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DISLOCATED HIP IN CATTLE: A RARE FIND FROM A ROMAN PERIOD SETTLEMENT

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In this paper I discuss the remains of a Roman Period (2nd–3rd century AD) cow discovered at the site of Baracs–Boldog-dűlő in Transdanubia, Hungary. The animal lived with a dislocated hip, a condition extremely rarely documented in archaeological assemblages; this is the first find of this kind in the region. The animal may have been a dairy cow kept alive for months or even years after the injury, even though it was probably unfit for physical work or calving. This find provides a glimpse into how such injuries were treated, as there is contemporary written evidence about applied veterinary treatments.

Keywords: archaeozoology, animal bones, animal husbandry, cattle, Roman period, paleopathology

INTRODUCTION

The archaeological site of Baracs–Boldog-dűlő is located in Fejér County in Hungary, close to the Roman military camp of Intercisa on the *limes* and 4.5 km away from the fort of Annamatia on the right side of the Danube. The remains of a 2nd–3rd-century AD settlement, and a 3rd-century AD Roman villa were unearthed here. The site was excavated in 2008–2009; however, no analysis of the faunal remains was conducted until recently.[2] Bones of domestic animals comprise the overwhelming majority of the finds, and pathological phenomena were observed on a surprisingly high number of them. Perhaps the most interesting find is the partial skeleton of a cow with perpetuated hip dislocation. The finds are kept in the Hungarian National Museum, in the National Institute of Archaeology (ID no. Z.1.59366.394.001).

MATERIAL AND METHODS

The partial cattle skeleton (*Fig. 1*) was recovered from feature O336/S394, a shallow and narrow trench in the southern end of the excavated area. Potsherds, *tegulae*, and fragmented bones of horses and small ruminants came to light from the same trench, suggesting the presence of mixed waste in its infill. A precise dating of the trench proved impossible due to the lack of any suitable finds.

The partial thoracic and lumbar spine, the pelvic girdle, and the hind legs of the cattle were found partly in anatomical order. Judged from the position of the pelvis, the animal was lying on its back with the hindlegs stretched to the back. Only a scapula fragment was preserved from the forelegs. The heavily fractured skull and the mandibles were deposited a few feet away from the rest of the bones, but they were more or less in anatomical position. While the long bones are relatively well preserved, the flat bones are poorly preserved, porous, and fall apart easily.

It was an adult animal. The proportions and size of the metatarsal bones suggest that it was a cow, with a withers height of 122 cm, which corresponds to the contemporary cattle livestock in Pannonia (Bökönyi 1974, 140, Table 2). A number of skeletal elements aided the estimation of the animal's age at death. The chewing surface of the teeth is heavily abraded, rated "m" on Grant's scale (Grant 1982); the root arches of the third lower molars (M_3) are visible on both sides (*Fig. 2*). According to the comparative examinations by Jones & Sandler (2012), this is characteristic for cattle that are 12–13 years old or older. The second

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[2] The site named Baracs–Kokasdi-ér-partja covers the same settlement; the faunal remains from this site are currently under processing; the results will be published in a comprehensive study of the settlement's record. The excavations were led by Dávid Bartus and Lóránd Olivér Kovács.

