Reconstruction and 3D-Modelling of a Unique Hungarian Conquest Period (10th Century AD) Horse Burial

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Abstract

In 2003 the Archaeological Institute of the Hungarian Academy of Sciences and the Móra Ferenc Museum, Szeged carried out an excavation at the already known 10th-century AD Conquest Period cemetery near Szentes, South-East Hungary. During the excavation the disturbed grave of an older man was found, who had been buried with his weapons. The two longer sides of the grave were formed in a step-like fashion. This rather rare grave-form of the period yielded another novelty: a partial horse burial, which was placed on the step along the northern side of the grave. There is much literature on early medieval graves with steps from Eastern Europe, the steppe and the Volga-Kama region, which usually explains this phenomenon – which can be observed in many periods and cultures – as the support for the cover (roof) of the grave. With the help of the 3D-modelling of this new grave from Hungary we tried to test this hypothesis and tried to reconstruct the process of placing the excised horse hide and skull into the grave during the burial ceremony.

In the presentation the authors will describe the grave, the process of the modelling, its phases and technical details, and the result of the analysis. The first step is the processing and resizing of the excavation drawings, then the process and details of the spatial modelling of the field elements will be presented (3D Studio Max). This is followed by the modelling of the human skeleton and the horse hide (Poser, Studio Max), and finally comes the modelling of the folding and placing of the horse hide into the grave with the help of a physics simulation software (Reactor, 3D Studio Max). The authors will present all the work phases through an animation.

Keywords

3D reconstruction, animation, horse burial, 10th century, Hungary

1. Introduction

Most scholars agree today that the beginnings of horse breeding among the ancestors of the Hungarians can be dated to the 2nd millennium BC, to the so-called Ugrian period (Bálint 1989, 195–197; Fodor 1996, 13–18). Horse remains are frequently found in the burials of the Hungarians who moved into the Carpathian Basin in 895 (Bálint 1969; 1970; 1971). Horse bones were already reported in 1834 from a Conquest Period find at Benepuszta, the first of its kind identified in the Carpathian Basin (Jankovich 1834), thus research on this topic has a long history (Langó 2005, 192–195; Vörös 2007). This practice fits well into the widespread custom of horse burial prevalent in Eurasia (*Fig. 1*) during the Early Middle Ages (Langó and Türk 2007).

In 2002, during the re-excavation of a site from this period in southern Hungary, an unusual horse burial came to light. In this paper we introduce a new formal variant of Conquest Period horse burials: a horse burial folded in hide, placed on a step running along the northern, long side of the grave. Furthermore, we present the results of our 3D modelling created on the basis of the observed position of the horse remains. With the help of the 3D modelling, we are looking at possible reconstructions of the burial ceremonies, especially with regard to the placement of the horse remains in the graves.

2. The archaeological context

The site is located in southeast Hungary, in the Great Hungarian Plain, near the confluence of the Tisza and Körös rivers. In 1940 Gábor Csallány unearthed four graves southeast of the city of Szentes, in the area called Derekegyházi-oldal, in the fields of Benjamin Berényi's farm (Csallány 1941). After 62 years, with some luck, we were able to locate the four test pits of the earlier excavation and eight further graves with a west-east orientation, placed in a row running from the north to the south (*Fig. 2*) (Langó and Türk 2003).

