively. Among the adults, 8 females (61.5%), 2 males (15.4%), 1 presumably female (7.7%), 1 presumably male (7.7%), and one individual of unknown sex (7.7%) were identified.

The demographic character of the buried individuals shows a pronounced presence of subadults and a notable scarcity of adult males, although the number of adult individuals of unidentified sex makes this observation uncertain. Despite this ambiguity, females still constitute the majority of analysed individuals. It is of utmost importance for the analysis that the excavation did not encompass the entire cemetery. These factors all affect the interpretative results, therefore caution is required when drawing definitive conclusions.

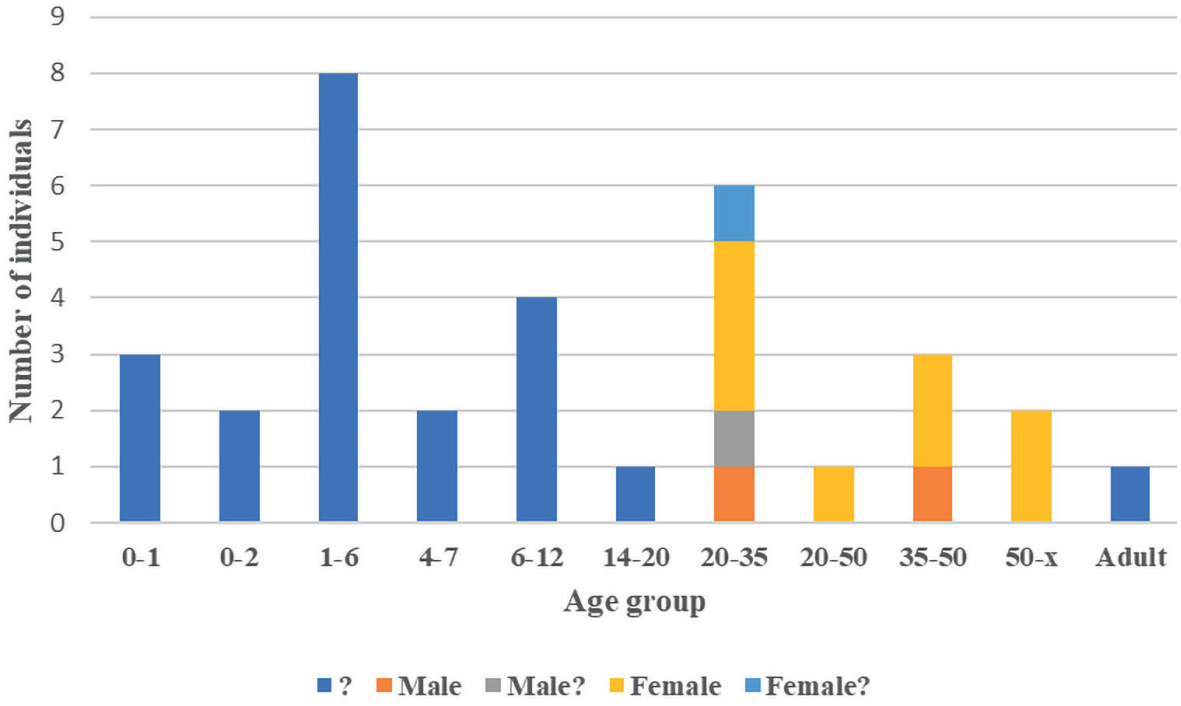

Fig. 68. Sex and age distribution of the skeletal remains from Tiszakürt-Zsilke-tanya

The remarkably large proportion of subadults aligns with observations in other cemeteries within the region during this period. In Szegvár-Sápoldal, seven out of ten examined individuals (70%) were subadults under the age of five.[210] This trend is similarly reflected in a broader burial context at Szegvár-Oromdűlő, where out of 450 individuals, the ratio of subadults was 62%. Furthermore, the adult population exhibited an unequal sex ratio, with females constituting 63% and males 37%.[211]

The low number of male graves, coupled with the high proportion of child graves, prompts certain assumptions. While speculative, one might consider whether the scarcity of male burials could be attributed to the war-related customs prevalent during the Early Avar Period, conflict with Byzantium played a significant role in the Carpathian Basin.[212] However, to answer this, further complex bioarchaeological analyses of early Avar cemeteries are necessary.

210 Szalai 2018.

211 Cf. Marcsik 2022, 708, Tab. 1.

212 Vida 2009, 108–111.

While an elevated ratio of subadults can be an indicator of increased fertility[213] and age-dependent mortality,[214] using ratios as demographic indices[215] alone does not provide a comprehensive understanding of population characteristics. Analysing population trends, health, and living conditions requires data from multiple cemeteries to establish central tendencies.

5.3 Metric analysis

The interpretative scope of the metric results obtained from cranial remains is constrained by both the limited sample size and the preservation status of the skeletal material. The availability of only one male cranium suitable for craniometric analysis further restricts the depth of contextual understanding. The analysis reveals distinctive features in this male cranium, characterized by hyperdolichocranic, hyperchamaecranic, and tapeinocranic traits, while the face exhibits euryprosopic and euryen features (Fig. 69).

The examination of cranial width-length ratio (M8:M1) among females reveals a heterogeneous pattern, with hyperdolichocranic and brachycranic individuals occurring in equal proportion. Notably, due to the limited availability of data, the indices assessing skull height to length and width (M17:M1, M17:M8, respectively) can only be evaluated in two individuals. These individuals represent opposite ends of the spectrum, with one displaying a tall (hyperhypsicranic-akrocranic) neurocranium, and the other manifesting a low (chamaecranic-hypertapeinocranic) neurocranium. For comparative purposes, the nearby Szegvár-Oromdűlő site provides valuable data due to its more representative sample size. In the anthropological material from this site, both short (brachycranic) and tall (hypsicranic) neurocrania are dominant, accompanied by a medium-wide facial skeleton (mesoprosopic-mesen) observed in both sexes.[216] The metric traits of the female individual of Grave 1436/1567 in Tiszakürt bear the closest resemblance to those found in the Szegvár-Oromdűlő site (Fig. 70). Additionally, dolichocranic elements are present, though in a smaller proportion and typically more prevalent among males. In the Tiszakürt material, a female individual from Grave 40/53 exhibited similar characteristics (Fig. 71). Individual craniometric measurements are presented in Tab. 4.

Stature was calculated using the formula that controls for all geographic areas and for both sexes using the femur.[217] The calculated stature for the single male individual was 165.37 cm. For females, stature estimation was feasible in six cases, yielding an average of 156.65 cm ±3.56 cm (standard error). Notably, this estimated average aligns closely with the previously determined value (158 cm) in the Szegvár-Oromdűlő cemetery.[218] Individual long bone measurements are presented in Tab. 5.

5.4 Ancestry estimation

The Arizona State University Dental Anthropology System (ASUDAS) was used for ancestry estimation using twenty-one essential dental features. Subsequently, the obtained results were entered into the rASUDAS web application using a naive Bayes classification algorithm. Our analysis focused exclusively on individuals for whom a minimum of 12 characters could be reliably classified. The methodology facilitated the categorization of individuals into seven predetermined geographical ancestry groups, with East Asian and Western Eurasian groups selected as a priori possibilities due to their historical relevance. Ancestry was evaluated based on dental traits for a sample of six

213 Bocquet-Appel 2002.
214 Milner – Boldsen 2023.
215 Milner – Boldsen 2023.
216 Marcsik 2022, 710.
217 Sjøvold 1990.
218 Marcsik 2022, 710.

Fig. 69. 25–30-year-old male, anterior and lateral view. Grave 1384/1513 (Photo: László György)

Fig. 70. 35–45-year-old female, anterior and lateral view. Grave 1436/1567 (Photo: László György)

Fig. 71. 24–26-year-old female, anterior and lateral view. Grave 40/53 (Photo: László György)

individuals (3 females, 1 male, 2 subadults). Predominantly, Western Eurasian ancestry emerged as the most probable, with posterior probabilities ranging from 0.78 to 0.99 in the majority of cases. However, for the individual in Grave 1314/1426, East Asian ancestry was estimated with a posterior probability of 0.91.

Non-metric cranial traits were assessed following J. T. Hefner's criterion[219], and the outcomes were incorporated into a web application utilizing a simple Bayes classifier.[220] Our consideration was

219 Hefner 2009.

220 Coelho et al. 2020.

Tab. 4. Individual craniometric data based on the measurements of Martin – Saller 1957

FEAT	40	1309	1311	1314	1383	1432	1436	1384
STRAT	53	1421	1423	1426	1512	1563	1567	1513
Sex	F	F	F	F	F	F	F	M
M1	185	180	—	192	177	—	167	190
M5	—	—	—	—	96	—	102	94
M8	134	—	—	137	144	—	138	139
M9	98	95	95	94	91	91	96	90
M10	118	—	—	110	—	—	117	118
M11	—	—	—	117	—	—	125	117
M12	109	—	—	111	—	—	—	—
M17		—	—	—	124	—	138	128
M40	91	—	—	—	—	—	102	92
M43	104	100	—	102	99	102	107	100
M45	—	—	—	—	—	—	—	122
M46	88	—	—	—	—	—	—	85
M47	109	—	—	—	—	—	118	97
M48	65	—	—	67	—	—	70	61
M51	41	—	34	41	—	—	42	42
M52	31	—	42	31	—	—	32	27
M54	—	—	—	22	—	—	26	21
M55	51	—	—	50	—	—	48	46
M62	—	—	—	—	—	—	48	51
M63	—	—	—	—	—	—	36	32
M65	—	—	—	—	115	—	—	120
M66	—	—	—	—	97	—	—	94
M69	—	—	24	34	28	—	38	26
M70	—	—	—	50	66	—	—	43
M71	—	—	33	31	24	—	35	26

limited to individuals exhibiting at least 10 out of the 12 characters required for classification. The methodology facilitated the assignment of individuals to 4 geographical ancestry groups. Three individuals met the criteria for classification, revealing Western Eurasian ancestry in two cases and East Asian ancestry in a single case. The results for a female individual in Grave 1314/1426 indicated disparate outcomes between dental and cranial non-metric analyses.

Most studies pertaining to Avar Period skeletal material in Hungary use P. Lipták's method, which was applicable to three cases in the Tiszakürt material.[221] The results revealed two individuals with dominantly dolichocranic Europid/Western Eurasian characters (cromagnoid-A, according to Lipták's nomenclature), and one individual with moderately pronounced East Asian traits.

221 Szeniczey 2020, 55.

Tab. 5. Individual postcranial measurements based on Martin – Saller 1957. Only the maximum lengths (M1) are reported

	FEAT	1307	1309	1311	1314	1383	1432	1436	40	1384
	STRAT	1419	1421	1423	1423	1512	1563	1567	53	1513
	Sex	F	F	F	F	F	F	F	F	M
Clavicle	left	—	—	—	135	—	—	—	—	—
	right	—	—	—	—	—	—	—	—	—
Humerus	left	—	292	—	295	—	—	305	307	—
	right	—	298	—	—	302	—	—	310	—
Ulna	left	—	—	—	—	—	—	—	254	—
	right	—	—	—	—	—	—	—	252	—
Radius	left	—	216	197	—	—	222	222	233	—
	right	—	—	—	—	215	—	—	231	241
Femur	left	—	—	—	—	410	—	—	439	441
	right	415	404	373	417	407	—	—	432	—
Tibia	left	340	—	—	—	—	—	—	—	340
	right	—	—	300	—	307	—	—	—	—
Fibula	left	—	—	—	—	—	—	—	—	340
	right	—	—	—	—	—	—	—	—	—

A. Marcsik conducted ancestry estimations on 71 skulls from the Early Avar Period skeletal material at the nearby Szegvár-Oromdűlő cemetery.[222] According to the findings, 46% of individuals were classified as Europid/Western Eurasian, while 54% exhibited East Asian-related non-metric traits to a certain extent. Among the Europid/Western Eurasian individuals, the dolichocranic Cromagnoid-A categories were found, but only among males, in a smaller proportion. The results of the different methods are summarized in Tab. 6.

5.5 Diseases of the joints

5.5.1 The appendicular skeleton

The diagnosis of osteoarthrosis was established based on the presence of eburnation or a combination of at least two of the following criteria: marginal osteophytes, new bone formation on the joint surface, pitting on the joint surface, and alterations in joint contour. Since the sample size does not allow for a statistical analysis of the findings, the results are presented on an individual level.

Except for the identification of marginal osteophytes in the right humerus of a male individual, no indications of osteoarthrosis were discerned. Among females, degenerative joint alterations, primarily in the form of marginal osteophytes, manifested in the young adult age group. Definitive signs of osteoarthrosis were evident exclusively in females aged 50 years and above. In these instances, the elbow, knee, and costovertebral joints were bilaterally affected, while osteoarthrosis in the wrist and hip joints presented unilaterally. In the case of the deceased in Grave 1432/1563, osteoarthrosis in the ankle was linked to a traumatic event, whereas in other cases, aging or physical activity emerged as the most plausible contributors to the changes observed.

222 Marcsik 2022, 711–714.

Tab. 6. Estimated ancestries with different anthropological methods. Probabilities are rounded to 2 digits (*AFR= African; AME= Amerindid; ASI=Asian; EUR=European)

		Scott et al. 2018		Hefner 2009*				Lipták 1965
OBJ	SNR	E-Asia	W-Eurasia	AFR	AME	ASI	EUR	
40	53	—	—	—	—	—	—	europid
1307	1419	0.01	**0.99**	—	—	—	—	—
1314	1426	**0.92**	0.08	0.02	0.09	0.06	**0.84**	—
1324	1437	0.04	**0.96**	—	—	—	—	—
1383	1512	0.00	**1.00**	—	—	—	—	—
1384	1513	0.13	**0.87**	0.00	0.02	0.00	**0.98**	europid
1436	1567	—	—	0.11	0.17	**0.70**	0.01	europid+east asian
1500	1637	0.22	**0.78**	—	—	—	—	—

5.5.2 The spine

The degenerative changes of the apophyseal joints were assessed in a manner similar to the synovial joints of the appendicular skeleton. Though this joint is diarthrodial, osteoarthrosis is associated with similar changes.[223] Marginal osteophytes, Schmorl's node, and pitting on the superior or inferior surface of the vertebral bodies were also evaluated.

The limited number of adult male individuals precluded a detailed statistical analysis of degenerative spine alterations. However, the female sample permitted the identification of certain trends. Marginal osteophytes were most frequently observed in the lumbar section of the spine, whereas they were least common in the cervical region. Notably, these changes were evident even in the young adult age group. Spondylarthrosis, a less frequent occurrence, was noted in two instances: one localized in the cervical spine and the other in the thoracic spine, observed in females from the middle and old adult age groups, respectively. Pitting on the vertebral endplates was identified in a middle adult and an old adult female, affecting the cervical and thoracic spine, respectively. Schmorl's nodes manifested frequently, exhibiting multiple forms without extension to the vertebral canal. Most commonly, they were found in the lower thoracic and lumbar sections of the spine. Interestingly, no discernible relationship was observed between their frequency and age, as they were present in all female individuals in the young adult age group.

5.6 Infections

Out of the 8 cases that could be investigated for endocranial lesions, extensive "hair-on-end" alterations were identified on the inner surface of the parietal bones and the sulci of the occipital bone in a 2.5–3.5-year-old child. Endocranial alterations are frequently linked to infectious diseases, often arising from inflammation.[224] However, with the exception of certain specialized forms of these lesions, determining the specific agent responsible for the disease remains elusive.[225] The presence of pitting on the floor and lateral walls of the nasal cavity in a 25–30-year-old female in Grave 1383/1512 suggests probable inflammation of the mucosa (Fig. 72). The involvement of the paranasal sinuses cannot be evaluated due to taphonomic changes. The inflammation observed in the nasal

223 Ortner 2003, 549.

224 Lewis 2004.

225 Spekker et al. 2021.

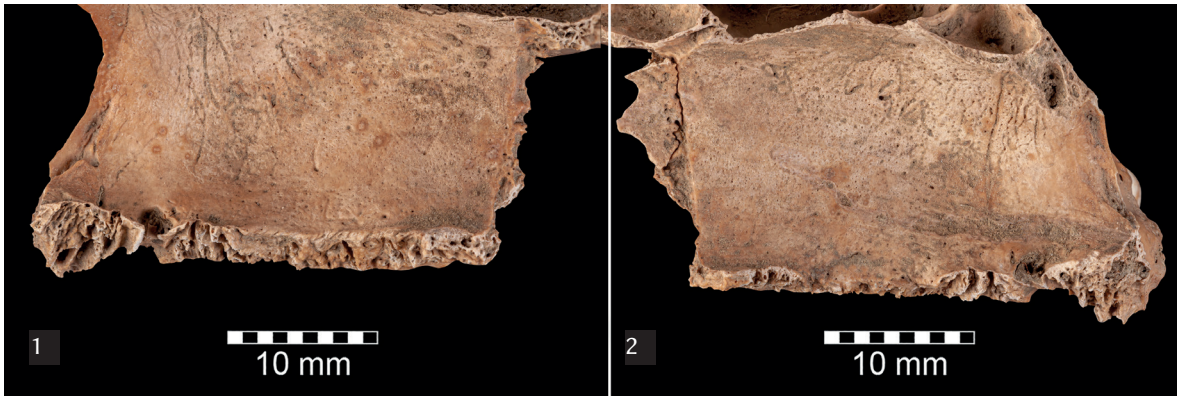

Fig. 72. Pitting on the floor and the lateral walls of the nasal cavity in a 25–30-year-old female. Grave 1383/1512. 1 – Right maxilla, 2 – Left maxilla (Photo: László György)

cavity could be associated with a broad spectrum of etiological factors. These may include viral or bacterial infections of the upper respiratory tract, autoimmune conditions, and occupational exposures to irritants.[226]

5.7 Metabolic diseases

On the anterior portion of the right maxilla of a 10.5–18-month-old infant in Grave 1414/1543, there is observable apposition of subperiosteal new bone around the infraorbital foramen, extending to the alveolar process and towards the edge of the nasal cavity (Fig. 73). Unfortunately, due to the poor preservation of the skeletal remains, evaluation of other cranial or postcranial elements is not possible.

In the case of a 2.5–3.5-year-old child in Grave 1439/1570, abnormal cortical porosity is evident in the orbital roofs, the occipital bone, and the greater sphenoid wings. While the skeletal remains are moderately preserved, other abnormal alterations cannot be identified.

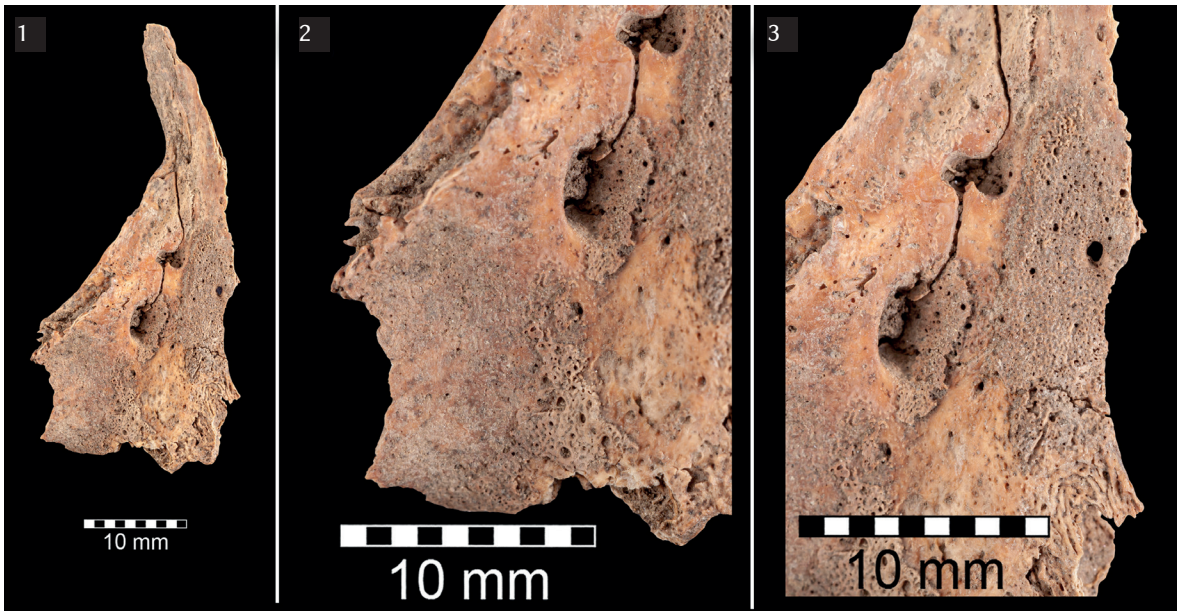

Fig. 73. Subperiosteal new bone formation on the left maxilla of a 10.5 months – 1.5 years-old child. Grave 1414/1543. 1 – The presence of extensive periosteal apposition is evident around the infraorbital foramen, extending to the alveolar process (2) and toward the edge of the nasal cavity (3) (Photo: László György)

226 Merret – Pfeiffer 2000.

Subadults are inherently more susceptible to diseases, and numerous skeletal stress markers lack specificity for particular conditions. Nevertheless, specific lesions and their combinations can be indicative of certain diseases. The previously described osseous lesions have been tentatively associated with scurvy, with diagnostic support from prior research.[227] However, due to the incomplete nature of these specimens, our diagnosis remains suggestive.

5.8 General stress markers

Porotic lesions of the orbital roof – cribra orbitalia – and parietal bones – cribra cranii – are often considered as signs of hematological disorders, parasitic infections, and vitamin deficiencies, though their etiology is still elusive.[228] Porotic lesions form mostly on an immature skeleton and persist throughout maturity, thus regarded to be good predictors of nutritional status and illness in early life (REF).

Porotic lesions of the orbital roof were observed in 3 subadults. In the case of a 2.5–3.5-year-old child in Grave 1439/1570, the lesions were associated with similar alteration on the parietal and occipital bone as that presented above as a potential sign of scurvy. In another case, involvement of the orbital roof and parietal bone also occurred together while in one case the porotic lesions were exclusively found in the orbits. Similarly, the porotic lesion of the parietal bone by itself also occurred in only one case.

Linear enamel hypoplasia, evident as linear grooves in dental enamel, serves as a marker of stress or disruptions during tooth development, thus offering valuable insights into health during childhood. In the case of a 2.5–3.5-year-old child in Grave 1310/1422, linear enamel hypoplasia has been identified on the maxillary canine and first molar teeth, suggesting a period of disruption or stress in tooth development between the ages of 1.5 to 2.2 years. The presence of hypoplasia on the upper canine of an adult individual of Grave 1313/1425 signifies a period of stress occurring between the ages of 2.8 to 4 years. Observing multiple instances of hypoplasia on various teeth in individual in Grave 1307/1419, it is plausible to infer the occurrence of at least two distinct stressful periods in tooth development, spanning between the ages of 1.5 and 5.2 years.

5.9 Traumatic alterations

In 5 out of 32 individuals were observed to have lesions suggestive of trauma. All instances occurred in adults, four of them females. The only male with trauma, in Grave 1384/1513, had a well-healed fracture on the distal end of the right humerus (Fig. 74). The male was 25–30 years old, and the fracture was barely noticeable, which suggests an earlier trauma. Given the supracondylar location of the trauma, it is probably related to a direct force trauma on a flexed elbow or a fall onto an outstretched hand.[229] The vast amount of clay dirt that had filled the bone over time made x-ray examination challenging. The distortion is obvious, but the actual bone fracture is not.

In the case of a 50+-year-old female in Grave 1311/1423 a well-healed fracture was observed on the right hand. The distal third, including the neck, of the right second metacarpal's shaft was broken and healed. Metacarpal fractures typically occur due to a direct blow or fall onto the hand. They are often associated with violent incidents and are more commonly found among males.[230] The so-

227 Snoddy et al. 2018.

228 Walker et al. 2009.

229 Egol et al. 2014, 165.

230 Waldron 2009, 151.

Fig. 74. Right humerus of a 25–30-year-old male. Grave 1384/1513. 1 – Anterior view and AP view radiograph of the humerus, 2 – Medial view and ML view radiograph of the humerus, 3 – Anterior view of the distal end of the humerus, 4 – Medial view of the distal end of the humerus (Photo: László György)

called 'boxer's fracture' mainly affects the 5th metacarpal,[231] but in this case, the 2nd metacarpal was injured. The woman from Grave 1309/1421 had *antemortem* fractures on her ribs, and these were also healed. An elderly female in Grave 1432/1564 showed signs of an ankle injury that does not occur often in an archaeological context. The traumas of this joint are not rare but, in this case, the fracture of the talar neck is accompanied by the dislocation of the ankle on the right side. The talus exhibited rotation in the medial and anterior directions and was not restored to its original

231 Kermad et al. 2002.

position (Fig. 75). Due to this displacement, the X-ray shows that the medial malleolus of the tibia was also injured (Fig. 76). Severe porosity and eburnation were evident on the articular surfaces of both the distal end of the tibia and the talus (Fig. 77). Additionally, the inferior articular surface of the right tibia transformed from a rectangular shape to oval. Following the accident, the woman continued to use her leg to a certain extent despite the distorted talus, which is evident from the presence of pseudo-joints observed in the secondary contact position of the bones. The calcaneus and fibula were missing as well as the other tarsals, metatarsals, and phalanges so the involvement of these bony elements cannot be confirmed. Given the dislocated position and the malunion of the fracture, the individual likely encountered significant challenges in mobility. The bones of another adult female in Grave 1383/1512 are remarkable because they show possible cut marks. On the antero-medial edge of the left clavicle shaft and the lateral edge of the distal end of the right radius, altogether three sharp force injuries with highly likely traumatic origin are visible (Figs 78–79). The lesions are consistent with perimortem cut marks due to the lack of remodelling and the presence of distinct kerfs with sharp walls and margins. The cut marks are probably connected to the defensive posture of the individual.

Fig. 75. Right tibia and talus of a 50+-year-old female. Grave 1432/1563. 1 – Anterior view of the tibia and talus, 2 – Medial view of the tibia and talus, 3 – Posterior view of the tibia and talus, 4 – Lateral view of the tibia and talus (Photo: László György)

Fig. 76. Radiograph (anterior-posterior view) of the right tibia and talus of a 50+ year-old female. The red arrow points to the partly healed fracture of the medial malleolus of the right tibia

Fig. 77. Posterior view of the distal end of the tibia (1), and the talus (2) of a 50+-year-old female. Grave 1432/1563 (Photo: László György)

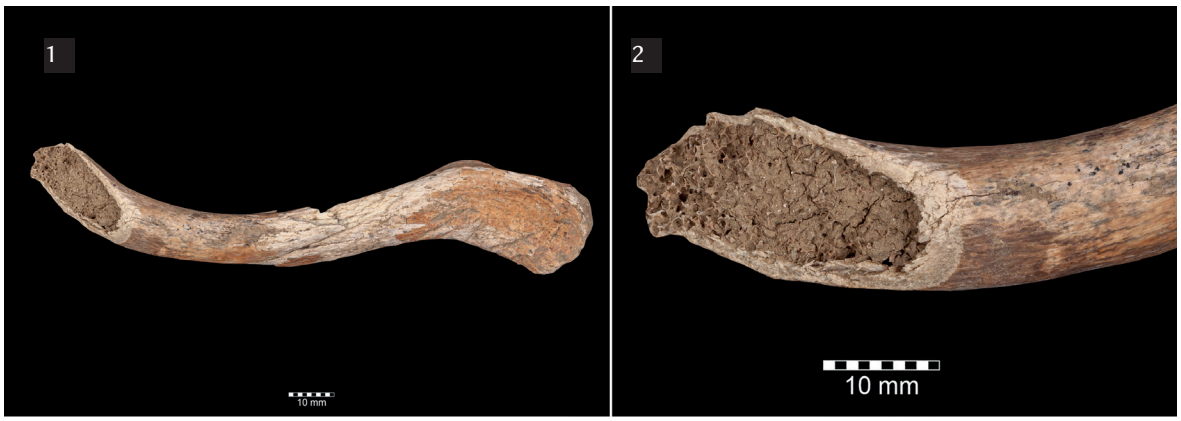

Fig. 78. The cutmarks on the left clavicle of a 25–30-year-old female. Grave 1383/1512. 1 – Superior view of the clavicle, 2 – The sternal end of the clavicular body (Photo: László György)

Fig. 79. Right radius of a 25–30-year-old female. Grave 1383/1512. 1 – Lateral view of the radius, 2 – Dorsal view of the distal end of the radius (Photo: László György)

6. Material culture

6.1 Belt parts

Seven graves certainly contained parts of belts. Belt fittings were present only in one of these burials, and there were buckles in all of them. Graves with belts were found scattered throughout the cemetery (Fig. 80). Only two infants were buried with belts, the rest belonged to juveniles and adults.

6.1.1 Iron buckles

Iron buckles were recovered from six burials.[232] Additionally, small fragments of an iron object were found in Grave 1307/1419, near the right side of the pelvis. The excavators recorded it as a buckle, however, its identification remains uncertain because the object has been lost.

One of the surviving buckles is rectangular, the rest were trapezoid. The buckles were deposited either near the pelvis or next to the proximal end of the femur in five cases; their position suggests that they may have been part of a belt. In Grave 1314/1426, the buckle was found on the inner side of the right knee. Similar items were discovered on the outer side of the knee in three burials at Szegvár-Oromdűlő.[233] In Grave 1528/1666 of Tiszakürt, the buckle was found to the right of the skull; here only the feet area was disturbed and therefore secondary displacement can be excluded.

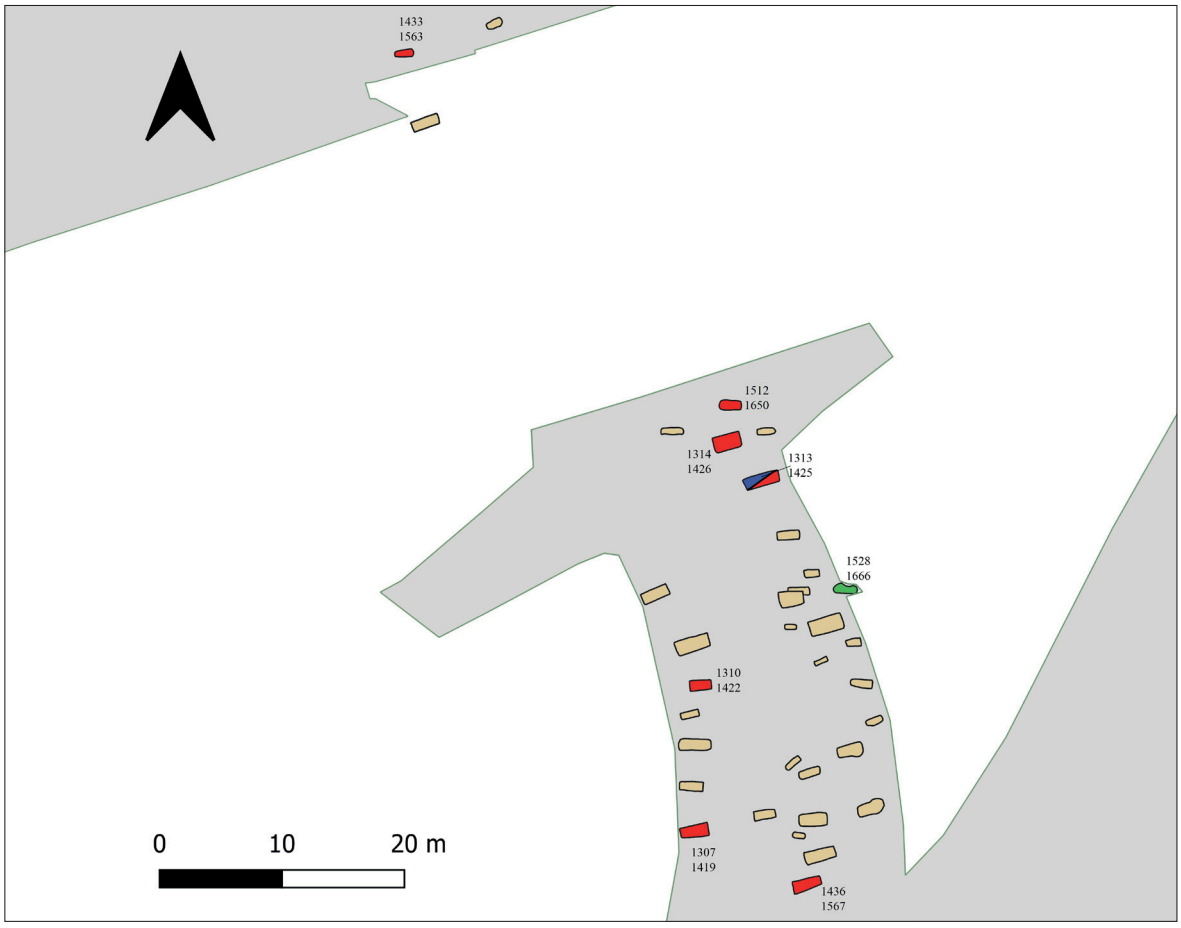

Fig. 80. Spatial distribution of the belt parts. Red – iron buckle, green – copper-alloy buckle, blue – belt fittings

232 Graves 1310/1421, 1313/1425, 1314/1426, 1433/1563, 1436/1567, and 1528/1666.

233 Lőrinczy 2022, 102.

Buckles found beside the knee or the skull can be associated with unbuckled belts, a phenomenon known from female graves of the period. The copper-alloy buckle in Grave 165 at Szegvár-Oromdűlő was deposited at the joint of the left upper arm and collarbone, while the strap end was found on the right scapula.[234] In Grave 3 at Gyoma-Ugari-tanyák-dűlő, the iron buckle and some belt fittings were found beside the skull, while other mounts were on the outer side of the left forearm.[235]

Out of the graves that yielded iron buckles, one yielded the remains of a child in the *infans I* age group, another one a juvenile person, while three adult and adult-mature women, and an adult-mature man were buried in the rest. In one additional grave of an adult woman, the presence of an iron buckle was hypothesized based on the remains.