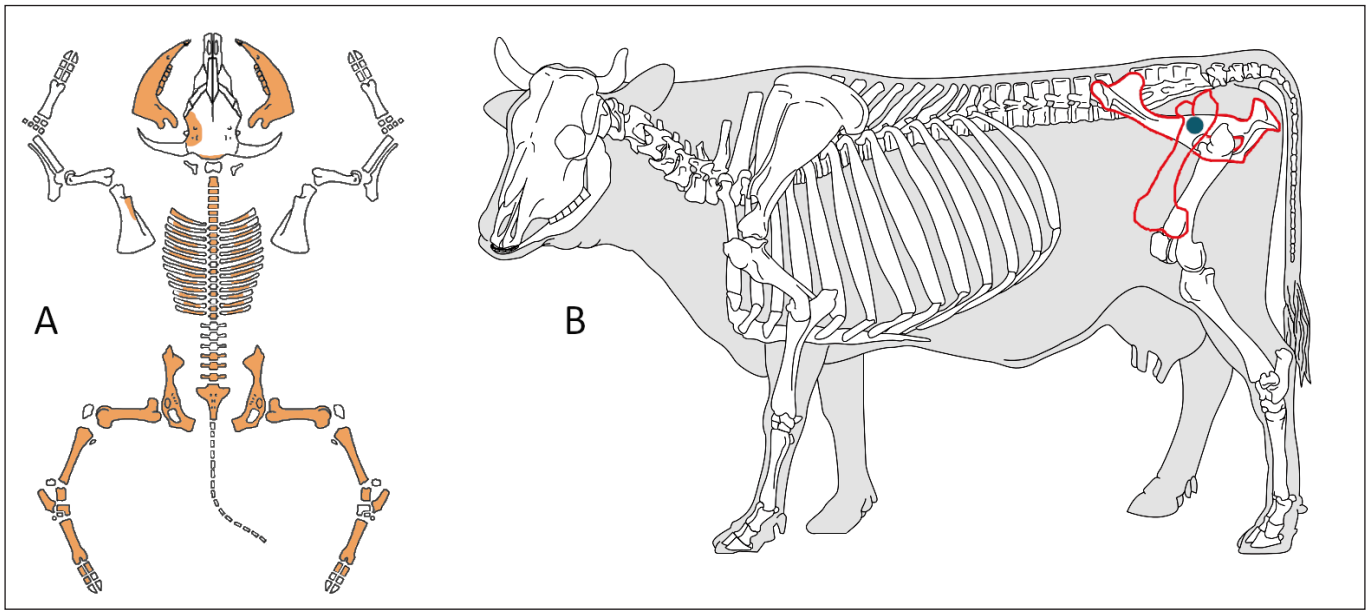

Fig. 1. Preserved skeletal elements of the cow (A) and the position of the dislocated femur (B, red line) and the place of the newly formed pseudojoint (blue dot). Source of the original images: Barone 1976, 22 (Creative Commons CC BY-NC-SA 4.0 DEED license)

Fig. 2. The right mandible of the animal. Root arches are clearly visible, P_2 is congenitally missing (photo by the author)

premolar (P_2) is congenitally missing from both mandibles (there is no alveolus either; this is common in primitive breeds, see Andrews & Noddle 1975). The X-ray of the distal epiphyses of the metapodia, juxtaposed with Telldahl's (2015) data, indicate an age of 8–14 years. All the above suggest that the cow died at 12–14 years of age.

In addition to macroscopic examination, X-rays were taken of the bones. This was made possible by the Szent István Király Museum in Székesfehérvár, with a TW-110 X-ray generator and a Saturn 8000 1417 direct digital flat panel, designed for veterinary purposes.

THE FINDS

The most remarkable part of the skeleton is the right pelvis and femur which show extreme distortion (*Figs. 3–4*). The head of the femur was detached from the acetabulum and formed a new articulation, a pseudo-joint with the ischium of the pelvis, causing a shortening of the limb. The bones rearticulated 5 cm below the femoral head and 5 cm above the acetabulum, resulting in a 10 cm limb length discrepancy.