The horse burial under discussion was found in Grave 6 (*Fig. 3*), a partially disturbed burial of a
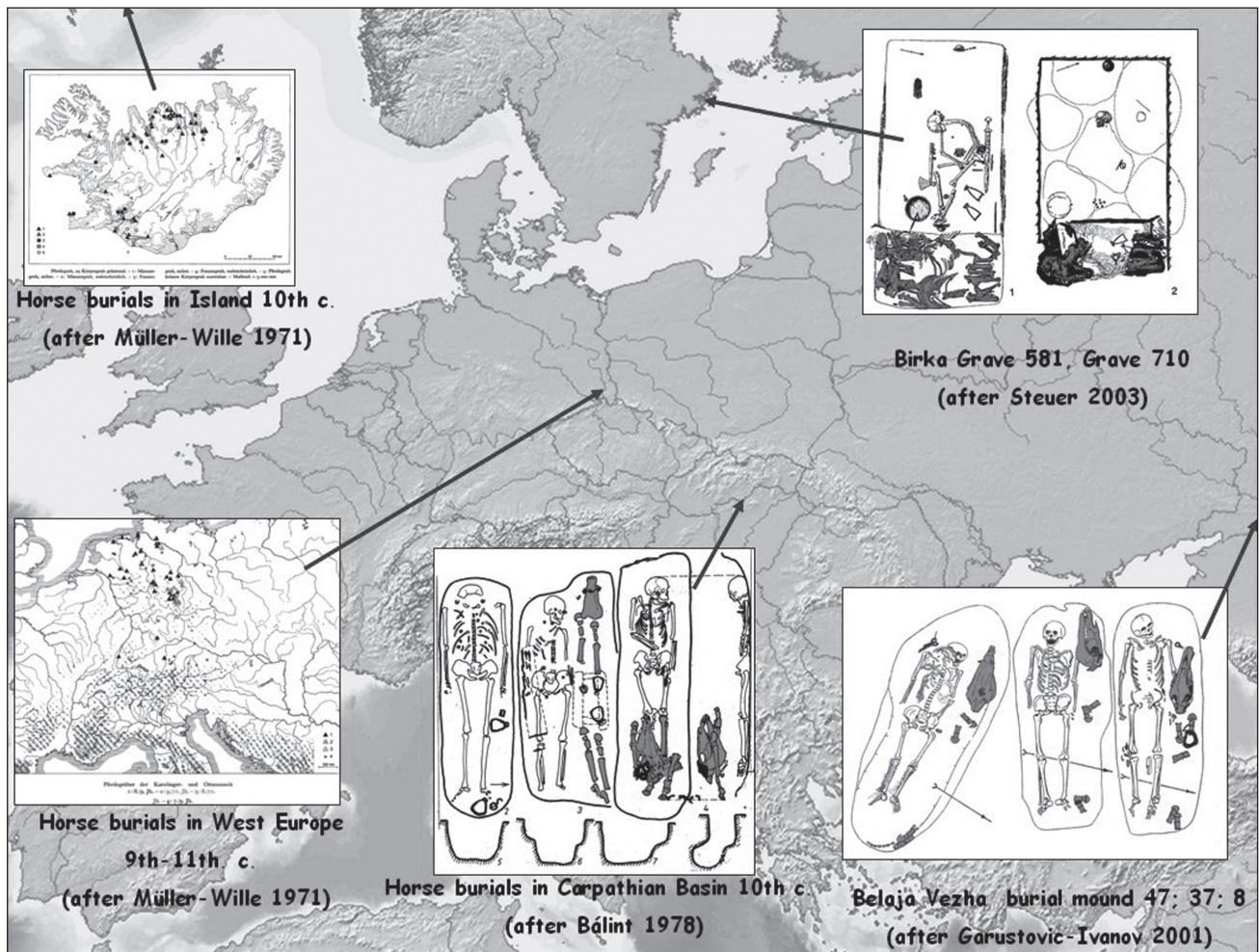
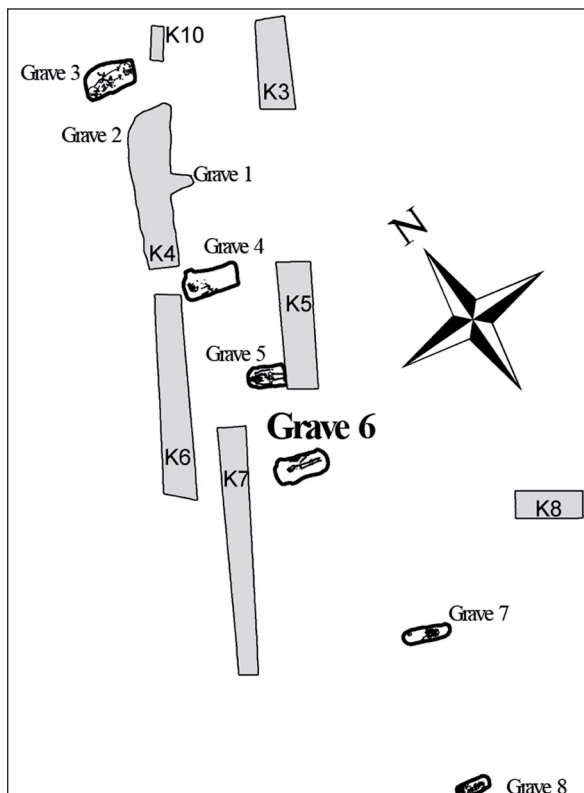*Fig. 1. Examples of horse burial customs in Early Medieval Europe.*

Fig. 2. Excavation of Szentes-Derekegyházi oldal, D3 tábla in 2002.

50-year-old man. Although no traces of secondary digging could be observed in the contour of the grave, some of the disturbed finds and bones were found around the northwestern corner of the grave pit. An interesting feature of the rounded rectangular grave pit, is that there was a 30–40cm high and 10–25cm wide step along its longer side, but not parallel to it. On this step the remains of a partial horse burial folded in hide were found (Langó and Türk 2004).

