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Squelette de chien *Canis familiaris* (Linnaeus, 1758) monté, Laboratoire de Recherche ostéoarchéologique, Stockholm. Crédit: L. Bartosiewicz / *Mounted dog* Canis familiaris *(Linnaeus, 1758) skeleton, Osteoarchaeological Research Laboratory, Stockholm. Credit: L. Bartosiewicz.*

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A dog's life: interpreting Migration Period dog burials from Hungary

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ABSTRACT
Of all domestic animals, dogs (*Canis familiaris* Linnaeus, 1758) have developed the tightest bond with humans during the history of civilization. Regardless of their chronological affiliation, articulated dog skeletons discovered in structured deposits show individuals within their biological contexts; their ageing and sexing are usually possible and even pathological histories can be reconstructed. This presentation is a concise review of five Migration Period (5th-6th century CE) deposits from western Hungary, the former territory of Roman Pannonia province. These burials are examples of dogs being interred with other animals as well as humans under various circumstances. The integration of multidisciplinary information in reconstructing both the morphotype and likely socio-cultural status of 13 individuals showed the presence of unusually large dogs in human burials by both late Antique and present-day standards. This raises the question of whether these large dogs were associated with humans or occasions that were seen as particularly significant. Could any large dog be added to the burial of a human considered important enough? The dualistic perceptions of dogs in the historical/ethnographic record offer a broad range of interpretations. The results of high-resolution zoological analysis provided by complete dog skeletons can contribute to a better understanding of dog-human relationships as well as the perception and value of individual dogs to people.

KEY WORDS
Animal burials, withers height, companion animals, social status of dogs.

RÉSUMÉ

Une vie de chien : interpréter les dépôts de chiens de la période migratoire en Hongrie.

De tous les animaux domestiques, le chien (*Canis familiaris* Linnaeus, 1758) est celui qui a développé le lien le plus étroit avec l'homme au cours de l'histoire des civilisations. Indépendamment de leur attribution chronologique, les squelettes articulés de chiens découverts dans des dépôts structurés révèlent des individus dans leur contexte biologique, ce qui permet généralement de déterminer leur âge et leur sexe, voire de reconstituer leur historique pathologique. Cette présentation consiste en un bref examen de cinq dépôts de la période de migrations (Ve-VIe siècle de notre ère) provenant de l'ouest de la Hongrie, l'ancien territoire de la province romaine de Pannonie. Ces sépultures constituent des exemples de chiens enterrés avec d'autres animaux ainsi qu'avec des humains dans des circonstances diverses. L'intégration d'informations multidisciplinaires pour la reconstitution de l'aspect morphologique et du statut socio-culturel probable de 13 spécimens révèle la présence de chiens de taille inhabituellement grande dans les sépultures humaines, selon les normes de l'Antiquité tardive et d'aujourd'hui. Se pourrait-il qu'un chien de grand gabarit soit associé à la sépulture d'un être humain considéré comme important ? Les perceptions duales entourant les chiens dans les archives historiques/ethnographiques offrent un large éventail d'interprétations possibles. Les résultats de l'analyse zoologique à haute résolution permise par les squelettes complets de chiens peuvent contribuer à une meilleure compréhension des relations entre chiens et humains, ainsi que de la perception et de la valeur des chiens pris individuellement pour les personnes.

MOTS CLÉS
Sépultures d'animaux, hauteur au garrot, animaux de compagnie, statut social du chien.

INTRODUCTION

Dog (*Canis familiaris* Linnaeus, 1758) remains are omnipresent in archaeological contexts, either as scattered remains or complete skeletons. Dogs often do not seem a primary material resource like other domesticates, but they have been associated with complex spiritualism in many cultures across the world (Morey 2006). Contemporary attitudes toward animals are also known to be linked to broader political, economic and socio-cultural shifts (Franklin 1999: 175). Continuing efforts to understand the motivations behind the ancient treatment of animals and the diverse roles they have always played in our lives helps elucidating our views about one another and the power dynamics symptomatic of our unequal society.

Among others, dogs played important roles in rituals performed by various Germanic tribes, who occurred during the Migration Period in the area of present-day Hungary. Also known as Lombards, the Langobards were a Germanic tribe, possibly originating in Scandinavia. According to the historical record, they migrated to the Danube region towards the end of the 5th century. By 526 they had moved to Pannonia and left the region when they invaded Italy in 568 (Bóna 1956: 185). This era is regarded the Migration Period in Hungary but corresponds to the Early Middle Ages in most of Europe.

Rituals are characterized by repetitive action. However, recurring elements are not always easy to identify in structured animal bone deposits. This study is a brief review of diverse Langobard dog deposits whose occurrence is narrowly defined in both time and space. Their only repetitious feature, however, is the presence of dogs interred in their entirety in various burial contexts.

Complete skeletal finds make the morphometric reconstruction of individual dogs easy in comparison with meat-purpose livestock whose bones are typically found in a fragmented and commingled state in settlement deposits. In animal burials, well-preserved long bones offer an opportunity for the estimation of stature. Moreover, the reconstruction of phenotypic size can be appraised in terms of the age and sex of each individual.

Beyond direct physical reconstruction, however, the diverse practical function of dogs is difficult recognize, not to speak of their likely symbolic value prescribed by religious beliefs and/or community tradition. In a broader context, Prummel (1992: 154, 155) identified many of the individuals found in Germanic burials as hunting dogs, while she attributed large skeletons to dogs used fighting. According to Vretemark (1989: 35, 36), the dogs in the Vallentuna grave in Sweden had served their owner as guards, hunting companions or fighting dogs. The *topos* regarding hunting dogs was also perpetuated by Bóna (1971) who described the two dogs as such in the grave of the man buried with a sword and lance in Grave 70 of the Hegykő cemetery. He was of the same opinion concerning an independent dog burial in the Langobard cemetery of Rácalmás based on its proximity to a high-ranking inhumation grave (Bóna 1971: 233). Importantly, these putative functions do not exclude each other, the same strong dogs may have been used in a variety of ways, including ritual roles directly evidenced by the burials themselves. Burials with humans offer more interpretable relationships in life than when dogs are found in the company of other animals. Not all Langobard dogs were buried alongside humans, although they were evidently important protagonists in various ritual scenarios. Except for simplistic interpretations, their empirical presence is difficult to relate to actual life histories. Several questions arise concerning animal traits, agency as well as how individuality developed in dogs recovered from often curious deposits:

– What were individual Langobard dogs like?