6.1.2 Copper-alloy buckle

A rectangular copper-alloy buckle with rounded corners was found in Grave 1512/1650. It was found on the pelvis, suggesting that it belonged to a belt. Although the form of the object is simple, similar buckles have not yet been recorded in the region of Tiszakürt.

6.1.3 Belt fittings

Four pressed and rounded belt fittings were found around the pelvis in Grave 1313/1425. Unornamented, pressed, and rounded mounts were common in the Carpathian Basin.[236] Functionally, these are counterparts of hemispherical fittings, such as the ones known from Grave 49 of Hódmezővásárhely-Kishomok. The belt fittings of Tiszakürt were found in a secondary position, therefore the exact structure of the belt cannot be reconstructed. Other types of mounts were not recovered from the grave. Belt sets that consist of rounded belt fittings are known from other cemeteries in the Early Avar Period as well, but they usually come to light along with masque-type belt fittings.[237] Belt sets similar to the Tiszakürt specimen were documented in six graves at Szegvár-Oromdűlő, and in Grave 351 at Nădlac 9M.[238]

6.2 Earrings

Earrings had diverse forms in the cemetery; altogether four different types were identified (Fig. 81). Seven graves contained earrings; they were worn in pairs in four burials. In Grave 1311/1423, two different types of earrings were recovered. In the Tiszakürt cemetery, only women and children wore earrings. Out of the seven individuals, one belonged to the *infans I*, one to the *infans II*, and one to the *maturus* age group, while four were adults.

6.2.1 Hoop earrings

A deformed ring was found on the left shoulder of the deceased in Grave 1310/1422. It was made of a thin copper-alloy wire with round cross-section. A fragmented copper-alloy ring was discovered under the skull in Grave 1433/1563. The former was identified by its shape, the latter by the artefact's position. Similar hoop earrings are known from 20 graves at Szegvár-Oromdűlő, they were worn in pairs in 8 cases.[239] The two graves of Tiszakürt that yielded hoop earrings belonged to a small child (*infans I* age group) and an adult woman. In Szegvár-Oromdűlő, this type of earrings

234 Lőrinczy 2020, 84.

235 Somogyi 1997, 99.

236 Gulyás – Samu 2022, 558–561.

237 Balogh 2016, 191.

238 Gulyás – Samu 2022, 560; Gáll 2017, 232, Pl. 6.2–17.

239 Lőrinczy 2022, 75.

was also found predominantly in female and infant graves, only in four cases were they recovered from the graves of males.[240]

An open silver hoop earring was found in Grave 1311/1423; another open and a closed one were discovered in Grave 1383/1512. The latter two came with a silver earring with a small spherical pendant. In Szegvár-Oromdűlő, hoop earrings were recovered from seven graves, and three earrings were worn in pairs. In Grave 58, a silver hoop earring was paired with a gold earring with small spherical pendant; in Grave 838, a pair of copper-alloy earrings with small spherical pendants were found in addition to the pair of silver earrings. Regarding the adults, males were more frequently interred with silver hoop earrings, only one mature woman was buried with this type of jewellery.[241]

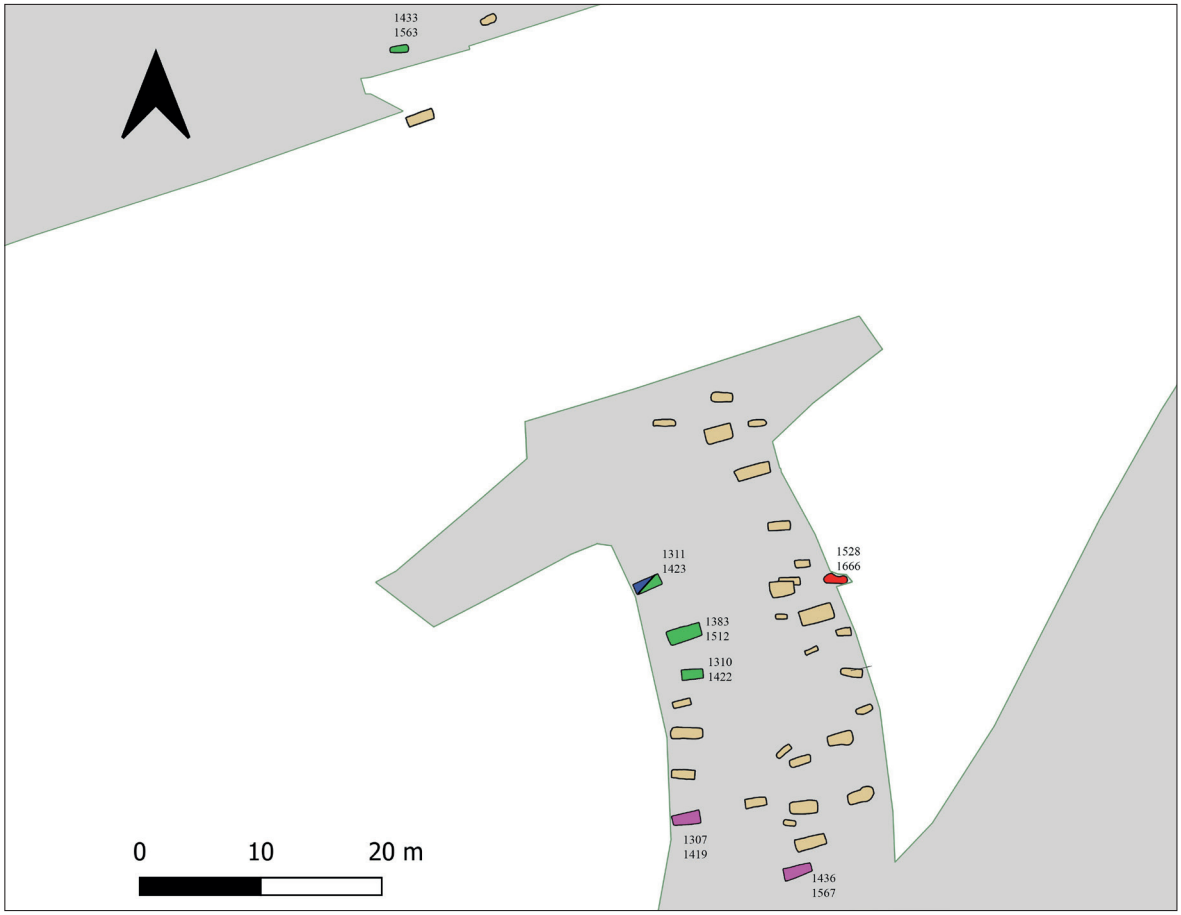

Fig. 81. Spatial distribution of different type of earrings. Green – hoops earring, red – earring with a large spherical pendant, blue – earring with a small spherical pendant, purple – earring with a large bead pendant

6.2.2 Earrings with a large spherical pendant

Grave 1500/1637 contained a silver earring with large spherical pendants (Fig. 82.1). This is one of the most iconic earring types of the Early Avar Period. Similar jewellery was found in 20 graves at Szegvár-Oromdűlő, twelve of which were worn in pairs (Fig. 82.2).[242] Three graves at the site of Szarvas-Grexa-téglagyár yielded earrings with large spherical pendants.[243] As it is also attested by

240 Lőrinczy 2022, 75.

241 Lőrinczy 2022, 73.

242 Lőrinczy 2022, 71–73.

243 Lőrinczy 2022, 81.

the Tiszakürt finds, this type of earrings was part of the female attire in the Trans-Tisza region, the only exception being Grave 33 of Szegvár-Oromdűlő, where an armed mature man was buried with this jewellery.[244]

Earrings with large spherical pendants could have been manufactured in the Trans-Tisza region. Several dies are known from the goldsmith graves of Felnac (Banat, Romania), Kisújszállás, and Kunszentmárton-Habranyi telep. In terms of size, the closest analogies to the Tiszakürt material were found in Kunszentmárton. However, these hemispherical dies may have been used not only for making earrings but parts of horse harness as well.[245]

6.2.3 Earring with a small spherical pendant

In Tiszakürt, the only silver earring with a small spherical pendant that was documented comes from Grave 1311/1423. The diameter of the pendant is 0.7 cm (Fig. 82.3). These earrings are only rarely unearthed in the Trans-Tisza region. They are documented in larger numbers only at Szegvár-Oromdűlő, where silver earrings with small spherical pendants were recovered from 23 graves, and 15 burials contained copper-alloy earrings of this type. Here, the pendants belonging to the copper-alloy artifact group were bigger than the one found in Tiszakürt: their diameter varied between 0.9 and 1.2 cm. In contrast, the silver earrings were smaller, the diameter of the smallest pendant was 0.46 cm.[246] The Tiszakürt grave with this type of earrings contained the remains of a mature woman, which corresponds to the trend observed in Szegvár, where this earring type was associated with adult women (Fig. 82.4).[247]

The silver variant of the earrings with small spherical pendants was more common in the wider area of Tiszakürt. Graves 48 and 54 of Szarvas-Grexa-téglagyár contained such jewellery.[248] The teenage girl interred in Grave 33 at Hódmezővásárhely-Kishomok was also buried with a similar earring.[249] A silver earring with a small spherical pendant was published more recently from the site of Hódmezővásárhely-IV. téglagyár, either from Grave 1 or Grave 2.[250]

Fig. 82. Analogies of the Tiszakürt earrings from Szegvár-Oromdűlő. Earrings with a large spherical pendant: 1 – Grave 1500/1637 of Tiszakürt-Zsilke-tanya, 2 – Grave 347 of Szegvár-Oromdűlő. Earrings with a small spherical pendant: 3 – Grave 1311/1423 of Tiszakürt-Zsilke-tanya, 4 – Grave 550 of Szegvár-Oromdűlő. Earrings with a large bead pendant: 5 – 1436/1567 of Tiszakürt-Zsilke-tanya, 6 – Grave 862 of Szegvár-Oromdűlő (2, 4, 6 after Lőrinczy 2020)

244 Lőrinczy 2022, 73.
245 Rácz 2014, 84.
246 Lőrinczy 2022, 72, 74.
247 Lőrinczy 2022, 74.
248 Juhász 2004, 81.
249 Bóna – Nagy 2002, 49,
250 Lőrinczy – Varga 2022, 31.

6.2.4 Earrings with a large bead pendant

Graves 1307/1419 and 1436/1567 each contained one pair of earrings with a large bead pendant (Fig. 82.5). The spherical dark bead, 0.8 cm in diameter, was connected to the hoop by a cylindrical part in both cases. Cs. Balogh and A. Pásztor classified similar artefacts of similar diameter as large bead pendants.[251] In their comprehensive collection, they grouped the earrings according to the type of the link, and the cylindrical shape was classified as Type 4.[252]

I. Kovrig held the view that earrings with a large bead pendant appeared in the early Avar Period.[253] According to A. Pásztor, they were used from the second quarter of the 7th century, the earliest specimens being light green, light blue, and translucent melon seed-shaped beads with copper-alloy tubes.[254] This type of earrings was uncommon in the Trans-Tisza region in the Early Avar Period. At Szegvár-Oromdűlő, this type of jewellery was observed in 14 graves, and a cylindrical link, probably ribbed or simple, was also recovered in six pieces (Fig. 82.6).[255] The earring of this type found in Grave 3 at Szegvár-Sápoldal had a blueish purple bead pendant.[256] At Szarvas-Grexa-téglagyár only one burial, Grave 367, contained a pair of such earrings.[257] Similar artefacts were also found in Grave 35 of Hódmezővásárhely-Kishomok.[258] The above listed earrings from Szegvár-Sápoldal, Szarvas, and Hódmezővásárhely also belong to Type 4 in the classification by Balogh and Pásztor. The only such artefact from the region that belongs to a different type is known from Grave 10 at the site of Öcsöd-MRT 96a; this earring was not equipped with a link.[259]

As regards the age and gender of the persons interred with this type of jewellery, it is mainly found in the graves of women and children. Grave 1307/1419 in Tiszakürt contained the remains of an adult woman, while Grave 1416/1515 belonged to a small child under the age of six. Also in Szegvár-Oromdűlő, this type of earring was worn exclusively by women and children: in three cases they were found in the graves of infants and in three cases from graves of adult women.[260] The artifact found in Grave 3 at Szegvár-Sápoldal also belonged to an adult female.[261] In the cemetery of Hódmezővásárhely-Kishomok, the earring was found in the grave of a slightly older child (*infans II* age group).[262] The earring discovered in Szarvas-Grexa-téglagyár is an exception because it was buried with a mature man.[263] Although this type of jewellery is rarely found in the graves of males in the Trans-Tisza region, it is not unprecedented: Grave 45 of Čoka (Banat region, Serbia) is one such example, even though it had a different structure from the specimens above.[264] Both graves 57 and 85 in Aradac (Banat region, Serbia) contained an earring with a large bead pendant.[265]

251 Balogh – Pásztor 2015, 581.
252 Balogh – Pásztor 2015, 587–588.
253 Kovrig 1963, 110.
254 Pásztor 2008, 316–317.
255 Lőrinczy 2022, 75.
256 Lőrinczy 2018, 76.
257 Juhász 2004, 56.
258 Bóna – Nagy 2002, 287, Taf. 13, Taf. 35.1–2.
259 Madaras 2004, 341.
260 Lőrinczy 2022, 75.
261 Lőrinczy 2022, 55.
262 Bóna – Nagy 2002, 49.
263 Juhász 2004, 56.
264 Kovrig – Korek 1960, 262.
265 Balogh – Pásztor 2015, 626, Tab. 1.6.

6.3 Beads

Nine graves contained beads in Tiszakürt-Zsilke-tanya. Women were interred in four of them, the other five burials belonged to children. These graves were scattered throughout the excavated cemetery section. Altogether 222 beads were recovered intact, but the exact number of beads is difficult to estimate since numerous small fragments were also found in addition. Two groups can be distinguished based on their material: glass and silver.

6.3.1 Glass beads

The vast majority of beads, 219 pieces, belong to this group. They can be divided into further groups by their shape and colour. Since the soil conditions in Tiszakürt were not favourable for their preservation, their surface was often oxidized or porous, and the precise shape classification frequently posed a challenge.

6.3.1.1 Monochrome glass beads

Monochrome glass beads were the most common kind present in all nine graves. They are varied in terms of typology. Altogether 23 intact and several fragmentary ring-shaped pieces were recovered from Graves 928/986 and 1307/1419. These were mainly blue, only one white and two brown pieces were collected. One of the ring-shaped pieces was iridescent. A similarly shaped, but larger iridescent blue bead came to light from Grave 1500/1637. In the cemetery of Szegvár-Oromdűlő, 246 pieces of ring-shaped beads, mainly yellow and blue ones, were found in 35 graves.[266] Two iridescent glass beads were found in Grave 3 at Szegvár-Sápoldal;[267] and similar pieces were discovered in Grave 55 at Hódmezővásárhely-Kishomok and in Grave 4 at Orosháza-Bónum.[268]

In terms of shape, flattened-spherical (spheroid) beads were the most common. They were recovered from eight burials, 104 of them intact, the rest fragmentary. Blue and yellow pieces were definitely the most popular, but white, brown, green, and black ones were also used. Most of them were opaque, but there was a light green bead in Grave 1307/1419 and a blue translucent one in Grave 1500/1637. Thirteen beads were iridescent; two had gilding on the surface. They were varied in size, too: two large yellow pieces were found in Grave 1500/1637. A large, opaque, light green bead was found in Grave 1434/1565. Spherical and flattened spheroid beads were the most common in the Szegvár-Oromdűlő cemetery as well; this is the best analogy in geographical terms. There, the beads were mostly opaque, only a few translucent pieces were found; the majority was white and yellow, but brown, green, and blue colours were also used.[269] In the cemetery of Szegvár-Sápoldal, the assemblage of flattened spheroid monochrome beads included blue, yellow, and black ones, recovered from three graves.[270] The strings of beads in Graves 35 and 55 at Hódmezővásárhely-Kishomok consisted mainly of blue and yellow pieces.[271]

A total of 13 spherical beads were recovered from four graves.[272] Of these, the two blue and blueish-green beads of Grave 1307/1419 may have belonged to an earring. This form is extremely diverse in terms of colours; in addition to brown and blue beads, there were also white, yellow, black, and orange pieces. Grave 1307/1419 contained four large, spherical black beads with a slightly pointed

266 Pásztor 2022, 417.

267 Pásztor 2018c, 92.

268 Pásztor 2018b, 624; Rózsa et al. 2013, 6, Fig. 1 on the bottom.

269 Pásztor 2022, 413–414.

270 Pásztor 2018c, 86–87.

271 Pásztor 2018b, 623–624.

272 Graves 928/986, 1307/1419, 1383/1512, and 1434/1565.

edge on one side. Their surface was heavily damaged and porous, and they were attached to the necklace with a loop made of copper alloy. According to A. Pásztor, spherical beads like these may even have belonged to earrings, although it seems unlikely in this case because there were four pieces in the grave.[273] A large white specimen with a heavily damaged surface was found in Grave 1434/1565. Regular spherical shapes are much rarer than flattened spheroids among Early Avar Period beads in the Trans-Tisza region. Green and brown spherical beads were also documented in the Szegvár-Oromdűlő cemetery.[274] A black piece is known from Grave 3 of Szegvár-Sápoldal.[275]

Four graves contained 34 intact and several fragmentary truncated conical beads altogether.[276] The vast majority are blue or yellow, but three white, two light brown, and one light green piece were also found. One piece shows traces of possible gilding, three of them were iridescent. This type of artifact was relatively rare in Szegvár-Oromdűlő, where strings of beads were usually made of one to three monochromatic and eye-inlaid pieces, primarily in blue and yellow.[277] In Grave 55 of Hódmezővásárhely-Kishomok, only one truncated cone-shaped bead was found.[278]

In Grave 1307/1419, a biconical bluish-white iridescent bead was found. Grave 1383/1512 also contained a biconical blue bead, but with a more elongated shape. A similar bead was found in Grave 527 of Szegvár-Oromdűlő.[279]

Graves 1307/1419 and 1482/1619 contained a long cylindrical bead each. The former was blue, the latter white, both with an iridescent surface. The type is known from 16 graves in Szegvár-Oromdűlő, where typically one to three pieces were deposited in one grave. These were usually dark red, green, and white.[280] A cylindrical white bead with an undecorated surface was found on a string of beads in Grave 35 of Hódmezővásárhely-Kishomok.[281] Grave 225 of Szarvas-Grexa-téglagyár also yielded two cylindrical pieces on a string of beads.[282]

Graves 1307/1419, 1436/1567 and 1500/1636 each contained a rectangular blue bead with cut corners. In the first two graves, the beads were opaque with iridescent surface, and the latter contained a translucent bead. A similarly shaped bead is known from Grave 862 in Szegvár-Oromdűlő.[283] Among the rectangular pieces with flattened corners, blue and green pieces were especially fashionable; as A. Pásztor noted, in the last third of the 7th century, blue pieces became popular again.[284] However, in the latter period, these were mainly found along with seed-shaped beads, sometimes accompanied by disc-shaped, cylindrical, and prismatic beads.[285] For this reason, the beads from Tiszakürt can be classified in the early chronological group.

Four exemplars of two-piece ring-shaped segmented beads were recovered from Grave 1307/1419 and one was found in Grave 1482/1619. Three of these objects are blue, one white and one brown. A. Pásztor mentions similar artifacts among the two-piece spheroid beads from Szegvár-Orom-

273 Pásztor 2018a, 282.
274 Pásztor 2022, 414.
275 Pásztor 2018c, 87.
276 Graves 928/986, 1307/1419, 1383/1512, and 1500/1637.
277 Pásztor 2022, 419.
278 Pásztor 2018b, 623.
279 Pásztor 2022, 415, Fig. 2.29.
280 Pásztor 2022, 418.
281 Pásztor 2018b, 623.
282 Juhász 2004, 142, Taf. 38.225:5.
283 Pásztor 2022, 415, Fig. 2.56.
284 Pásztor 2022, 423.
285 Pásztor 2022, 423.

dűlő,[286] however, these actually seem to be more ring-shape than spheroid. A similar specimen in ochre-yellow colour was also found in Grave 4 at Orosháza-Bónum.[287]

Grave 928/986 yielded one, Grave 1307/1419 five, and Grave 1500/1637 four two-piece spheroid segmented beads. Of these, six were yellow, three were blue, and one was translucent, iridescent white. Many of these are broken, and only one half of them is intact. In these cases, it is not clear whether they entered the graves damaged. The same is true for those beads that consisted of two conical members. Grave 928/986 had three, and there were two each in Grave 1307/1419 and 1500/1637. Three were blue, two yellow, and two white. A. Pásztor did not differentiate between the two groups, calling them two-piece spheroid segmented beads.[288] This type is known from 27 graves in Szegvár-Oromdűlő, they were never used exclusively in strings of beads but were mixed with other types. Most of them were yellow, blue and brown, but white, green, and black pieces are also known.[289] This type is considered common in the region. Grave 3 at Szegvár-Sápoldal and Grave 55 in Hódmezővásárhely-Kishomok each contained a yellow bead.[290] There were blue and yellow segmented beads in Grave 4 in Orosháza-Bónum.[291]

A four-piece yellow segmented bead is known from Grave 1307/1419. This type occurs mainly on necklaces of Late Antique style. Blue beads are predominant, but there are also white, light green, or, as in Tiszakürt, yellow versions.[292] They appeared roughly at the same time as the early melon seed beads, in the second quarter or third of the 7th century.[293]

Grave 1482/1619 contained two disc-shaped, light green iridescent beads, with a copper tube inserted in the hole in the middle. Similar tubular fragments were also recovered from the grave, but it is not known whether they belonged to disc or melon seed pieces. Based on their design, A. Pásztor classified such objects as melon seed-shaped; there were similar beads in Grave 938 at Szegvár-Oromdűlő.[294] A good analogy was found in Grave 615 at Csanádpalota-Juhász T. tanya which can be dated to the last third of the 7th century.[295]

Graves 1383/1512, 1433/1563, and 1482/1619 also contained large melon seed-shaped beads. These were light green, turquoise, and white, with copper tubes inserted into their holes. The Tiszakürt pieces are very poorly preserved, only two intact pieces remain. T. Vida and T. Völling suggested, that melon seed-shaped beads with tubes originally came from the Mediterranean and the Balkans.[296] However, most melon seed-shaped beads were found in the Carpathian Basin.[297] Metal tubes have been used from as early as the 6th–7th centuries in Baden-Württemberg, Germany, and the technique became widespread in the Carpathian Basin and the surrounding territories around the turn of the 7th–8th centuries.[298] This spread may be linked to an emerging network of local bead-making workshops. A. Pásztor dated the appearance of the type to the second third, second

286 For example, Pásztor 2022, 411, Fig. 1.58.
287 Rózsa et al. 2013, 8.
288 Pásztor 2022, 414.
289 Pásztor 2022, 414.
290 Pásztor 2018c, 83; Pásztor 2018b, 624.
291 Rózsa et al. 2013, 8.
292 Pásztor 2022, 414–416.
293 Pásztor 2022, 416.
294 Pásztor 2022, 415, Fig. 2.67.
295 Pópity 2021, 41, Fig. 12.7.
296 Vida – Völling 2000, 85.
297 Staššíková-Štukovská 2017, 367.
298 Frey – Greiff 2009, 373–374.

quarter of the 7th century.[299] Eight graves in Szegvár-Oromdűlő contained early melon seed-shaped beads, including both translucent and iridescent pieces, typically made in different shades of green, brown, and black.[300] These were found mainly in graves with an endwall shaft, appearing on necklaces made of beads of antique and mixed-origin.[301] Graves 2 and 3 Szegvár-Sápoldal contained two and three melon seed-shaped beads, respectively.[302]

6.3.1.2 Polychrome glass beads

A total of seven polychrome beads were found in four graves in the Tiszakürt-Zsilke-tanya cemetery. Grave 1307/1419 had three, Grave 1310/1422 had two, while Graves 1433/1563 and 1500/1637 had one piece each. These beads were all unique, so they will be discussed individually below.

Grave 1307/1419 contained a dark green bead in the shape of a flattened spheroid, with red bands visible on its surface. The exact analogy of this type is not known. In the Szegvár-Oromdűlő cemetery, one of the bead fragments found as a stray find was cobalt blue with ruby red parts. However, based on its composition, A. Pásztor connects it to the Sarmatian period.[303]

Also in the same grave, a dark brown spheroid bead with four protruding yellow eyes was also found. The necklace found in Grave 35 in Hódmezővásárhely-Kishomok contained similar pieces, but with more prominent eyes.[304] The type, known from 32 graves, was relatively popular in Szegvár-Oromdűlő. They were usually strung between other beads, 1–3 pieces were found per burial.[305]

Grave 1433/1563 had a flattened dark brown spheroid bead with white lines at each end and with three white and three yellow eye-shaped inlay decorations. No exact parallel of the type is known from the region. A red bead with a similar decoration was found in Grave 1999/30 of the Keszthely-Fenékpuszta, Pusztaszentegyházi-dűlő site.[306] A similar specimen was found in Grave 17 in Szegvár-Oromdűlő, but all six eye-shaped inlays are yellow and the white paint is only found at one end of the hole.[307]

Grave 1310/1422 also contained a flattened spherical red bead decorated with white intersecting wavy lines and five turquoise eye-shaped inlays on a white base. As this type was used for a relatively long time, there is no more precise dating value within the Early Avar Period.[308] It was popular in the studied region as well. Similar pieces were found in 15 graves in Szegvár-Oromdűlő. These are mainly dark red, but black and dark brown versions are also known.[309] The necklace of Grave 5 of Szegvár-Sápoldal contained a specimen belonging to this type.[310]

Grave 1500/1637 contained a single polychrome bead, also of a flattened spheroid shape. Its dark green background is decorated with yellow wavy lines and four white eye-shaped inlays. Such beads were found in 38 graves in Szegvár-Oromdűlő. Most of them are red or reddish brown, but black pieces are also known.[311]

299 Pásztor 2018c, 93.
300 Pásztor 2022, 424.
301 Pásztor 2022, 425.
302 Pásztor 2018c, 85.
303 Pásztor 2022, 489.
304 Pásztor 2018b, 623.
305 Pásztor 2022, 429.
306 Pásztor 2014, 269, Fig. 7.30.
307 Pásztor 2022, 429.
308 Pásztor 2018c, 91.
309 Pásztor 2022, 434.
310 Pásztor 2018c, 98.
311 Pásztor 2022, 429.

Grave 1307/1419 contained a large spheroid opaque bead. It is brownish-red in colour, with a white continuous band along the holes and four slightly protruding white eye-shaped inlays. The only good analogy in the region is known from Grave 346 in Szegvár-Oromdűlő, however, the eye-shaped inlays were originally ochre-yellow in this case.[312]

Grave 1310/1422 contained a brick-red two-piece spheroid segmented bead, decorated with yellow intersecting wavy lines and 4-4 white-blue eye-shaped inlays. This type was considered common in the Early Avar Period, but relatively few are known from the studied region. They can be dated to the middle or the second third of the 7th century.[313] A similar piece was discovered in Grave 738 of Szegvár-Oromdűlő.[314] Beads of a similar shape were also found in Grave 1 at Szentes-Berekhát, Farkas-tanya, but the publication does not mention their colour, and the black-and-white drawings do not help in deciding the question.[315] Based on the black-and-white photos, beads similar to those in Tiszakürt were found on the necklaces in Graves 54 and 225 at Szarvas-Grexa-téglagyár.[316]

6.3.2 Silver bead

A fragment of a silver bead was found in Grave 1500/1637. This object was composed of two hemispheres made of a thin plate and attached to a necklace by a ribbed cylindrical collar. The bead was found to the right side of the skull, at a distance from the glass beads that were also deposited around the neck. This means that the silver bead was possibly placed in the grave in a position that does not reflect the way it was worn. This object type was mainly in fashion in the Trans-Tisza region, and many examples are known from the Nyíri-Mezőség area as well.[317] Similar jewellery has also been recorded in the area of Tiszakürt. Three golden specimens were collected at the site of Endrőd-Doboskert.[318] Altogether 93 spheroid and spherical metal beads were brought to light from 22 burials in Szegvár-Oromdűlő, both from men's and women's graves. Necklaces made only from metal beads were absent in the Tiszakürt cemetery, they were always mixed with glass beads.[319] G. Lőrinczy and Zs. Rácz dated these beads to the second third or the beginning of the last third of the 7th century.[320]

6.3.3 Iron chain links

In Graves 1310/1422 and 1383/1512, a piece of an iron chain consisting of several intact and fragmented links was found, while Grave 1433/1563 contained a single small iron chain link. Similar chain links were strung among the beads in necklaces at Szegvár-Oromdűlő.[321] Since they are mainly found in infant graves, G. Lőrinczy suggested that they could have been used as amulets.[322] According to the observations of I. Juhász, the iron chains found in the Szarvas-Grexa-téglagyár cemetery had two main functions. Pieces consisting of larger eyes may have been hanged on the belt, while the smaller pieces were possibly parts of a necklace, like the ones from Szegvár.[323] The pieces from Tiszakürt were probably also used like the latter.

312 Pásztor 2022, 430.
313 Pásztor 2018b, 263.
314 Pásztor 2022, 437.
315 Madaras 1999, 329, Fig. 3.5.
316 Juhász 2004, 167, Taf. 3.2, Taf. 54.1.
317 Lőrinczy – Rácz 2014, 155–156.
318 Jankovich et al. 1989, 137.
319 Pásztor 2022, 454.
320 Lőrinczy – Rácz 2014, 156.
321 Lőrinczy 2022, 83.
322 Lőrinczy 2022, 83.
323 Juhász 2004, 94.

6.3.4 Composition of strings of beads

Based on the number of beads, four groups can be distinguished. The graves containing 1–4 beads were classified into the first group. Five to 29 beads were strung on short necklaces, 30–44 on medium-long necklaces, and more than this on long necklaces. In addition, the character of the beads can be classified as antique style, Avar-type, and mixed bead strings.[324] With one exception, these were all made of only glass beads; except for the necklace in Grave 1500/1637, which had silver beads too.