The sacrificial horse was a nine-year-old stallion, had a withers height of 141cm. It is interesting that in the case of both the thoracic and the pelvic limbs, one of the pair was in a ventral, the other in a dorsal position (*Fig. 4*). Beside the horse's limb bones and skull, the tongue-bone and a few of the tailbones were discovered as well. There was a 3–4cm thick fill under the bones and above the step. It was 8–15cm thick under the end of the bones that had been moved towards the bottom of the grave, which suggests that the bulk of the hide was positioned under them and supported them. Three of the limbs lay with their hoofs towards the bottom of the grave pit and the human skeleton, slightly slid off the step, and
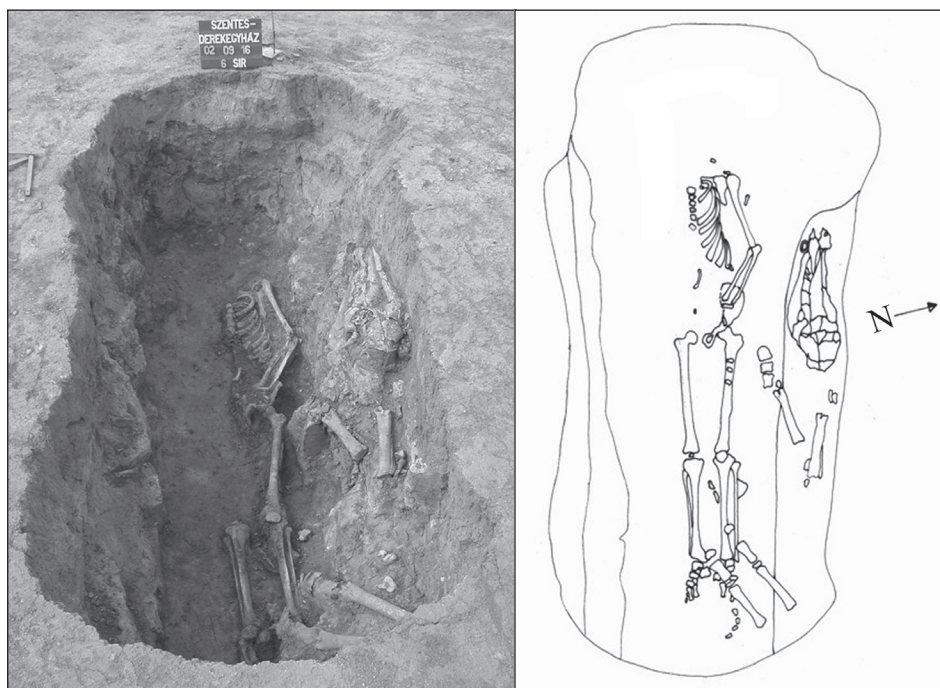
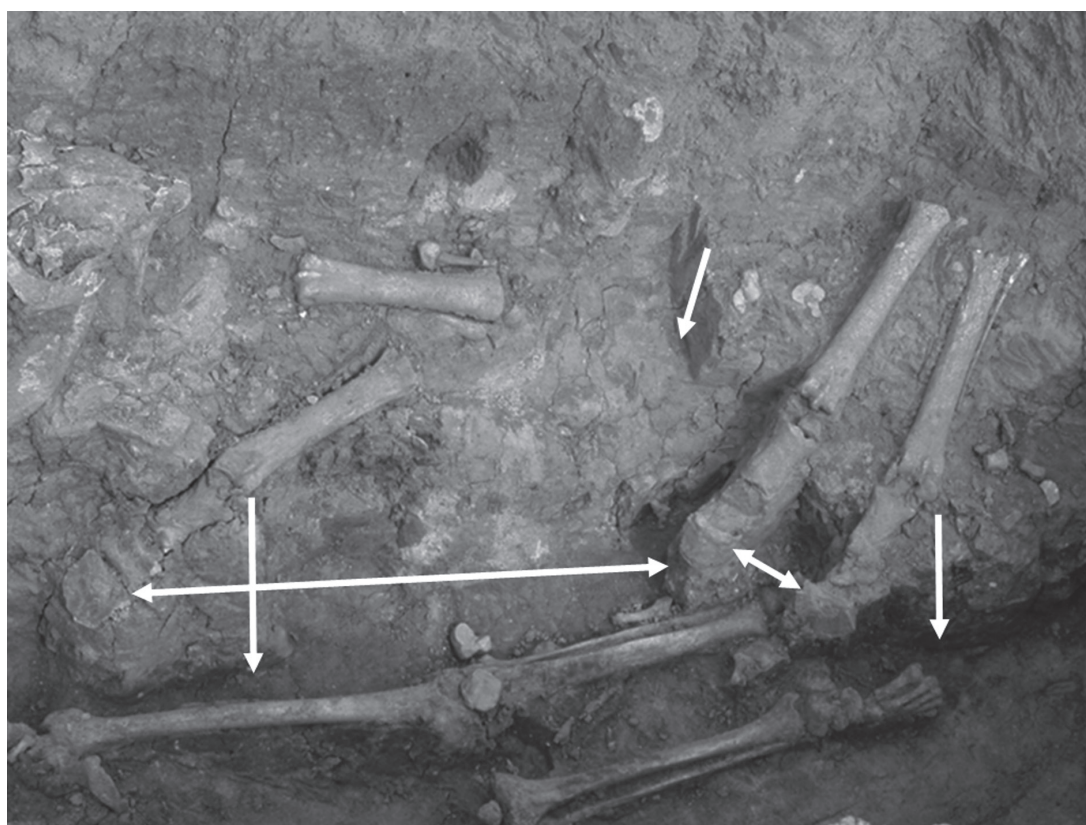*Fig. 3. Szentes, Derekegyházi-oldal, D3 tábla, Grave 6.*