– Were specific sizes/morphotypes associated with different types of burials?

– What could be the roles assigned to Langobard dogs in the archaeological deposits reviewed here?

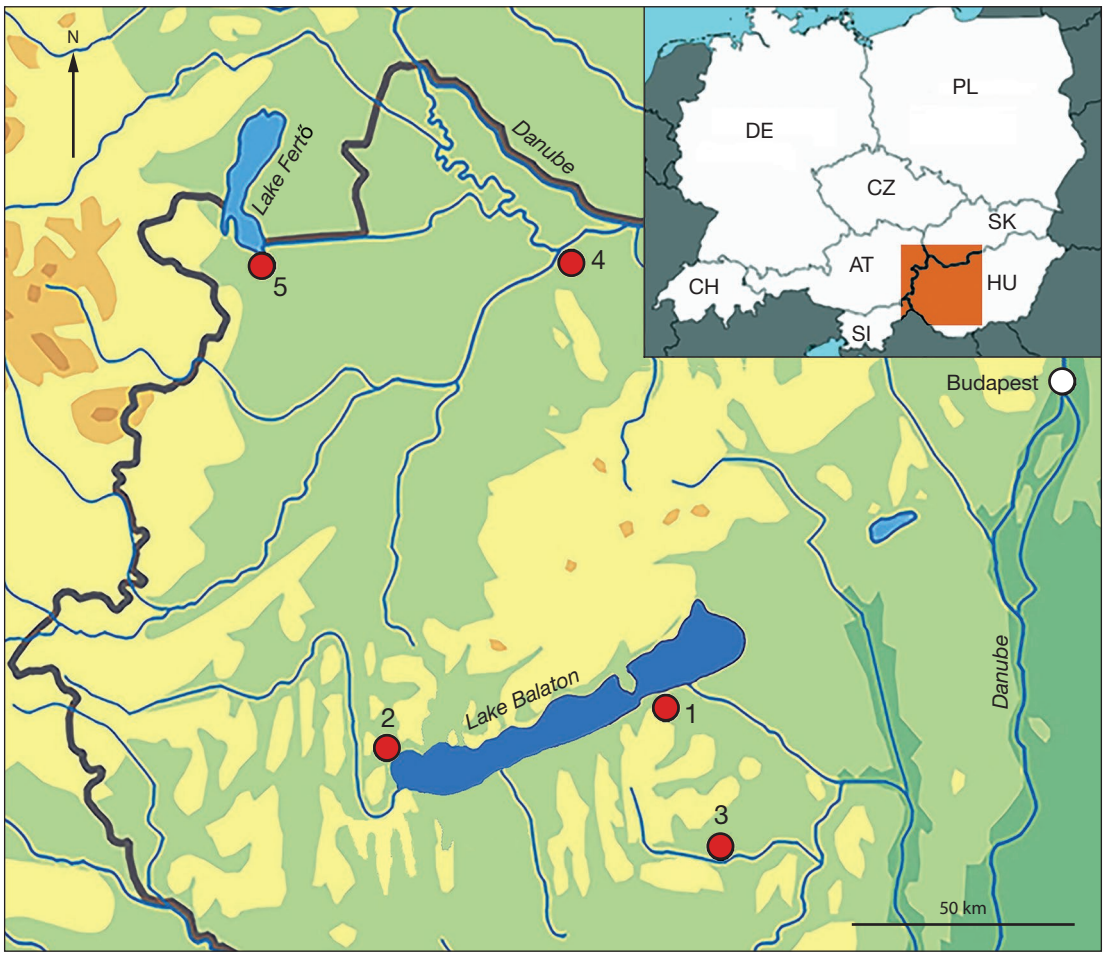

Fig. 1. — Sites in western Hungary mentioned in the study in relation to central Europe (insert): **1**, Zamárdi – Kútvölgyi-dűlő II; **2**, Keszthely – Általános iskola; **3**, Dombóvár – TESCO; **4**, Ménfőcsanak – Bevásárlóközpont; **5**, Hegykő – Mező. Abbreviations: **AT**, Austria; **CH**, Switzerland; **CZ**, Czech Republic; **DE**, Germany; **HU**, Hungary; **PL**, Poland; **SI**, Slovenia; **SK**, Slovakia.

As our research has been dealing with deposits constructed by humans, a degree of anthropocentrism will be inherent to the interpretation of these burials even in the absence of human skeletons. Beyond empirical description pivotal to this study, other individual differences between animals can only be guessed at. Speciesism is also apparent in the likely different meanings the animals discussed (dogs, horses and the lynx) mediated to participants of the rites at the time: we inevitably see and interpret these species through our own contemporary knowledge and perceptions of animals.

MATERIAL

We studied 13 dog skeletons dated to the Migration Period. They originate from the western section of present-day Hungary, the former Roman province of Pannonia, invaded by Germanic tribes around the time the Roman Empire collapsed (Fig. 1). The deposits studied can be dated from the mid-5th to the mid-6th century and are largely associated with the Langobards residing in the Carpathian Basin at the time.

Archaeological individuals

Dog skeletons were studied from a variety of structured deposits recovered at the following five archaeological sites:

Zamárdi – Kútvölgyi-dűlő II

At this settlement four adult dogs were found in a 140 cm deep, round pit above the carcass of a fully grown male lynx (Gál 2007: 299, 300, fig. 307). The feature contained no datable archaeological artefacts The dogs were found in the following order:

– female, on her right side by the southern side of the pit, depth: *c.* 20-30 cm below the present-day surface;
– male, on his right side in the centre, depth: *c.* 65 cm;
– female, on her right side near the eastern side, depth: *c.* 85 cm;
– male, on his right side along the northern side, depth: *c.* 100 cm.