There was one bead in Grave 1436/1567 and two each in Graves 1310/1422, 1433/1563, and 1434/1565. Graves 1433/1563 and 1436/1567 belonged to adult women, while the other two graves contained the remains of children belonging to age groups *infans I* and *infans I–II*, respectively. Three of the four graves contained antique, and one contained Avar-type beads. They were all deposited in the neck and chest area, so judging by their position, they could have been strung around the neck and worn as jewellery. I. Bóna classified burial containing 1–4 beads as the graves of rich men.[325] According to A. Pásztor, these were placed in the graves for apotropaic purposes, but this explanation is not exclusive.[326]

A prismatic blue bead with cut corners was found in Grave 1436/1467. From Graves 73 and 863 at Szegvár-Oromdűlő, only one bead of the same shape is known.[327] Grave 1433/1563 contained a melon seed-shaped turquoise and an antique-style bead with a single-layer eye-shaped inlay, as well as an iron chain link in the same necklace. In Grave 1434/1565, a large white and a large green bead were found. The two pieces of antique-style beads were also rare in Szegvár-Oromdűlő; they were found in eleven graves only.[328]

Grave 1310/1422 contained a flattened spheroid bead and a two-piece spheroid segmented bead. The former is white, the latter is decorated with yellow intersecting wavy lines, with four and eight eye-shaped inlays. The necklace was closed with iron links and a perforated circular copper-alloy object. In the Szegvár-Oromdűlő cemetery, there were two Avar-type beads in nine graves. The two beads were different in each case. It is striking that all of these burials contained very few grave goods.[329]

In Graves 928/986, 1383/1512, and 1482/1619, there were short necklaces of antique-style beads. These were made of spherical, flattened spheroid, and truncated conical single-piece, as well as two-piece spheroid segmented beads. They are mainly yellow and white, many of them iridescent. A total of seven graves contained necklaces made of monochrome beads in Szegvár-Oromdűlő. However, these were shorter than the strings of beads in Tiszakürt; they consisted of 7–17 beads.[330] A short necklace with blue and yellow spheroid beads was worn by a woman deposited in a house at Csanádpalota-Juhász T. tanya.[331] The strings of beads in Graves 1383/1512 and 1482/1619 contained monochrome beads, including large melon seed- and disc-shaped pieces. A string of beads of a similar composition was also found in Grave 938 in Szegvár-Oromdűlő; it contained two pearls shaped like melon seeds.[332] In addition to the monochrome beads, Graves 2 and 3 in Szegvár-Sápoldal contained large melon seed-shaped pieces. The strings of beads from Grave 2 also contained a carnelian bead.[333]

324 Cf. Pásztor 2022, 457–479.
325 Bóna 1979, 27–28.
326 Pásztor 2018c, 90.
327 Pásztor 2022, 457.
328 Pásztor 2022, 459.
329 Pásztor 2022, 472–473.
330 Pásztor 2022, 460–461.
331 Pópity 2021, 713, Pl. 32.
332 Pásztor 2022, 461.
333 Pásztor 2018c, 92.

Flattened-spheroid, truncated conical, and two-piece spheroid segmented beads were primarily found in Grave 1500/1637. They were yellow and blue, and some of the latter were large-size prismatic with cut edges and a flattened spheroid shape. Besides these, a ring-shaped bead with single-layered eye-shaped inlay was strung on the necklace. There were a few silver beads between the glass pieces. In Szegvár-Oromdűlő, the silver beads were also strung between glass beads; in each case, they belonged to nine short and one long string of beads.[334]

The only long string of beads was found in Grave 1307/1419. It contained at least 130 beads, including single- and two-piece, monochrome and polychrome beads, respectively. The shape of the beads is also varied: spherical, spheroid, ring-shaped, truncated conical, or prismatic with cut edges. The necklace also includes large spherical black beads and cut-edged prismatic blue beads. There were three antique-style beads with eye-shaped inlays. Only Grave 898 of Szegvár-Oromdűlő contained a long necklace with antique-style beads, but there are also some Avar-style specimens among them. These typically consist of small, flattened spheroids and conical beads with larger, differently shaped pieces of glass and silver strung between them.[335] In three burials, the long strings of beads were arranged in several rows.[336] Since the beads in the Tiszakürt grave were in a state of disarray, the original number of rows is not known.

6.4 Pendants

6.4.1 Fragment of a possibly Roman glass vessel

A pendant made of greenish-blue glass was found under the skull in Grave 1433/1563. It appears that the object was originally the round handle of an *aryballos*-type cosmetics container.[337] According to L. Barkóczi, this vessel form was most common in Pannonia in the 2nd century, and its popularity gradually decreased from the 3rd century onwards (Fig. 83).[338] The fact that this date coincides with the time of production of the *terra sigillata* found in the Sarmatian settlement at Tiszakürt warrants caution, since it suggests that the glass fragment could also have originated from these Sarmatian layers.[339]

Recycled and reused Roman glass fragments are rare in early Avar burials in the Trans-Tisza region, but the phenomenon is not unprecedented. In Grave 674 of Szegvár-Oromdűlő, the bottom fragment of a light olive coloured glass cup was included on a string of beads.[340] Roman glass remains placed on the outer side of the right leg of the adult woman in Grave 3 of Szegvár-Sápoldal included glass cup fragments dating back to the 3rd–4th centuries.[341]

Fig. 83. Late Roman *aryballos* found in Nubia (after Francigny – Bishop-Wright 2022)

334 Pásztor 2022, 454.
335 Pásztor 2022, 469.
336 Pásztor 2022, 464–465.
337 We are grateful to Kata Dévai for the identification of the fragment.
338 Barkóczi 1988, 157–158.
339 Fülöp et al. 2018, 507.
340 Pásztor 2022, 448.
341 Lőrinczy 2018, 76.

In connection with glass fragments used in the necklaces, A. Pásztor noted that they may have functioned as amulets.[342] This explanation cannot be dismissed; the shape of the Tiszakürt piece in fact resembles a head ring or a seal, objects which sometimes seem to take on apotropaic functions. Seals are very rare in the Avar material, the only piece from this period has been discovered in the region of Tiszakürt: in the female Grave 366 of Szarvas-Grexa-téglagyár, a Sasanian seal with a Pehlevi inscription was found strung into a string of beads.[343] Due to its rarity, the object lost its original function and was used with the beads due to its apotropaic or simply aesthetic value.

6.4.2 Pendant made of a slotted spoon

In Grave 1310/1422 a circular object made of a thin copper plate seems to have been included in the necklace around the neck of the deceased (Fig. 84.1). The object's surface is covered in small holes and its design is similar to the head of a slotted spoon, however, its position in the grave makes this identification highly unlikely. It was probably added to the necklace as a pendant. This object is not unparalleled in the Early Avar Period in the Trans-Tisza region: three graves at Szegvár-Oromdűlő yielded similar pendants (Fig. 84.2–3). According to G. Lőrinczy, they were made from slotted spoons, and the pendant loop was made by bending back the neck and handle.[344] A similar piece was discovered in Grave 13 in the cemetery at Gerla-Szakács-föld.[345]

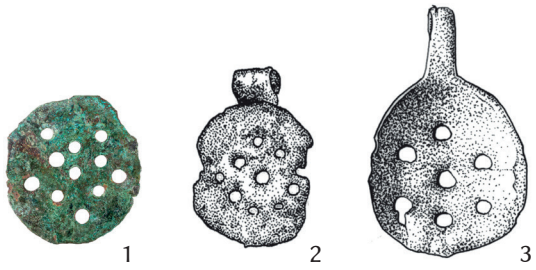

Fig. 84. Pendants made from a slotted spoon. 1 – Grave 1310/1422 of Tiszakürt-Zsilke-tanya, 2 – Grave 699 of Szegvár-Oromdűlő, 3 – Grave 704 of Szegvár-Oromdűlő (2–3 after Lőrinczy 2020)

6.5 Brass bracelet

The adult woman in Grave 1383/1512 had a bracelet on her right wrist. The jewellery was made from a thin copper-alloy plate, rolled back at both ends. To date, this item is unique in the Avar material. Bronze or copper-alloy bracelets are relatively rare among the finds of the region in the Early Avar Period. A pair of bracelets with straight ends was found in Grave 5 of Orosháza-Bónum.[346] The known objects include several pieces with flaring terminals. In addition, open or closed cast bracelets have also been discovered.[347] Bracelets have been unearthed across the entire Trans-Tisza region, the southernmost example comes from the Vălcani cemetery in the Romanian part of the Banat region.[348]

6.6 Arrowhead

Grave 1384/1513 contained a trilobate iron arrowhead. The blade is rhomboid, slightly rounded, and its exact analogy was found in Grave 700 at Szegvár-Oromdűlő.[349] The arrowhead was found beside the left pelvic blade of the adult male, along with a flint. This may indicate that it was carried in a pouch and used as a fire striker. However, no analogies are known for this in the Early Avar Period in the region.

342 Pásztor 2022, 448.
343 Juhász 2004, 56.
344 Lőrinczy 2022, 82.
345 Jankovich et al. 1998, 434–435.
346 Lichtenstein 2006, 144, Fig. 3.9–10.
347 Lőrinczy 2022, 100.
348 Lőrinczy 2022, 100; Gáll et al. 2023, 74.
349 Lőrinczy 2022, 385, Fig. 68.5.

6.7 Tools

6.7.1. Disc-shaped and biconical spindle-whorls

Spindle accessories were relatively common in the cemetery; five graves yielded a disc-shaped spindle-whorl each, and two contained the biconical type.[350] The disc-shaped specimens were made from the side fragments of high-quality Sarmatian vessels; two were orange and two were light gray. The biconical spindle whorls from Grave 1433/1563 are irregularly shaped and grey, while the one from Grave 1500/1637 is of a much higher quality.

Two individuals accompanied by these objects were probably girls, belonging to the *infans II* age group, between 6–14 years of age, and four were adult women. The objects' original position could be reconstructed only in six cases; three were placed at the right leg, one at the left elbow, one beside the left forearm, and one behind the skull.

In the Szegvár-Oromdűlő cemetery, 102 graves contained disc-shaped and biconical spindle-whorls. Most of these were also made using fragments of Sarmatian pottery.[351] G. Lőrinczy considers spindle-whorls placed around the skull to be special, because their position in the grave is not justified by their function. This phenomenon was observed in six graves in Szegvár.[352] Past scholarship often held the view that disc-shaped spindle-whorls are more typical of the Early Avar Period, while the biconical ones were used in the Late Avar Period.[353] However, this is not supported by the patterns detected in the Tiszakürt or Szegvár cemeteries. The best evidence for the co-occurrence of the two object types is the burial in Gyula-Dobos István utca, where three disc-shaped and three biconical spindle-whorls were found together.[354]

6.7.2 Needle case

In Grave 1500/1637, a needle case was found next to the deceased. The object was made from the metatarsal of a sheep or goat. It has an elongated cuboid shape, its heavily worn surface shows what appears to be a zigzag pattern. In the Trans-Tisza region, lathe-turned needle holders were widespread in the Early Avar Period. In the Szegvár-Oromdűlő cemetery, five out of six needle cases were made using a technique similar to the one in Tiszakürt.[355] There was a lathe-turned piece in Grave 3 at Szentes-Donát as well.[356]

The main distribution area of this object type is the Maros valley. In the Makó-Mikócsa-halom cemetery, several pieces were found that were made from the femur and ulna of sheep.[357] There were lathe-turned needle cases with unique ornamentation in Grave 3 of Deszk-Site 'Sz', Grave 3 of Deszk-Site 'T', and Graves 2 and 7 of Kiszombor-Site 'O'.[358] The only undecorated specimen, probably made from the ulna of a bird, comes from Grave 30 at Kövegy-Nagy-földek.[359] A fragment of a carved needle case was recently found in a grave at Vălcani, south of the Aranca River.[360]

350 There were disc-shaped spindle-whorls in Graves 40/53, 1307/1419, 1383/1512, 1436/1567 and 1482/1619, while the two biconical ones were found in Graves 1433/1563 and 1500/1637.

351 Lőrinczy 2022, 185.

352 Lőrinczy 2022, 192.

353 Lőrinczy 2022, 192.

354 Lőrinczy 1998, 348–349.

355 Lőrinczy 2022, 183.

356 Csallány 1900, 395, Grave 3, Fig. 2.

357 Balogh 2021, 135.

358 Lőrinczy 2022, 183–184.

359 Benedek – Marcsik 2017, 392.

360 Gáll et al. 2023, 76.

6.7.3 Iron knives

Iron knives are known from five graves;[361] Grave 1384/1513 yielded the fragments of two pieces. These are all single-edged knives with a straight spine. They all come from burials of adults, four women and one man, respectively. Their size suggests that they may have been utility tools. Four knives were placed next to the arm of the deceased, and one was put next to the pelvis, in the position it had been worn.

6.7.4 Pouch fastener

A fragmented pouch fastener made of copper alloy was found in Grave 1307/1419. The object may have been already damaged when it was placed in the grave, but it is more likely that it broke in two when the grave was disturbed. Similar pieces were classified by B. Tobias as belonging to Type 1a1.[362] A. Lakatos points out that these could originally have been parts of Byzantine lamp holder chains.[363] Although the original spatial position of the Tiszakürt specimen is not known due to grave disturbance, this type of objects is usually found on the left side in burials in the Carpathian Basin.[364] This is possibly the case with the Tiszakürt grave as well, because the object was discovered in the southern part of the burial pit. This object type was most widespread in the Danube-Tisza interfluve area and in Eastern Transdanubia; only one specimen is known from the Trans-Tisza region, from Aradac.[365]

6.7.5. Flints

An oblong brown and an orangish-white piece of flint were found in Grave 1384/1513. No clear traces of processing are visible on their surface, only the brown one may have been used as a tool. As settlement features from the Middle Neolithic also came to light at Tiszakürt-Zsilke-tanya, it cannot be ruled out that the flints originate from those layers.[366] A 25–35-year-old man was laid to rest in the Tiszakürt grave with the flints, which is in line with the trend observed in Szegvár-Oromdűlő, where mainly adult and mature men received this type of grave goods.[367]

6.8. Vessels

A total of 12 vessels were discovered in 11 graves of Tiszakürt. Without exception, they were made without the use of a potter's wheel. From a formal and functional point of view, they can be divided into three main groups; the majority were pots (ten pieces), as well as a bowl in one grave and a jug in another.

6.8.1 Cooking pots

The pots from Tiszakürt are all short or medium tall. The clay is roughly or moderately treated, only the vessel from Grave 1512/1650 is well-formed. The inclusions were mostly organic material or grog; in almost half of the cases, the clay was tempered with sand grains, and in one case, chaff and gravel are visible in the structure of the material. Seven vessels show no traces of surface treatment, in several cases larger grog fragments are visible on the surface. In the pots of Graves 1500/1637 and

361 Graves 40/53, 1307/1419, 1383/1512, 1384/1513, and 1433/1563.

362 Tobias 2011, 279.

363 Lakatos 2001, 149.

364 Tobias 2011, 279.

365 Tobias 2011, 284–285.

366 Fülöp et al. 2018, 500–506.

367 Lőrinczy 2022, 125.

1512/1650, and one of the vessels in Grave 1433/1563, slight traces of smoothening can be observed on the pots, but not on the entire surface. The poor technological execution indicates that these vessels were probably not made by craftsmen.

In terms of shape, the cooking pots from Tiszakürt are rather diverse. The typological classification of T. Vida was used but some vessels were impossible to assign to a single group. The pots belonging to group IIID1 are relatively small, their widest point located either in the upper third of the vessel or at the midline, and their rims are slightly curved.[368] In earlier scholarship, finger impressions or diagonally incised decorations were highlighted as major characteristics of this subgroup, but these were not observed on all the Tiszakürt vessels.[369] The two cooking pots from Grave 1433/1563 and the single vessel from Grave 1512/1650 belongs to this group. An object of this shape was found in Grave 7 at Öcsöd-MRT 96a; also with an undecorated rim.[370] Four of the six vessels from Szeg-vár-Sápoldal belong to this group.[371] The type was also numerous at the Szegvár-Oromdűlő site: 20 graves contained ceramics of this type.[372] One of the vessels from Grave 33 of Hódmezővásárhely-Kishomok can also be classified within group IIID1.[373]

Vessels from Graves 1414/1543, 1500/1637, 1501/1638, and 1416/1555 belong to the subgroup IIID2 in Vida's classification. These objects have a narrowing mouth and a body that is widest in the middle or at the bottom.[374] The pot in Grave 1416/1555 had a rudimentary base ring, which is considered unique in this subgroup. Type IIID2 occurred in fewer cemeteries of the studied region. One of the vessels from Grave 33 at Hódmezővásárhely-Kishomok or a stray find from the site of Öcsöd-MRT 96a are notable examples.[375] At the same time, this subgroup was the most widespread in Szegvár-Oromdűlő, with 33 burials containing such cooking pots.[376]

The vessels of Graves 1324/1437, 1426/1555, and 1439 belong to the subgroup IIID5. These are relatively short cooking pots, characterized by a widening, funnel-like rim.[377] Tivadar Vida emphasized that these vessels are not related to the tall, narrow funnel-necked pots typical of the Trans-Tisza region, and their distribution is also different.[378] The rims of pots from Graves 1426/1555 and 1439/1570 were decorated with finger impressions. Although this rim decoration is not very common in the group, similar embellishments can be observed on the vessel found in Grave 329 at Szegvár-Oromdűlő.[379] The type is represented by 18 examples in the Szegvár-Oromdűlő cemetery.[380] In Grave 7 of Szegvár-Sápoldal, there was a vessel protruding in the middle, which belongs in this group based on its rim.[381]

6.8.2 Bowl

In Grave 1482/1619, a bowl made without potter's wheel was found to the left side of the human skull. This vessel form is quite rare in the Trans-Tisza region in the 6th–7th centuries; only two other

368 Vida 2022, 529.
369 Vida 1999, 138; Vida 2022, 529.
370 Madaras 2004, 360, Fig. 6.7.
371 Cf. Lőrinczy 2018, Fig. 11.1,3,4,6.
372 Cf. Vida 2022, 544, Tab. 4.
373 Lőrinczy – Varga 2022, 25, Fig. 10.2.
374 Vida 1999, 138; Vida 2022, 531.
375 Madaras 2004, 362, Fig. 8.10; Lőrinczy – Varga 2022, 25, Fig. 10.3.
376 Cf. Vida 2022, 544, Tab. 4.
377 Vida 1999, 138; Vida 2022, 532.
378 Vida 2022, 532.
379 Vida 2022, 539, Fig. 13. IIID5/c3.
380 Cf. Vida 2022, 532, Tab. 4.
381 Lőrinczy 2018, 66, Fig. 11.2.

examples are known. In Grave 10 at Öcsöd-MRT 96a, a large pedestal bowl was deposited behind the skull of the deceased. It contained animal bones. Based on the description, a child was found in the grave, and the earring with a large bead pendant suggests that it was a girl.[382] Another bowl was found in Grave 352 at Szegvár-Oromdűlő, deposited to the left of the skull of an older (*infans II* age group) child.[383]

The three graves are connected not only by their relative geographical proximity, but also by the fact that a child was laid to rest in them; based on the grave goods, two of them were probably girls. At the same time, the three vessels differ in their design; the one from Öcsöd had a high pedestal. Their depth is also different, the one in Szegvár is the deepest, followed by the one in Tiszakürt. This feature may also refer to different functions.

6.8.3 Jug

A funnel-necked jug with a high shoulder was found above the feet of the deceased in Grave 1313/1425. It was made without a potter's wheel. Jugs are uncommon in the Trans-Tisza region; they mainly come to light as tall vessels with small handles.[384] The shape of the Tiszakürt jug is comparable to a small pot with a wide shoulder and a funnel-neck, i.e., Type IIIA2/c1 in Vida's typology.[385] An example of such a vessel is also known from Grave 33 at Hódmezővásárhely-Solt-Palé and Grave 29 at the site of Kiszombor-E.[386] Similar artifacts were found in three burials of Szegvár-Oromdűlő,[387] and in Graves 111 and 182 of the site of Rákóczifalva-Bagi-földek 8a.[388] The Tiszakürt jug may have developed from this form, the main difference being that in its original form, the artifact was equipped with a spout and a handle.

The connection between Type IIIA2/c1 and the jar from Tiszakürt is supported by the black paint-run pattern on the shoulder and on both sides of the spout on the jug (Fig. 85.1,3). Previously, this has only been documented on funnel-necked vessels.[389] Similar decorations are also known from the vicinity of Tiszakürt, e.g. from Grave 32 at Öcsöd-Site Nr. 59, Hódmezővásárhely-Sóshalom and Graves 692, 727, and 870 of Szegvár-Oromdűlő as well as from Grave 131 at Békésszentandrás-Bendatanya (Fig. 85.2).[390] A pottery sherd with a similar decoration was found in the Avar settlement of Hódmezővásárhely-Batida (Fig. 85.4),[391] and a fragmented jug with paint-run pattern was recovered from Grave 6 at Kövegy-Nagy-földek.[392]

6.8.3.1 Examination of the paint-run pattern on the jug

In order to determine the origin of the paint, analyses were carried out using a Renishaw inVia Qontor Raman microspectrometer. Raman spectroscopy is a non-invasive, non-destructive analytical technique that provides insights into the molecular composition and vibrational modes of matter. This method involves illuminating a sample with monochromatic visible light (with lasers). When light interacts with the molecules in an object, some of the light scatters inelastically,

382 Madaras 2004, 341.
383 Lőrinczy 2020, 150.
384 Vida 1999, 134–135.
385 Cf. Vida 1999, 116, Abb. 37.
386 Vida 1999, 261–262.
387 Vida 2022, 513, Tab. 1.
388 Mácsai 2012, 111, Pl. 40.1, 182, Pl. 51.1.
389 Vida 2022, 516.
390 Vida 1999, 113; Vida 2022, 516; Balogh et al. 2023, 233, 7. kép 1.
391 Pópity 2021, 62, Fig. 30.2.
392 Benedek – Marcsik 2017, 434, Pl. 22.1.

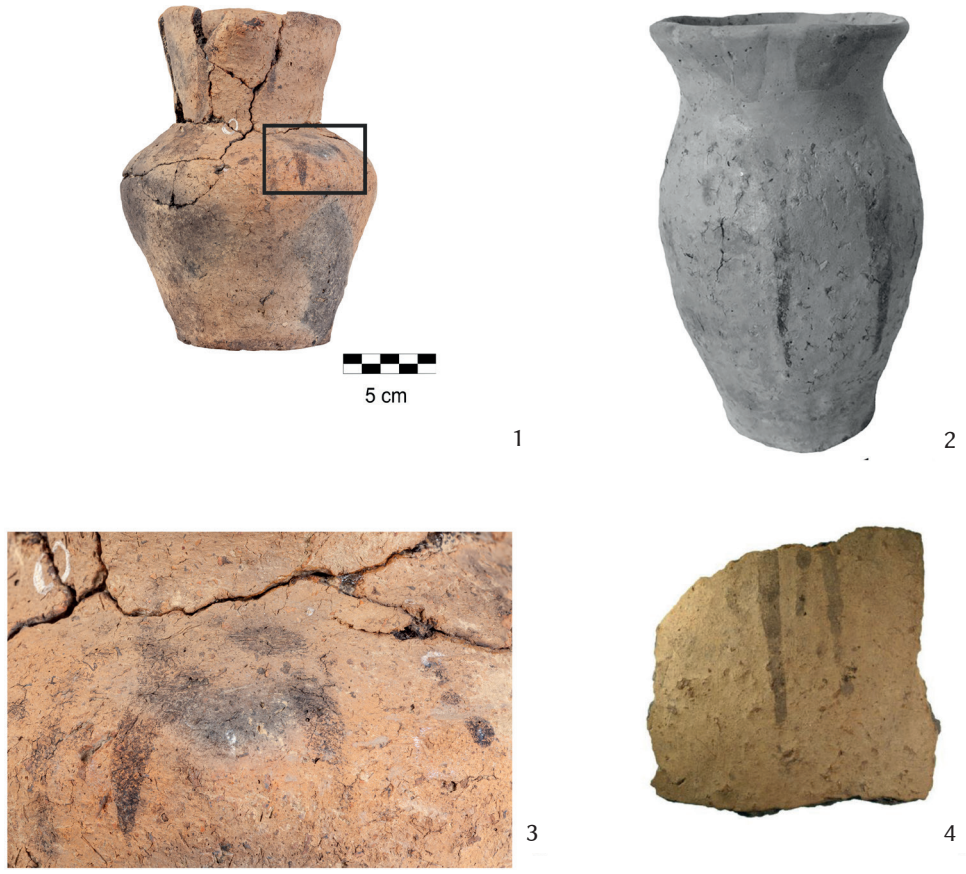

Fig. 85. Vessels with black paint-run pattern. 1, 3 – Tiszakürt-Zsilke-tanya, 2 – Grave 131 of Békésszentandrás-Benda-tanya, 4 – Hódmezővásárhely-Batida (2 – after Balogh et al. 2023, 4 – after Pópity 2021)

a phenomenon called Raman scattering. Unlike traditional spectroscopy, Raman scattering observes changes in energy levels of scattered photons. These energy shifts are related to the vibrational and rotational motions of molecules within the sample, offering a molecular fingerprint of the substance. These fingerprints are then compared to a database to determine the composition and structure of various substances.

The measurements were conducted at the National Institute of Archaeology of the Hungarian National Museum in Budapest. Diode-pumped solid-state laser with a 532 nm (green) excitation wavelength was used to illuminate the samples, displaying ~0.5 mW on the sample surface. A Leica 20× (N.A. = 0.40) objective was used to focus the laser on the jug's surface, meanwhile a Leica 50× (N.A. = 0.5) objective was used to analyse the scratched off materials. The instrument was used with standard confocality and 1200 grooves/mm optical grating. The measurements were carried out with varying exposure times to achieve the best possible noise to signal ratio. Wire 5.6 software was used to elaborate the Raman spectra.

To determine the composition and origin of the black paint on the jug, *in situ* measurements, as well as analyses of removed, scratched-off black material were carried out. On all the gathered spectra, the main Raman bands of carbon-carbon bonds were observed (Fig. 86). Bands, characteristic for amorphous and poorly crystalline carbonaceous materials, were observed near 1360–1380 and 1590–1600 cm^{-1}. The first one is usually referred to as D-band (disordered), meanwhile the latter one as the G-band (graphite). The position, as well as the width and intensity of these two bands suggest that the black paint consists of carbonized carbonaceous materials, such as coal, char, tar or pitch. By quantifying these parameters of the D and G band, it is possible to assume the origin (plant, animal, or natural hydrocarbon), firing temperature, and oxidation of the carbonaceous material.

Based on the recent work of D. Deldicque and his colleagues, we determined the position and height of bands D and G (H_D, H_G), and the valley (H_V) in between them (Fig. 86.2,3).[393] According to them, the shift of D and G bands towards higher Raman shift and their increased intensity can be accounted for later oxidation of the carbonaceous material. Based on the ratio of H_D and H_G (~0.8–0.9), a firing temperature between 800 and 900 °C can be assumed,[394] but the slight shift of D-bands to 1363–1376 cm^{-1} indicates oxidation. This oxidation can lead to overestimated firing temperatures, however, if only those spectra are used which exhibit the least oxidation, the firing temperatures still range between 833 and 895 °C (±15 °C). Besides the two main bands, a small intensity band near 1700 cm^{-1}, characteristic for carbonyl groups, was also studied.[395] Its intensity suggests plant origin for the studied carbonaceous materials.[396]

According to the results, the black paint on the jug is made of charred organic material. Carbon-based black pigments are the most common ancient black pigments,[397] and their main types can be described based on their origin: chars (from plants), cokes (bone) and flame carbons (hydrocarbons). All these black pigments had to be produced by burning the raw material before its application to the pottery, thus further analyses on the matrix of the ceramic and on the burn marks may help determine the firing temperature of the pottery as well.

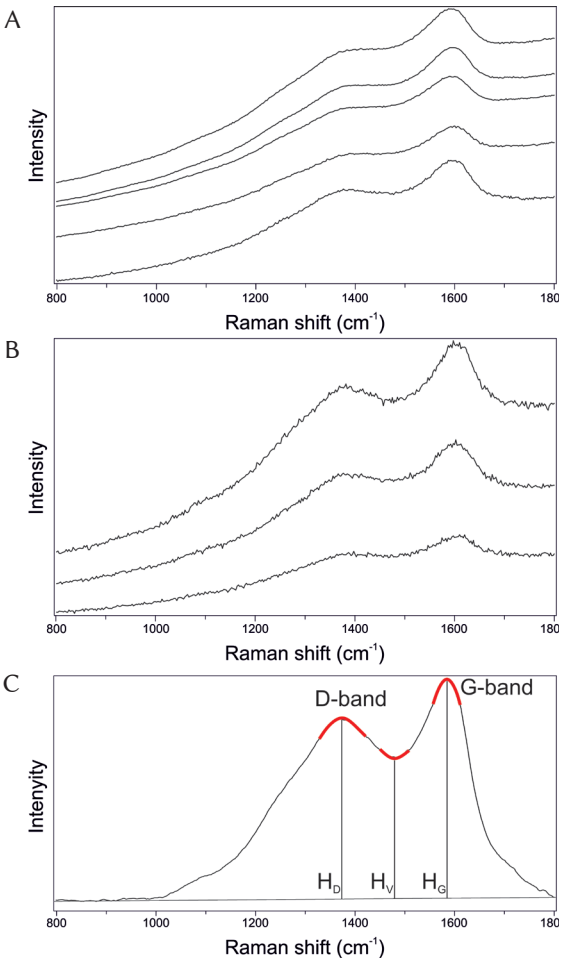

Fig. 86. Typical Raman spectra of the black paint-run pattern on the vessel (A) and from the scraped samples (B). C – Characteristic parameters of the Raman spectrum of carbonized organic material

6.9 XRF and SEM analysis of selected glass objects

6.9.1 Analytical methods

Analytical measurements were performed on twelve glass samples (Tab. 7). The instrumental analyses were preceded by a Leica M125 C type stereomicroscope examination, where the external characteristics of the objects were analyzed and the areas for the instrumental analysis were selected (Fig. 87). The samples intended for examination were measured with a scanning electron microscope (SEM) and a micro-X-ray fluorescence spectrometer (μXRF). The analysed objects were only subjected to surface cleaning to remove the outer layer, possibly covering the sample, from the areas to be measured. In the case of glass samples, the preservative and weathered outer layer;

393 Deldicque et al. 2023.
394 Deldicque et al. 2016.
395 Socrates 2004.
396 Deldicque et al. 2023.
397 Eastaugh et al. 2007.