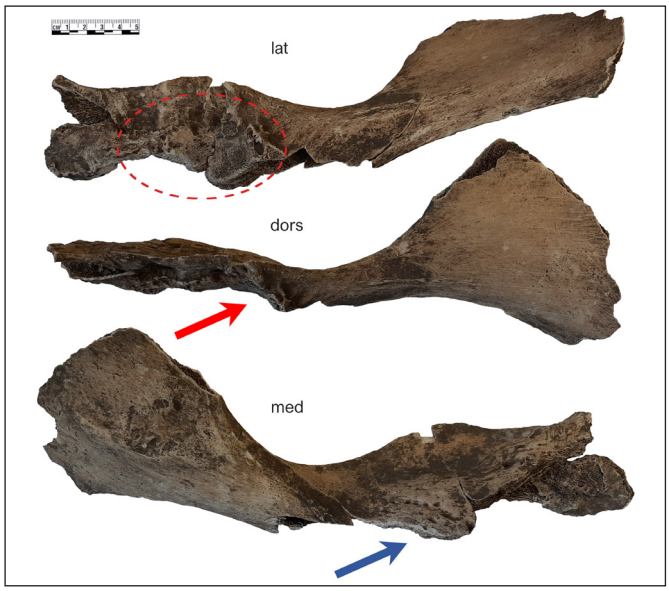

Fig. 3. Lateral, dorsal, and medial view of the pelvis. The red arrow and the dotted line shows the place of the pseudojoint and the eburnation, the blue arrow indicates the remodelled bone tissue on the medial side. The depression caused by the femur is visible on the dorsal view (photos by the author)

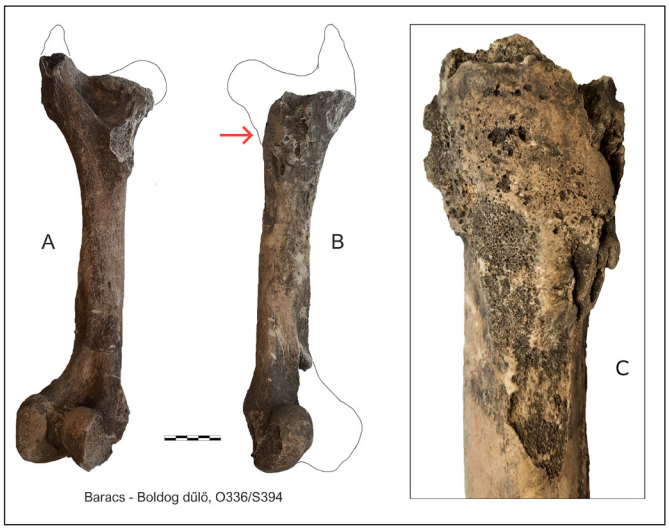

Fig. 4. Caudal view of the healthy (A) and the distorted (B) femur and medial view of the eburnated surface (C) (photos by the author)

The newly formed articulation surfaces are sclerotic and eburnated, with exostoses present. Neither the femoral head nor the acetabulum was found, but it seems that the diaphysis of the femur rearticulated with the pelvis at the lesser trochanter. The pelvis became deformed, with depressions and solid osteophytes on its lateral surface and a remodelling into uneven, slightly cavernous bone tissue on its medial side. The *facies aspera,* where the adductor muscles attach on the caudal side of the femur's diaphysis, also has a compact, irregular, uneven surface, suggesting that the abnormal position after the trauma resulted in the overworking of the muscles.

One of the rib fragments shows signs of a healed fracture: a slight distortion and thickening, with an irregular surface of compact tissue and a hole-like depression (but not a fistula) (*Fig. 5*). It is not clear from which rib the approximately 6 cm long distorted fragment originated, but it is likely to belong to the posterior third of the rib cage, with the damage occurring around the middle section of the rib.