The only radiocarbon dated dog skeleton in the entire material was the first dog on top of the deposit. It yielded a date encompassing two centuries (calibrated 2s: AD 340-540). Dates for the lynx at the bottom fell between the 5th-6th century (calibrated 2s: AD 420-550), congruent with the historical dating of Langobard presence in Hungary. The discrepancy

between the two dates was explained by the omnivorous diet of dogs in comparison with that of the lynx, possibly causing a reservoir effect (Gál *et al.* 2022: 784).

Keszthely – Általános iskola
Three structured deposits came to light near the northern edge of a later, Avar Period cemetery at this site. Each contained the skeleton of an adult dog accompanying a mature stallion. The horses were each laid to rest in the narrow pits more-or-less on their left side with legs contracted. This repetitive pattern, however, was not manifest in the positioning of the dogs:

– male, on the rump of the horse, *c*. 220 cm below the present-day surface;

– male, parallel along the abdomen of the horse, depth: 195 cm;

– male, near the rump behind the horse, depth: 179 cm.

Although no datable artefacts were recovered from these burials either, the gross arrangements of animals were consistent with those observed in 5th-6th century Germanic animal burials (Vörös 1999: 121).

Dombóvár – TESCO
Two burials including animals stood out among the 21 late Roman Period graves excavated at this site. The dogs available for study were as follows:

– Grave 83: male (?) found at the rump of a partially harnessed mature stallion;

– Grave 84: male found above a brick-lined burial, near the right shoulder of a 30-35 year old man.

The position of the dog in relation to the horse is reminiscent of those in the 1 and 3 Keszthely animal burials. The dog adjacent to Grave 84 seems associated with the inhumation and may have had some relation to the deceased (Daróczi-Szabó & Bartosiewicz 2018: 244, 245, figs 1, 2).

Ménfőcsanak – Bevásárlóközpont
Two dogs were identified in Grave 262 among 27 inhumation and three cremation burials of the Langobard cemetery excavated at this site (Vaday 2015: 163):

– Dog 262/A: male, found in a secondary position above the skeleton of a 40-50 years old woman;

– Dog 262/B: female, recovered *in situ* on a small bank near the right shoulder of the same woman.

Originally, the dogs lay on either side of the woman's body. Judged by the work invested in her deep grave, she may have been of reasonably high social status (Vaday 2015: 214). The carcass of Dog 262/A seems to have been dumped back into the burial pit following coeval grave robbery (Bartosiewicz 2015: 252, fig. 3). The left leg of the human skeleton was likewise disturbed (Vaday 2015: 188, fig. 10). A healed compound fracture in the right ulna of the dog caused the fusion and deformation of his metacarpal bones indicative of a chronic, visible limp (Bartosiewicz 2013: 50, fig. 33).

Hegykő – Mező
Two dogs lay curled up overlapping each other by the feet of an adult man buried with a sword and lance in Grave 70 in this cemetery of 77 burials. The man's social status was evidently high; in addition to the weaponry, his was one of the four skeletons found among identifiable coffin fragments in the cemetery.

Bökönyi (1974: 326) published only the cranial measurements of these two dogs. He did not comment on their age and sex but suggested that they had originated from the same litter in light of their apparent craniometric similarity. According to *in situ* photographs (Bóna 1963: 138, 139, fig. 1) both were straight-legged, large individuals. Thus, even in the absence of long bone measurements, they were deemed comparable to the other Langobard dog skeletons discussed in this study.

Reference individuals

Skeletal measurements of 24 extant canines were used in reconstructing phenotypic size in the archaeological material. They included 13 domestic dogs and a wolf (*Canis lupus* Linnaeus, 1758) listed in the classic work by Koudelka (1885: 137) as well as eight dogs and two wolves studied in the Osteological Research Laboratory (ORL), Stockholm (Table 1; Appendices 1, 2)[1].

Currently we have no methods for accounting for individual dog behaviour in archaeology, a hindrance in trying to trace reliable life histories. A good example of this is "Fanghund", a term used by Koudelka, unknown in modern German. It seems to have meant fighting dog in either pastoral or hunting contexts. Their different withers heights of 52 cm and 70.5 cm (Koudelka 1885: 137) support the impression that the author refers to function rather than a breed.

Although comparisons to contemporary dog breeds is always tempting, using the concept of breed would be inappropriate in an archaeological context as breeds in the modern sense were not standardized until the last two centuries. Moreover, depending on our personal experiences and even taste, associations with concrete modern breeds evoke emotions potentially influencing our interpretations. Breeding dogs for specific functions has resulted in forms different in temperament but sometimes similar in size/physique. Our occasional references to extant breeds only aid illustrating the general phenotype of each reconstructed Langobard individual. Table 1 shows the summary of skeletons included in our analyses.

Abbreviations

Bp	proximal breadth (von den Driesch 1976)
GL	greatest lenght (von den Driesch 1976)
PC	principal component
PC1	first principal component
PCA	principal component analysis
SD	smallest diameter (von den Driesch 1976)
WH	wither height

METHODS

Based on the summary table of dog ontogeny by Habermehl (1975: 168, 169), contemporary dogs may be considered adult after 1.5 years of age based on epiphyseal fusion (although sexual maturation may take until three years). These calendar ages, however vary between extant breeds depending on size

1. Harcourt (1974) calculated regression equations based on 34 dogs of known withers height. Unfortunately, his raw data were not published at the time.

and longevity. While tooth eruption sequences can be profitably used in the dental ageing of dogs (Schmid 1972: 77, table X), studies of tooth wear in wolf (Gipson *et al.* 2000) show decreasing accuracy with the advancement of age. Inaccuracies are further exacerbated in domestic dogs by intraspecific variability.