Tab. 7. The investigated glass samples according to site, designation and identifiers

Grave number	Designation	Tracking number	Investigated number of items	Sample number
1383/1512	fragments of melon seed-shaped beads	3610	4	3610_a
				3610_b
				3610_c
				3610_d
1433/1563	melon seed-shaped bead	3269	1	3269
1433/1563	pendant made from a handle of glass vessel	3266	1	3266
1482/1619	melon seed shaped-bead	3543	1	3543
		3544	1	3544
		3546	2	3546_a
				3546_b
	fragmented brown bead	3547	1	3548
	fragmented green bead	3578	1	3578

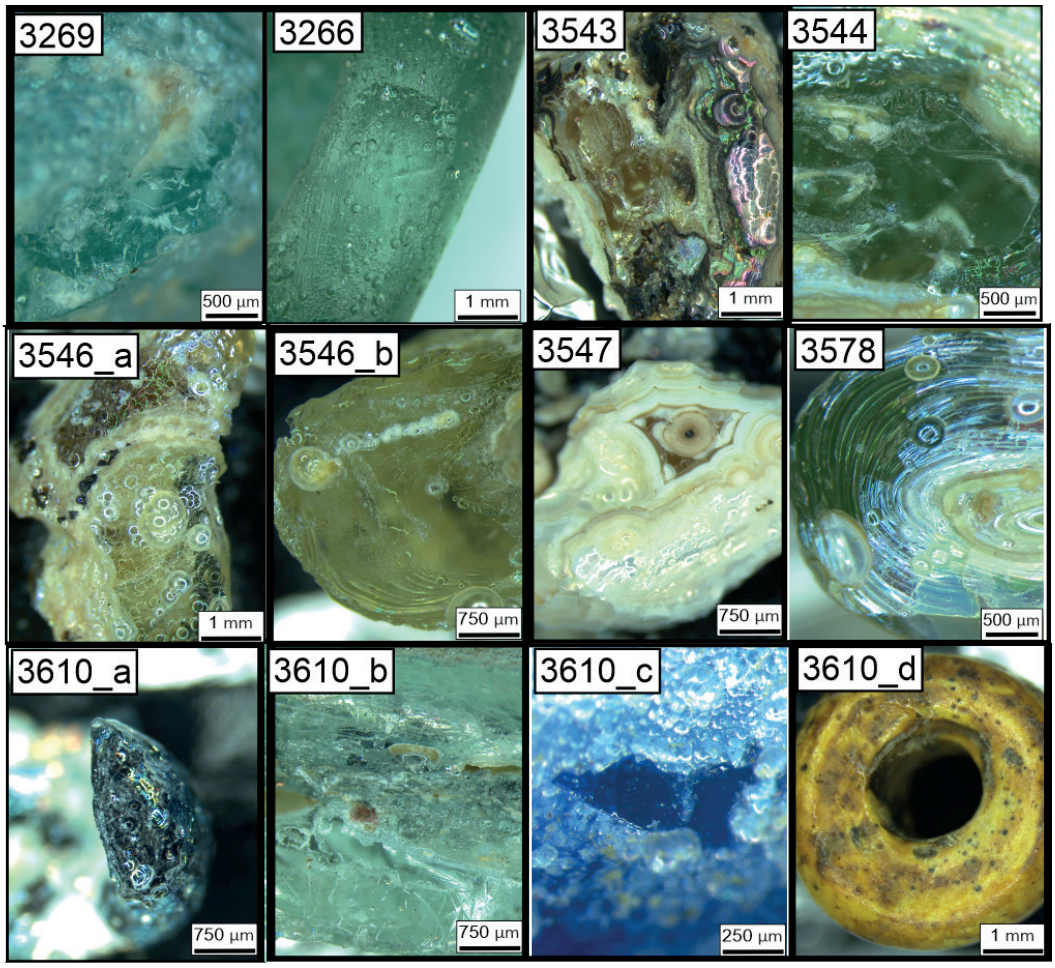

Fig. 87. Stereomicroscopic images of the measured glass samples

in the case of metal samples, both the preservative and external corrosion layers were removed. The SEM examinations were performed with a JEOL IT510/LA scanning electron microscope, during which the analytical measurements were performed with a JEOL EX-74760U1LQ energy dispersive spectrometer with a 60 mm^2 detector surface. The measurements were carried out in a high vacuum (maximum 2 mPa) and an accelerating voltage of 20 kV. In the case of the glass samples, area measurements of 500-2000 μm^2 were made with low magnification, so that the surfaces without a conductive layer were charged as little as possible, while in the case of the metal objects, point measurements were made. In the measurement areas, values between 16,000 and 25,000 cps were typical, with 10–12% deadtime and a net measurement time of 30 seconds. The µXRF measurements were performed on a Bruker M4 Tornado Plus AMICS device, using a Rh radiation source at an accelerating voltage of 50 kV, a sample current of 600 µA, at 2 mbar, with an XFlash 660 XMA energy dispersive spectrometer. Metal objects were analysed with a point measurement of 20 µm in diameter, with a measurement time of 60 seconds; glass samples with a point measurement of 200 µm in diameter, with a measurement time of 100 seconds. Concerning measurement, the three important visible properties of glasses are weathering, colour, and any internal elements. These properties are summarized in Tab. 8. Six of the samples were green, three were blue, three were brown or partially brown, and one was yellow. All but a few were transparent. The exterior of the glass was weathered, which affected a significant part of the sample. This required special attention to identifying the areas with the best possible retention, typically the innermost parts of the samples. The Samples 3543 and 3546_a was dotted with thin black layers, which appeared in the weathered parts, not in less exposed areas. The outer part of Sample 3546_a was light brown, while the inner part was green and pale green. Of the two parts, the green area inside the bead was most suitable for measurement. There were no larger or deeper fracture marks in the Samples 3610_c, 3269, and 3266, so in these cases the least exposed and weathered sections were selected for measurement. The assessment by optical microscope showed internal structural variability in the case of Samples 3547 and 3578. The pattern appeared in the form of thin bands and layers, where the surface was generally much more weathered.

6.10.2 Discussion

The chemical analysis was conducted to determine the original composition of the glass as precisely as possible, and to identify the elements responsible for the colouring. Tab. 9 summarizes the presence of various oxides in the glass, the chemical composition of the measurement points can be found in Tab. 10.

Regarding the original composition of the glass materials, the twelve measured samples could be divided into four groups:

Group 1. This includes six samples (3610_a, 3610_b, 3610_c, 3269, 3543, 3547). These are certainly glass made of natron soda alkali, since the corrected amount of MgO and K2O is below 1.5% by weight. The Na_2O content of the glass was high, mostly over 20 wt% (see Tab. 4), while the CaO content was low, around 5 wt%.[398] In the case of natron soda-type glass, in addition to sand or quartz gravel, slag was mostly used as an alkali-rich fluidizing agent, which results in a higher sodium content and a lower calcium and phosphorus content.[399] The K_2O and MgO values of such glass materials are typically lower (<1.5–1.5 wt%).

Group 2. Sample 3610_d has an exceptionally high lead (58.8–63.85 wt% PbO) and tin content (~2 wt% SnO_2). During the measurement, K_2O could not be recorded, but <1 wt% MgO was detected, which

398 Nagy et al. 2010; Foster – Jackson 2009; Arletti et al. 2008.

399 Wedepohl 1993; Freestone 2005; Arletti et al. 2008; Nagy et al. 2010; Freestone 2021.

Tab. 8. Summary of the visible properties of the investigated glass samples

Sample number	Photo of the sample	Fresh glass color	Transparency	Weathering	Other characteristic (optic/SEM)
3610_a		dark blue/ black	translucent	moderately weathered outer layer	the exterior is blue and slightly translucent
3610_b		green	transparent	slightly weathered outer layer	
3610_c		dark blue	opaque/ translucent	moderately weathered outer layer	
3610_d		yellow	opaque	not weathered	Pb, Sn patches on BSE image
3269		blue/ turquoise	translucent	moderately weathered outer layer	
3266		green	transparent	moderately weathered outer layer	
3543		light brown	transparent	heavily weathered outer layer	black/iterative layers in the glass (Figure 2)
3544		green	transparent	heavily weathered outer layer	inhomogeneity in the glass on the BSE image
3546_a		green/ slightly brown	transparent	heavily weathered outer layer, slightly weathered inner parts	outer part is light brown; black/iterative layers in the glass
3546_b		green	transparent	slightly weathered outer layer	
3547		brown	translucent	heavily weathered	inhomogeneity inside the glass based on colors
3578		green	transparent	heavily weathered outer layer	layers appearance inhomogeneity in the glass on the BSE image

suggests that the base glass was of the natron soda type in this case as well,[400] but due to the large amount of lead stannate added as a pigment, the Na_2O (<1 wt%) and SiO_2 content (<10 wt%) was significantly reduced.

Group 3. The inner part of Sample 3266 was less accessible and the measurement may also have been affected by the weathering of the glass, so the evaluation of the sample is somewhat limited. This is indicated by the content of 3 wt% Na_2O, 10 wt% Al_2O_3 and 75 wt% SiO_2. Compared to previous glass groups, this sample had a higher MgO (>3 wt%) and K_2O (>3 wt%) content, which is characteristic of 'plant ash'-types of glass. For plant-ash glass, the sodium-rich ash of halophytic plants was used.[401] In this case, too, a higher sodium content (Na_2O >15 wt%) is typical, but with a slightly higher calcium and phosphorus content than the natron soda, and the K_2O and MgO content of the plant-ash type glass is typically ~2–2.5 wt% above. In the range between the K_2O and MgO content of the two types of glass (1.5–2 wt%), it can be assumed either that the two types of glass were mixed with each other, or that the ash of another plant was used for making the glass.[402] Plant-ash glass is known to have been in use since the Bronze Age, and after a larger hiatus in the 8th and 9th centuries.[403] From the turn of the 9th century, the glass type began to spread again. On the other hand, the use of natron soda glass produced from Egyptian soda ash was widespread in the territories of the Roman Empire.[404]

Group 4. In four samples (3546_a; 3546_b; 3544; 3578), a higher amount of MgO (>1.8 wt%) was observed, but a very low K_2O content (<0.8 wt%). The combination of the increased magnesium and potassium content suggests plant-ash base glass,[405] however, it is justifiable to assume the use of a mixed alkaline glass type. The base glass in this case is also Na–Ca–SiO_2, mixed with plant ash, which slightly increased the magnesium level, but not in a proportion that would be typical for plant-ash base glass. It differs only slightly from the magnesium ratio of natron soda glass. In addition, a slightly elevated Al_2O_3 is expected for these samples. The proportion of aluminium in natron soda glass is relatively standard around 2.5 wt%, while the examined samples uniformly varied between 3–4.5 wt%. On the one hand, the increased aluminium may also mean that the source of the sand has changed,[406] but together with the increased magnesium content, it can also be linked to the recycling of glass. The higher aluminium ratio comes from impurities from the crucibles, which increases the viscosity of the glass, so some source of alkali is needed to make it easier to work with. The differences in the potassium and magnesium content, as well as the variable aluminium content, could be related to the source of alkali added to the broken glass, in our case, the addition of plant ash and the recycling of the glass.[407] It is imperative to stress here that the reprocessing of the glass fragments could not have taken place in the Carpathian Basin either, since the Avars could not have access to the ash of halophytic plants rich in potassium/magnesium. Like all early medieval glass, it may have come from the Middle East as a commercial commodity, then the raw material was heated locally and shaped into beads of various shapes.

Different oxides (CuO, CoO, FeO, PbO, SnO_2, MnO) added to the base glass are responsible for the different colours of the glasses. However, the sand used to make the glass contains impurities, so even without any additives, the basic glass itself is not completely transparent, but usually has a

400 James et al. 2014, 16.

401 Nagy et al. 2010; Henderson et al. 2004; Freestone 2005; Dussart et al. 2004, 77.

402 Cottam – Jackson 2018, 95.

403 Henderson et al. 2004; Freestone 2021.

404 Freestone et al. 2000; Mirti et al. 2008.

405 Nagy et al. 2010; Henderson et al. 2004; Freestone 2005; Dussart et al. 2004, 77.

406 Dussart et al. 2004, 79–80.

407 Dussart et al. 2004, 78–81.

green, blue-green (turquoise), light blue shade. These colours are mainly due to Fe^{2+}, which is present in the sand or in the ash of halophytic plants.[408]

Out of the twelve glass samples examined, six had a transparent green-light green colour. Another three pieces were of different shades of opaque and/or translucent blue. Two of the remaining three pieces were brown translucent glass, and one was yellow and opaque.

Fig. 88 shows the MgO and K_2O wt% content of the examined pieces, marked by their colour. Two larger groups emerge in the diagram, showing a colour grouping of sorts. The vast majority of green pieces are above the dotted line, which is typical of mixed alkali type glass, while the blue, brown, and yellow ones are below the dotted line, which are typical of natron soda type base glass. The inner part of the green Sample 3266 was less accessible, so the method of colouring could only be partially examined. The yellow glass Samlpe 3610_d has the lowest MgO and K_2O content.

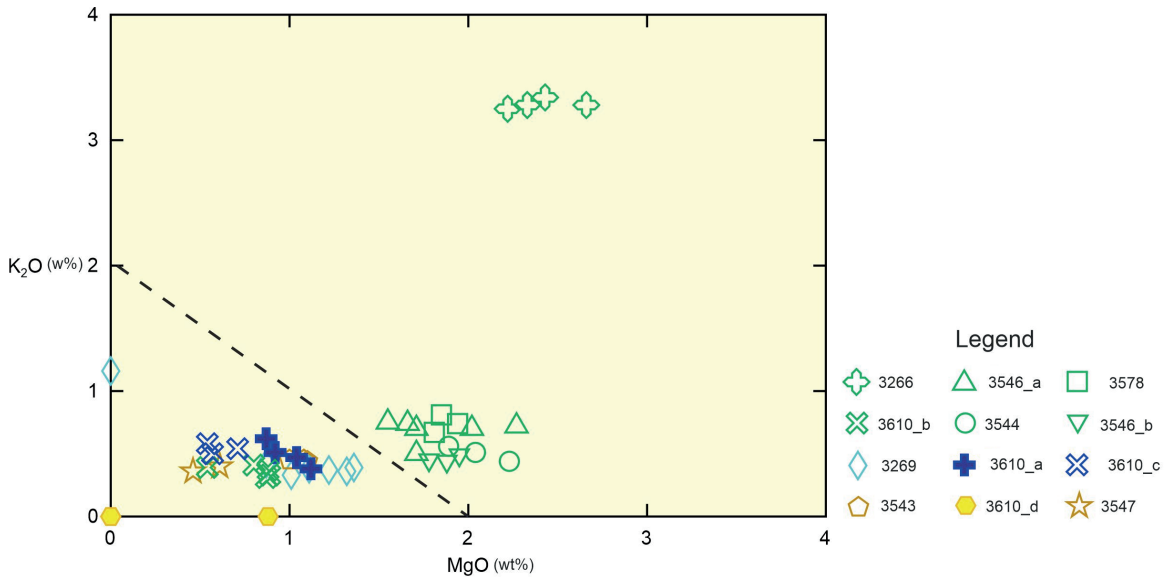

Fig. 88. Representation of the MgO and K_2O oxide mass percentage values of the measured glass samples on a Harker diagram. The area below the dashed line represents the 'soda' or Roman type of base glass, while the area above the dashed line represents the 'ash'; or Mesopotamian glass

Tab. 9 shows the elements responsible for colouring. Manganese and iron are present in all coloured glass, only their concentration varies.[409] The amount of iron does not exceed 1 wt% (average 0.73 wt%) in the examined samples, so it cannot be considered an additive in the base glass. In the completely green pieces, the amount of MnO varies between 0.2–0.33 wt%, however, in brown glass it was close to 1 wt% and on average values above 0.7 wt% could be measured. Thus, the transparent green colour of the glass may be caused by the inherent iron content of the base glass, while brown colouring is caused by a higher manganese content and the combined presence of FeO.[410] However, a value below 1 wt% does not necessarily mean the use of an additive,[411] so the tint is not necessarily the result of a conscious colouring process.[412] This is also suggested by the fact that the occurrence

408 Silvestri et al. 2005; Foster – Jackson 2009; Nagy et al. 2010.

409 Dussart et al. 2004, 79–80.

410 Nagy et al. 2010; Heck – Hoffman 2002, 76.

411 Fórizs 2008.

412 Experimental archaeological research has shown that colouring is one of the most complex parts of glass processing. The colour is formed by the combination of impurities and added oxides in the base glass, also depending on the oxidation environment in which it is made. Thus, the process can often result in an unexpected result, cf. Staššíková-Štukovská et al. 2020.

Tab. 9. List of elements detected by SEM and μXRF in the examined glass samples according to the color of the glass. The elements are shown in their oxide form, and the colored cells marked with an X indicate their possible glass coloring

Sample	Color	Na_2O	MgO	$Al2O_3$	SiO_2	$P2O_5$	SO_3	Cl	K_2O	CaO	TiO_2	MnO	FeO	CuO	CoO	BaO	PbO	ZrO_2	SnO_2
3269	blue/turquoise	X	X	X	X			X	X	X	X		X	X			X		
3578	green	X	X	X	X	X	X	X	X	X	X	X	X						
3547	brown	X	X	X	X		X	X	X	X		X	X						
3544	green	X	X	X	X			X	X	X									
3546_a	green (slightly brown)	X	X	X	X	X	X	X	X	X	X	X	X	X		X			
3546_b	green	X	X	X	X		X	X	X	X		X	X						
3543	light brown, black	X	X	X	X	X	X	X	X	X	X	X	X	X		X			
3266	green	X	X	X	X			X	X	X			X						
3610_d	yellow	X	X	X	X	X		X		X			X				X	X	X
3610_a	dark blue / black	X	X	X	X		X	X	X	X		X	X	X					
3610_b	green	X	X	X	X			X	X	X									
3610_c	dark blue	X	X	X	X			X	X	X			X	X (xrf)	X (xrf)				

of brown beads cannot be considered common in the Avar period. Interestingly, the iridescent black parts of the brown glass have a very high manganese content (MnO 36.1–47.74 wt%), as well as a significant amount of barium (BaO 2.78–3.83 wt%), and little copper (CuO 2.04–3.27 wt%).

There are three different shades of blue glass. The turquoise colour can be achieved by adding copper and/or lead (Tab. 11).[413] In the turquoise Sample 3269, 6.63–8.95 wt% PbO was measured by SEM, but the presence of copper could not be detected with sufficient certainty. Due to the higher excitation energy and its greater sensitivity to heavier metals, copper (1.37 wt% CuO) was detected in the sample already during the XRF measurement. Since there are significant differences between the PbO and CuO content of the SEM and XRF measurements, and it was difficult to find fresh areas on Sample 3269, it is not possible to establish the exact ratio of lead and copper with absolute certainty. In the dark blue-black sample marked 3610_a, the presence of copper was also detected (SEM: 0.33–1.15 wt%; XRF: 1.33–1.36 wt%), which may have been the cause of the blue colour. In addition to copper, compared to the other glass samples, a somewhat larger amount of manganese (0.58–1 wt% MnO) was detected, which may have caused the darker colour and transparency of the sample. The presence of cobalt (0.27 wt% CoO) was detected by XRF on the relatively less exposed surface of the dark blue Sample 3610_c, and a small amount of copper (0.45 wt% CuO) was also detected. However, a small amount of cobalt is sufficient for the dark blue colour of the sample, as it is one of the strongest metal colouring agents and can produce a characteristic 'cobalt blue' colour in the glass even in a few hundred ppm quantity.[414]

413 Fórizs 2008; Nagy et al. 2010; Henderson 1985; Weyl 1951.

414 Henderson 2013, 69.

Compared to the other samples, the yellow opaque Sample 3610_d has an extremely high lead (58.8–63.85 wt% PbO) and tin content (~2 wt% SnO_2). On the BSE image (Fig. 89), light spots with an average diameter of 4 µm can be observed, which are almost entirely lead-tin oxides (~66 wt% PbO, ~30 wt% SnO), giving the bead its opaque character.[415] The use of lead stannate (PbSnO3) as a colorant is known from the 4th century, when tin took over the role of antimony-based colorants. Heating the oxides of lead and tin produced a pigment that was mixed into the existing natron soda glass to produce an opaque yellow glass. The method of colouring with lead-stannate and a high proportion of lead is a production technique often found in early medieval yellow glass beads.[416]

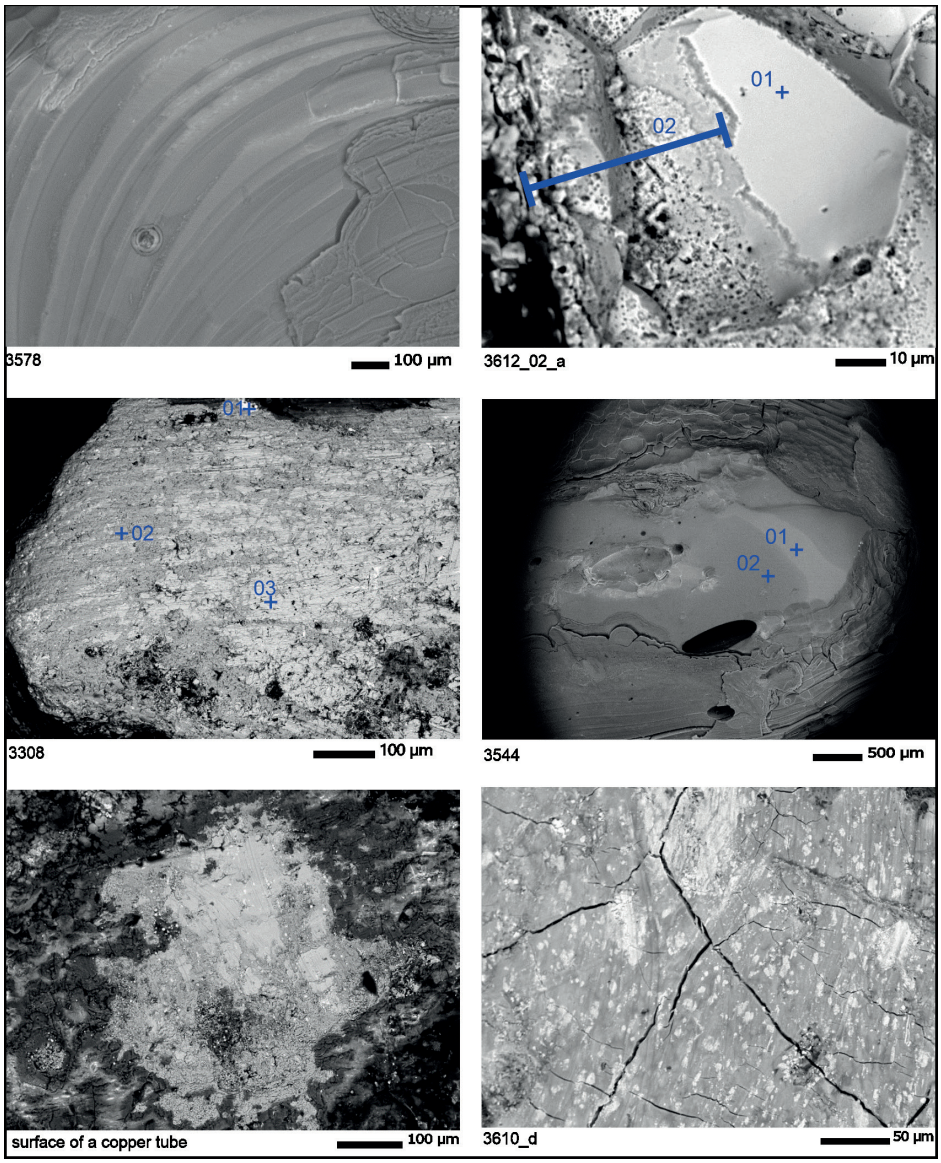

Fig. 89. BSE images of the glass and metal samples. 3578: broken surface of green glass (medium gray color indicates fresher parts than those that have a darker gray color); 3612_02_a – fractional section of the earring (01 – clear silver, 02 – bromine chlorine weathered zone); 3308 – fragment of the pouch fastener (01 – lead grain; 02 – copper; 03 – copper-zinc alloy); 3544 – broken surface of green glass (01 – fresher part, 02 – weathered part); surface of a copper tube of a bead (white grains: lead, tin, arsenic etc. grain compositions, light gray parts: clear copper composition); 3610_d – surface of the yellow lead glass (light spots indicate parts that are rich in lead and tin; the lead-rich parts are grey)

415 Fórizs 2008.

416 James et al. 2014, 18; Heck et al. 2003.

6.10.3 Conclusions

Based on the twelve glass samples examined, four types of glass could be distinguished: half of the samples belong to the sodium glass group that has been common since Roman times. In addition, a natron soda glass with a high lead content, four types of mixed alkaline glass, and a possible plant-ash glass were identified. The MgO and K_2O discrimination diagram shows the samples of the different groups clearly separated from each other.

Four basic colours could be distinguished: green, blue, brown, and yellow. Based on the measurements, the green colour and the transparency come from the composition typical of the base glass, which may be caused by the presence of iron.[417] Two to three times higher manganese composition could be measured in the brown glasses than in the green glasses, and it may have caused a brown colour together with iron oxide.[418] Black iridescent layers could be observed in the brown glass, which showed a high MnO composition exceeding 30 wt%, and more than 3 wt% BaO. Among the blue pieces, three colour shades were distinguished, which differed in their chemical composition. In the turquoise blue glass Sample 3269, the combined presence of copper and lead is likely to have caused the turquoise colour. The dark blue-black colour of the Sample 3610_a can also be caused by the presence of copper, while MnO around 1 wt% can be responsible for the darkness and opacity. In addition to the presence of copper, the dark blue (royal blue) colour of the glass marked 3610_c is caused by a small amount of cobalt, which can produce a dark blue colour even in a very low concentration. The yellow colour in the Sample 3610_d and the opaque character are caused by the lead-tin oxide particles with an average diameter of 4 μm in the glass.

Despite the small number of samples, the analysis identified a number of characteristics. The widespread use of natron soda glass and the method of producing opaque yellow glass beads were well known from earlier times.[419] Both were common in early medieval glass production and bead making, and are demonstrated within this cemetery too. The use of mixed alkaline glass is also detected, which, however, is considered an uncommon practice. To date, no similar data has been reported in the Carpathian Basin, so its presence in the region definitely shows the variability of the imported glass material.

The appearance of several types of glass within a single cemetery, as well as the difference in colouring procedures (even within a single shade), proves the heterogeneity of glass procurement and processing. While the type of glass used was determined by trade, the colour and shade was determined by the technical knowledge of local craftsmen.

6.11 XRF and SEM analysis of selected metal objects

6.11.1 Analytical methods

In total, eleven metal items were examined,[420] four of them were the metal tubes of the melon seed-shaped beads. Primarily, μXRF measurements were carried out on these objects (Tab. 12) to gain a general understanding regarding the material composition. In addition, some samples were also subjected to electron microscopic examinations when the μXRF measurement results raised further questions or when the optical examination suggested that the given sample was structurally complex. The samples underwent preliminary cleaning to ensure a fresh test surface. Based on the μXRF results, three main compositional groups were distinguished: silver, copper-alloy, and lead-based items.

417 Silvestri et al. 2005; Fórizs 2008; Foster – Jackson 2009; Nagy et al. 2010.

418 Nagy et al. 2010; Heck – Hoffman 2002, 76.

419 Fórizs 2008; Staššíková-Štukovsá – Plško 1997.

420 Two earrings were broken, in those cases two and three parts were examined respectively.

Tab. 12. List of the examined metal objects

Grave number	Designation	Tracking number
1310/1422	pendant made from a slotted spoon	3249
1311/1423	silver earring	3150 and 3312
1383/1512	silver hoop earring	3161
1383/1512	bronze bracelet	3157
1500/1637	silver earring	3609 and 3612; 3610 and 3612
1307/1419	pouch fastener	3308

6.11.2 Discussion

The first group consists of silver earrings. The silver hoop earring from Grave 1311/1423 (Sample 3150) has a concentration of 79.25 wt% silver and 13.88 wt% gold, the highest gold content in the assemblage by far. The analysis of their chemical composition revealed that most of the silver items were made from pure silver. Gold and copper may be present as impurities and may originate from the ore used. This earring has a higher concentration of gold and can be considered as more of a silver-gold alloy. The metal composition analysis of the earring from Grave 1500/1637 revealed that it contains less than 90 wt% of silver. Gold could be detected between 1–5 wt%, and a copper concentration of around 2–3 wt% was also evident. The hoop earring from Grave 1383/1512 (Sample 3160) contained the highest amount of silver: around 90% of wt. The earring with spherical pendant from Grave 1311/1423 (Sample 3312) had less than 90% wt of silver, around 19 wt% chlorine, and 7 wt% of bromine. Based on the composition, the silver may have undergone a complex method of transformation, but the base metal must have had a high concentration of silver. Since no public information is available about the examination of the material composition of similar silver objects,[421] contextualizing the results remains a task for the future.

Copper alloy objects come with diverse material compositions; practically all of them can be classified into different types.[422] For example, the bracelet from Grave 1383/1512 (Sample 3157), has a copper concentration of 82.45 wt%, with 10.77 wt% zinc present as the second largest amount. Besides the copper and zinc, it had a 1.93 wt% concentration of tin and 3.61 wt% lead, so the composition of the bracelet can be considered brass. To date, no brass jewellery has been examined from the Early Avar Period, so some objects from the Early Byzantine site of Jerash in Jordan can be used as a comparison. The examined objects contained Zn between 12 wt% and 23 wt%, which is considerably higher than the ratio in the sample from Tiszakürt.[423] The fragmented pouch fastener from Grave 1383/1512 (Sample 3308), on the other hand, has only 5.39 wt% zinc, 5.45 wt%, tin, and 1.76 wt% lead, so it can be described as leaded tin bronze. As noted above, this object was probably a part of an Early Byzantine lamp holder chain. Such objects were examined from Sardis, in Anatolia. According to J. Waldbaum, the chains were primarily made of brass, however, one polycandelon was leaded tin bronze.[424] The pendant made from a slotted spoon (Sample 3249) had the highest copper content; in addition to a copper concentration of 92.39 wt%, zinc, lead, and tin also appeared, but in less than 2 wt% concentrations, so it cannot be classified as a special alloy.

421 Only the earrings with large spherical pendants from Grave 2 of Orosháza-Bónum were examined. They were made of brass, and tinning was traced on their surface (Rózsa et al. 2013, 10).

422 For the hereby-used terminology was borrowed, see Bourgarit – Thomas 2012; Asinelli – Martinón-Torres 2016.

423 Orfanou et al. 2020.

424 Waldbaum 1983, 175–176.

The metal tubes were examined at high magnification with an electron microscope so that the internal structure of the exposed surface could be seen, and in the same areas, the average composition of the metal tubes was also examined with μXRF with a measurement point size of 20 μm.

During the SEM examinations, it was observed that the tubes are almost entirely made of copper because the presence of copper was over 99 wt% in the parts, showing a larger, homogeneous area (Fig. 89). The inhomogeneity present in the samples was shown in grains with an average diameter of 1 μm, which consisted predominantly of lead, antimony, tin, and arsenic (Tab. 13). In one case, silver particles could be found in the metal tube belonging to glass sample 3544; however, it cannot be ruled out that if larger and cleaner surfaces were examined, these silver particles would not occur in all samples.

Examining their average composition, the 20 μm measurement points of the μXRF also showed an exceptionally high copper composition of around 98 wt% (Tab. 13). The difference between the SEM-EDS and μXRF data is mainly due to the difference in measurement points and excitation energy, as well as the fact that in the case of μXRF, it was less likely to exclude more corroded areas.

The item from Grave 1483/1620 could not be properly interpreted due to its poor preservation and unusual form. It showed a lead concentration of 93.24 wt% and a tin concentration of 6.67 wt%, which suggests that the sample can be considered a lead-tin alloy.

Electron microscopic examination was made on four samples: 3249, 3308, 3612_02_a, and the lead object from Grave 1483/1620. The spherical pendant 3612_02_a resembles 3312_a, in which an advanced transformation was detectable by XRF measurement, based on its composition. A fresh cross-sectional fracture was found on the sample examined with SEM, which allowed an insight into the internal structure of the pendant. Based on the BSE images (Fig. 89), two distinct layers can be observed. The inner core showed 97 wt% of silver and 5 wt% of copper, while the outer layer showed 84 wt% of silver, 8.54 wt% of chlorine, and 5.21 wt% of boron. This is consistent with the data measured by μXRF on Sample 3312_a and supports the idea that the material had already undergone a more advanced transformation.

6.11.3 Conclusions

In summary, three main compositional groups could be distinguished. Most of the metal objects are made of silver-gold alloy, among which the silver ring, Sample 3150, stands out with its nearly 14 wt% of gold content. Copper alloys comprise another large group of artifacts, with several subgroups. The bracelet (Sample 3157) was made of brass; the pouch fastener (Sample 3308) is made of leaded tin bronze due to its significant zinc content, while the pendant made from a slotted spoon (Sample 3249), with its nearly 7 wt% content of other elements, is more widely classified as a copper object. The metal tubes of the glass beads are made of copper, in which various other elements occur in varying amounts; lead was detected in the largest amount, followed by antimony, tin, and arsenic. Sample SNR_1620 is a lead-tin alloy.