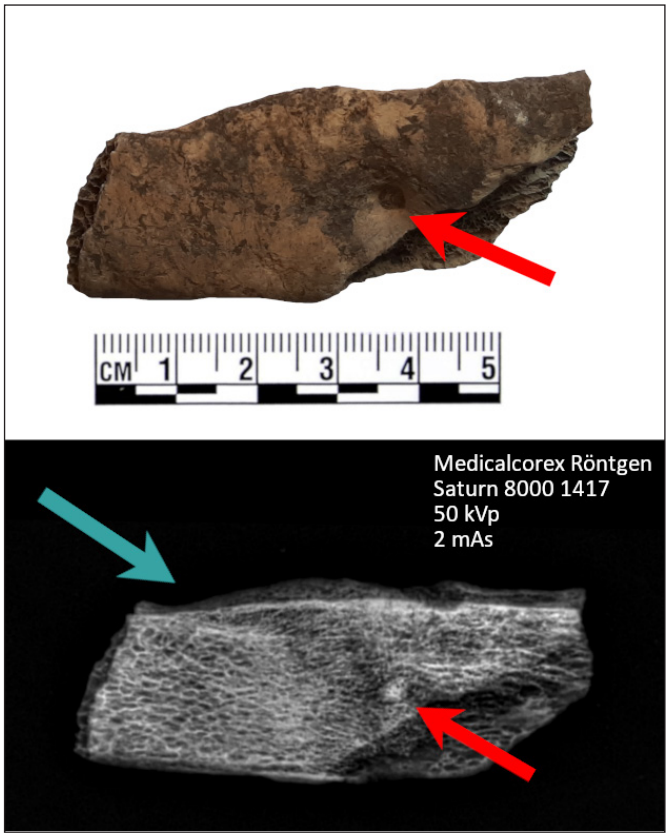

Fig. 5. Photo (lateral view) and X-ray (mediolateral projection) of the fractured rib. The red arrow indicates the hole-like depression, the blue arrow shows the place of the hypothesized fracture (photo by the author)

RECONSTRUCTING THE INJURY

Since it was not readily perceptible whether it was a simple dislocation or the animal suffered a fracture of the femur, I took X-rays of the finds. The images (*Fig. 6*) reveal that the femur's compact tissue is intact and there is no thickening or fracture-related dislocation, although a transverse, uneven, linear shadow is visible on the proximal end. This shadow corresponds to the place of the newly formed pseudo-joint and probably represents the sclerotic, eburnated tissue of the new articulation surface. As both the femoral head and the acetabulum are missing, it is now impossible to tell if there was a fracture on those parts.