The identification of primary sexual dimorphism is easy in the presence of *baccula*. Although the absence of this osteological evidence cannot be taken as the evidence of absence, burials are usually excavated carefully enough to guarantee the recovery of the *c*. cigarette-size penis bones of large males.

Cranial morphometry has proven largely impossible to consider across our small Langobard sample as most skulls showed fragmentation to varying degrees precluding their in-depth comparative study. Consequently, individual dogs were characterized by the analysis of the greatest lengths (GL [mm]; von den Driesch 1976) of the largest long bones: humerus, radius, femur and tibia (the fragile ulna and fibula were not always preserved in full length). When pairs of measurable bones were available, the mean values of their lengths were used in calculations. Due to fragmentation, the radius length of the Zamárdi 2 and femur lengths for the Keszthely 1 and Dombóvár 3 individuals were estimated using multiple correlations between long bone lengths in the archaeological sample.

Evaluation was carried out in four steps, using the Past 2.0 software (Hammer 2020) in statistical analyses:

– lengths of the four long bones served in grouping all individuals (Ward method, based on Euclidean distances). In addition to showing similarities in size, this multivariate calculation also expected to account for some differences in extremity proportions;

– Koudelka (1885) calculated the proportion of each long bone relative to WH. Such estimations are biased by discrepancies between the variation in the reference sample and random variation in the archaeological finds: the resulting WHs vary bone by bone within the same individual, a problem usually solved by averaging the estimates. Harcourt (1974: 154) developed synthetic regression equations for calculating WH from bones of the front (humerus + radius) and hind leg (femur + tibia). In this study, the four long bone lengths were first subjected to a principal component analysis. Rather than illustrating the evidently high correlation between various long bones, this method was chosen to characterize each dog using a single score based on both size and extremity proportions. The linear regression between individual PC scores (x; synthesized bone lengths in each individual) and known WH values (y) were used in estimating WH from the PC scores of the Langobard dogs;

– in the absence of long bone measurements, the total length of skull served as a proxy to WH for the Hegykő 1 and 2 dogs (Bökönyi 1974: 556). Alpak *et al.* (2004: table 4) found highly significant, positive correlations ($r = 0.933$ to 0.940; $p < 0.01$) between this cranial measurement (x) and the greatest lengths of long bones (y). Broad variability among domesticates may weaken this correlation if, for example, chondrodystrophic dog breeds were included. However, since short-legged forms are not subject to our study, this bias could be discounted in the case of the evidently straight-legged Hegykő individuals shown in the excavation photographs (Bóna 1998: 114, table I, 1-3);

TABLE 1. — Summary of canine skeletons available for study. Abbreviations: **non-id**, non identified; **ORL**, Osteoarchaeological Research Laboratory, Stockholm.

	Sex			
Source	**female**	**male**	**non-id.**	**Total**
Archaeological	3	7	3	13
Extant – Koudelka 1885	–	2	12	14
Extant – ORL	4	4	2	10
Grand Total	7	13	17	37

– the slenderness (relative width) of zygopodium bones (SD of radius, Bp of tibia; von den Driesch 1976) were compared to that of Roman Period dogs using the scheme developed by Bennet *et al.* (2016) to fine-tune the phenotypic analysis of Langobard dogs.

RESULTS

All Langobard dogs under discussion here were adults based on their full dentition and epiphyseal fusion of limb bones. This makes phenotypic reconstructions more realistic as only sexual dimorphism needs to be taken into consideration in interpreting size, the remaining variation potentially illustrating human choice of specific morphotypes to be interred in the ritual deposits under discussion.

Clustering Langobard dogs with extant individuals

The grouping of dog skeletons based on long bone lengths is shown in Figure 2. Size decreases toward the bottom of the dendrogram. However, the formation of clusters is also influenced by similarities in extremity proportions. For example, hunting dogs that primarily rely on sight and speed (sight hounds, *Windhunde*) such as Greyhound tend to have shorter stylopodia (humerus and femur) relative to their zygopodia (radius and tibia) within the same individual (Nichols 2021: 3), a general trend related to the efficiency of locomotion, also observed e.g., in ruminants (Bartosiewicz 1987: 444). Male dogs tend to have relatively shorter upper arms due the more pronounced curvature of their humerus (Ruscillo 2006: 65). Vörös (1999: 126) also noted differences in limb proportions between the males from Keszthely. Patterning relevant to the archaeological individuals occurs within the Euclidean distance of 30 (Fig. 2: dashed line).

None of the Langobard dogs are similar to large, robust modern breeds that exceed all but one of the studied male wolves in size. Wolves form another cluster which also includes the Langobard dogs from Dombóvár and the Keszthely 1 and 2 individuals. Keszthely 3 falls in a separate group dominated by males, including the Zamárdi 2 individual. The smallest Langobard dogs studied tend to be females, with the exception of the Zamárdi 4 individual, a male. Even these dogs, however, seem to be rather large, comparable to a contemporary female German Shepherd.

The large Ménfőcsanak A male is an outlier connected to the latter two groups of domestic dogs but loosely. The rest of the clusters include extant individuals of small WH. Koudelka's grey sight hound of small WH is the size of an