Fig. 4. Horse remains on a step in Grave 6.

probably held in its place by the hide underneath. Since the horse remains lay above the left leg of the human skeleton, it is probable that during the burial ceremony first the human was placed into the grave, and then the horsehide. The mouth of the horse contained a horse bit with rings, and the rest of the finds included other typical elements of the harness, and the remains of archery equipment.

3. Tenth-century horse burials in the Carpathian Basin

A typological system of Conquest Period horse burials was worked out by Csanád Bálint (Bálint 1969) (*Fig. 5*), and later elaborated by István Vörös (Vörös 2001). The ratio of horse burials among the tenth-century burials of the Carpathian Basin is less
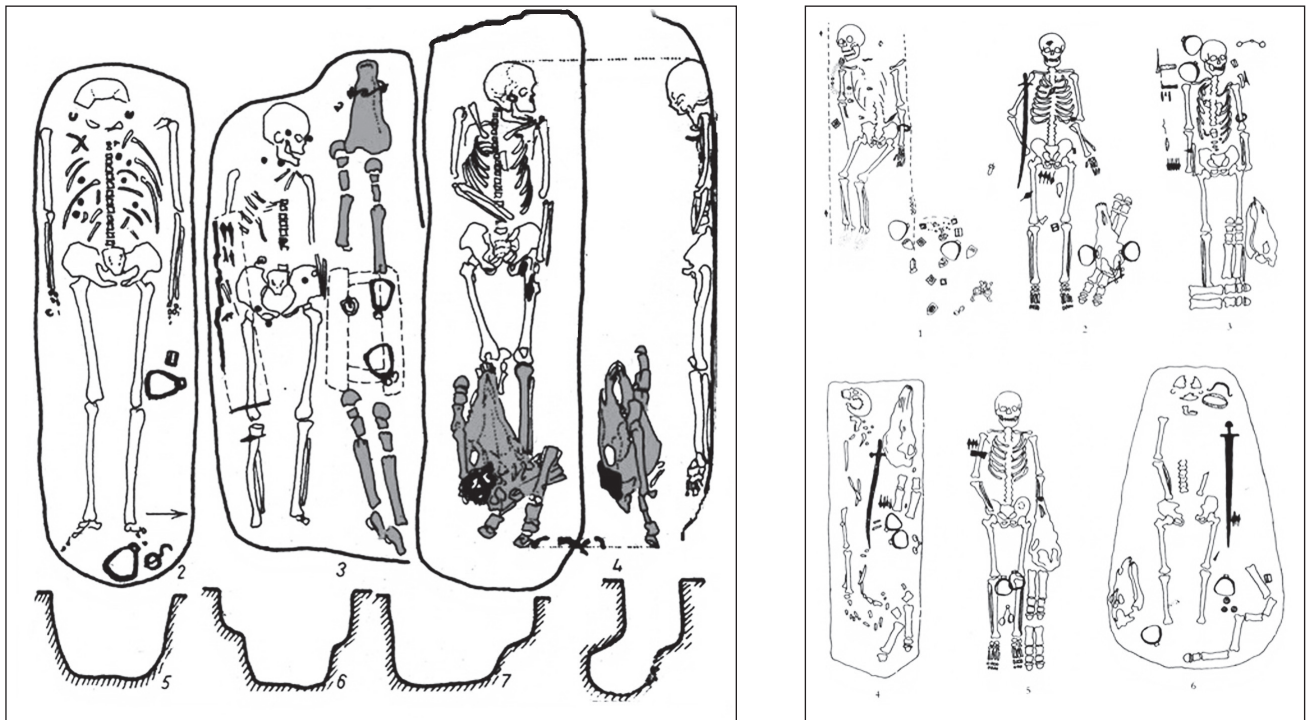
Fig. 5. Classification of tenth-century horse burials in the Carpathian Basin by Csanád Bálint
(after Bálint 1976, CI. tábla ; Bálint 1969, I. tábla).

than 10%. If we take into consideration only those cemeteries where this rite occurs at all, then this ratio is 15–20% (Vörös 2007). It can be observed that horse burials within a cemetery tend to be similar. The most frequent form – partial horse remains placed at the legs of the dead – is regarded by many scholars as one of the most important ethnic markers of the early Hungarians wandering in Eastern Europe (e.g. Аксёнов *et al.* 1996, 127).

However, exact formal parallels of such graves are not known in the published contemporaneous material of the Carpathian Basin. Although the step-like fashioning of the grave pit has already been attested, data from earlier excavations must be handled with criticism because of their excavation methods.