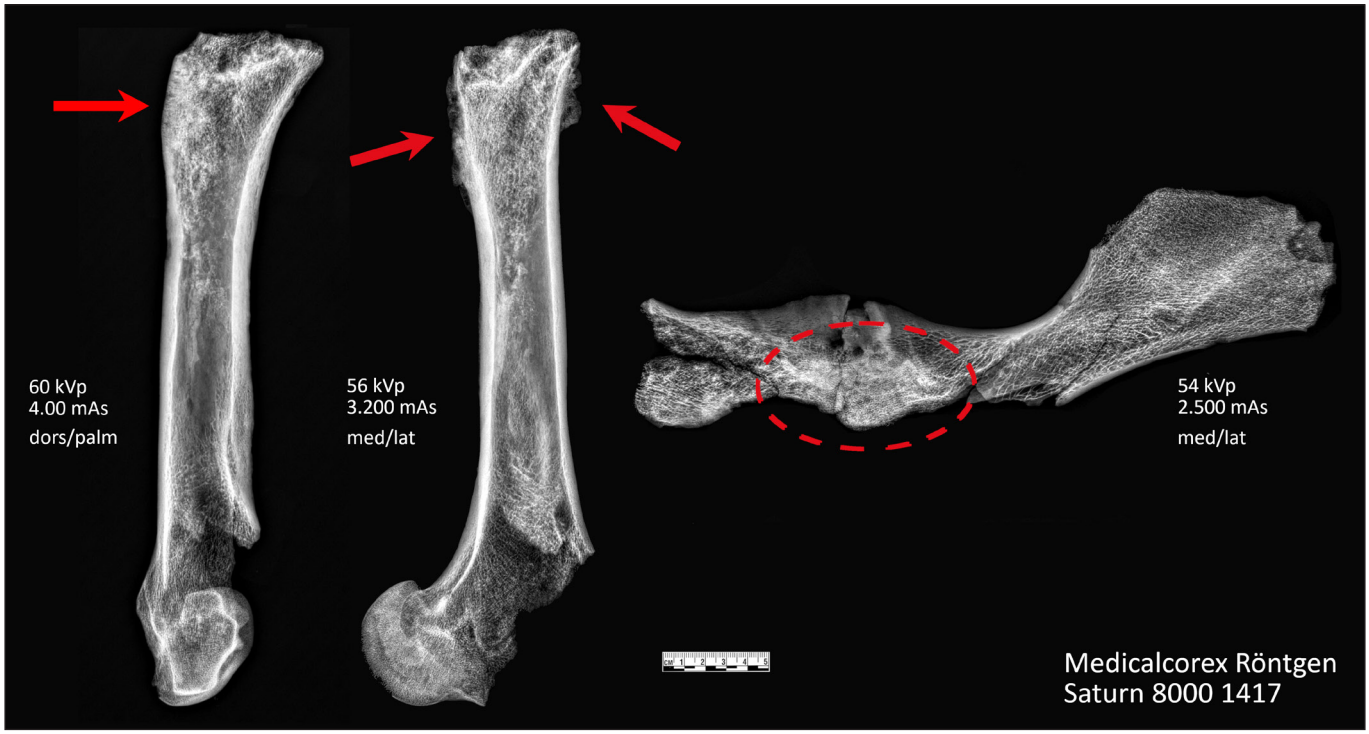

Fig. 6. Dorsopalmar (left) and mediolateral (middle) X-ray of the femur, and mediolateral X-ray of the pelvis (right). The red arrow and circle indicate the eburnated, sclerotic surfaces and the parts covered with osteophytes. Signs of discontinuity on the pelvis are results of post mortem fragmentation (photos by the author)

Dislocation of the hip, i.e., coxofemoral luxation, is relatively frequent in cattle (Hull 1996, 48; Marchionatti *et al*. 2014, 247). It is usually trauma-related, caused by a fall on slippery ground or during mating. The broken rib also suggests a traumatic origin; the two injuries may have happened at the same time, although not necessarily. Rib fractures are frequent in archaeological assemblages, simply because this injury has good chances of healing and such pathological bones are therefore often preserved.

A typical form of coxofemoral luxation is the craniodorsal version. In these cases, the femoral head moves to the front and upwards due to the contraction of the muscles, as can be seen in the individual from Baracs. This causes damage in the articular capsule and the ligament attached to the head of the femur usually tears. The muscles that are inserted at the femoral head are responsible for complex movements, such as flexing and extending the hip joint and rotating the limb. An animal with a dislocated hip turns its knee outwards, the ankle joint inwards, and one side of the hip is higher. The injured limb is often extended and stiff with impaired mobility and the animal adopts an altered gait to minimize discomfort, resulting in severe limping or the appearance of lameness (Reynolds 1996, 46; Tamás 1987, 336). If the livestock is regularly checked, this injury is impossible to miss. In large farm animals, the injury's prognosis is dubious at best, because the reduction of the dislocated femur is difficult and stabilizing the limb in one position is impossible (Tamás 1987, 337). Healing without surgical intervention is most likely in animals that are younger than 3 years and lighter than 400 kg, and in cases when the injury is treated within 12 hours (Jubb *et al*. 1989; Larcombe

& Malmo 1989). Arthritis is likely to form even if the injury is treated and the femoral head is placed back in the acetabulum. When the injury is left untreated, a pseudo-joint is typically formed, as observed in the Baracs cow. In such cases, limping persists for months and can become perpetual (Tamás 1987, 338).

Both the femoral nerve and the sciatic nerve, the greatest nerve in the body that innervates the hindlimb, are inserted in this pelvic region. These are also easily damaged in case of a hip luxation, which means that the sensation and movement of the leg may be severely hampered (Cox 1992, 24) but it is impossible to say if this was the case with the Baracs cow. Both the luxation and the rib fracture must have remained closed injuries; there was no open wound, and so there was no secondary infection either.

The finds are fragmented and it is uncertain whether the distortion affected the missing proximal end of the femur and whether the proximal epiphysis had already been fused at the time of the injury. According to Silver (1963), this epiphysis fuses around 3 and a half years of age. Modern data suggest that hip dislocation is most frequent in young, 2–5-year-old cattle (Weaver et al. 2005, 248). If the accident happened at such a young age, the animal must have lived with the injury for long years.

It is difficult to estimate the time required for the lesions to develop, i.e. the minimum time interval between the accident and the death of the animal. The formation of osteophytes is a similar process to that of new bone formation in fractures, but takes more time, and while exercise stimulates the formation of new bone tissue, rest slows it down (Hsia *et al*. 2018). The rate of new bone formation and remodelling depends on several factors, such as the nature of the injury and the age, health, and nutrition of the animal. In cattle, compared to other farm animals, osteophytes can appear relatively quickly, with the first signs of exostoses visible on X-rays as early as 7–10 days after trauma (Kofler *et al*. 2014, 17). However, the new, eburnated pseudo-joint in the Baracs animal indicates that the cow continued to move around for a long time, and the compactness of the bone growths suggests that the process of periosteal inflammation was no longer acute at the time of death. The healed rib fracture also indicates that the injury occurred long (maybe even years) before the animal died.