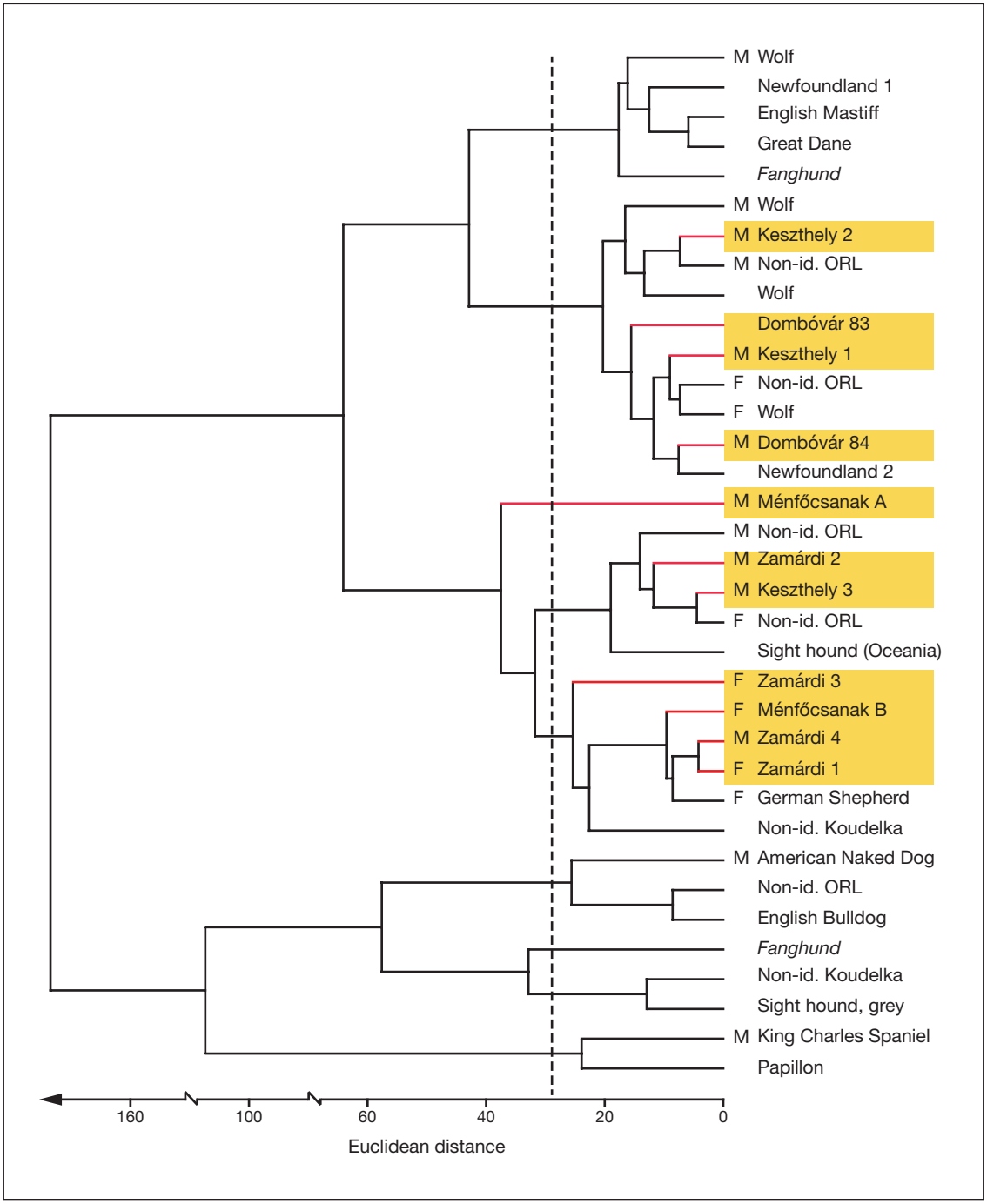

FIG. 2. — The grouping of extant and Langobard dogs (highlighted in yellow) based on the greatest lengths of four long bones. The Euclidean distance of 30 is marked by a **dashed line**. Abbreviations: **F**, female; **M**, male; **Non-id**, non identified; **ORL**, Osteoarchaeological Research Laboratory, Stockholm.

TABLE 2. — First principal component (PC1) loadings in comparison with the proportion of long bones to withers heights. Abbreviations: **λ,** latent root; **GL,** greatest lenght.

Skeletal element, GL	PC1 loadings λ = 99.2%	Koudelka's coefficients
Humerus	0.468	3.37
Radius	0.482	3.22
Femur	0.522	3.01
Tibia	0.525	2.92

Italian greyhound, smaller than a Whippet. A taller "sight hound from Oceania" was collected during the 1857-1859 expedition by the Austrian frigate Novara and brought to Vienna live (Koudelka 1885: 137).

WH ESTIMATES BASED ON THE SYNTHESIS OF BONE LENGTHS

Linear body measurements within the same geometrical dimension grow together, i. e. tend to be highly correlated. It is thus unsurprising that the PCA resulted in a single, highly