We were confronted with this unique placement of horse remains during the reconstruction of the possible burial ceremonies. "Experimental archaeological" surveys in connection with horse burial began in Hungary in the early 1960s and provided much useful information for the archaeologists. Most problems faced with were in connection with the vanished horsehide: how it was folded up and placed in the grave, and generally how its mass should be modelled, which archaeologists did not, or often could not, take into account (Vörös

in press).[1] The presence of a horsehide in graves had been demonstrated already by the end of the 1960s – in addition to fortunate observations – also by chemical analysis (Duma 1971). However, since horsehide does not leave recognisable salient traces in the archaeological record, researchers could only infer its presence based on horse remains and the size of the grave. The archaeozoologist István Vörös, for example, made an assumption based in most cases on the small space between the horse bones and the side wall of the grave that the horse remains placed alongside the human skeleton were not stuffed (Vörös 2000, 371). At the same time he demonstrated that there were instances when the horsehide was definitely not placed in the grave, as opposed to the cut-off horsetail, which was more often included.

Among the few experimental archaeological results available up till now, the veterinarian László Sótonyi documented the skinning of a horse slaughtered in a slaughterhouse in 1962 (*Fig. 6*), and drew some conclusions regarding the horse remains buried in the tenth-century grave at Öttevény (Sótonyi 1962). A few years later, the veterinarian Zala Tihanyi established in connection with Cemetery 1 at Szabadkígyós that two experienced individuals can skin a horse in 15 minutes. He also concluded

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[1]   We would like to thank the author for providing access to his unpublished manuscript.
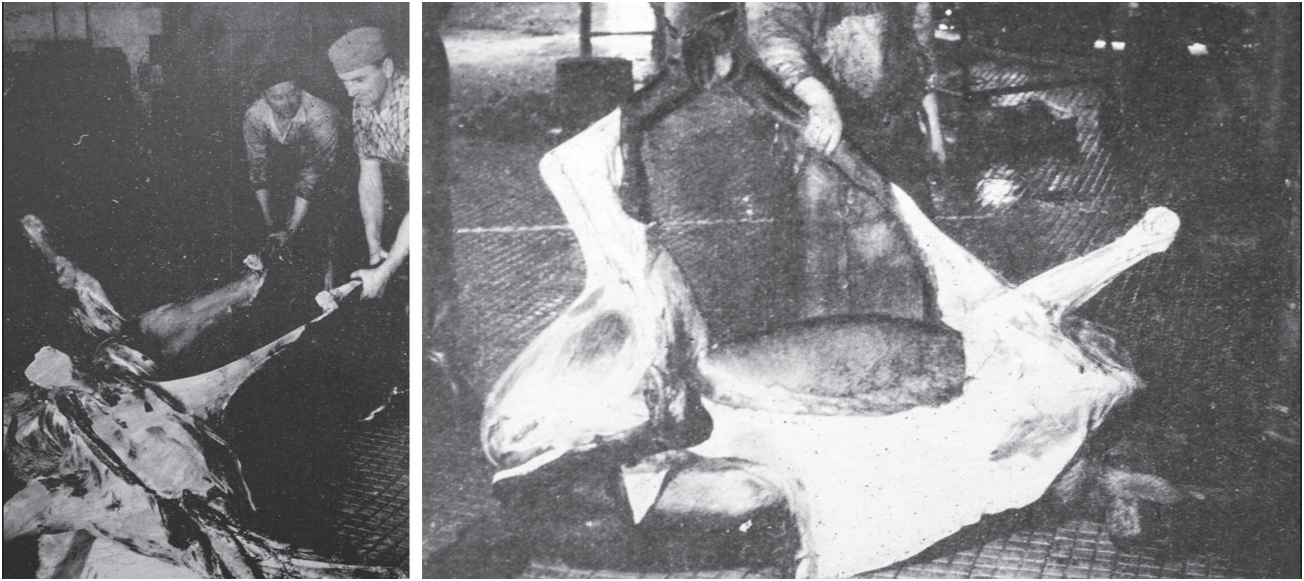
Fig 6. The skinning of a horse in a slaughterhouse (after Sótonyi 1962).

that the hide, together with the limbs stumped at the tarsus and the cranium, can be folded in a so-called "hide-suitcase" 60cm long, 40cm wide and 60cm high. Of the 60cm height 30cm accounts for the folded hide and the other 30cm for the horse skull (Bálint 1970, 41).

The position of the horse bones observed in the grave and the average size of the grave pits indicate this arrangement. Based on the unique shape of the Szentes grave, it is now obvious that this widely accepted reconstruction cannot be applied in this case. The horsehide was certainly placed in the grave, which is evident from the archaeozoological analysis of the horse remains and the position of the horse bones somewhat above the bottom of the grave and the surface of the step. The above-mentioned position of the ends of the limbs, the adjustment of the horse skull on the narrow step and the placement of a horse-bit in the mouth of the skull indicate the careful and conscious deposition of the remains. All these suggest in our opinion an obviously deliberate burial ceremony, which we decided was interesting enough to merit detailed modelling.