7. Association between the spatial location, grave goods, age at death, and sex

The limited number of graves and the lack of comprehensive knowledge about the entire cemetery, including its extent and larger structure, pose challenges to our analysis. Consequently, any broader conclusions must be approached with caution. Notably, graves of children were predominantly situated within a distinct group (Fig. 90). Similarly, the two certifiably male graves were relatively close to each other rather than dispersed throughout the excavated cemetery. In contrast, there is no apparent correlation in the location of female graves, and no discernible pattern emerges in the spatial arrangement of female and child graves.

Tab. 13. The averaged μXRF and SEM-EDS measured results of metal objects in the form of atomic weight percentage, normalized to 100%. Cells marked with dark green indicate the most abundant elements in the given sample, yellow ones indicate the second most abundant element, blue indicates the third most abundant element in the sample

SEM results of the metal tubes of the melon seed-shaped beads

Sample	Spectrum	O	Mg	Al	Si	P	S	Cl	K	Ca	Ti	Fe	Ni	Cu	Zn	As	Br	Ag	Sn	Sb	Au	Pb	Total
Metal_3578	spt_01	9.36						0.89						89.75									100
Metal_3578	spt_02	0.47												99.53									100
Metal_3578	spt_03	4.1						0.69						56.92		4,64				0.91		32.74	100
Metal_3578	spt_04	1.05						0.29						98.67									100
Metal_3544	spt_01	18.42						5.36				0.91		16.39					3.53	20.8		34.59	100
Metal_3544	spt_02	2.27			0.2			0.34						33.86				63.33					100
Metal_3544	spt_03	11.06										0.58		34.2						14.51		39.66	100
Metal_3544	spt_04	0.5			0.13									99.37									100
Metal_3544	spt_05	0.69			0.17									99.15									100
Metal_3544	spt_06	0.58			0.17									99.25									100
Metal_3546	spt_01	3.64												62.41		4.32				2.03		27.6	100
Metal_3546	spt_02	3.14												61.4		2.65				7.52		25.28	100
Metal_3546	spt_03	3											0.74	52.46		2.29				15.05		26.46	100
Metal_3546	spt_04	0.51												99.49									100
Metal_3546	spt_05	0.63						0.13						99.24									100
Metal_3546	spt_06	0.51												99.49									100
Metal_3543	spt_01	2.99					0.81							39.72						5.25		51.23	100
Metal_3543	spt_02	0.73					0.22							99.05									100
Metal_3543	spt_03	0.38												99.62									100
Metal_3543	spt_04													100									100

μXRF results of the metal tubes of the melon seed-shaped beads

Sample	Spectrum	O	Mg	Al	Si	P	S	Cl	K	Ca	Ti	Fe	Ni	Cu	Zn	As	Br	Ag	Sn	Sb	Au	Pb	Total
Metal_3578	spt_01						0.08						0.15	99.70								0.07	100
Metal_3578	spt_02						0.96						0.13	98.66								0.25	100
Metal_3578	spt_03						0.22						0.16	99.31								0.31	100
Metal_3544	spt_01						1.03						0.01	98.86								0.10	100
Metal_3544	spt_02						0.85						0.01	99.05								0.09	100
Metal_3546	spt_01						1.00						0.05	98.38								0.57	100
Metal_3546	spt_02						1.62						0.04	97.05								1.29	100
Metal_3546	spt_03						0.72						0.03	96.74								2.52	100
Metal_3543	spt_01						1.31						0.00	98.52								0.17	100
Metal_3543	spt_02						0.88						0.02	98.99								0.11	100

Avarage μXRF results of the metal items

Sample	Identification	O	Mg	Al	Si	P	S	Cl	K	Ca	Ti	Fe	Ni	Cu	Zn	As	Br	Ag	Sn	Sb	Au	Pb	Total
3150	silver earring			0.50	0.86		2.56					0.04		2.87	0.04			79.25			13.88		100
3157	bracelet							0.71				0.19	0.02	82.45	10.77	0.33			1.93			3.61	100
3161	silver earring													3.07	0.03			90.22	1.85		4.73	0.09	100
3249	pendant made from a slotted spoon				0.54	2.62							0.04	92.39	1.30	0.25			0.66	0.13		2.07	100
3312_a	earring			4.44	1.57			19.1				0.26		0.26			6.78	67.6					100
3312_b	pendant of the earring						0.41	18.12				0.05		0.05			7.34	74.03					100
3609	silver earring													2.22				94.49			3.29		100
3612_01	silver earring													1.99				95.98			1.87	0.16	100
3612_02_a	pendant of the earring						0.15	0.27						2.87			0.06	95.71			0.71	0.22	100
3612_02_b	pendant of the earring							1.06						1.75			0.56	94.4			2.23		100
3308	fragment-ed pouch fastener				1.19	1.05						0.46	0.06	85.86	5.39				5.45			1.76	101.22
SNR_1620	lead object													0.09					6.67			93.24	100

In this early Avar cemetery, the distribution of biological sexes is disproportionate. The analysis of the male graves showed that they adhered to the expected trend: a weapon was found alongside an iron knife and flints in 1384/1513,[425] and a handmade jug and a bronze-riveted belt with an iron buckle was deposited in 1313/1425. These findings align with the expectation of typical Avar Period male grave characteristics. However, an intriguing deviation was observed in the third, presumably male grave (1433/1563), where mainly female-associated grave goods, i.e. spindle-whorl were found. Despite masculine skeletal characteristics, the highly fragmented and incomplete nature of the skeleton does not rule out the possibility of a female burial. If this burial is considered a female grave, then the two males in the excavated cemetery section are situated adjacent to each other.

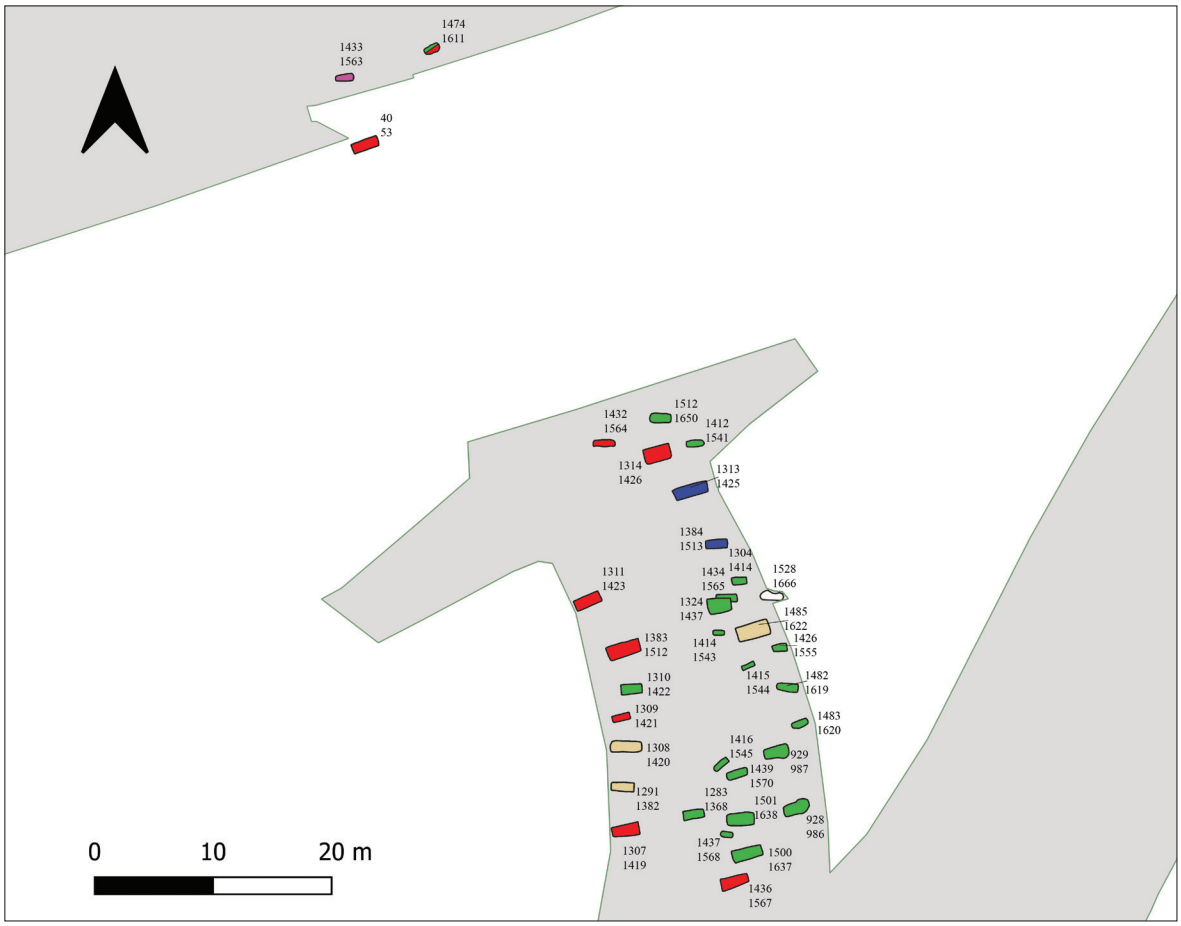

Fig. 90. Sex and age distribution of the graves. Blue – male, red – female, green – child, white – undefined, brown – cenotaph

Five out of the eight female and one presumably female graves contained feminine grave goods, while three had no objects, and one had neutral items. The female burials of Graves 1311/1423 and 1383/1512 contained silver earrings, which can be considered as the most precious items in the cemetery. Strings of beads are also common in the female graves in Tiszakürt-Zsilke-tanya.

In child graves, representing the largest group, 16 had some type of object, whereas six lacked any grave goods, notably those under 5 years of age. Masculine objects, such as weapons, were notably absent from child graves in this cemetery, which correlates with the data from Szegvár-Oromdűlő and Szegvár-Sápoldal cemeteries, where the youngest people who were buried with weapons

425 This object may have had a different function. See Chapter 6.6.

belong to the *juvenis* grave group.[426] Beads, likely suggesting female burials, were found in five child graves. Four were over 5 years of age. Additionally, spindle-whorls were found in two child graves, specifically in Graves 1482/1619 (6.5–7.5 years old) and 1500/1637 (12.5–13.5 years old), suggesting a connection to a grown-up female status. Analogies are known from the region: in Orosháza-Bónum for example, a disc-shaped spindle-whorl belonged to the 10.5–11.5-year-old child buried in Grave 5.[427] In Szegvár-Oromdűlő, the youngest children buried with this item were 5–6 years old.[428]

These findings contribute to our understanding of the conceptual distinction between adulthood and childhood in this archaeological context. Biological age is relevant for understanding how a society treats a child,[429] and affects children's connection to their physical and social environment. S. Gütermann carried out an age-based analysis on Szarvas-Grexa-téglagyár cemetery. His findings show that beads were the sole finding type in the *infans I* graves, and other grave goods appear in graves of the *infans II* age group.[430] Zs. Rácz and G. Lőrinczy examined richly furnished child graves in the northern part of the Trans-Tisza region. They pointed out that the 12–14 years old children were buried with grave goods typical for adults.[431] The 'richest' female burials in the region contained mounted headbands and toiletry sets. While mounted headbands did appear in infant graves, they are more typically associated with the juvenile and young adult women.[432] The youngest child buried with a toiletry set and a string of beads was buried at the age of 4–5 years.[433] The isolated burial of Hódmezővásárhely-Kopáncs II belonged to a juvenile girl. This is one of the richest assemblage of the region containing a pair of gold earring with a large spherical pendant, a pair of lead bracelets with glass inlay, and a Byzantine *solidus*.[434]

These findings are comparable to similar analyses regarding later periods. For example, an interdisciplinary research project by F. Curta and M. Koval focused on medieval childhood in East Central Europe, analysing archaeological sites from the 10th–12th centuries from Lubien in Poland and Kérpuszta in Hungary.[435] A remarkable societal division is detectable around the age of seven.[436] At the Lubien archaeological site, graves of children with female attributes under seven contained only beads. In contrast, lock rings can be found in graves of children older than seven.[437] Although from a later period, these parallels offer intriguing insights into the nuanced transitions of childhood across cultures.

7. Chronology

The dating of the excavated cemetery section is challenging due to the modest grave goods; only a few types of artifacts are informative in this regard. Pressed round belt fittings, for example, were in use for a relatively long time. The radiocarbon dating of Grave 540 in Szegvár-Oromdűlő is available for comparison; the burial can be dated between 570 and 603 with 68.3% accuracy. However,

426 Lőrinczy 2018, 68; Lőrinczy 2022, 160, 163.
427 Lichtenstein 2006, 131.
428 Lőrinczy 2022, 185.
429 Lewis 2006, 5.
430 Brather et al. 2009, 335–336.
431 Lőrinczy – Rácz 2014, 180–182.
432 Lőrinczy – Straub 2005b, 133.
433 Lőrinczy 2020, 330–331.
434 Herendi 2012.
435 Curta – Koval 2018.
436 Curta – Koval 2018, 91.
437 Kurasinski – Skóra 2012, 107.

it contradicts the archaeological dating of the grave, because it was dated to the first quarter of the 7th century.[438] Grave 49 at Hódmezővásárhely-Kishomok was recently dated by G. Lőrinczy and S. Varga to the second quarter of the 7th century or a bit later.[439]

The earrings with large spherical pendants cannot be dated more precisely within the Early Avar Period.[440] According to J. Ormándy, earrings with small spherical pendants are thought to have appeared a little later, and the versions made of gold only appeared in the second half of the 7th century.[441] At the same time, the leading archaeologist at the Szegvár-Oromdűlő cemetery dated objects of these types to the first half of the 7th century.[442] Earrings with a large bead pendants began to appear in the second quarter of the 7th century.[443] G. Lőrinczy dated the appearance of this object type in the Szegvár-Oromdűlő cemetery to the second quarter or third of the century, noting that it was mainly worn by children and young adult women.[444] It is noteworthy that at Tiszakürt, the graves with such jewellery were found on the southern edge of the cemetery.

Spheroid and conical blue and yellow opaque beads were used until the end of the 7th century, but gradually fell out of fashion by the last third of the century.[445] As noted above, the metal beads can be dated to the second and third thirds of the 7th century, although the vast majority of them were in use in the middle third of the century.[446] According to A. Pásztor, large melon seed-shaped beads with an iridescent surface appeared east of the Tisza River in the middle of the 7th century.[447] G. Lőrinczy determined the time of their use in the middle third of the century.[448] I. Kovrig demonstrated that earrings with a large bead pendants and melon seed-shaped beads appeared at the same time.[449] These two object types did not occur together in any of the graves at Tiszakürt (Fig. 91). Grave 333a at Szegvár-Oromdűlő contained both object types.[450] Grave 3 of Szegvár-Sápoldal is important in terms of dating because here melon seed-shaped beads and an earring with a large bead pendant were found together. This was the grave of an adult woman, which also yielded an imitation of the silver *miliarensis* of Constans II, issued in 651/2–654. The radiocarbon dating conducted in Debrecen, established that the burial may have taken place between 666 and 698 with a 68.2% probability, while the measurements taken in Vienna suggest a dating between 651 and 688.[451] Taking all the above into consideration, G. Lőrinczy dated the burial to the second half of the second third of the 7th century.[452]

The pendant made from a slotted spoon cannot be dated more precisely due to the poor grave goods.[453] G. Lőrinczy dated the fashion of placing slotted spoons in graves to the second quarter

438 Cf. Lőrinczy – Siklósi 2022, 689, Tab. 1.
439 Lőrinczy – Varga 2022, 24.
440 Balogh 2016, 335.
441 Ormándy 1995, 161.
442 Lőrinczy 2022, 262.
443 Balogh – Pásztor 2015, 613.
444 Lőrinczy 2022, 264.
445 Cf. Pásztor 1995, 89, Tab. 2.
446 Lőrinczy – Rácz 2014, 156.
447 Pásztor 2022, 426.
448 Lőrinczy 2022, 262.
449 Kovrig 1963, 164–165.
450 Lőrinczy 2022, 264.
451 Lőrinczy 2018, 55–59.
452 Lőrinczy 2018, 78.
453 Cf. Lőrinczy 2020, 102, 224–225, 228–229.

or second third of the 7th century.[454] Among the graves containing slotted spoons, the radiocarbon dating of Grave 762 in Szegvár-Oromdűlő confirmed that the burial must have taken place between 600 and 635 with a probability of 68.2%.[455]

Although the Tiszakürt cemetery seems sizeable in the examined region, the obtained demographic data suggest that its long-term use is doubtful. The small number of male burials makes it highly unlikely that more than two generations were buried in Tiszakürt.[456] Based on the large number of children, one to three large families may have been interred here, and the few datable object types suggest that they used the cemetery for a maximum of 30–40 years. In conclusion, the cemetery section excavated at Tiszakürt-Zsilke-tanya must have been in use in the 640s–680s. However, based on the belt fittings, it cannot be excluded that the cemetery started to be used even earlier.

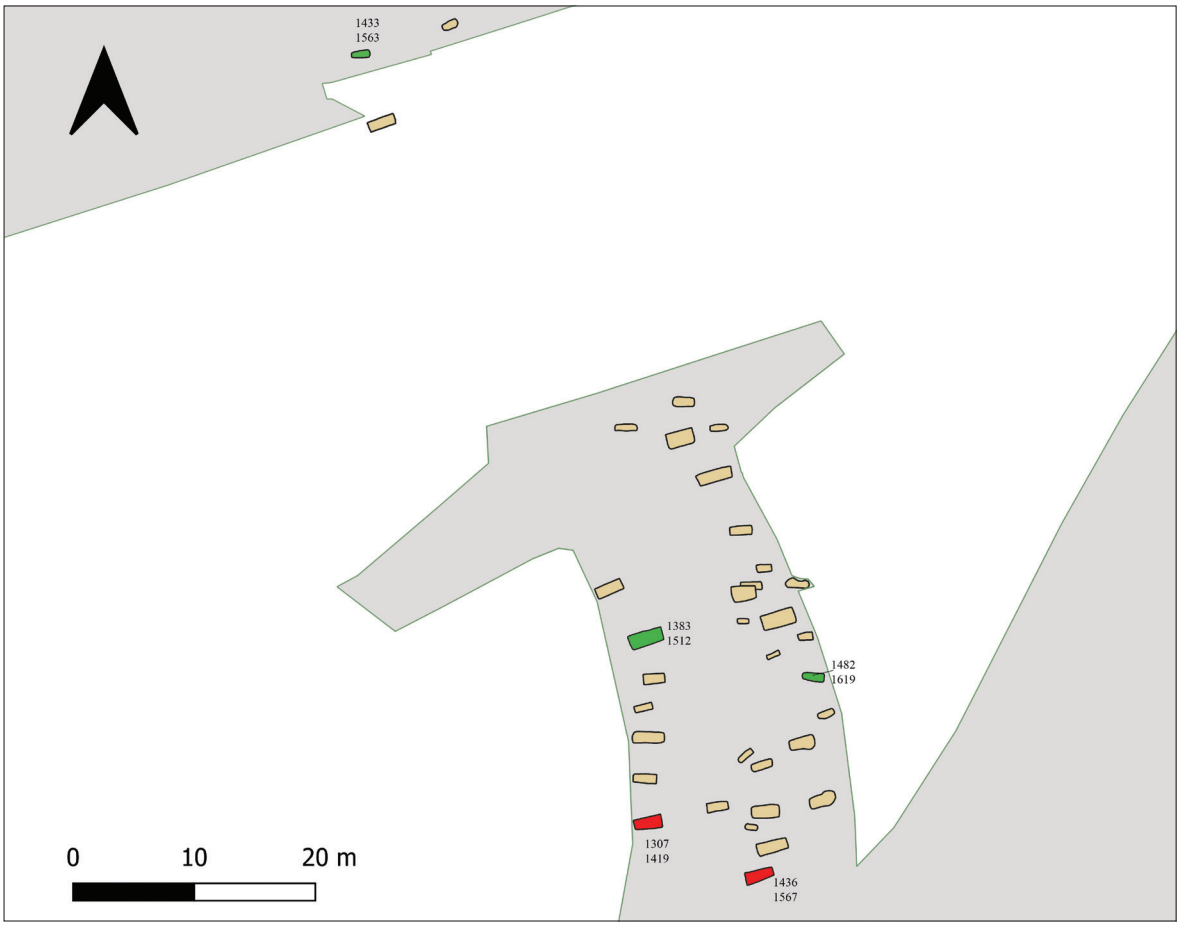

Fig. 91. Spatial distribution of the graves with melon seed-shaped bead (green) and earrings with large bead pendants (red)

8. Cultural links of the community

The cemetery of Tiszakürt-Zsilke-tanya fits into the overall image of the Avar Period in the Trans-Tisza region. The population of Eastern European Steppe origin that arrived in the area together with the communities with East Asian links associated with Avars can be distinguished on the basis of their burial customs. The typical orientation of their graves is E–W, NE–SW, less often N–S or W–E.

454 Lőrinczy 2022, 267.

455 Cf. Lőrinczy – Siklósi 2022, 689, Tab. 1.

456 It cannot be ruled out that the other male graves remained undiscovered or were destroyed.

In addition to shaft graves, a high number of graves with longitudinal ledges, with a sidewall niche, or with an endwall shaft are also known. Skins of horses, cattle, sheep, or goats were placed in most of the graves, usually spatially separated from the dead. The typical food offering was mutton (meat cuts from the sheep's round), placed behind the skull together with the vessels.[457] These burial customs are known from the Eastern European steppe region in the period, suggesting that the communities who settled in the Trans-Tisza region at that time originated from the North Pontic area.[458]

Not all of the above-mentioned rites were present in Tiszakürt. Some phenomena, such as graves with an endwall shaft or the deposition of three or more sacrificed animals, are completely missing. According to G. Lőrinczy, the population of Eastern European steppe origin initially occupied only the interfluve between the Aranca, Tisza, and Körös rivers; north of this area, they intermingled with groups of different cultural characteristics. North of the Körös rivers, he hypothesized the presence of newcomers from other areas of the Carpathian Basin, whose burial rites differ from the communities of Eastern European steppe-origin. According to him, the graves of the new group typically oriented in the N–S and W–E direction, and markedly lacking animal skins.[459] However, to determine the typical burial customs of the population of Eastern European steppe-origin, G. Lőrinczy relied on the observations made during D. Csallány's excavations in the Szeged region, in addition to his own excavations in Szegvár. On the other hand, as shown above, a somewhat different picture emerges in the Körös Valley. The most important difference is a large number of W–E-oriented burials; the sites of Kunszentmárton-Habranyi telep and Öcsöd-MRT Site 96a are also characterized by this orientation and its variants. The other significant distinction is a high number of shaft graves, while graves with a sidewall niche or an endwall shaft are rare. However, these differences do not necessarily indicate that the region had an ethnically different or mixed population; the differences could also be the result of social or economic background.

A special mention should also be made of those cemeteries of the Körös–Tisza–Maros region which, according to traditional chronology, contain both early and late Avar finds. Based on certain burial rites, such as graves with an endwall shaft, placing cattle and sheep skins in graves, and mutton (meat cuts of the sheep's round) as a food offering, these communities can be connected culturally to populations with East-European steppe origin. The NW–SE orientation was predominant at the sites of Szarvas-Grexa-téglagyár, Székkutas-Kápolnadűlő, and Pitvaros-Víztározó, while at Csárdaszállás-Hanzély-tanya, the N–S orientation was prevalent.[460] Rákóczifalva-Bagi-földek Site 8a, located in the Central Tisza region, resembles the latter group.[461] L. Bende dated these cemeteries to the second half of the Avar period, despite their early Avar period assemblages. Burial customs typical of 6th–7th-century cemeteries in the Trans-Tisza region, such as the E–W orientation, the horse remains, and the graves with a sidewall niche, are missing from the early phase of the above-mentioned sites. In addition, no cemeteries are known where the change of particular burial customs, such as the orientation of the graves, the technique of skinning the animals, or the disappearance of the horse skin burials can be documented.[462] These observations were later supported by G. Lőrinczy.[463] This question is particularly problematic in terms of the sites of Szarvas-Grexa-téglagyár and Székkutas-Kápolnadűlő, namely, these cemeteries yielded some material dated to the Early Avar Period as well. In our opinion, questions of chronology can only be clarified by future ^{14}C analyses.

457 Lőrinczy 2016, 156–165.
458 Gulyás 2015.
459 Lőrinczy 1998, 351–355.
460 Bende 2017, 252, 323.
461 Mácsai 2012.
462 Bende 2017, 10.
463 Lőrinczy 2016.

In light of the above, it seems that several funeral traditions coexisted in Tiszakürt's vicinity. Based on the E–W orientation and the animal sacrifices, the cemetery shows close connections with the cemeteries south of the Körös and east of the Tisza River, that is, Szegvár-Oromdűlő, Szegvár-Sápoldal, and Hódmezővásárhely-Kishomok. However, graves with a endwall shaft and mass animal sacrifices are uncharacteristic for Tiszakürt, which distinguishes it from the two Szegvár sites.

Among the sites located on the left bank of the Körös, shaft graves and the small number of sacrificial animals were prevalent at the sites of Kunszentmárton-Habranyi telep, Öcsöd-MRT 96a, and Szarvas-Ponyiczky-tanya. The graves excavated here had W–E and NW–SE orientations. However, rites that are considered common across the Trans-Tisza region appear in these cemeteries as well, so they do not indicate groups moving in from other areas of the Avar Khaganate.

The early graves of Békésszentandrás-Benda-tanya and probably the earliest graves of Szarvas-Grexa-téglagyár constitute a third group. These are characterized by NW–SE orientation and the presence of graves with an endwall shaft, as well as burials containing horse harnesses. Considering the three groups with different funeral customs, the explanation for these discrepancies might be social, economic, or even chronological differences, or—less likely—different cultural traditions or ethnicities.[464] In the future, further scientific tests, such as nitrogen, oxygen, and strontium isotopes as well as radiocarbon analyses, can help decide this question.

9. Summary

Altogether 35 Early Avar Period burials were excavated at the site of Tiszakürt-Zsilke-tanya. The exact dimensions of the cemetery remain unknown, and the construction of the modern road cut through the rows of graves; therefore, it is uncertain whether any graves went unnoticed or were destroyed. Burials are oriented E–W or along its variations; reversed orientation was observed in five cases. In addition to the simple shaft graves, there were three graves with ledges on the longitudinal sides and one grave with a sidewall niche. Remains of animal skins came to light in relatively high numbers; in addition to sheep, the skulls and extremities of seven cattle and one horse were found in the graves. Ceramic vessels were placed in eleven graves.

The graves have poor or modest grave goods. In most cases, earrings were found, two of which had a large bead pendant and three had spherical pendants. In women's and children's graves, shorter and longer strings of beads were relatively common, consisting mainly of monochrome, antique-type beads. In addition to these, there is a pendant made from the head of a slotted spoon in Grave 1310/1422. The copper-alloy bracelet in Grave 1383/1512 is also noteworthy. The only set of belt parts was found in Grave 1313/1425; it was decorated with copper-alloy rivets with round heads.

In terms of burial rites, the population who used the cemetery followed the burial traditions widespread in the Eastern European steppe region. In the 6th–7th centuries, these customs appeared in the Carpathian Basin, mainly in the Trans-Tisza region. In addition to the E–W orientation of the burials, the compound graves and especially the large number of animal skins point to these cultural connections. At the same time, the skinning method observed at the site, i.e., the breaking of extremity bones with dull tools, is unprecedented both in the Carpathian Basin and in the Eastern European steppe region. The dating of the cemetery section is problematic due to the lack of datable grave goods. On the basis of the early-type melon seed-shaped beads and earrings with a large bead pendant, the graves can probably be dated to the end of the second third of the 7th century or the beginning of the last third, i.e., around the 640s–680s. Since only very few adult men

464 For the criticism of ethnic identifications in archaeology, see Brather 2004.

were interred in the excavated part of the cemetery, it seems that it was used by only one or two generations. Most likely, one to three large families were buried here, in a relatively short period of time. However, this hypothesis can only be verified through a comprehensive archaeogenetic analysis and ^{14}C dating.

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References

Atavin, A. G. 1984: Nekotorye osobennosti zakhoroneniya chuchel koney v kochevnicheskikh pogrebeniyakh X–XIV vv (Some peculiarities of interments of stuffed horses in Nomadic burials of the 10th–14th centuries). *Sovietskaya Arkheologiya*, 134–143.

Alekseev, V. P. – Debets, G. F. 1964: *Kraniometria. Metodika antropologicheskikh issledovaniy* [Craniometry. Methodology of the anthropological analysis]. Moskva.

AlQahtani, S. J. – Hector, M. P. – Liversidge, H. M. 2010: Brief communication: The London atlas of human tooth development and eruption. *American Journal of Physical Anthropology* 142, 481–490. https://doi.org/10.1002/ajpa.21258

Arletti, R. – Vezzalini, G. – Biaggio Simona, S. – Maselli Scotti, F. 2008. Archaeometrical studies of Roman Imperial Age glass from Canton Ticino. *Archaeometry* 50, 606–626. https://doi.org/10.1111/j.1475-4754.2007.00362.x

Asinelli, M. G. – Martinón-Torres, M. 2016: Copper-alloy use in a Tyrrhenian medieval town: The case of Leopoli-Cencelle (Italy). *Journal of Archaeological Science: Reports* 7, 597–608. https://doi.org/10.1016/j.jasrep.2015.09.023

Balasse, M. – Gillis, R. – Živaljević, I. – Berthon, R. – Kovačiková, L. – Fiorillo, D. – Arbogast, R. M. – Bălăşescu, A. – Bréhard, S. – Nyerges, É. Á. – Dimitrijević, V. – Bánffy, E. – Domboróczki, L. – Marciniak, A. – Oross, K. – Vostrovská, I. – Roffet-Salque, M. – Stefanović, S. – Ivanova, M. 2021: Seasonal calving in European Prehistoric cattle and its impacts on milk availability and cheese-making. *Scientific Reports* 11, 8185. https://doi.org/10.1038/s41598-021-87674-1

Balasse, M. – Tresset, A. – Bălăşescu, A. – Blaise, E. – Tornero, C. – Gandois, H. – Fiorillo, D. – Nyerges, É. Á. – Frémondeau, D. – Bánffy, E. – Ivanova, M. 2017: Animal Board Invited Review: Sheep birth distribution in past herds: a review for prehistoric Europe (6th to 3rd millennia BC). *Animal* 11/12, 2229–2236. https://doi.org/10.1017/S1751731117001045

Balogh, Cs. 2006: Avar kori kettős- és többes temetkezések a Duna–Tisza közén (Dual and multiple burials in the region between the Danube and the Tisza River from the Avar age). *Arrabona* 44, 41–86.

Balogh, Cs. 2015: A homokrévi 8. sír faragott csontlemezei. Adatok az avar kori tegezek típusaihoz (The carved bone plates of Grave 8 from Mokrin (SRB). New data to the types of the Avar age quivers). In: Balogh, Cs. – Petkes, Zs. – Sudár, B. – Zsidai, Zs. (eds): *„…in nostra lingua Hringe nominant" – Tanulmányok Szentpéteri József 60. születésnapjára.* Budapest, 39–70.

Balogh, Cs. 2016: *Régészeti adatok a Duna–Tisza közi avarok történetéhez* (The history of the Avars in the Danube–Tisza interfluve as reflected in the archaeological record). Studia ad Archaeologiam Pazmaniensia 6. Budapest.

Balogh, Cs. 2017: Orta Tisa Bölgesi'nde Doğu Avrupa Bozkır Kökenli Göçebe Bir Topluluğa Ait Mezarlık (Makó, Mikócsa-halom, Macaristan) (A Cemetery Belonging to an Nomad Community of Eastern Europe Steppe Origin in the Middle Tisa Region [Makó, Mikócsa-halom, Hungary]). *Art Sanat* 7, 53–70.

Balogh, Cs. 2021: Egy Maros-völgyi kora avar kori közösség életmódjáról a régészeti adatok alapján – Makó-Mikócsa halom [Archaeological data on the lifestyle of an Early Avar community in the Maros Valley - Makó-Mikócsa halom]. In: Törőcsik, T. – Gulyás, S. – Molnár, D. – Náfrádi, K. (eds): *Környezettörténet. Tanulmányok Sümegi Pál professzor 60 éves születésnapi köszöntésére*. Szeged, 129–142.