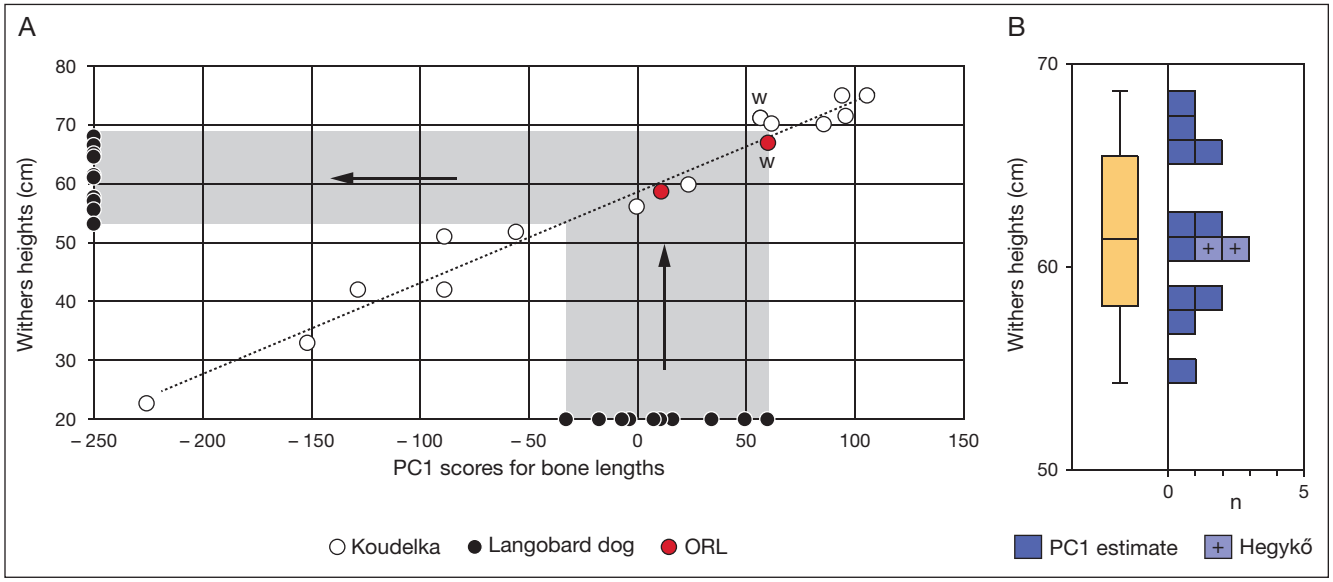

FIG. 3. — **A**, estimating the withers heights of Langobard dogs. The relationship between first principal component (PC1) scores and skeletal withers heights in the reference material and estimates for the Langobard individuals; **B**, size distribution enlarged. The withers height (WH) distribution of Langobard dogs summarized in a box plot and histogram, including the Hegykő individuals. Abbreviations: **ORL**, Osteoarchaeological Research Laboratory, Stockholm; **w**, wolf.

dominant principal component (PC1) encompassing almost 99% of the total variance[2] determined by the four bone lengths.

PC1 loadings in Table 2 show the association with each bone length and PC1. They are higher in the case of the hind leg. Within either extremity, bones of the zygopodium have a stronger connection to PC1 than stylopodium bones. Koudelka's coefficients however reveal that this phenomenon is caused by allometry: longer bones make up a smaller proportion of both total variance and WH.

In the next step, known WH values of the reference material (y) were plotted against the pertinent PC1 scores based on the four long bone lengths (x). The resulting linear regression equation ($y = 1.532x + 58.924$) is supported by a high correlation ($r = 0.985$, $p < 0.01$). Figure 3A illustrates how the WH of archaeological dogs was estimated from PC1 scores using this equation.

WH estimates in the absence of long bones

In the next step, the two individuals from Hegykő were added to the analysis. Exceeding the results of Alpak *et al.* (2004: table 4), a very high ($r = 0.956$, $p < 0.001$) correlation was found between the total length of skull (x) and the WH estimated from long bones (y) in the small but homogeneous sample of Langobard individuals of intact cranial length (Keszthely 3, Ménfőcsanak A, B and Zamárdi 3). Using the pertinent linear regression equation ($y = 3.3154x-89.009$), withers heights of the two Hegykő dogs could be estimated as 61.7 and 61.4 cm respectively. Table 3 shows WH estimates for Langobard individuals in increasing order with reference to the sex of the dog and burial context.

According to Hornberger's (1970: 113) five WH categories the 54.3-68.8 cm range shown in Table 1 corresponds to groups "d" (medium size: 50-58 cm) and "e" (dogs larger than German Shepherds). It is noteworthy that it is mostly identifiable females that fall into the medium size category: with one exception, males are over 60 cm WH. Both the box plot and histogram in Fig. 3B show the symmetric distribution of estimated WH values in the small Langobard sample, numerically supported by the parameters listed in Table 4.

2. Total variance is determined by the number of cases and the number of variables included in the data set.

TABLE 3. — Withers height estimates (in cm) for Langobard dogs by Hornberger's (1970) size categories. Abbreviations: **d**, medium-size: 50-58 cm; **e**, dogs larger than German Shepherds; **F**, female; **M**, male; **PC1**, first principal component; **WH**, withers height.

Individual	PC1 score	WH (cm)	Size category	Sex	Buried with
Zamárdi 3	–30.1	54.3	d	F	lynx
Ménfőcsanak 262/B	–13.6	56.8	d	F	woman
Zamárdi 1	–5.3	58.1	e	F	lynx
Zamárdi 4	–3.8	58.3	e	M	lynx
Hegykő 2	–	61.4	e	?	man
Zamárdi 2	17.0	61.5	e	M	lynx
Hegykő 1	–	61.7	e	?	man
Keszthely 3	22.9	62.4	e	M	horse
Ménfőcsanak 262/A	29.9	63.5	e	M	woman
Dombóvár 83	40.8	65.1	e	?	horse
Keszthely 1	47.5	66.2	e	M	horse
Dombóvár 84	51.3	66.7	e	M	man
Keszthely 2	64.7	68.8	e	M	horse

TABLE 4. — Summary statistics of withers height estimates (in cm) for Langobard dogs.

Parameter	Value
Number of individuals	13
Minimum	54.3
Maximum	68.8
Mean	61.9
Median	61.7
Standard deviation	4.2
Skewness	–0.2

Both the median and the mean value fall only slightly above the 60 cm cutting point between Hornberger's medium/large size category. The relative standard deviation is approximately 6% of these values, and the small negative value obtained for skewness confirms the high degree of symmetry in the size distribution of the small sample of 13 Langobard individuals.

DISCUSSION

Human/animal encounters foster discursive processes that reinforce relationships by mutual action. In real life such encounters have been taking place in locations where humans and animals physically meet, "arenas where mutual becomings are generated" (Armstrong Oma 2010: 180). The special cognitive relationship between dogs and humans has been evolving since the wolf became domesticated 12 000-14 000 years ago: dogs possess more cultural significance than most other animals (Crockford 2009: 11). The social structure of the wolf pack and its adaptation to people's needs through breeding allowed integrating dogs into human society. They became a prime example of mutual becoming, a process that takes place at conjunctions between live animals and humans. At these points animal behavior is shaped in social interaction with humans, including the effects of selective breeding.

Unfortunately, structured animal bone deposits, interpreted as ritual, show merely a snapshot of the fascinating dog-human relationship. Excavated evidence illustrates only the end-point of a complex process, frozen in time. Burials, therefore cannot be readily translated into dynamic life situations as even deceased humans are passive participants in the burial rite, assigned attributes by the community based on their perception by others.

Live animals impact on humans, continuous mutual adjustment to each other thus resulting in basic reciprocity (Birke *et al.* 2004: 168). However, real-life situations are difficult to translate in the interpretation of ritual deposits without better understanding the animals themselves.