4. Modelling the Szentes burial

Since skinning a real horse and folding its hide were out of the question, we turned to computer modelling to provide information on this process. The graphics workshop of the Archaeological Institute of the Hungarian Academy of Sciences has already created several 3D reconstructions of various archaeological phenomena. The novelty in this case was, besides the modelling of the grave, the modelling of the folding and placement of the horsehide in the grave.

For this process a software was required which was able to provide an entire physical simulation in order to achieve the most authentic and precise results possible.

Another issue to be addressed was if the steps, considering of their size and shape, could hold the boards laid down across the grave to cover the dead. Many analogies are known for this practice throughout the wide Eastern European steppes. Russian and Ukrainian archaeologists also interpret these side steps in graves this way (Василев 2005, 295–298), but in the Carpathian Basin no relevant data from the given period has been reported yet.

The first step was to create the virtual horse in *Fig. 7* and the virtual horsehide in *Fig. 8*. We sized the horsehide based on the horse's withers height. We imported a horse model into the character set of Poser 4 (http://en.wikipedia.org/wiki/Poser [last accessed 1/4/2010]), a program for 3D character design and animation. Modelling was carried out with a 3D Studio Max software (http://en.wikipedia. org/wiki/3ds_Max [last accessed 1/4/2010]).

We know that tenth-century Hungarians stumped the limbs of the horse to be skinned at the tarsus. This technique is easily differentiated from the contemporary method used for example by their eastern neighbours, the Petchenegs (Атавин 1984). The next step was modelling the placement of the virtually skinned horsehide on the ground, its folding and its preparation for being deposited in the grave. For this we used the physical simulation plug-in built into 3D Studio Max, with the help

of which we simulated the physical behaviour of the horsehide, taking the gravitation coefficient, friction, etc. into consideration, in order to achieve principally lifelike dynamics. The most difficult, and at the same time the most important, step was the folding of the hide, where human hands are indicated by geometric shapes (*Fig. 9*). The most important factor determining the authenticity of the simulation is the definition of the adequate parameters. Entirely different results can be obtained if we alter any of
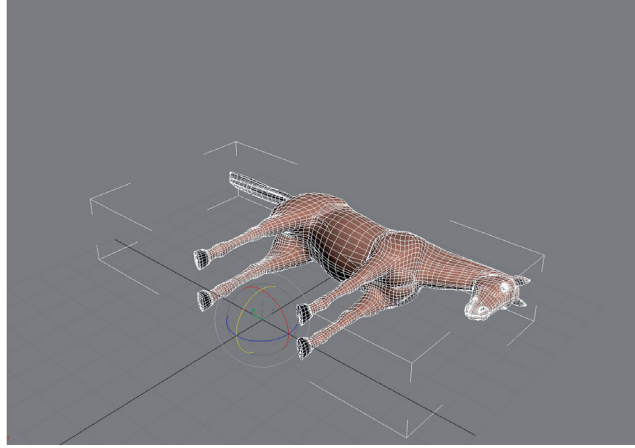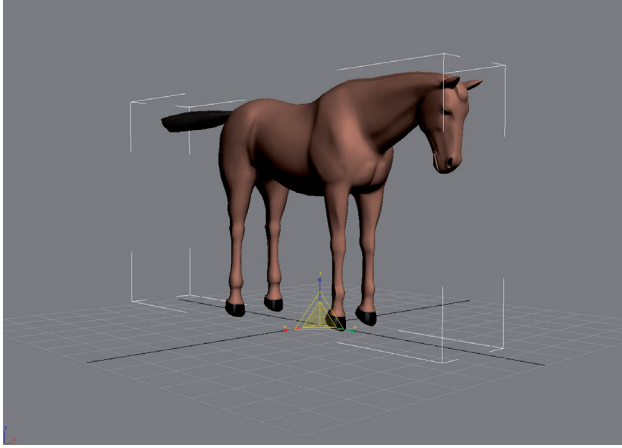

Fig. 7. Creation of a virtual horse.