ROMAN PERIOD TREATMENTS

In an archaeological context, healed femoral and pelvic traumas are extremely rare in large farm animals, which means that these injuries were usually lethal or led to slaughter (Bartosiewicz 2013, 62). There are a few exceptions; for instance, a healed femur fracture was found in a Roman Period cattle in Belgium (Van Neer & Udrescu 2015), which suggests that in extreme cases even major injuries had a chance to heal. In the Carpathian Basin, coxofemoral luxation was documented in pigs: Sándor Bökönyi recorded a case from the Roman site of Tác-Gorsium (Bökönyi 1984, 11), and László Bartosiewicz reported another case from the Avar Period (Bartosiewicz 2013, 56). To my present knowledge, only one such case has been recorded in cattle, from a medieval site in present-day Tallin, Estonia (Maldre 2008, 56, Fig. 14). This animal, however, was younger than the Baracs cow and the femoral head was dislocated in a different direction.

Prognosis also depends on age: in adult animals, healing is often hampered by the great body weight carried by the limbs. Although the thick layers of muscles in the pelvic region may help keep the injured bones in place (Nichols et al. 2010, 43), they also make it difficult to move the femoral head back into the acetabulum (Reynolds 1996, 48). In a study conducted on modern livestock by Tulleners *et al*. (1987), 94% of the cattle with dislocated hips did not become recumbent "downer cows", did not suffer additional muscle trauma, and managed to walk by minimizing the pressure placed on the injured limb. Whenever an injured animal is unable to stand up, lifting it with a sling is necessary because irreversible damage can occur in the recumbent animal within a few hours (Amstel & Shearer 2006, 152–153). Since the Baracs individual was not slaughtered after the injury, it is safe to assume that it did not become a downer cow and was able to move around, although it must have been difficult for the animal to lie down and stand up due to the asymmetry of the two hindlimbs.

Although information about the veterinary practices of the native population in Pannonia is limited, medicinal knowledge prevalent in the Roman Empire can be gleaned from a number of surviving treatises.

Injured animals were usually treated by herdsmen and those who worked around the livestock on a daily basis. Varro writes that a *medicus* is needed only if the injury is severe, otherwise the *pastor diligens* is perfectly able to care for the sick animals (Varro [1960], 326–327, translated by W. D. Hooper). Columella reports on similar practices (Fisher 1988, 192).

In his 5th-century AD treatise titled *Digesta artis mulomedicinae*, Vegetius draws on Greek sources and describes a "Barbarian" method to treat hip dislocations. In addition to applying various potions, he reports on a manual way of relocating the bones:

"But if a Horse or Mule has thrust out its Hip, or put it out of its Place, there is taught a surer, and more easy Method of Cure, which has been found out, approved: for they place an Animal, that has been a long while lame, in the Sun, and they warm him with warm Wine and Oil, that is, they rub the Joints of his Hip therewith for a very long while, till he sweats; then they pull the Animal with an Halter, and make him run by little and little, another Person, holding a leather Thong, or a Rope slack in his Hand, follows him, and all of a sudden, while the Animal is running, draws with Violence the Hip, straight towards himself; if it sounds or gives a Crack, you may know that it is returned to its Place, and you shall stop a little while; afterwards you shall try it by walking up and down leisurely. If it is returned into its Place, and he sets down his Feet straight when he draws them back, and does not go so lame as he did, you shall not vex and torment the Animal any further, but foment him with warm Vervain Water; afterwards you shall apply the Caustick. But if the Joint cannot be set right the first Day, you shall pull the Hip frequently on the second Day after the same Manner, till it return to its Place…(Vegetius [1748], 276–277, translated by A. Millar).