Germanic dog burials in time and space

Prummel (1992) summarized finds in 271 Migration Period/early Medieval Germanic dog burials across Europe. People were interred in the company of dogs most frequently in Northern Europe. Such joint graves reached only about 25% of all dog burials in the rest of the continent and Britain. This geographical pattern is consistent with a chronological trend: human/dog burials by Franks, Alamans, Thüringians, and Langobards in Central Europe as well as Anglo-Saxons in Britain date to the 5th-8th century. Friesian and Saxon human/dog burials toward the north of the continent are known from the 7th-9th century, while the latest examples occur in Scandinavia during the 7th-11th century. In the north, Gräslund (2000: 86) correlated this diachronic trend with the advancement of Christianity.

Comparisons with Roman Period dogs

Although our 13 individuals dated to the 5th-6th century form a small sample, they could be interpreted against the backdrop of the great variability of dogs kept in provinces of the Roman Empire. Those dogs represent a broad size range between dwarf forms and those larger than wolves. The majority, however, fall within the 50-65 cm WH interval (Bökönyi 1984; Peters 1997). A smaller sample of dogs from the Sarmatian settlement of Gyoma 133 in the Roman Period Barbaricum east of the Danube (Bartosiewicz 1996) shows a very similar size distribution with fewer extremes (Fig. 4). This may be an artefact of smaller sample size, although it is realistic to assume that small lap dogs were more fit for Roman urban settlements and large guard dogs played more of a role at rural sites in the Barbaricum (Bartosiewicz 2000: 187). The three Roman Period WH distributions summarized in Figure 4 invariably display a remarkable negative skew, due to the presence of numerous medium size and small dogs toward the bottom of the diagram.

In contrast to the dominant *c.* 50-65 cm withers height range among Roman Period dogs, withers height estimates for the 13 individuals from Langobard burials fell higher, between 54.3-68.8 cm. This seems indicative for selection by size in this latter group.

The morphotype of Langobard dogs was compared to the visual scheme by Bennet *et al.* (2016: 84, fig. 21) based on skeletal remains from several Roman Period sites (Fig. 5A). Medio-lateral widths of the radius and tibia were chosen to characterize the Langobard individuals (the lesser stature of short-legged forms is usually related to the exaggerated curvature of zygopodium bones whose "robusticity" is in part determined by their actually shorter length rather than greater diameter; Bartosiewicz 2013: 206).

According to Figure 5B, C, most Langobard dogs fall into the tall and even gracile category, especially both Dombóvár and the Ménfőcsanak A males. It is the smaller dogs from Zamárdi (half of them females) which lay somewhat closer to the more mundane-looking, eumorphic forms, although even they are taller and more slender-legged than average. The large Keszthely and Dombóvár dogs form relatively tight clusters.

Examples of extant breeds of comparable WH (https://www.dimensions.com/collection/dogs-dog-breeds, last consultation on 9 January 2023) include Pointers (54-60 cm), German Shepherd (56-66 cm), Rhodesian Ridgeback (61-69 cm) and Doberman (61-71 cm). Even if likewise anachronistic, the 1564-1565 fresco "Charlemagne confirms the donation of Ravenna to the Church" by the Zuccari brothers in the Apostolic Palace, Vatican, shows a large and gracile pre-modern dog at the feet of the king. This depiction is compatible with the largest individuals emerging from our osteological reconstruction (curiously enough, the preparatory sketch of this painting kept in the British Museum collection shows a rather non-distinct, medium size individual). In comparison with the Langobard dogs, the "primitive", eumorphic form in Figure 5A is similar to dogs of medium stature and light skeletal makeup typical of panmictic populations under limited human control both in prehistory (Bartosiewicz 2002: 83) and the Middle Ages (Tassi 2006: 88).