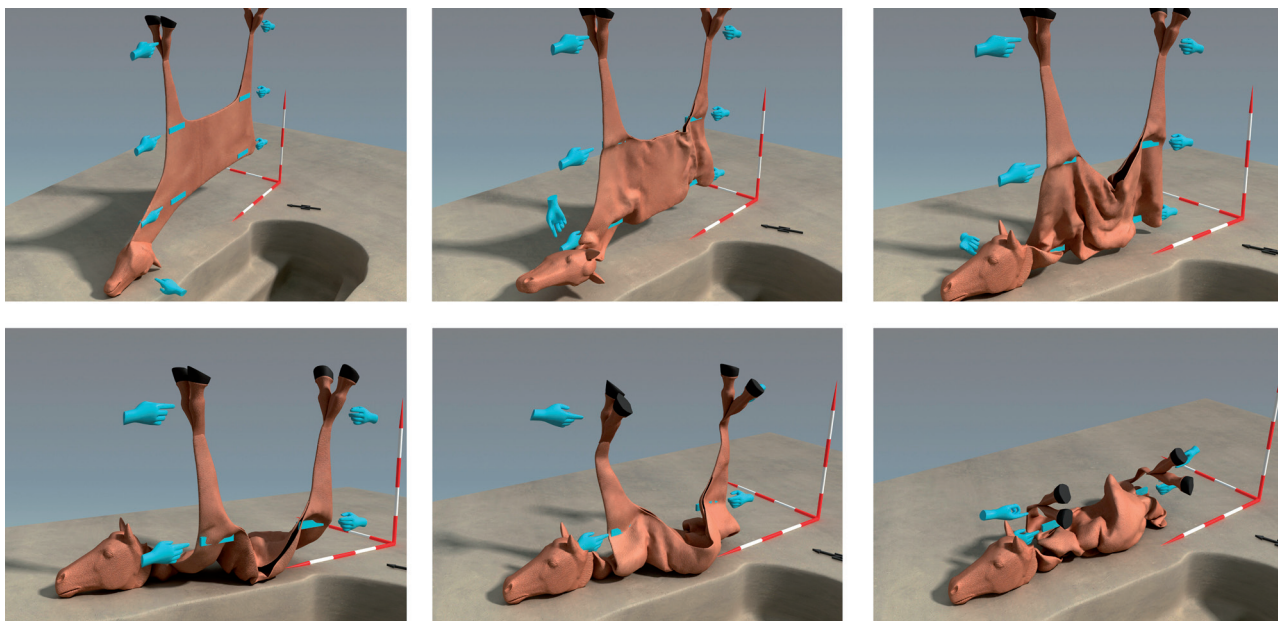*Fig. 8. Real (after Bischop 2006, Abb. 3) and virtually skinned horsehide.*

Fig. 9. Folding of the virtually skinned horsehide and its preparation for placement in the grave.

the parameters, for example flexibility, or the most important aspect, mass, which we determined based on an expert's opinion as appr. 18kg. From this point on the behaviour of the given material was calculated by the program.

Based on the results obtained from the simulation, the most feasible scenario seems to be that the horse remains were folded to some extent outside the grave, and were then prepared for placement in the grave.

This is all the more probable, since not only was the available space in the grave rather limited, but also the horsehide had to be folded along its longitudinal axis, as indicated by the position of the remains.

The next step of the reconstruction of the entire burial was the modelling of the grave pit, based on the full-scale data from the excavation plans, again by the 3D Studio Max software.
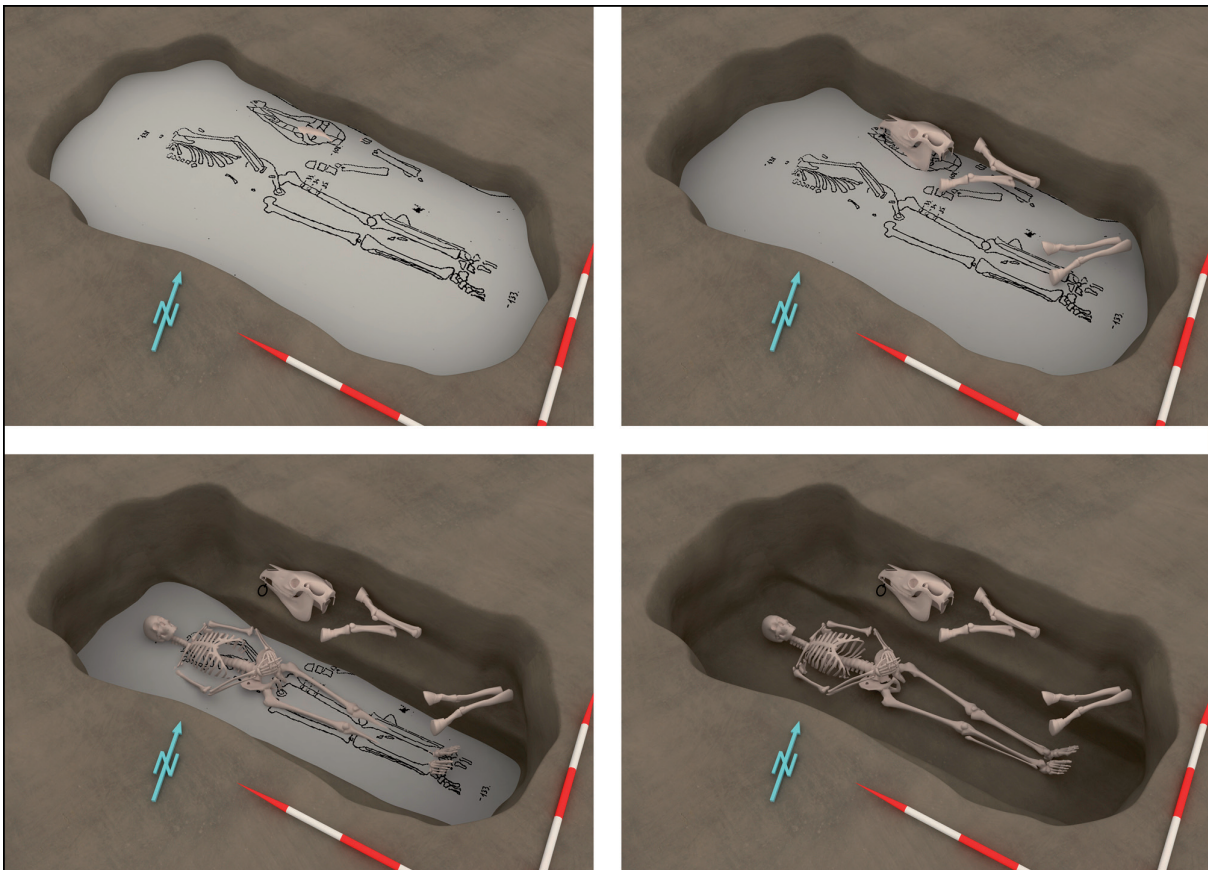