That is, the dislocated joint was repositioned either manually or by a vigorous pull executed by ropes and animal force. The 2–3-day interval mentioned in the text corresponds to the 48-hour intervention window specified in modern praxis (Amstel & Shearer 2006, 159; Cramer & Solano 2023). Similar simple methods of relocating the joint are also in use today, but the intervention is to be performed within 12 or maximum 24 hours after the injury (Larcombe & Malmo 1989, 353–354; Hull 1996, 51). It is unclear if the owners of the Baracs cow tried to relocate the hip with a similar method – if they did, the treatment certainly failed and the dislocation became perpetual.

ECONOMICAL CONSIDERATIONS

The presumable attempt to heal the animal and the fact that it was kept alive are interesting in the wider context of the whole settlement. Artefacts recovered from the site testify that the locals were not particularly wealthy; the features mostly yielded pieces of rough pottery and animal bones. It is unclear which was more remunerative: whether to keep the animal alive or to slaughter it. It is certain that the Baracs cow was unable to perform physical work after the injury. The shortening of the leg and the distortion of the hip joint usually leads to other lesions on the legs, and the fact that the skeletal remains present nothing of this sort suggests that the cow's movement was restricted and it did not work after the injury.

One possible explanation is that it was a dairy cow at the time when the injury occurred, and so it was logical to keep the limping animal alive and harvest its milk. In fact, coxofemoral luxation in cows often occurs either during mating or calving, or after calving as a result of milk fever or nerve damage (Marchionatti *et al*. 2014, 250). However, to perpetuate its use as a dairy cow, the animal had to give birth to new calves even after the injury. While this is not likely, it cannot be excluded completely. Cows may stay reproductive up to the age of 30 years; such examples have been recorded in the 20th century as well (Csukás 1954, 170–173). The injury of the Baracs cow did not necessarily exclude calving, as the pelvic girdle was not narrowed and the birth canal probably remained unaffected. However, the increase in body weight and the increased load in the limbs during pregnancy and calving must have caused problems, even if the cow gave birth in a standing and not a lying position.

It is also pertinent that the animal's body had not been processed in any way before it was tossed into the trench: nothing suggests that it was killed and eaten. There were very few cutmarks on the bones at this site in general; instead, they were broken up while fresh and wet and so they have *post mortem* spiral fractures

as a sign of marrow extraction. However, the limb bones of this cow are intact, and they were found partly in anatomical order, which excludes slaughter and meat consumption.

Emotional attachment to the animal is a possible motivation; however, this is something one can only speculate on. Whole and partial skeletons came to light in surprisingly high numbers at this site, and the presence of an intact Iuppiter altar beside a stone building (Bartus 2010, 139) raises the question of a possible ritual context. As the skeleton is partial and the animal was found prone and in a twisted position, a ritualistic burial seems highly unlikely. Moreover, the altar was found in a secondary position, approximately 200 metres from the cow's remains, and their original spatial relation is uncertain. Contemporary written sources are equivocal about sacrificing sick animals. The sacrificial animal had to meet a number of criteria (Ekroth 2014, 332–333, 344) and its meat was sold at a high price, so it was seen as food of great quality. At the same time, Marcus Terentius Varro reports that the health of cattle bought exclusively for sacrificial purposes was usually not stipulated ("those who buy for sacrifice do not usually demand a guarantee of soundness in the victim"; Varro [1960], 373). There must have been a difference between latent disease and visible disability. It is certain that sick or injured animals were sometimes sacrificed, even if only on the odd occasion (Ekroth 2014, 332). In the case of the Baracs individual, the dubious archaeological context of the altar and the position of the animal suggest a natural death; the animal may have been seen unfit for consumption for reasons of sanitation, religion, or on an emotional basis.

SUMMARY

The partial cow skeleton found at the Baracs–Boldog-dűlő site provides a glimpse into the "biography" of an animal from the 2nd–3rd century AD. Macroscopic and X-ray examinations revealed that the animal probably fell and suffered a rib fracture and a hip dislocation, which was either left untreated or its treatment failed, and the abnormal position and shortening of the limb became perpetual. After the injury, the animal was unfit for any agricultural work, and was probably unable to reproduce without problems, but it was not slaughtered. The cow died at the age of 12–14 years, of unknown but probably natural causes, and its flesh was not consumed.

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