Balogh, Cs. – Pásztor, A. 2015: Az avar kori nagy gyöngycsüngős fülbevalók (Large bead-pendant earrings from the Avar period). In: Türk, A. (ed.): *Hadak útján. A népvándorláskor fiatal kutatóinak XXIV. konferenciája, Esztergom 2014. november 4–6.* Studia ad Archaeologiam Pazmaniensia 4. Budapest–Esztergom, 581–648. https://doi.org/10.55722/Arpad.Kiad.2015.3.1_23

Balogh, Cs. – Gulyás, A. – Lőrinczy, G. 2023: 7. századi temetkezések Békés vármegyéből – Adatok a Tiszántúl avar kori lószerszámos temetkezéseihez (7th century graves from Békés County (SE-Hungary): Data for Avar-age burials with horse harness from the Trans-Tisza region). *Archaeologiai Értesítő* 148, 223–267. https://doi.org/10.1556/0208.2023.00041

Barkóczi, L. 1988: *Pannonische Glasfunde in Ungarn*. Studia Archaeologica 9. Budapest.

Barone, R. 1976: *Anatomie comparée des mammifères domestiques. Tome I Ostéologie: atlas*. Paris.

Bartosiewicz, L. 2018: Animal Remains in the Avar cemetery of Szegvár-Szőlőkalja. In: Drauschke, J. – Kislinger, E. – Kühtreiber, K. – Kühtreiber, T. – Scharrer-Liška, G. (eds): *Lebenswelten zwischen Archäologie und Geschichte: Festschrift für Falko Daim zu seinem 65. Geburtstag*. Monographien des Römisch-Germanischen Zentralmuseums 120. Mainz, 43–56.

Bende, L. 2000: Fülkesírok a pitvarosi avar kori temetőben. Adatok a fülkés és lószerszámos temetkezések kronológiájához (Stollengräber im awarenzeitlichen Gräberfeld von Pitvaros. Angaben zur Chronologie der Stollengräber und Bestattungen mit Pferdegeschirr). In: Bende, L. – Lőrinczy, G. – Szalontai, Cs. (eds): *Hadak útján. A népvándorlás kor fiatal kutatóinak konferenciája*. Szeged, 241–279.

Bende, L. 2017: *Temetkezési szokások a Körös–Tisza–Maros közén az avar kor második felében* (Bestattungsbräuche in den zweiten Hälfte der Awarenzeit im Gebiet zwischen Körös, Theiss und Maros). Studia ad Archaeologiam Pazmaniensia 8. Budapest.

Benedek, A. – Marcsik, A. 2017: Kora avar kori temetőrészlet Kövegyről. Új temetkezési szokások a Tisza–Körös–Maros mentén a kora avar korból (Cemetery part from the Early Avar Age in Kövegy. New burial habits in the Early Avar Age along the rivers Tisza–Körös–Maros). In: T. Gábor, Sz. – Czukor, P. (eds): *Út(on) a kultúrák földjén. Az M43-as autópálya Szeged–országhatár közötti szakasz régészeti feltárásai és a hozzá kapcsolódó vizsgálatok*. Szeged, 369–442.

Bernert, Zs. – Évinger, S. – Hajdu, T. 2007: New data on the biological age estimation of children using bone measurements based on historical populations from the Carpathian Basin. *Annales historico-naturales Musei nationalis hungarici* 99, 199–206.

Bernert, Zs. – Évinger, S. – Hajdu, T. 2008: Adatok a gyermekek életkorbecsléséhez a Kárpát-medencei történeti népességek gyermekhalottainak csontméretei alapján (New data on the biological age estimation of children using bone measurements based on historical populations from the Carpathian Basin). *Anthropologiai Közlemények* 49, 43–50.

Bocquet-Appel, J. P. 2002: Paleoanthropological traces of a Neolithic demographic transition. *Current anthropology* 43, 637–650. https://doi.org/10.1086/342429

Bökönyi, S. 1963: A bólyi avarkori temető állatmaradványai (Untersuchung der Tierknochenfunde des Gräberfeldes von Bóly-Sziebert-puszta). *A Janus Pannonius Múzeum Évkönyve*, 91–122.

Bóna, I. 1979: A szegvár-sápoldali lovassír. Adatok a korai avar temetkezési szokásokhoz (Das Reitergrab von Szegvár-Sápoldal. Beiträge zu den frühawarischen Bestattungssitten). *Archaeologiai Értesítő* 106, 3–32.

Bóna, I. – Nagy, M. 2002: Hódmezővásárhely-Kishomok (Kom. Csongrád). In: Bóna, I. – Nagy, M.: *Gepidische Gräberfelder am Theissgebiet I*. Monumenta Germanorum Archaeologica Hungariae 1. Budapest, 34–189.

Bourgarit, D. – Thomas, N. 2012: Late medieval copper alloying practices: A view from a Parisian workshop of the 14th century AD. *Journal of Archaeological Science* 39/10. 3052–3070. https://doi.org/10.1016/j.jas.2012.04.009

Brather, S. 2004: *Ethnische Interpretation in der frühgeschichtlichen Archäologie, Grundlagen und Alternativen.* Reallexikon der Germanischen Altertumskunde – Ergänzungsbände 42. Berlin–New York. https://doi.org/10.1515/9783110922240

Brather, S. – Gütermann, S. – Künzie, M. – Reinecke, J. – Schmid, Ch. – Streit, K. – Tolkach, D. – Wächtler, N. – Zadow, V. 2009: Grabausstattung und Lebensalter im frühen Mittelalter. Soziale Rolle im Spiegel der Bestattungen. *Fundberichte aus Baden-Württemberg* 30, 273–378. https://doi.org/10.11588/fbbw.2009.0.33921

Brooks, S. – Suchey, J. M. 1990: Skeletal age determination based on the os pubis: A comparison of the Acsádi-Nemeskéri and Suchey-Brooks methods. *Human Evolution* 5, 227–238. https://doi.org/10.1007/BF02437238

Brůžek, J. – Santos, F. – Dutailly, B. – Murail, P. – Cunha, E. 2017: Validation and reliability of the sex estimation of the human os coxae using freely available DSP2 software for bioarchaeology and forensic anthropology. *American Journal of Physical Anthropology* 164, 440–449. https://doi.org/10.1002/ajpa.23282

Buikstra, J. (ed.) 2019: *Ortner's Identification of Pathological Conditions in Human Skeletal Remains.* (3rd ed.) London. https://doi.org/10.1016/C2011-0-06880-1

Coelho, J. D. O. – Curate, F. – Navega, D. 2020: Osteomics: decision support systems for forensic anthropologists. In: Obertová, Z. – Stewart, A. – Cattaneo, C. (eds): *Statistics and probability in forensic anthropology.* London, 259–273. https://doi.org/10.1016/B978-0-12-815764-0.00005-8

Cottam, S. – Jackson, C. 2018: Things that travelled: Precious things for special people? In: Rosenow, D. – Phelps, M. – Meek, A. – Freestone, I. C. (eds): *Things that travelled. Mediterranean glass in the first millennium CE.* London, 92–106. https://doi.org/10.14324/111.9781787351172

Covington 2009: Covington, Tony. 2009. *Tanning Chemistry. The Science of Leather.* Cambridge.

Csallány, D. 1933: *A kunszentmártoni avar kori ötvössír* (Goldschmiedgrab aus der Awarenzeit von Kunszentmárton [Ungarn]). Szentes.

Csallány, D. 1934: A Szentes-lapistói népvándorláskori sírlelet (Der Grabfund von Szentes-Lapistó aus der Völkerwanderungszeit). *Dolgozatok* 9–10, 206–215.

Csallány, D. 1939: Kora-avarkori sírleletek (Grabfunde der Frühawarenzeit). *Folia Archaeologica* 1–2, 121–155.

Csallány, D. 1968: Neue Ergebnisse der awarenzeitlichen Forschungen in Ostungarn. *Študijné Zvesti Archeologického Ústavu SAV* 16, 59–70.

Csallány, G. 1900: Avar sírleletekről Szentes határában Donáton [About Avar graves on the outskirts of Szentes in Donát]. *Archaeologiai Értesítő* 20, 393–398.

Cseh, G. – Varga, S. 2017: Avar kori temetkezések Apátfalva-Nagyút dűlőn (M43 43. lh.) (Burials from the Avar Age at the site Apátfalva-Nagyút-dűlő [site M43 43]). In: T. Gábor, Sz. – Czukor, P. (eds): *Út(on) a kultúrák földjén. Az M43-as autópálya Szeged-országhatár közötti szakasz régészeti feltárásai és a hozzá kapcsolódó vizsgálatok.* Szeged, 443–477.

Curta, F. – Koval, M. 2018: Children in Eleventh- and Twelfth- Century Hungary and Poland. In: Nagy, B. – Vadas, A. – Schmieder, F. (eds): *The Medieval Networks in East Central Europe.* London. 87–122. https://doi.org/10.4324/9781315149219-7

Daim, F. 1987: *Das awarische Gräberfeld von Leobersdorf, NÖ.* Österreichische Akademie der Wissenschaften. Philosophisch-Historische Klasse Denkschriften 194 – Studien zur Archäologie der Awaren 3. Wien.

Daróczi-Szabó, M. 2021: Amit az avarok lovairól tudni érdemes (What we know about the Avar's horses). In: Dani, J. – Hága, T. K: *A kagán lovasa, avagy egy avar páncélos lovas életre keltése.* Kiállítási katalógus. Debrecen, 101–105.

Deldicque, D. – Rouzaud, J.-N. – Vandevelde, S. – Medina-Alcaide, M. Á. – Ferrier, C. – Perrenoud, Ch. – Pozzi, J.-P. – Cabanis, M. 2023: Effects of oxidative weathering on Raman spectra of charcoal and bone chars: Consequences in archaeology and paleothermometry. *Comptes Rendus – Geoscience*, 355, 1–22. https://doi.org/10.5802/crgeos.186

Deldicque, D. – Rouzaud, J.-N. – Velde, B. 2016: A Raman – HRTEM study of the carbonization of wood: A new Raman-based paleothermometer dedicated to archaeometry. *Carbon* 102, 319–329. https://doi.org/10.1016/j.carbon.2016.02.042

DiGangi, E. A. – Bethard, J. D. – Kimmerle, E. H. – Konigsberg, L. W. 2009: A new method for estimating age-at-death from the first rib. *American Journal of Physical Anthropology* 138, 164–176. https://doi.org/10.1002/ajpa.20916

von den Driesch, A. 1976: *A Guide to the Measurement of Animal Bones from Archaeological Sites.* Peabody Museum Bulletin 1. Cambridge, MA.

Dussart, O. – Velde, B. – Pierre-Marie, B. – Jean-Pierre, S. 2004: Glass from Qal'at Sem'an (Northern Syria): The reworking of glass during the transition from Roman to Islamic Compositions. *Journal of Glass Studies* 46, 67–83.

Eastaugh, N. – Walsh, V. – Chaplin, T. – Siddall, R. 2007: *Pigment compendium: A dictionary of historical pigments.* London. https://doi.org/10.4324/9780080473765

Egol, K. – Koval, K. J. – Zuckerman, J. D. 2014: *Handbook of fractures.* (5th ed.) Philadelphia.

Éry, K. – Kralovánszky, A. – Nemeskéri, J. 1963: Történeti népességek rekonstrukciójának reprezentációja (A representative reconstruction of historic populations). *Anthropologiai Közlemények* 7, 41–90.

Fazekas, G. – Kósa, F. 1978: *Forensic fetal osteology.* Budapest.

Fórizs, I. 2008: Üvegkészítés Magyarországon a kezdetektől a XVIII. századig [Glassmaking in Hungary from the beginning to the 18th century]. *A Miskolci Egyetem Közleményei. A sorozat: Bányászat* 74, 113–136.

Foster, H. E. – Jackson, C. M. 2009: The composition of 'naturally coloured' late Roman vessel glass from Britain and the implications for models of glass production and supply. *Journal of Archaeological Science* 36, 189–204. https://doi.org/10.1016/j.jas.2008.08.008

Francigny, V. – Bishop-Wright, H. C. 2022: Beyond the Roman World: A Decorated Glass Plate in Sudanese Nubia. *Journal of Glass Studies* 64, 59–74.

Freestone, I. C. 2005: The provenance of ancient glass through compositional analysis. *Materials Research Society Symposium Proceedings* 852, OO8.1.1–OO8.1.1.14. https://doi.org/10.1557/PROC-852-OO8.1

Freestone, I. C. 2021: Glass production in the First Millenium CE: A compositional perspective. In: Klimscha, F. – Karlsen, H. J. – Hansen, S. – Renn, K. (eds): *Ancient Glass and Glass Production.* Studies of the Ancient World 67. Berlin, 245–263. https://doi.org/10.17171/3-67

Freestone, I. C. – Gorin-Rosen, Y. – Hughes, M. J. 2000: Primary glass from Israel and the production of glass in Late Antiquity and the early Islamic period. In: Nenna, M. D. (ed.): *La route du verre: ateliers primaires et secondaires de verriers du second millenaire av J.-C. au Moyen-Age.* Lyon, 65–84.

Frey, A. – Greiff, S. 2009: Early medieval glass beads with metal tubes. In: Ignatiadou, D. – Antonaras, A. (eds): *ANNALES: du 18e Congrès de l'Association Internationale pour l'Histoire du Verre.* Thessaloniki, 373–378.

Fülöp, K. – Lönhardt, D. M. – Szabó, N. – Váczi, G. 2018: Preliminary report on the excavation of the site Tiszakürt-Zsilke-tanya. *Dissertationes Archaeologicae* 3.6, 499–514. https://doi.org/10.17204/dissarch.2018.499

Gáll, E. 2017: *At the Periphery of the Avar Core Region. 6th–8th Century Burial Site near Nădlac. (The Pecica–Nădlac Motorway Rescue Excavations).* Patrimonium Archaeologicum Transylvanicum 13. Paris–Budapest.

Gáll, E. – Gindele, R. – Blaskó, M. 2023: Valkány kora középkori temetőinek előzetes vizsgálata (Preliminary analysis of early medieval funerary sites from Vălcani/Valkány). *Communicationes Archaeologicae Hungariae*, 69–88. https://doi.org/10.54640/CAH.2021.69

Gáll, E. – Mărginean, F. 2020: Archaeological discoveries linked to the 'first generation' of the Avar conquerors living east of the Tisa during the 6th–7th centuries. The grave cluster in Nădlac – Site 1M. *Sprawozdania Archeologiczne* 72, 373–407. https://doi.org/10.23858/SA/72.2020.2.1864

Gallina, Zs. – Gulyás, B. – Gulyás, Gy. – Harangi, F. – Tóth, Zs. 2022: Early Avar Cemetery in Babarc. Preliminary report. *Hungarian Archaeology* 11/4, 12–27. https://doi.org/10.36338/ha.2022.4.1

Gulyás, B. 2015: Újabb adatok a kora avar kori Tiszántúl kelet-európai kapcsolataihoz (New results of research concerning the relations between Hungary and the Eastern European steppe in the Early Avar

period). In: Türk, A. (ed.): *Hadak útján. A népvándorláskor fiatal kutatóinak XXIV. konferenciája, Esztergom 2014. november 4–6.* Studia ad Archaeologiam Pazmaniensia 4. Budapest–Esztergom, 499–512. https://doi.org/10.55722/Arpad.Kiad.2015.3.1_20

Gulyás, B. 2023: Populations of east European steppe origin in the cemeteries of Szekszárd-Bogyiszlói street and Kölked-Feketekapu B (7th century AD). *Communicationes Archaeologicae Hungariae*, 159–174. https://doi.org/10.54640/CAH.2022.159

Gulyás, B. – Lőrinczy, G. 2018: Szabolcs-Szatmár-Bereg megye avar sírleletei IV. A Tiszavasvári-Koldusdombi kora avar kori temető (Avar finds from Szabolcs-Szatmár-Bereg County IV. Early Avar graves from Tiszavasvári-Koldusdomb). In: L. Nagy, M. – L. Szőlősi, K. (eds): *„Vadrózsából tündérsípot csináltam." Tanulmányok Istvánovits Eszter 60. születésnapjára.* Nyíregyháza, 529–569.

Gulyás, B. – Lőrinczy, G. 2020: A részleges állatmelléklet egy sajátos változata a Szegvár-oromdűlői kora avar kori temető sírjaiban és annak kelet-európai kapcsolatai (A special Form of the Partial Animal Burials in the Early Avar Period Burials of Szegvár-Oromdűlő and its East European Connections). In: Nemes, G. – Czigány, D. – Nemesné Matus, Zs. (eds): *Tomka 80. Ünnepi tanulmányok Tomka Péter köszöntésére.* Győr, 179–190.

Gulyás, B. – Lőrinczy, G. – Strokov, A. A. 2021: Pogrebeniya s tselymi skeletami koney v Zatisye i stepyakh Vostochnoy Yevropy VI–VII vv n. e. (Burials with Whole Horse Skeletons in the Tiszántúl and Eastern European Steppe Region in the 6th–7th centuries AD). *Stratum Plus* 2021/5, 281–293. https://doi.org/10.55086/sp215281293

Gulyás, B. – Lőrinczy, G. – Sztrokov, A. 2022: Juh fartő, mint ételmelléklet 6–7. századi sírokban a Kárpát-medencében és Kelet-Európában (Sheep rump as food offering in the Carpathian basin and Eastern Europe in the 6th–7th centuries A. D. In: Türk, A. – Jancsik, B. – Sudár, B. (eds): *Hadak útján. A népvándorláskor kutatóinak XXIX. konferenciája. Budapest, 2019. november 15–16.* Vol. 1. Magyar Őstörténeti Kutatócsoport Kiadványok 4.1. Budapest, 297–308. https://doi.org/10.55722/Arpad.Kiad.2021.4.1_16

Gulyás, B. – Samu, L. 2022: A Szegvár-oromdűlői növényi ornamentikával díszített és a maszkos veretek kapcsolatai (The connections of the belt mounts decorated with plant ornaments and human face depiction at Szegvár-Oromdűlő). In: Lőrinczy, G. – Major, B. – Türk, A. (eds): *A szegvár-oromdűlői temető és a Tiszántúl kora avar időszaka.* Studia ad Archaeologiam Pazmaniensia 25 – Magyar Őstörténeti Kiadványok 5. Budapest–Szeged–Szentes, 555–597. https://doi.org/10.55722/arpad.kiad.2022.5_06

Hága, T. 2021: A lelőhely és a leletegyüttes feltárása (Excavation of the site and the find assemblage). In: Dani, J. – Hága, T. K. (ed.): *A kagán lovasa avagy egy avar páncélos lovas életre keltése.* Kiállítási katalógus. Debrecen, 13–21.

Heck, M. – Hoffman, P. 2002: Analysis of early medieval glass beads – The Raw materials to produce green, orange, and brown colours. *Microchimica Acta*, 71–76. https://doi.org/10.1007/s006040200042

Heck, M. – Rehren, T. – Hoffman, P. 2003: The production of lead-tin yellow at Merovingian Schleitheim (Switzerland). *Archaeometry* 45, 33–34. https://doi.org/10.1111/1475-4754.00095

Hefner, J. T. 2009: Cranial nonmetric variation and estimating ancestry. *Journal of Forensic Sciences* 54, 985–995. https://doi.org/10.1111/j.1556-4029.2009.01118.x

Henderson, J. 1985: The raw materials of early glass production. *Oxford Journal of Archaeology* 4, 267–291. https://doi.org/10.1111/j.1468-0092.1985.tb00248.x

Henderson, J. 2013: *Ancient glass. An Interdisciplinary Exploration.* Cambridge. https://doi.org/10.1017/CBO9781139021883

Henderson, J. – Mcphail, D. – McLoughin, S. 2004: Radical changes in Islamic glass technology: Evidence for conservatism and experimentation with new glass recipes from Early and Middle Islamic Raqqa, Syria. *Archaeometry* 46, 439–468. https://doi.org/10.1111/j.1475-4754.2004.00167.x

Herendi, O. 2012: Avar kori női sír Hódmezővásárhely-Kopáncson (Csongrád megye) (Avar Age female grave at Hódmezővásárhely-Kopáncs (Csongrád County). In: Kvassay, J. (ed.): *Évkönyv és jelentés a Kulturális Örökségvédelmi Szakszolgálat 2009. évi feltárásairól.* Budapest, 353–362.

Holmes, M. – Thomas, R. – Hamerow, H. 2021: Periodontal disease in sheep and cattle: Understanding dental health in past animal populations. *International Journal of Paleopathology* 33, 43–54. https://doi.org/10.1016/j.ijpp.2021.02.002

İşcan, M. Y. – Loth, S. R. – Wright, R. K. 1984: Age estimation from the rib by phase analysis: White males. *Journal of Forensic Sciences* 29, 1094–1104. https://doi.org/10.1520/JFS11776J

İşcan, M. Y. – Loth, S. R. – Wright, R. K. 1985: Age estimation from the rib by phase analysis: White females. *Journal of Forensic Sciences* 30, 853–863. https://doi.org/10.1520/JFS11018J

Istvánovits, E. – Lőrinczy, G. 2017: Szabolcs-Szatmár-Bereg megye avar sírleletei III. Avar temető és teleprészlet Nyíregháza és Tiszavasvári határából (Avarian finds of Szabolcs-Szatmár-Bereg County III. Avarian Age cemetery and settlement parts from the vicinities of Tiszavasvári and Nyíregyháza). *A nyíregyházi Jósa András Múzeum Évkönyve* 59, 35–178.

James, R. – Peake, N. – Freestone, I. C. 2014: Opaque yellow glass production in the early medieval period: new evidence. In: Keller, D. – Price, J. – Jackson, C. (eds): *Neighbours and successors of Rome. Traditions of glass production and use in Europe and the Middle East in the later 1st Millenium AD.* Oxford–Philadelphia, 15–21. https://doi.org/10.2307/j.ctvh1dq24.7

Jankovich, B. D. – Makkay, J. – Szőke, B. M. 1989: *Békés megye régészeti topográfiája IV/2. A szarvasi járás* [Archaeological topography of Békés County IV/2. The District of Szarvas]. Magyarország Régészeti Topográfiája 8. Budapest.

Jankovich, B. D. – Medgyesi, P. – Nikolin, E. – Szatmári, I. – Torma, I. 1998: *Békés megye régészeti topográfiája IV/3. Békés és Békéscsaba környéke* [Archaeological topography of Békés County IV/3. The vicinity of Békés and Békéscsaba]. Magyarország Régészeti Topográfiája 10. Budapest.

Juhász, I. 2004: *Das awarenzeitliche Gräberfeld in Szarvas-Grexa-téglagyár, FO 68.* Monumenta Avarorum Archaeologica 7. Budapest.

Kermad, F. – Cazeneuve, J. F. – Hassan, Y. – Rihan, B. – Boustani, H. 2002: Two-pin L fixation of fractures of the fifth metacarpal neck. *Acta Orthopaedica Belgica* 68, 231–234.

Kiss, A. 1996: *Das awarenzeitlich gepidische Gräberfeld von Kölked-Feketekapu A.* Monographien zur Frühgeschichte und Mittelalterarchäologie 2 – Studien zur Archäologie der Awaren 5. Innsbruck.

Kovalovszki, J. 1975: Előzetes jelentés a dobozi Árpád-kori faluásatásról 1962–1974 (Vorbericht über die Ausgrabung der árpádenzeitlichen Dorfes Doboz. 1962–1974). *Archaeologiai Értesítő* 102, 204–223.

Kovrig, I. 1963: *Das awarenzeitliche Gräberfeld von Alattyán.* Archaeologia Hungarica 40. Budapest.

Kovrig, I. 1975: The Dévaványa cemetery. In: Garam, É. – Kovrig, I. – Szabó, J. Gy. – Török, Gy: *Avar Finds in the Hungarian National Museum.* Cemeteries of the Avar period (567–829) in Hungary 1. Budapest, 121–155.

Kovrig, I. – Korek, J. 1960: Le cimetère de l'époque de Csóka (Čoka). *Archaeologica Academiae Scientiarum Hungaricae* 12, 257–297.

Kőrösi, A. 2005: A székkutas-káplonadűlői avar temető archaeozoológiai vizsgálata (Archäozoologische Untersuchungen im awarischen Gräberfeld von Székkutas-Kápolnadűlő). *A Móra Ferenc Múzeum Évkönyve – Studia Archaeologica* 11, 229–276.

Kőrösi, A. 2010: Felgyő-Ürmös tanya avar temető állatcsontmellékletei. In: Balogh, Cs. - P. Fischl, K. (eds): *Felgyő-Ürmös-tanya. Bronzkori és avar kori leletek László Gyula felgyői ásatásának anyagából.* Móra Ferenc Múzeum Évkönyve – Monumenta Archeologica 1. Szeged, 393–426.

Kurasinski, T. – Skóra, K. 2012: *Wczesnosredniowieczne cmentarzysko szkieletowe w Lubieniu, pow. piotrkowski.* Łódź.

Kürti, B. 2002a: Deszk-G. In: Szentpéteri, J. (ed.): *Archäologische Denkmäler der Awarenzeit in Mitteleuropa.* Varia Archaeologica Hungarica 13/1. Budapest, 109–110.

Kürti, B. 2002b: Deszk-P. In: Szentpéteri, J. (ed.): *Archäologische Denkmäler der Awarenzeit in Mitteleuropa.* Varia Archaeologica Hungarica 13/1. Budapest, 111.

Lakatos, A. 2001: Închizătoare de geantă din bronz în mediul avar (sec. VI–VII p. Chr.) (Bronzene Taschenverschlüsse im awarischen Milieu [6.–7. Jh. n. Chr.]). *Ephemeris Napocensis* 11, 145–163.

Lewis, M. E. 2004: Endocranial lesions in non-adult skeletons: Understanding their aetiology. *International Journal of Osteoarchaeology* 14, 82–97. https://doi.org/10.1002/oa.713

Lewis, M. E. 2006: *The Bioarchaeology of Children: Perspectives from Biological and Forensic Anthropology.* Cambridge. https://doi.org/10.1017/CBO9780511542473

Lichtenstein, L. 2006: Kora avar sírok Orosháza-Bónumról (Early Avarian graves of Orosháza-Bónum). *A Szántó Kovács Múzeum Évkönyve* 8, 131–146.

Lipták, P. 1965: On the taxonomic method in the paleoanthropology (historical anthropology). *Acta Biologia Szegediensis* 11, 169–183.

Liska, A. 1997: Avar kori temetők és telepek Szentes határában. Régészeti lelőhelykataszter (Awarenzeitliche Gräberfelder und Siedlungen in der Gemarkung von Szentes. Archäologischer Fundortkataster). *A Móra Ferenc Múzeum Évkönyve – Studia Archaeologica* 3, 153–168.

Lőrinczy, G. 1991: A szegvár-oromdűlői kora avar kori temető 1. sírja (Das Grab 1 des frühawarenzeitlichen Gräberfeldes von Szegvár-Oromdűlő). *A Móra Ferenc Múzeum Évkönyve*, 127–154.

Lőrinczy, G. 1992a: Vorläufiger Bericht über die Freilegung des Gräberfeldes aus dem 6.-7. Jahrhundert in Szegvár-Oromdűlő. Weitere Daten zur Interpretierung und Bewertung der partiellen Tierbestattungen in der frühen Awarenzeit. *Communicationes Archaeologicae Hungariae*, 81–124.

Lőrinczy, G. 1992b: Megjegyzések a kora avar kori temetkezési szokásokhoz. A tájolás (Anmerkungen zu der frühawarenzeitlichen Bestattungsriten. Die Orientierung). *A nyíregyházi Jósa András Múzeum Évkönyve* 30–32, 155–171.

Lőrinczy, G. 1996: Kora avar kori sír Szentes-Borbásföldről (Ein frühawarenzeitliches Grab in Szentes-Borbásföld). *A Móra Ferenc Múzeum Évkönyve – Studia Archaeologica* 2, 177–189.

Lőrinczy¸ G. 1998: Kelet-európai steppei népesség a 6–7. századi Kárpát-medencében. Régészeti adatok a Tiszántúl kora avar kori betelepüléséhez (Osteuropäische Steppenbevölkerung im 6. und 7. Jahrhundert im Karpatenbecken. Archäologische Beiträge zu frühawarenzeitlichen Einsiedlung des Gebietes jenseits der Theiß). *A Móra Ferenc Múzeum Évkönyve – Studia Archaeologica* 4, 343–372.

Lőrinczy, G. 2016: A tiszántúli VI–VII. századi sírok és temetők sajátosságai. A kora avar kori népesség továbbélése a VII–IX. század a Körös–Tisza–Maros-közén (Characteristic features of 6th–7th century burials and cemeteries east of the Tisza). *A nyíregyházi Jósa András Múzeum Évkönyve* 58, 155–176.

Lőrinczy, G. 2018: A Szegvár-sápoldali 7. századi sírcsoport (Eine Gräbergruppe des 7. Jahrhunderts von Szegvár-Sápoldal). *Archaeologiai Értesítő* 143, 51–84. https://doi.org/10.1556/0208.2018.143.3

Lőrinczy, G. 2020: *A szegvár-oromdűlői 6–7. századi temető* (The cemetery of Szegvár-Oromdűlő from the 6th–7th centuries). Studia ad Archaeologiam Pazmaniensia 14 – Magyar Őstörténeti Témacsoport Kiadványok 8. Budapest–Szeged–Szentes. https://doi.org/10.55722/Arpad.Kiad.2020.8

Lőrinczy, G. 2022: A Szegvár-oromdűlői kora avar kori temető (The Avar-period populations of Szegvár-Oromdűlő and the Trans-Tisza Region). In: Lőrinczy, G. – Major, B. – Türk, A. (eds): *A szegvár-oromdűlői temető és a Tiszántúl kora avar időszaka.* Studia ad Archaeologiam Pazmaniensia 25 – Magyar Őstörténeti Kutatócsoport Kiadványok 5. Budapest–Szeged–Szentes, 11–404. https://doi.org/10.55722/arpad.kiad.2022.5_03

Lőrinczy, G. – Major, B. – Türk, A. (eds) 2022: *A szegvár-oromdűlői temető és a Tiszántúl kora avar időszaka* (The Szegvár-Oromdűlő Cemetery and the Avar Period in the Trans-Tisza Region). Studia ad Archaeologiam Pazmaniensia 25 – Magyar Őstörténeti Kutatócsoport Kiadványok 5. Budapest–Szeged–Szentes.

Lőrinczy, G. – Rácz, Zs. 2014: Szabolcs-Szatmár-Bereg megye avar sírleletei II. Tiszavasvári-Kashalom-dűlő kora avar kori temetkezései (Avarian finds from Szabolcs-Szatmár-Bereg County II. Early Avarian graves from Tiszavasvári-Kashalom-dűlő). *A nyíregyházi Jósa András Múzeum Évkönyve* 56, 141–217.

Lőrinczy, G. – Siklósi, Zs. 2022: A szegvár-oromdűlői sírok radiokarbon vizsgálatának eredményei (The radiocarbon dating, Bayesian analysis and archaeological interpretation of the Early Avar Age cemetery of Szegvár-Oromdűlő). In: Lőrinczy, G. – Major, B. – Türk, A. (eds): *A szegvár-oromdűlői temető és a Tiszántúl kora avar időszaka.* Studia ad Archaeologiam Pazmaniensia 25 – Magyar Őstörténeti Kutatócsoport Kiadványok 5. Budapest–Szeged–Szentes, 669–699. https://doi.org/10.55722/arpad.kiad.2022.5_10

Lőrinczy, G. – Straub, P. 2005a: Alpi típusú övgarnitúra a szegvár-oromdűlői 81. sírból (Alpine-type belt set from Szegvár-Oromdűlő, grave 81). *Zalai Múzeum* 14, 137–167.

Lőrinczy, G. – Straub, P. 2005b: Újabb adatok az avar kori szűrőkanalak értékeléséhez III (Neue Angaben zur Bewertung der awarenzeitlichen Sieblöffel III). *A Móra Ferenc Múzeum Évkönyve – Studia Archaeologica* 11, 127–145.