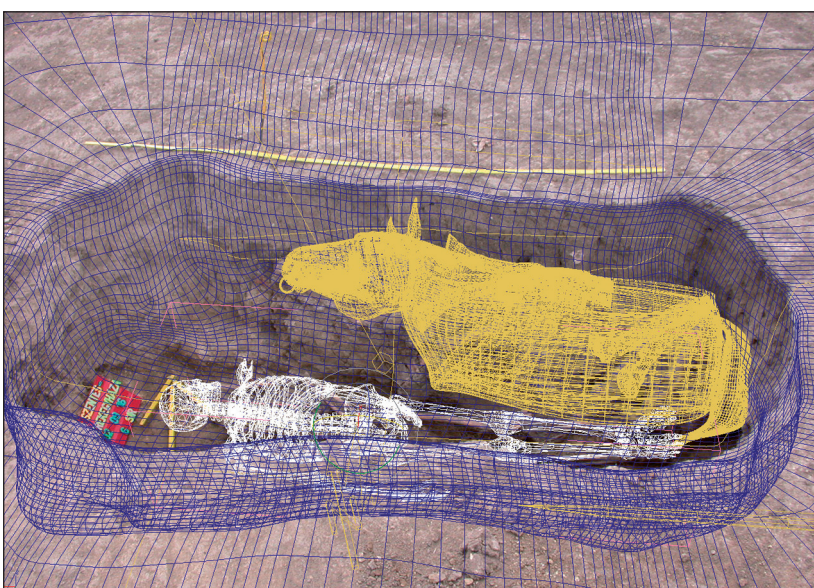Fig. 10. Modelling of the grave pit and the remains.

Fig. 11. Modelling of the grave pit based on the excavation documentation.

Some cross-sections, surface drawings and levelling data were sufficient for the reconstruction of the grave. The technology used here and the preparation made by the graphical expert enables modelling phenomena deriving from older excavations as well. This opens new doors for the use of data derived from such excavations, where no laser scanners or other technologies were available yet, which are used in the field specifically to create 3D reconstructions.

We also simulated the covering of the body with boards placed on the step of the grave. The uneven, narrow surface and side of the steps observed

on the excavation photographs and the picture of the virtual board-cover strongly indicate that the grave was not covered with such boards. The shape of the grave pit distinctly differs from those instances where such a cover was observed beyond doubt, for example in the case of early Muslim graves prevalent in the Eastern European steppes from the ninth century onwards, which some of the researchers assign to the so-called Zlviki horizon of the Saltovo-Mayatskaya culture (Кравченко 2005, 158).

5. Conclusion

To sum up the course of the burial ceremony, it seems that the body was first placed in the grave pit, followed by the "package" of the prepared horse remains, which was adjusted to the specific shape of the step of the grave. The limbs were placed on the top of the horsehide, also carefully adjusted. The horse skull, which – based on the archaeozoological data – was not cut off the hide, was deposited on the top of the narrow step while attached to the hide, and then pushed tightly to the wall. Finally, the horse-bit was placed into the mouth of the horse. The present phenomenon is so far unique in the contemporary archaeological record, and the deliberate care observed in the burial ceremony indicate that the population settling the Carpathian Basin in 895 consisted of different components not only in terms of ethnicity, but also their religious beliefs. The investigations of these, however, are beyond the possibilities of archaeological methods. We emphasize that the reconstruction presented here is *only one of the possible variants*. Although many factors cannot be modelled precisely or at all, we believe that our results are not unrealistic.

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