Lőrinczy, G. – Straub, P. 2006: Az avar kori padmalyos temetkezésekről. Szempontok a Kárpát-medence padmalyos temetkezéseinek értékeléséhez (Über die awarenzeitlichen Nischengräber. Angaben zur Bewertung der Nischengräber des Karpatenbeckens). *Arrabona* 44, 277–314.

Lőrinczy, G. – Szalontai, Cs. 1993: Újabb régészeti adatok Csongrád megye területének 6–11. századi településtörténetéhez I (Archäologische Beiträge zur Siedlungsgeschichte des Komitats Csongrád im im 6.-11. Jahrhundert). *A Herman Ottó Múzeum Évkönyve* 30–31, 279–320.

Lőrinczy, G. – Varga, S. 2022: Kora avar lelőhelyek és leletek a Hód-tó és a Száraz-ér tágabb környékén (Early Avar sites and finds at Hód Lake and the wider area of Száraz Creek). *A Tornyai János Múzeum Évkönyve* 4, 7–50.

Lyman, R. L. 1979: Available Meat from Animal remains: A Consideration of Techniques. *American Antiquity* 44, 536–546. https://doi.org/10.2307/279552

Mácsai, V. 2012: *A Rákóczifalva-Bagi-földek 8A avar temetőjének feldolgozása* [Examination of the Avar cemetery at Rákóczifalva-Bagi-földek Site 8A]. MA Dissertation, ELTE Eötvös Loránd University, Budapest.

Madaras, L. 1999: Újabb avar kori temetők Szentes határában (Neue awarenzeitliche Gräberfelder in der Gemarkung von Szentes). *A Móra Ferenc Múzeum Évkönyve – Studia Archaeologica* 5, 317–345.

Madaras, L. 2004: Kora avar kori sírok Öcsödről (Frühawarenzeitliche Gräber in Öcsöd). *A Móra Ferenc Múzeum Évkönyve – Studia Archaeologica* 10, 339–363.

Marcsik, A. 2022: Szegvár-Oromdűlő avar kori lelőhely humán csontanyaga. Újabb adatok az Alföld avar kori népességéhez (The Avar Age human skeletal remains at the site Szegvár-Oromdűlő: Newer data to the Avar Age populations on the Great Hungarian Plain). In: Lőrinczy, G. – Major, B. – Türk, A. (eds): *A szegvár-oromdűlői temető és a Tiszántúl kora avar időszaka* (The Szegvár-Oromdűlő Cemetery and the Avar Period in the Trans-Tisza Region). Studia ad Archaeologiam Pazmaniensia 25 – Magyar Őstörténeti Kutatócsoport Kiadványok 5. Budapest–Szeged–Szentes, 707–767. https://doi.org/10.55722/arpad.kiad.2022.5_12

Martin, R. – Saller, K. 1957: *Lehrbuch der Anthropologie in systematischer Darstellung*. Stuttgart.

Matolcsi, J. 1968: Avarkori háziállatok maradványai Gyenesdiáson (Überreste von Haustieren aus dem Zeitalter der Awaren in Gyenesdiás). *A Magyar Mezőgazdasági Múzeum Közleményei*, 85–124.

Matolcsi, J. 1970: Historische Erforschung der Körpergrösse des Rindes auf Grund von ungarischen Knochenmaterial. *Zeitschrift für Tierzüchtung und Züchtungsbiologie* 87, 89–137. https://doi.org/10.1111/j.1439-0388.1970.tb01330.x

McFadden, C. 2020: The past, present and future of skeletal analysis in palaeodemography. *Philosophical Transactions of the Royal Society B* 376/1816, 20190709. https://doi.org/10.1098/rstb.2019.0709

Meindl, R. S. – Lovejoy, C. O. 1985: Ectocranial suture closure: a revised method for the determination of skeletal age at death. *American Journal of Physical Anthropology* 68, 57–66. https://doi.org/10.1002/ajpa.1330680106

Merrett, D. C. – Pfeiffer, S. 2000: Maxillary sinusitis as an indicator of respiratory health in past populations. *American Journal of Physical Anthropology* 111, 301–318. https://doi.org/10.1002/(SICI)1096-8644(200003)111:3<301::AID-AJPA2>3.0.CO;2-0

Milner, G. R. – Boldsen, J. L. 2023: Population trends and the transition to agriculture: Global processes as seen from North America. *Proceedings of the National Academy of Sciences of the United States of America* 120, 2209478119. https://doi.org/10.1073/pnas.2209478119

Mirti, P. – Pace, M. – Negro Ponzi, M. M. – Aceto, M. 2008: ICP-MS analysis of glass fragments of parthian and sassanian epoch from Seleucia and Veh Ardašir (Central Iraq). *Archaeometry* 50, 429–450. https://10.1111/j.1475-4754.2007.00344.x

Nagy, G. – Pásztor, A. – Fórizs, I. – Tóth, M. 2010: Szarmata és avar kori üveggyöngyök elektronmikroszondás vizsgálata (Investigation of Sarmatian and Avar glass beads by electron microprobe). *Archeometriai Műhely* 7, 27–50.

B. Nagy, K. 2003: A székkutas-kápolnadűlői avar temető [The Avar cemetery of Székkutas-Kápolnadűlő]. In: B. Nagy, K: *A székkutas-kápolnadűlői avar temető.* Monographia Archaeologica 1. Szeged, 11–304.

Needs-Howarth, S. 1995: Quantifying Animal Food Diet: A Comparison of Four Approaches Using Bones from a Prehistoric Iroquoian Village. *Ontario Archaeology* 60, 92–101.

Némethi, M. – Klima, L. 1992: Kora avar kori temetkezések (Frühawarenzeitliche Reiterbestattungen). *A Nyíregyházi Jósa András Múzeum Évkönyve* 30–32, 173–244.

Nobis, G. 1954: Zur Kenntnis der ur- und frühgeschichtlichen Rinder Nord- und Mitteldeutschlands. *Zeitschrift für Tierzüchtung und Züchtungsbiologie* 63, 155–194. https://doi.org/10.1111/j.1439-0388.1954.tb01015.x

Novotnik, Á. 2011: Ein besonderer Bestattungsbrauch: "Leere" Gräber in der Awarenzeit. *Acta Antiqua Academiae Scientiarum Hungaricae* 51, 99–113. https://doi.org/10.1556/AAnt.51.2011.2.3

Orfanou, V. – Birch, T. – Lichtenberger, A. – Raja, R. – Barfod, G. H. – Lesher, Ch. E. – Eger, Ch. 2020: Copper-based metalwork in Roman to early Islamic Jerash (Jordan): Insights into production and recycling through alloy compositions and lead isotopes. *Journal of Archaeological Science: Reports* 33, 102519. https://doi.org/10.1016/j.jasrep.2020.102519

Ormándy, J. 1995: Granulációs díszítés avar kori tárgyakon. Gúla- és lemezgömbcsüngős arany fülbevalók (Awarenzeitliche Gegenstände mit Granulationsverzierung. Goldene Ohrgehänge mit Pyramiden- und Kugenanhänger). *A Móra Ferenc Múzeum Évkönyve – Studia Archaeologica* 1, 151–181.

Ortner, D. J. 2003: *Identification of a pathological conditions in human skeletal remains.* San Diego.

Pásztor, A. 1995: A kora és közép avar kori gyöngyök és a bizánci éremleletes sírok kronológiai kapcsolata (Die chronologische Beziehung der Perlen und byzantinische Münzen führenden früh- und mittelawarenzeitlichen Gräber). *Somogyi Múzeumok Közleményei* 11, 69–92.

Pásztor, A. 2008: Ergebnisse der typochronologischen Untersuchung awarenzeitlicher Perlenfunde in Ungarn – Perlentracht in der Früh und Mittelawarenzeit. *Antaeus* 29–30, 307–324.

Pásztor, A. 2014: Die Perlenfunde aus dem frühawarenzeitlichen Gräberfeld von Keszthely-Fenékpuszta, Ödenkirche-Flur. In: Müller, R.: *Die Gräberfelder von Keszthely-Fenékpuszta, Ödenkirche-Flur.* Castellum Pannonicum Pelsonense 5. Budapest–Leipzig–Keszthely–Rahden, 257–310.

Pásztor, A. 2018a: A hajós-cifrahegyi avar kori gyöngyleletek (Beads from the Avar cemetery of Hajós-Cifrahegy). In: Varga, M. – Szentpéteri, J. (eds): *Két világ határán: természet- és társadalomtudományi tanulmányok a 70 éves Költő László tiszteletére.* Kaposvár, 255–291. https://doi.org/10.26080/krrmkozl.2018.6.255

Pásztor, A. 2018b: A hódmezővásárhely-kishomoki avar kori sírok gyöngyleletei (Perlenfunde in den awarenzeitliche Gräbern von Hódmezővásárhely-Kishomok [Kom. Csongrád, Ungarn]). In: Korom, A. (ed.): *Relationes rerum. Régészeti tanulmányok Nagy Margit tiszteletére.* Studia ad Archaeologiam Pazmaniensia 10. Budapest, 615–624.

Pásztor, A. 2018c: A szegvár-sápoldali 7. századi sírcsoport gyöngyleletei (The beads from the Avar Period grave group at Szegvár-Sápoldal). *Archaeologiai Értesítő* 143, 85–97. https://doi.org/10.1556/0208.2018.143.4

Pásztor, A. 2022: A szegvár-oromdűlői temető gyöngyleletei (Bead finds from the cemetery of Szegvár-Oromdűlő). In: Lőrinczy, G. – Major, B. – Türk, A. (eds): *A szegvár-oromdűlői temető és a Tiszántúl kora avar időszaka.* Studia ad Archaeologiam Pazmaniensia 25 – Magyar Őstörténeti Kiadványok 5. Budapest–Szeged–Szentes, 405–508. https://doi.org/10.55722/arpad.kiad.2022.5_04

Pópity, D. 2021: *Avar* és *Árpád-kori népesség a Maros mentén. Településtörténeti kutatások a Maros folyó völgyének magyarországi szakaszán* [Avar and Árpád era population along the Maros. Settlement history research in the Hungarian section of the Maros river valley]. PhD Dissertation, ELTE Eötvös Loránd University, Budapest. https://doi.org/10.15476/ELTE.2021.019

Rácz, Zs. 2014: *Die Goldschmiedgräber der Awarenzeit.* Monographien des Römisch-Germanischen Zentralmuseums 116. Mainz.

Reed, R. 1972: *Ancient Skins, Parchments and Leathers.* London–New York.

Reitz, E. J. – Quitmyer, I. R. – Hale, H. S. – Scudder, S. J. – Wing, E. S. 1987: Application of Allometry to Zooarchaeology. *American Antiquity* 52, 304–317. https://doi.org/10.2307/281782_

Rózsa, Z. – Pásztor, A. – Szatmáriné Bakonyi, E. 2013: Kora avar kori sírok Orosháza-Bónumból II. [Early Avar Period graves from Orosháza-Bónum II]. *Mozaikok Orosháza és vidéke múltjából* 10, 3–13.

Rózsa, Z. – Vörös, I. 2004: Kora avar kori sír Gyulán (Early Avar grave at Gyula). In: Kisfaludy, J. (ed.): *Régészeti Kutatások Magyarországon 2002 – Archaeological Investigations in Hungary 2002.* Budapest, 35–41.

Schaefer, M. C. – Black, S. – Scheuer, L. 2009: *Juvenile Osteology: A Laboratory and Field Manual.* Amsterdam.

Scott, G. R. – Pilloud, M. A. – Navega, D., d'Oliveira, J. – Cunha, E. – Irish, J. D. 2018: rASUDAS: A new web-based application for estimating ancestry from tooth morphology. *Forensic Anthropology* 1, 18–31. https://doi.org/10.5744/fa.2018.0003

Silver, I. A. 1963. The Ageing of Domestic Animals. In: Brothwell, D. – Higgs, E. (eds): *Science in Archaeology: A Comprehensive Survey of Progress and Research.* New York, 250–268.

Silvestri, A. – Molin, G. – Salviulo, G. 2005: Roman and medieval glass from the Italian area: Bulk characterization and relationships with production technologies. *Archaeometry* 47, 797–816. https://doi.org/10.1111/j.1475-4754.2005.00233.x

Sjøvold, T. 1990: Estimation of stature from long bones utilizing the line of organic correlation. *Journal of Human Evolution* 5, 431–444. https://doi.org/10.1007/BF02435593

Snoddy, A. M. E. – Buckley, H. R. – Elliott, G. E. – Standen, V. G. – Arriaza, B. T. – Halcrow, S. E. 2018: Macroscopic features of scurvy in human skeletal remains: A literature synthesis and diagnostic guide. *American Journal of Physical Anthropology* 167, 876–895. https://doi.org/10.1002/ajpa.23699

Socrates, G. 2004: *Infrared and Raman characteristic group frequencies: Tables and charts.* Chichester.

Sokolov, P. – Gulyás, B. 2023: Graves of the early medieval nomads from the eastern Azov region. *Archeologiai Értesítő* 148, 29–48. https://doi.org/10.1556/0208.2023.00044

Somogyi, P. 1997: Drei frühawarenzeitliche Bestattungen aus der Fundstelle Nr. 264 von Gyoma (Három kora avar kori sír a Gyoma-264. sz. lelőhelyről). *A Móra Ferenc Múzeum Évkönyve – Studia Archaeologica* 3, 97–116.

Spekker, O. – Hunt, D. R. – Berthon, W. – Paja, L. – Molnár, E. – Pálfi, G. – Schultz, M. 2021: Tracking down the White Plague. Chapter three: Revision of endocranial abnormally pronounced digital impressions as paleopathological diagnostic criteria for tuberculous meningitis. *PLoS ONE* 16/3, e0249020. https://doi.org/10.1371/journal.pone.0249020

Staššíková-Štukovská, D. 2017: Natron and plant ash glass in the Middle Danube region during the early Middle Ages. In: Wolf, S. – Pury-Gysel, A. (eds): *ANNALES du 20e Congrès de l'Association Internationale pour l'Histoire du Verre.* Romont, 366–373.

Staššíková-Štukovská, D. – Galusková, D. – Plško, A. 2020: Glass melting experiments in the reconstruction of glass furnace from the 9th century. *Archeologia Polski* 65, 215–260. https://10.23858/APol65.2020.006

Staššíková-Štukovská, D. – Plško, A. 1997: Typologische und technologische Aspekte der Perlen aus dem frühmittelalterlichen Gräberfeld in Borovce. In: von Freeden, U. – Wieczorek, A. (eds): *Perlen: Archäologie, Techniken, Analysen des Internationalen Perlensymposium in Mannheim 1994.* Bonn, 259–274.

Stloukal, M. – Hanáková, H. 1978: Die Lange der Langsknochen altslawischer Bevölkerungen unter besonderer Berücksichtigung von Wachstumsfragen. *Homo* 29, 53–69.

Szabó, J. Gy. 1981: A Mátra-vidéki avarkori temetők állatcsont leleteinek néhány tanulsága (Einige Lehren aus den Tierknochen Funde der awarenzeitlichen Gräberfeldern im Mátra-Gebiet). *Szolnok Megyei Múzeumi Évkönyv*, 65–70.

Szalai, F. 2018: A Szegvár-Sápoldal lelőhelyen feltárt avar sírok csontvázmaradványainak antropológiai vizsgálata (Anthropological examinations of the skeletal remains excavated at the Szegvár-Sápoldal Avar age cemetery). *Archaeologiai Értesítő* 143, 99–104. https://doi.org/10.1556/0208.2018.143.5

Szeniczey, T. 2020: A nazomaláris szög és szimotikus húr alkalmazása metrikus alapú taxonómiai osztályozási feladatokban (The utility of nasomalar angle and simotic chord in ancestry estimation from craniometric data). *Anthropologiai Közlemények* 61, 53–62. https://doi.org/10.20330/AnthropKozl.2020.61.53

Szücsi, F. – Lencsés, Zs. – Libor, Cs. – Szeifert, B. – Gerber, D. – Mende, B. G. (in press): Avar kori többes temetkezések a Mezőföldön [Avar-age double burials in the Mezőföld region]. In: *"Hadak útján". A népvándorláskor fiatal kutatóinak XXX. konferenciája.* Székesfehérvár, in press.

Takáts, I. – Somhegyi, T. – Bartosiewicz, L. 1995: Avar-kori lovakról Vörs-Papkert B temető leletei alapján (A study of Avar period horses on the basis of bones from the cemetery of Vörs-Papkert). *Somogyi Múzeumok Közleményei* 11, 183–188.

Tanács, L. – Pinnyei, Sz. 2018: *Mezőgazdasági termékek feldolgozása. 2: Állati eredetű nyersanyagok feldolgozása* [Processing of agricultural products 2: Processing of raw materials of animal origin]. Szeged.

Teichert, M. 1975: Osteometrische Untersuchungen zur Berechnung der Widerristhöhe bei Schafen. In: Clason, A. T. (ed.): *Archaeozoological Studies*. Amsterdam–Oxford–New York, 51–69.

Tobias, B. 2011: Avar kori tarsolyzárók a Kárpát-medencében (Awarenzeitliche Taschenverschlüsse im Karpatenbecken) *A Móra Ferenc Múzeum Évkönyve – Studia Archaeologica* 12, 277–312.

Tomka, P. 1978: Adatok a Kisalföld avar kori népességének temetkezési szokásaihoz III. Koporsóhasználat a tápi temetőben (Angaben zum Bestattungsbrauchtum der Bevölkerung vom Kleinen Alföld in der Awarenzeit III. Sarggebrauch im Gräberfeld von Táp). *Arrabona* 19–20, 17–108.

Tomka, P. 2003: Az avar kori temetkezési szokások kutatásának újabb eredményei. Kettős- és többes temetkezések (Neue Erkenntnisse in der Forschung der Bestattungsbräuche zur Zeit der Awaren Doppel-, Mehrfachbestattungen). *Arrabona* 41, 11–56.

Tornero, C. – Balasse, M. – Bréhard, S. – Carrère, I. – Fiorillo, D. – Guilaine, J. – Vigne, J.-D. – Manen, C. 2020: Early evidence of sheep lambing de-seasoning in the Western Mediterranean in the sixth millennium BCE. *Scientific Reports* 10, 12798. https://doi.org/10.1038/s41598-020-69576-w

Vida, T. 1999: *Die awarenzeitliche Keramik I.* Varia Archaeologica Hungarica 8. Budapest.

Vida, T. 2009: "… Kérték, hogy Pannoniában lakhassanak." Az avarok letelepedése ["…They asked to be settled in Pannonia." The settlement of the Avars]. In: Anders, A. – Szabó, M. – Raczky, P. (eds): *Régészeti dimenziók. Tanulmányok az ELTE BTK Régészettudományi Intézetének tudományos műhelyéből.* Budapest, 105–122.

Vida, T. 2022: Sírkerámia a szegvár-oromdűlői avar kori temetőben (Grave pottery in the Avar Age cemetery of Szegvár-Oromdűlő). In: Lőrinczy, G. – Major, B. – Türk, A. (eds): *A szegvár-oromdűlői temető és a Tiszántúl kora avar időszaka.* Studia ad Archaeologiam Pazmaniensia 25 – Magyar Őstörténeti Kutatócsoport Kiadványok 5. Budapest–Szeged–Szentes, 509–554. https://doi.org/10.55722/arpad.kiad.2022.5_05

Vida, T. – Völling, T. 2000: *Das slawische Brandgräberfeld von Olympia.* Archäologie in Eurasien 9. Rahden/Westf.

Vitt, V. O. 1952: Loshadi pazirikskikh kurganov [Horses of the kurgans from Pazyryk]. *Sovietskaya Arkheologiya* 16, 163–205.

Vörös, I. 1996: A szentes-borbásföldi kora avar kori 4. sír állatcsontleletei (Die Tierknochenfunde des frühawarenzeitlichen Grabes 4 von Szentes-Borbásföld). *A Móra Ferenc Múzeum Évkönyve – Studia Archaeologica* 2, 191–194.

Vörös, I. 1998: A békéssámsoni kora avar sír lova (Das Pferd des frühawarenzeitlichen Grabes von Békéssámson). *A Móra Ferenc Múzeum Évkönyve – Studia Archaeologica* 4, 373–376.

Vörös, I. 2002: Áldozatiállat-maradványok a tótkomlósi avar kori sírban (Reste von Opfertieren im awarenzeitlichen Grab von Tótkomlós). *A Móra Ferenc Múzeum Évkönyve – Studia Archaeologica* 8, 345–350.

Vörös, I. 2013: Adatok a honfoglalás kori lovas temetkezésekhez (Archaeological data on the typology of tenth-century horse burials and burials with horses in the Carpathian Basin). In: Révész, L. – Wolf, M. (eds): *A honfoglalás kor kutatásának legújabb eredményei. Tanulmányok Kovács László 70. születésnapjára.* Monográfiák a Szegedi Tudományegyetem Régészeti Tanszékéről 3. Szeged, 321–336.

Vörös, I. 2017: A pitvarosi avar temető archaeozoológiai vizsgálata [Archaeozoological examination of the Avar cemetery at Pitvaros]. In: Bende, L.: *Temetkezési szokások a Körös–Tisza–Maros közén az avar kor második felében.* Studia ad Archaeologiam Pazmaniensia 8. Budapest, 533–564.

Vörös, I. 2022: Szegvár-Oromdűlő kora avar kori temető archaeozoológiai vizsgálata (Archaezoological analysis of the early Avar period cemetery of Szegvár-Oromdűlő). In: Lőrinczy, G. – Major, B. – Türk, A. (eds): *A szegvár-oromdűlői temető és a Tiszántúl kora avar időszaka* (The Szegvár-Oromdűlő Cemetery and the Avar Period in the Trans-Tisza Region). Studia ad Archaeologiam Pazmaniensia 25 – Magyar Őstörténeti Kutatócsoport Kiadványok 5. Budapest–Szeged–Szentes, 769–883. https://doi.org/10.55722/arpad.kiad.2022.5_13

Waldbaum, J. C. 1983: *Metalwork from Sardis: The finds through 1974.* Archaeological Exploration of Sardis 8. Cambridge–London.

Waldron, T. 2009: *Palaeopathology.* Cambridge. https://doi.org/10.1017/CBO9780511812569

Walker, P. L. – Bathurst, R. R. – Richman, R. – Gjerdrum, T. – Andrushko, V. A. 2009: The causes of porotic hyperostosis and cribra orbitalia: A reappraisal of the iron-deficiency-anemia hypothesis. *American Journal of Physical Anthropology* 139, 109–125. https://doi.org/10.1002/ajpa.21031

Wedepohl, K. H. 1993: *Die Herstellung mittelalterlicher und antiker Gläser*. Akademie de Wissenschaften und der Literatur: Abandlungen der Mathematisch-Naturwissenschaftlichen Klasse 3. Stuttgart.

Weyl, W. 1951: *Coloured Glasses*. Sheffield.

Tab. 1. Animal remains in the early Avar graves

Feature Nr.	Strati-graphical Nr.	Burial	Age and sex of the deceased	Species	Age of animal	Description	Season of burial
53	40		female, 24–26 yrs	swine	infantile / neonate	left partial foreleg (food offering): radius and ulna	unknown
928	986	coffin, disturbed (?)	child, 4–6 yrs	cattle	juvenile, ca. 18 months	head, truncated legs, feet (hide): cranium, mandibula sin-dext, os hyoideum, radius sin-dext (fr.), metacarpus sin-dext, tibia sin-dext (fr.), astragalus sin-dext, calcaneus sin-dext, ossa tarsi sin-dext, metatarsus sin-dext, phalanges; teeth: upper dp2-4 sin-dext, M1-3 (M3 not yet in wear); lower I1 dext, dpi2 dext, dp3 dext, dp4 sin-dext, M1-3sin-dext (M3 not yet in wear)	autumn, September–October
				swine	adult	humerus (food offering)	
				sheep	adult	truncated leg (hide?): tibia sin (fr.), metatarsus sin-dext, astragalus sin, os centrotarsale sin	
929	987	coffin	child, 7.5–9.5 yrs	sheep	adult / mature	head, truncated legs, feet (hide): cranium, mandibula sin-dext, metacarpus sin-dext, tibia sin-dext (fr.), metatarsus sin-dext, phalanges	autumn, September–October
				cattle	juvenile, ca. 18 months	head, truncated legs, feet (hide): cranium, mandibula sin-dext, os hyoideum, atlas, 3 vertebrae caudales, metacarpus sin-dext, tibia sin-dext (fr.), astragalus sin, calcaneus sin-dext, ossa tarsi sin, metatarsus sin-dext, phalanges; teeth: upper dp2-4, M1-2 sin-dext; lower dpi2 sin-dext, dp2-4, M1-2 sin-dext.	
				swine	infantile, max. 12 months	hindleg (food offering): pelvis sin-dext, tibia sin, fibula sin, astragalus sin, calcaneus sin	
1291	1382	cenotaph (?)		sheep	adult	head, truncated legs, feet (hide): cranium, mandibula sin-dext, radius dext (fr.), metacarpus sin-dext, tibia sin-dext (fr.), astragalus dext, calcaneus sin-dext, os centrotarsale sin-dext, metatarsus sin-dext, phalanges; teeth: upper M1-3 dext; lower P3-4 dext, M1-3 sin-dext	unknown
1307	1419	disturbed	female, 25-40 yrs	sheep	adult / mature	head, truncated legs, feet (hide): cranium, mandibula sin-dext, os hyoideum, 2 vertebrae caudales, radius sin-dext (fr.), ossa carpi sin-dext, metacarpus sin-dext, tibia sin (fr.), astragalus dext, metatarsus sin-dext, phalanges; teeth: upper P2 dext, P3-4 sin-dext, M1-3 sin-dext; lower P2 sin, P3-4 sin-dext, M1-3 sin-dext	unknown

Feature Nr.	Stratigraphical Nr.	Burial	Age and sex of the deceased	Species	Age of animal	Description	Season of burial
1308	1420	cenotaph		cattle	juvenile, 18–20 months	head, truncated legs, feet (hide): cranium, mandibula sin-dext, os hyoideum, atlas, epistropheus, vertebra cervicalis III, radius sin-dext (fr.), ossa carpi sin-dext, metacarpus sin-dext, tibia sin-dext (fr.), astragalus sin-dext, calcaneus sin-dext, ossa tarsi sin-dext, metatarsus sin-dext, phalanges; teeth: upper dp2-4 sin-dext, M1-2 sin-dext, M3 sin-dext (not yet in wear); lower I2 sin-dext, dp3-4 sin-dext, M1-2 sin-dext.	autumn/winter, September–November
				sheep	juvenile, 18–24 months	head, truncated legs, feet (hide): cranium, mandibula sin-dext, radius sin-dext (fr.), metacarpus dext, tibia sin (fr.), phalanges; teeth: upper P2-3 sin-dext, dp4 sin-dext, M1-3 sin-dext; lower I1 dext, dp3 dext, dp4 sin-dext, M1-3 sin-dext (M3 not yet in wear)	
1310	1422		child, 2.5–3.5 yrs	sheep	adult	head, truncated legs, feet (hide): cranium, mandibula sin-dext, os hyoideum, atlas, 3 vertebrae caudales, radius sin (fr.), metacarpus sin-dext, tibia sin-dext (fr.), calcaneus sin-dext, metatarsus sin-dext, phalanges; teeth: upper P2-4 sin-dext, M1-3 sin-dext; lower I1-3 dext, P3-4 sin-dext, M1-3 sin-dext	unknown
1324	1437	disturbed	child, 9.5–10.5 yrs	horse	subadult, 4–4.5 yrs, mare	head, truncated legs, feet (hide): cranium, mandibula sin-dext, os hyoideum, atlas, vertebra caudalis, radius sin-dext (fr.), ossa carpi sin-dext, metacarpus sin-dext, tibia sin-dext (fr.), astragalus sin-dext, calcaneus sin-dext, ossa tarsi sin-dext, metatarsus sin-dext, phalanges; teeth: upper I1-3 sin-dext, P1 dext, P2-4 sin-dext, M1-3 sin-dext; lower P2-4 sin-dext, M1-3 sin-dext	summer/autumn, July–November
				sheep	juvenile, 16–20 months	head, truncated legs, feet (hide): mandibula sin, radius sin-dext (fr.), metacarpus sin-dext, tibia sin (fr.), astragalus sin, calcaneus sin, metatarsus sin-dext, phalanges; teeth: upper M1-2 sin; lower M1-2 sin	
1384	1513		male, 25–30 yrs	sheep	adult	head, truncated legs, feet (hide): cranium, mandibula sin-dext, radius sin (fr.), metacarpus sin-dext, tibia sin-dext (fr.), astragalus dext, metatarsus sin-dext; teeth: upper P2 sin, P3-4 sin-dext, M1-3 sin-dext; lower I1-2 sin, P2-3 dex,t P4 sin-dext, M1-3 sin-dext.	unknown
				small ruminant	adult?	head (attribute?) (lost?)	
1412	1541		child, 0–1 yrs	sheep	adult	head, truncated legs, feet (hide): cranium, mandibula sin-dext, os hyoideum, metacarpus dext, tibia sin (fr.), astragalus sin, calcaneus sin, metatarsus sin, phalanges; teeth: upper P2-4 sin-dext, M1-3 sin-dext; lower C sin, P2-4 sin, M1-3 sin	unknown
				domestic hen	juvenile	wing, breast (food offering): sternum (fr.), ulna dext.	

Feature Nr.	Strati-graphical Nr.	Burial	Age and sex of the deceased	Species	Age of animal	Description	Season of burial
1414	1543	disturbed	child, 10.5 months – 1.5 yrs	cattle	infantile / neonate	head, truncated legs, feet (hide): cranium, mandibula sin-dext, os hyoideum, atlas, vertebra caudalis, radius dext (fr.), ossa carpi sin-dext, metacarpus sin-dext, , astragalus sin, phalanx; teeth: none preserved	spring, March–April
1416	1545	disturbed	child, 1.5–2.5 yrs	sheep	adult	head, truncated legs, feet (hide): cranium, mandibula sin-dext, os hyoideum, radius sin (fr.), ossa carpi sin-dext, metacarpus sin-dext, os centrotarsale dext, calcaneus dext, metatarsus sin-dext, phalanges; teeth: upper P2-4 sin-dext, M1-3 sin-dext; lower I1 sin, I2-3 sin-dext, P2 sin, P3-4 sin-dext, M1-3 sin-dext	unknown
1426	1555		child, 10.5 months – 1.5 yrs	sheep	adult	head, truncated legs, feet (hide): cranium, mandibula sin-dext, vertebra caudalis, radius sin (fr.), metacarpus sin, tibia sin-dext (fr.), astragalus sin-dext, metatarsus sin-dext, phalanges; teeth: upper M2-3 sin, M3 fr dext; lower M1 sin, M2-3 sin-dext	summer, May–August
				sheep	infantile, 3–6 months	head, truncated legs, feet (hide): cranium, mandibula sin-dext, os hyoideum, metacarpus sin-dext, tibia sin-dext (fr.), metatarsus sin, phalanges; teeth: upper dp3-4 sin-dext, M1 sin-dext; lower dpi1-2 dext, dp2-4 sin-dext, M1 sin-dext	
				sheep	subadult	lumbar vertebrae III-IV (food offering)	
				domestic hen	adult	wing (food offering): radius dext	
				domestic goose (?)		eggshell	
1433	1563	disturbed, robbed	female, 50+ yrs	domestic hen	adult	almost complete skeleton, without head (food offering, in pot): sternum, costae, scapula sin-dext, humerus sin-dext, coracoideum sin-dext, radius dext, ulna sin-dext, metacarpus sin-dext, femur sin-dext, tibiotarsus sin-dext	unknown
1436	1567		female, 35–45 yrs	cattle	juvenile, 18–24 months	head, truncated legs, feet (hide): cranium, mandibula sin-dext, atlas, radius sin (fr.), ossa carpi sin, metacarpus sin, tibia dext (fr.), astragalus sin, os centrotarsale sin, metatarsus sin, phalanges; teeth: upper dp2-4 sin-dext, M1-2 sin-dext; lower dpi2 sin, dpi3 sin-dext, dp2-4 sin-dext, M1-2 sin-dext	autumn/winter, September–February
				cattle	adult	partial hindleg (food offering?): tibia sin (fr.)	
1437	1568	disturbed, robbed	child, max. 5 months	sheep	juvenile, max. 13–16 months	head, truncated legs, feet (hide): cranium, mandibula sin-dext, os carpale IV-V sin, metacarpus sin-dext, astragalus dext, calcaneus dext, os centrotarsale dext, metatarsus dext, phalanges; teeth: lower M1 or M2 dext. (fr.)	spring/summer, April–July
				sheep	adult	partial lower leg (hide?): metatarsus sin (fr.)	

Feature Nr.	Stratigraphical Nr.	Burial	Age and sex of the deceased	Species	Age of animal	Description	Season of burial
1439	1570		child, 2.5–3.5 yrs	sheep	adult	head, truncated legs, feet (hide): cranium, mandibula sin-dext, radius sin-dext (fr.), os carpi intermedium dext, metacarpus sin-dext, metatarsus sin-dext, phalanges; teeth: upper P2-4 sin-dext, M1-3 sin-dext; lower P3-4 sin-dext, M1-3 sin-dext	winter/spring, December–April
				sheep	juvenile, 9–12 months	head, truncated legs, feet (hide): cranium, mandibula sin-dext, metacarpus sin-dext, calcaneus dext, phalanx media; teeth: upper M1-2 dext; lower dp2-3 dext, dp4 sin-dext, M1 sin-dext	
				swine	infantile, max. 12 months	parts of the left foreleg and right hindleg (food offering): scapula sin, humerus sin (fr.), tibia dext, fibula dext, astragalus dext	
1482	1619	coffin	child, 6.5–7.5 yrs	sheep	adult / mature	head, truncated legs, feet (hide): cranium, mandibula sin-dext, os hyoideum, atlas, metacarpus sin, tibia dext (fr.), calcaneus sin, metatarsus sin, phalanx (fr.); teeth: upper M1-3 sin-dext; lower M1-3 sin-dext; heavily worn teeth	summer/autumn, May–October
				cattle	juvenile, 15–18 months	head, truncated legs, feet (hide): cranium, mandibula sin-dext, os hyoideum, atlas, tibia sin (fr.), astragalus sin, calcaneus sin, ossa tarsi sin, metatarsus sin, phalanges; teeth: upper dp2-4 sin-dext, M1 sin-dext; M2 sin-dext erupting; lower dp2-4 sin-dext, M1 sin-dext, M2 sin-dext erupting	
				swine	adult (?)	pelvis dext fr. (food offering)	
1483	1620		child, max. 5 months	sheep	adult (?)	hoof (attribute?): phalanx distalis	unknown
1500	1637		child, 12.5–13.5 yrs	cattle	juvenile, 18–24 months	head, truncated legs, feet (hide): cranium, mandibula sin-dext, os hyoideum, radius sin-dext (fr.), ossa carpi sin-dext, metacarpus dext, tibia sin-dext (fr.), astragalus sin-dext, calcaneus sin-dext, ossa tarsi sin-dext, metatarsus sin-dext, phalanges; teeth: upper dp3-4 dext, M1-3 sin-dext (M3 erupting); lower I2 sin, dp3-4 sin-dext, M1-3 sin-dext (M3 erupting)	autumn/winter, September–February
				sheep	subadult/adult, 3–4 yrs	head, truncated legs, feet (hide): mandibula sin-dext, atlas, radius dext (fr.), metacarpus sin-dext, tibia sin-dext (fr.), os centrotarsale sin-dext, astragalus sin-dext, calcaneus sin-dext, metatarsus sin-dext, phalanges; teeth: upper M2 dext, lower I3 dext (not yet erupted), M2 dext, M3 sin-dext (M3 not fully in wear)	
1501	1638	disturbed	child, 1–2 yrs	sheep	adult	head, truncated legs, feet (hide): cranium, mandibula sin-dext, radius dext (fr.), metacarpus sin-dext, tibia dext (fr.), astragalus sin, calcaneus sin, phalanges; teeth: upper P2-3 sin, P4 sin-dext, M1-3 sin-dext; alsó P3-4 sin-detx, M1-3 sin-dext; lower M1 heavily worn, lower P4 irregularly worn on both sides	unknown

Feature Nr.	Strati-graphical Nr.	Burial	Age and sex of the deceased	Species	Age of animal	Description	Season of burial
1512	1650	disturbed, robbed	child, 2.5–3.5 yrs	sheep	adult / mature	head and left partial foreleg (hide?): cranium, mandibula sin-dext, radius sin (fr.), phalanges; teeth: upper M1-3 dext, lower M2 dext, M3 sin-dext; heavily worn	unknown
1528	1666	disturbed	teenager of unknown sex, 14–15 yrs	cattle	adult	calcaneus (attribute?)	unknown
				sheep	juvenile/ sub-adult	6 lumbar and a caudal vertebrae (food offering)	
				swine	juvenile, max. 12 months	parts of the left hindleg (food offering): femur sin, fibula sin, os tarsale tertium sin, 2 metatarsi sin, phalanges	

Tab. 2. Measurements on the animal bones. 1 – greatest length, 2 – greatest proximal breadth, 3 – greatest proximal depth, 4 – smallest breadth of the diaphysis, 5 – smallest depth of the diaphysis, 6 – greatest distal breadth, 7 – greatest distal depth, 8 – other measurements after von den Driesch 1972

ID	age and sex	skeletal element	side	1	2	3	4	5	6	7	8	note
Z.1.72845.986.001 cattle	juvenile, kb. 18 months, probably cow	astragalus	sin								GLl: 61.8; GLm: 56.2; Dl: 35.2; Dm: 32.3; BD: 39.6	
		astragalus	dex								GLl: 62.7; GLm: 56.7; Dl: 35.2; Dm: 30.7; BD: 38.8	
		atlas									BFcd: 84.3	
		calcaneus	sin	123.2*								
		calcaneus	dex								BG: 36.4	
		cranium									26: 93.9; 28: 33.6	
		mandibula	sin								2: 322*; 12: 142.1; 13: 131.9;	
		metacarpus	sin	190*	53.4	32.5	29.4	21				
		metacarpus	dex				29.2	21				
		metatarsus	sin	211*		42.7	25	23				
		metatarsus	dex	212*	44.1	43.4	25.5	23				
		os centrotarsale	sin								BG: 51.7	
		os centrotarsale	dex								BG: 53.7	
Z.1.72845.987.002 cattle	juvenile, ca. 18 months, probably cow	astragalus	sin								GLl: 61.6; GLm: 55.2; Dl: 34.5; Dm: 34.8; BD: 39.8	
		cranium									26: 77.3; 28: 33.5; 29: 35*; 31: 113*; 32: 136.5; 45: 35.8; 46: 29.4	
		mandibula	sin								1: 266; 2: 270*; 6: 227	
		mandibula	dex								12: 113; 13: 105.3; 14: 150; 15b: 40.6; 15c: 29.4	
		metacarpus	sin	174.5*	51.6	30.7	24	18				
		metatarsus	sin	193.2*	42.9	37.9	20	19				
		metatarsus	dex		42.2	39	19.7	20				

ID	age and sex	skeletal element	side	1	2	3	4	5	6	7	8	note
Z.1.72845.1420.001 cattle	juvenile, 18–20 months, probably cow	astragalus	sin	57.8							GLl: 57.1; GLm: 52.9; Dl: 32.6; Dm: 27.7*; BD: 34.8	small, ca. 70 mm-long horn core
		astragalus	dex	58							GLm: 52.3*; BD: 36	
		metatarsus	sin	205	40.9	37.5	21.7					
		metacarpus	sin	182.3*	47.4*	29.3	26.2	19				
		metatarsus	dex		39.8	37.2	21.9					
		mandibula	sin								11: 66.3; 12: 141.5; 13: 131.2; 14: 181.9; 15b: 47.8	
		os centrotarsale	sin								GB: 44.8	
		os centrotarsale	dex								GB: 45	
Z.1.72845.1567.001 cattle	juvenile, 18–24 months	astragalus	sin								GLl: 59.8; GLm: 55; Dl: 32.5; Dm: 29*; BD: 37.9	small, rudimentary horn cores, measuring 22.7×22.7 mm at their base (fragmented)
		atlas									BFcr: 82.7; H: 58.9*	
		cranium									26: 80*; 28: 34.3*; 29: 37.5*	
		mandibula	sin								12: 123.5; 13: 117.1; 14: 168.3	
		metacarpus	sin	177*	48.7	29.3	23.8	17				
		metatarsus	sin	40.7	39.8	20.4	19.9					
Z.1.72845.1619.002 cattle	juvenile, 15–18 months, probably cow	atlas	sin								BFcr: 74.4; H: 58.8	small, rudimentary horn cores, measuring 21.2×17.7 mm at their base, ca. 26 mm long (fragmented)
		cranium									26: 73.6; 28: 31.8; 29: 33.1; 31: 101	
		metatarsus		197*	40	38.5	16.7	17				
Z.1.72845.1637.001 cattle	juvenile, 18–24 months, probably cow	astragalus	sin								GLl: 56.1; GLm: 50.9; Dl: 32.4; Dm: 30; BD: 37.2	
		astragalus	dex								GLl: 56.5; GLm: 50.2; Dl: 32.4; Dm: 30.8; BD: 35.7	
		metacarpus	dex	178*	47.6	28.6	26.2	19				
		metatarsus	dex	197*	38.2	38.1	22	22				
		metatarsus	sin	199*	38	39.2	22.3	22				
		os centrotarsale	dex								GB: 45.6	
		os centrotarsale	sin								GB: 45.8	

ID	age and sex	skeletal element	side	1	2	3	4	5	6	7	8	note
Z.1.72845.0986.003 sheep	adult	astragalus									GLl: 30.8; GLm: 28.4; Dl: 16.8; Dm: 16.5; BD: 19.3	
		metatarsus		130.9	23.0	20.4	12.0	10.0	25.1	16.6		
		metatarsus		131.0	22.9	20.8	12.1	10.1	25.6	16.5		
		os centrotarsale									BG: 23.5	
Z.1.72845.987.001 sheep	adult / mature	cranium									27: 50*; 29: 21.9; 30: 17.6; 31: 41*	est. withers height: 61 cm
		mandibula	sin								3: 58.4; 5: 119*; 6: 143*; 8: 44.3; 12: 73.3; 13: 66.1; 14: 99.8; 15a: 35.4; 15b: 22.3; 15c: 21.1*	
		mandibula	dex								7: 69.5* (alveolus mérve); 8: 46.7; 15b: 22; 15c: 16*12: 73.8; 13: 67; 14: 98.2	
		metacarpus	sin	126.8			13.3	9.4	25.8	16.4		
		metacarpus	dex	127.0	24.9	17.0	13.3	9.3	25.9	16.6		
		metatarsus	sin	136.1	21.7	20.5	12.0	10.6		16.5		
		metatarsus	dex				11.8	10.7	24.9	16.6		
		tibia	dex						25.5	20.4		
Z.1.72845.1382.001 sheep	adult	astragalus	dex								GLl: 28.2; GLm: 26.7; Dl: 15.7; Dm: 17.2; BD: 17.5	est. withers height: 63 cm
		calcaneus	dex								GL: 56.8; GB: 17.3	
		cranium									22: 45; 30: 67.1*; 31: 42*;	
		mandibula	dex								4: 121.1*; 7: 71*; 8: 49.7; 9: 22.2*; 15c: 21.9	
		mandibula	sin								8: 48.7; 15a: 40.1; 15b: 24.6	
		metacarpus	dex	130.4	22.0	16.0	13.9	9.2	24.3	15.4		
		metacarpus	sin		22.5	16.5	14.1	9.7				
		metatarsus	dex		21.5*	19.9		9.5	23.8	15.4		
		metatarsus	sin			19.6						
		radius	dex				8.9	28.8	17.6			
		tibia	sin						26.2	20.8		
		tibia	dex						25.4	20.5		

ID	age and sex	skeletal element	side	1	2	3	4	5	6	7	8	note
Z.1.72845.1419.001 sheep	adult / mature	mandibula	dex								7: 67.5*; 8: 45.4; 9: 21.6*; 15a: 33.4; 15b: 22.8; 15c: 17.4	est. withers height: 61.5 cm
		metacarpus	sin	126.3	24.8	17	13.5	11	26.5	16.1		
		metacarpus	dex		24.5	17.7		11	26.7	16.1		
		metatarsus	dex	136.4	20.5	20.4	12.6	10	24.3	15.2		
		metatarsus	sin	137.5	20.9	20.6	12.3	9.9	25.4	16		
		radius							29.2	19.5*		
		radius	sin						30*	19.8		
Z.1.72845.1420.002 sheep	juvenile, 18-24 months	cranium									27: 44.2; 29: 18.8; 30: 17.1	
		mandibula	sin								15b: 27.3; 15c: 18.2	
		metacarpus	dex		25.5	17.3	15	11				
Z.1.72845.1422.001 sheep	adult	atlas									GL: 51; GLF: 46.8; BFcd: 43.2; BFcr: 47.6	est. withers height: 60 cm
		calcaneus	sin								GL: 57.1; GB: 19.2	
		calcaneus	dex								GL: 57.4; GB: 19.4	
		cranium									1: 245**; 9: 51.4; 20: 77.6; 21: 70.8; 22: 47.6; 23: 23.7; 26: 70.5; 27: 48.5; 28: 70*; 29: 20.3;30: 17.8; 31: 38.3; 33: 65.4; 34: 114.5; 37: 32.1;	
		mandibula	sin								6: 145*; 7: 74.5; 8: 51.6; 9: 20.9; 11: 47.8; 15b: 23.8; 15c: 19.3	
		mandibula	dex								1: 178.6; 2: 187.5*; 3: 53.5; 4: 130*; 5: 124.3; 6: 124.3; 7: 74; 11: 45; 12: 59.1; 13: 61.6; 14: 85.3; 15a: 38; 15b: 23.7; 15c: 18.6	
		metacarpus	sin	124.4	24.1	17.3	14.7	9.1	24.7			
		metacarpus	dex	124.4	24.3	17.2	14.5	9.4	25	16.3		
		metatarsus	sin	134	21.3	19.4	12.4	10	24.4	16		
		metatarsus	dex	132.2	20.9	20	12.3	10	24.8	15.9		
		os hyoideum										
		radius	sin						29.3	22		

ID	age and sex	skeletal element	side	1	2	3	4	5	6	7	8	note
Z.1.72845.1422.001 sheep	adult	tibia	sin						27.6	21.5		
		tibia	dex						27	21.1		
Z.1.72845.1437.002 sheep	juvenile, 16–20 months	metatarsus	dex		21.3	19.5	13	11.7*				
Z.1.72845.1513.001 sheep	adult, castrated?	astragalus	dex								GLl: 29.6; GLm: 28.7; Dl: 16.3; Dm: 17.2; BD: 19.6	small, rudimentary horn core, ca. 12 mm long, est. withers height: 64,5 cm
		cranium									22: 45.9; 24: 35.6*; 41: 10.5; 42: 8.8; 43: 12	
		mandibula	sin								3: 56*; 8: 49.6; 12: 69.4; 13: 60.1; 14: 94.8; 15a: 38.2; 15b: 23*;	
		mandibula	dex								7: 71.7*; 8: 50.8; 9: 20.6; 15a: 35.3*; 15b: 25.8; 15c: 21.1;	
		metacarpus	sin	133.4	22.9	17	13.5	9.2	24.7	16.6		
		metacarpus	dex	134.3	22.6	16.7	13.5	9.1	24.6	16.6		
		metatarsus	sin	141.3	20.3	19	12.2	9.3				
		metatarsus	dex	142.4			12.1	8.8	23.4	16.0		
		radius	sin						29.6	19.7		
		tibia	dex					13	27.1	20.8		
Z.1.72845.1541.001 sheep	adult	astragaluss	sin								GLl: 27.9; GLm: 26; Dl: 15.2; Dm: 15.6; BD: 17.9	polled individual, est. withers height: 58,5 cm
		calcaneus	sin	56.6							GB: 19.3	
		cranium									9: 50.4; 18: 116.7; 19: 94.7; 21: 67; 22: 44.8; 23: 23.3; 26: 67.2; 27: 42.1; 28: 61.7; 29: 17.7; 30: 15.9; 31: 37.9; 33: 63.8	
		mandibula	sin								7: 70.3; 8: 48.8; 9: 21.8; 11: 36.6; 15a: 38.8; 15b: 21.6; 15c: 17.7	
		mandibula	dex								1: 168*; 3: 49*; 4: 118.2; 5: 118*; 6: 137*; 7: 70.3; 8: 47.8; 9: 21.7; 12: 67.8; 13: 61.5; 14: 87.8	
		metacarpus	dex	121.4	22.8	16.6	13.5	9.6	26.0	16.0		
		metatarsus	sin	128.2	21.1	19.2	11.8	9.6	24.5	15.7		
		tibia	dex						26.0	20.5		

ID	age and sex	skeletal element	side	1	2	3	4	5	6	7	8	note
Z.1.72845.1545.001 sheep	adult	calcaneus	dex	58.1*								est. withers height: 59,8 cm
		mandibula	sin								9: 25.9; 15c: 20.6	
		metacarpus	dex	127.3*	24	16.3			25.2	16.1*		
		metacarpus	sin		23.9	17						
		metatarsus	dex						24.5	16.8		
		os centrotarsale									GB: 24.3	
		radius							30.7	20.1		
Z.1.72845.1555.001 sheep	adult	astragalus	dex								GLl: 28.8; GLm: 27.1; Dl: 16; Dm: 17; BD: 19.7	polled individual, est. withers height: 61,4 cm
		cranium									27: 50.3; 29: 18.3; 30: 18	
		metacarpus	sin	128.5	24.7	17.7	13.3	10	27.8	16.4		
		metatarsus	sin	134.5	21.3	20.9	11.5	9.8	25.4	16.3		
		os centrotarsale	sin								GB: 24.6	
		phalanx distalis ant									DLS: 30.3; MBS: 6.5; Ld: 19.8	
		phalanx distalis post									DLS: 27.6; MBS: 5.9; Ld: 19.5	
		tibia	sin						28.1	21.6		
		tibia	dex							21.6		
Z.1.72845.1570.001 sheep	adult	cranium									27: 48.8; 29: 20.4; 30: 15.3	small, rudimentary horn cores, ca. 22 mm long, slightly twisted; est. withers height: 61 cm
		mandibula	sin								8: 50.1; 15a: 37.7; 15b: 23.8	
		mandibula	dex								7: 71.7*; 8: 49.4; 15b: 24.1; 15c: 17.6	
		metacarpus	sin		24	17.3	14.6	9.2				
		metacarpus	dex	125.3	23.8	17.5	14.7	9.4	25.6	16.0		
		metatarsus			20.4		12.7	9.9				
		os carpi intermedium	dex									
		phalanx prox										
		radius	sin						30.3	20.8		

ID	age and sex	skeletal element	side	1	2	3	4	5	6	7	8	note
Z.1.72845.1619.001 sheep	adult	atlas									BFcr: 47.7; BFcd: 46.3; H: 37.8	polled individual, est. withers height: 62 cm
		calcaneus	sin								GL: 57.4; GB: 18.9	
		cranium									9: 54.3; 27: 47.3; 29: 20.8; 30: 17.5; 31: 43	
		mandibula	sin								12: 70.7; 13: 64.9; 15a: 34.3	
		mandibula	dex								12: 71.7; 12: 65.5; 14: 99.1; 15a: 33.7	
		metacarpus	sin						24.4	16.2		
		metatarsus	sin	137.5	21.3	20.6	11.4	10	24.3	15.9		
Z.1.72845.1637.002 sheep	subadult, 3–4 years	astragalus	dex								GLl: 31.9; GLm: 30.5; Dl: 17.9; Dm: 16.3*; BD: 20.8	est. withers height: 70 cm
		astragalus	sin								GLl: 32.1; Dl: 17.9	
		calcaneus	dex								GL: 59.5	
		calcaneus	sin								GL: 61; GB: 19.5	
		metacarpus	dex		25.7	18.5						
		metacarpus	sin				14.8	12	28.8	17.5		
		metatarsus	sin	155	23.1	22.7	13.2	12	27.1	18.1		
		metatarsus	dex		22.8	21.5	13.1					
		os centrotarsale	sin								GB: 26.6	
		radius	dex						33.8	21.3		
		tibia	dex						29.2	22.2		
Z.1.72845.1638.001 sheep	adult	astragalus	sin								GLl: 29.2; GLm: 27.2; Dl: 16.1; Dm: 17.4; BD: 18.4	polled individual, est. withers height: 62 cm
		calcaneus	sin								GL: 55.9; GB: 19.2	
		cranium									6: 115.5*; 9: 46.5*;10: 76.6*; 11: 91.5*; 22: 40.8; 27: 51.3*; 29: 19.9; 30: 17.2; 31: 41.3*	
		mandibula	sin								3: 60*; 5: 124; 6: 144*; 7: 63.1; 8: 41.7; 9: 20.3; 12: 70*; 13: 65.2; 15a: 34.5; 15b: 22.9; 15c: 19.3	

ID	age and sex	skeletal element	side	1	2	3	4	5	6	7	8	note
Z.1.72845.1638.001 sheep	adult	mandibula	dex								7: 62.4; 8: 42.6	
		metacarpus	sin	129	25.3	17	14	9.8				
		metacarpus	dex					9.7	27.2	16.3		
		metatarsus	sin					11	25.7	16.5		
		metatarsus	dex		22.2	20.8		11	25.8			
		phalanx prox										
		radius	dex	156	30.6*	16.5	16.4	8.9	31	21.9		
		tibia	dex						28.3	23.2		
Z.1.72845.1650.001 sheep	adult / mature	cranium									27: 48.2; 29: 19.5; 30: 18.5; 41: 24.7; 42: 15.6	
		radius	sin						29.2	20.9		
Z.1.72845.1437.001 horse	subadult, 4–4.5 yrs, mare	astragalus	dex								GH: 52,3; BFd: 48,3; GB: 59,3; LmT: 53,8	est. withers height: 132 cm
		astragalus	sin								GH: 52,8; BFd: 49,7	
		atlas									H: 69,2	
		calcaneus	sin	100.1							GB: 48,6	
		cranium									22 (P-M hossza): 114*	
		mandibula	dex								6: 188,2; 6a: 175,8; 7: 93,5; 8: 93,6; 22b: 78,4; 22c: 57,6	
		mandibula	sin								8: 95; 22b: 78,2; 22c: 59	
		metacarpus	dex	211			33.2	20				
		metatarsus	dex		45.8		31.8					
		metatarsus	sin				31.5					
		os tarsale tertium	dex								GB: 42,8	
		os tarsi centrale	dex								GB: 48	
		phalanx prox post	sin	76.3	52.6	36.5	31.7	19	41.3			
		tibia	sin						68,1*			

ID	age and sex	skeletal element	side	1	2	3	4	5	6	7	8	note
Z.1.72845.1258.002 domestic hen	adultus	coracoideum	dex	48.9							Lm: 47,9; Bb: 13,4	
		femur	dex	75.1	14.6	10.7	6.8	6.2	15.2	12.6	Lm: 71,6	
		femur	sin				6.8	6.1	14.4	10,8*		
		humerus	dex	69.9	17.9	9.4	6.8	5.6	15	7.9		
		sternum										
		tarsometatarsus	sin									
		tarsometatarsus	dex	106.6							La: 102,5; Dip: 19,1; Dd: 10,2*	
		ulna	dex	68.8	9.5		4				Dip: 12; Did: 9,1	
Z.1.72845.1555.004 domestic hen	adultus	radius	dex	53.7	4.7	4.5	2.8	2	6	3.7		
Z.1.72845.1563.001 domestic hen	adultus	carpometacarpus		32.6	9.7						Did: 7	
		coracoideum	sin	44.2							Bb: 12,3; BF: 10,9; Lm: 42,7	
		coracoideum	dex								BF: 10,6	
		humerus	sin		16.7	9.5						
		humerus	dex	60.3	16.8	9.6	6.1	5	13	7.3		
		radius	dex		4.5	4.3						
		tibiotarsus	dex				5.7	4.9				
		ulna	dex								BP: 7,4	
		ulna	sin								Did: 7,6	

Tab. 10. SEM-EDS measurement data of the examined glass samples in oxide weight percentage (wt%) form, normalized to 100%. The measurement points highlighted in gray indicate measured materials other than the base glass

Sample	Spectrum	Na_2O	MgO	Al_2O_3	SiO_2	$P2O_5$	SO_3	Cl	K_2O	CaO	TiO_2	MnO	FeO	NiO	CuO	BaO	PbO	ZrO_2	SnO_2	Total
3269	spt_01	25.41	1.36	5.11	65.23				0.39	2.5										100
3269	spt_02	25.22	1.32	5.35	59.04				0.36	2.04							6.67			100
3269	spt_03	23.78	0.87	4.69	58.95			0.65	0.42	3.08							7.56			100
3269	spt_04	23.88	1.22	4.72	59.78			0.57	0.37	2.34							7.12			100
3269	spt_05	25.03	1.01	5.19	58.13			0.46	0.33	1.87			0.92	0.43			6.63			100
3269	spt_06	23.42	1.11	4.19	59.63			0.68	0.38	2.87			0.29				7.43			100
3578	spt_01	22.31	1.81	3.29	64.96	0.27	0.27	0.63	0.67	5.19		0.24	0.36							100
3578	spt_02	13.64	1.94	4.46	71.99		0.3	0.61	0.74	5.42		0.2	0.7							100
3578	spt_04	13.48	1.85	4.51	71.26		0.26	0.57	0.81	6.08		0.28	0.9							100
3547	spt_03	24.76	0.46	2.08	64.48		0.68	0.83	0.36	5.57		0.78								100
3547	spt_04	22.2	0.61	2.36	65.88		0.59	0.84	0.4	5.77		0.81	0.54							100
3544	spt_01	27.34	2.04	3.04	62.75			0.52	0.51	3.8										100
3544	spt_02	27.46	2.23	3	62.71			0.52	0.44	3.64										100
3544	spt_03	27.31	1.89	3.06	62.85			0.53	0.56	3.8										100
3546_a	spt_01	21.45	1.71	3.26	65.03		0.52	0.63	0.7	5.49		0.76	0.45							100
3546_a	spt_02	25.85	1.71	3.51	63.65			0.57	0.5	3.9		0.31								100
3546_a	spt_03	14.93	2.27	4.56	70.77			0.57	0.72	4.94		0.71	0.53							100
3546_a	spt_04	20.92	2.02	4.15	66.65			0.55	0.7	4.45		0.56								100
3546_a	spt_05		2.31	6.4	39.92	0.84			0.61	3.74	2.56	36.97			3.27	3.38				100
3546_a	spt_06	21.64	1.55	2.99	64.83			0.68	0.75	5.97		0.91	0.68							100
3546_a	spt_07	22.48	1.66	2.96	65.75			0.71	0.74	5.7										100
3546_b	spt_01	26.63	1.95	3.38	62.49		0.48	0.56	0.49	3.75		0.27								100
3546_b	spt_02	27.26	1.88	3.63	62.34			0.52	0.44	3.6		0.33								100
3546_b	spt_03	26.38	1.78	3.27	63.04		0.46	0.56	0.45	3.74		0.32								100
3543	spt_01	23.93	1.08	2.49	64.07		0.53	0.69	0.45	5.35		0.98	0.43							100

Sample	Spectrum	Na_2O	MgO	Al_2O_3	SiO_2	$P2O_5$	SO_3	Cl	K_2O	CaO	TiO_2	MnO	FeO	NiO	CuO	BaO	PbO	ZrO_2	SnO_2	Total
3543	spt_02	24.39	1.08	2.51	64.25		0.56	0.65	0.45	5.19		0.92								100
3543	spt_03	24.91	1	2.5	63.76		0.55	0.69	0.45	4.91		0.81	0.42							100
3543	spt_04	23.88	1.1	2.55	64.04		0.58	0.69	0.44	5.37		0.98	0.37							100
3543	spt_05		2.67	3.81	47.32				0.25	2.34	1.52	36.1	3.21			2.78				100
3543	spt_06	1.19	3.9	3.11	32.61	1.12				3.14	1.32	47.74			2.04	3.83				100
3266	spt_01	3.46	2.43	10.93	75.51			0.58	3.34	3.13			0.62							100
3266	spt_02	3.34	2.66	10.77	75.16			0.8	3.28	3.38			0.61							100
3266	spt_03	3.47	2.22	10.11	75.56			0.85	3.25	3.8			0.74							100
3266	spt_04	3.92	2.33	10.11	74.72			0.84	3.28	4.03			0.77							100
3610_d	spt_01		0.88	1.16		20.01		1.78		13.79			0.78				61.6			100
3610_d	spt_02	0.65			4.92	16.42		1.64		9.99			0.48				63.85		2.05	100
3610_d	spt_03	0.85		1.8	9.67	15.07		1.48		9.28			0.89				58.8		2.16	100
3610_d	spt_04				3.76												66.33	0.78	29.13	100
3610_d	spt_05																67.88		32.12	100
3610_d	spt_06				3.84												66.57	1.15	28.44	100
3610_d	spt_07				3.42					1.39							67.8		27.39	100
3610_a	spt_01	22.56	0.92	2.39	63.9		0.39	1.13	0.51	5.58	0.1	1	0.38		1.15					100
3610_a	spt_02	24.38	1.04	2.53	63.22		1.02	1.15	0.47	4.71	0.11	0.66	0.3		0.39					100
3610_a	spt_03	24.84	1.12	2.49	63.23		0.97	1.07	0.38	4.59	0.03	0.58	0.25		0.46					100
3610_a	spt_04	22.26	0.87	2.42	63.75		1.01	1.44	0.62	6.1	0.06	0.7	0.44		0.33					100
3610_b	spt_01	17.72	0.54	2.96	71.73			0.85	0.39	5.81										100
3610_b	spt_02	20.99	0.88	2.94	69.49			0.83	0.37	4.5										100
3610_b	spt_03	21.53	0.8	3.09	69.09			0.73	0.41	4.35										100
3610_b	spt_04	21.79	0.87	2.95	68.9			0.72	0.31	4.46										100
3610_b	spt_05	21.18	0.89	2.98	69.35			0.77	0.33	4.5										100
3610_c	spt_01	21.02	0.57	2.66	68.69			0.69	0.5	5.44			0.43							100
3610_c	spt_02	18.2	0.54	2.57	69.18			0.82	0.58	7.37			0.74							100
3610_c	spt_03	17.96	0.71	2.86	70.55			0.77	0.54	6.08			0.53							100

Tab. 11. µXRF measurement data of the measured blue glass samples in oxide weight percentage form, normalized to 100%

Sample	Spectrum	Na_2O	MgO	$Al2O_3$	SiO_2	$P2O_5$	SO_3	Cl	K_2O	CaO	TiO_2	MnO	Cr_2O_3	FeO	CuO	CoO	ZnO	SrO	PbO	Total
3610_c	spt_01	0.89	0.55	6.54	65.91	0.13	0.39	1.14	2.94	16.62	0.24	0.24		3.38	0.45	0.27	0.03	0.23	0.04	100
3610_c	spt_02	14.75	0.38	3.28	70.13	0.00	0.21	1.03	0.81	8.01	0.07	0.07		0.98	0.11	0.08	0.01	0.06	0.01	100
3610_a	spt_01	20.30	0.60	2.18	64.22		0.47	1.43	0.50	6.54	0.13	1.41	0.01	0.74	1.33			0.07	0.07	100
3610_a	spt_02	19.98	0.59	2.35	64.20		0.48	1.42	0.53	6.63	0.13	1.43	0.00	0.76	1.36			0.07	0.07	100
3269	spt_01	11.66	0.88	5.25	60.91	0.00	0.00	0.88	1.34	7.05	0.07	0.02		0.38	1.37			0.08	10.11	100