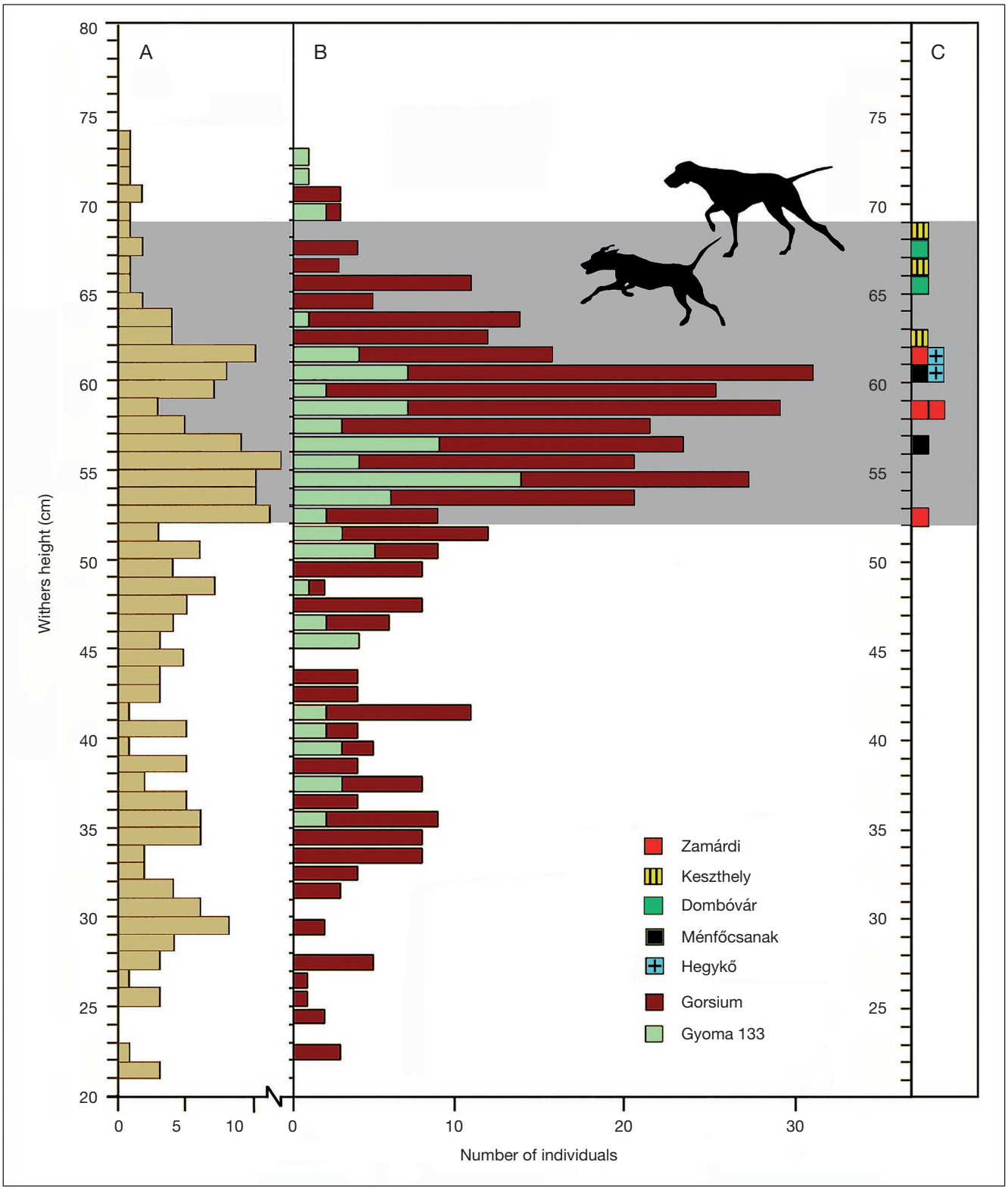

FIG. 4. — Comparison of size distributions of Roman Period dogs in Germania (**A**; Peters 1997) and Pannonia (**B**; Bökönyi 1984; Bartosiewicz 1996) with those of Langobard dogs (**C**).

LANGOBARD DOG BURIALS IN HUNGARY

The finds analyzed in this paper fit the overall trend in Germanic dog burials. Unfortunately, however, it is impossible to precisely identify the real-life animal-human relationships they represent. In the absence of documentary sources, the role of and motivation for Langobard animal sacrifices remains unknown. Although the dogs reconstructed in this study originate from different archaeological contexts, they rather

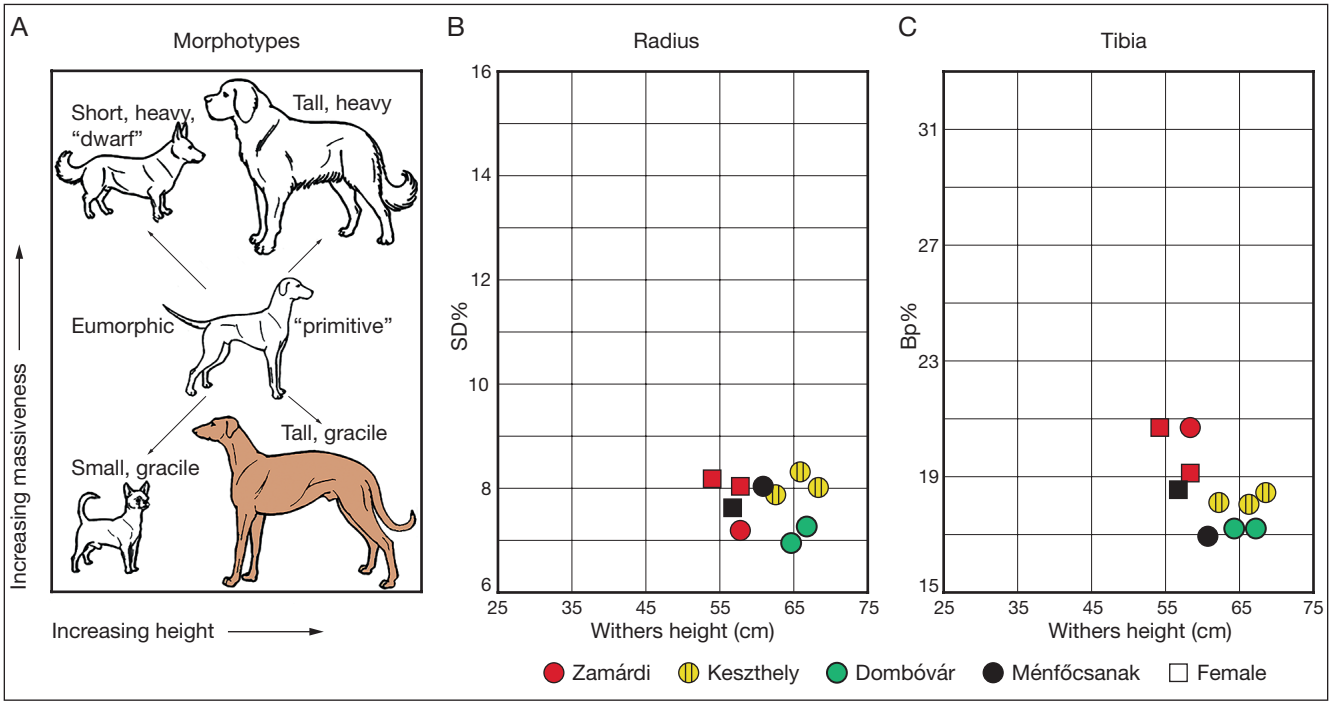

FIG. 5. — **A**, Scheme of Roman Period morphotypes drafted by Bennet *et al*. (2016); **B**, **C**, position of Langobard dogs in relation to this visual key (females are distinguished by square symbols). Abbreviations: **Bp**, proximal breadth (von den Driesch 1976); **SD**, smallest diameter (von den Driesch 1976).

uniformly represent large individuals, especially those interred with horses and humans:

– The four dogs of mixed sex and relatively smaller stature found in the Zamárdi "lynx pit" are the most difficult to understand. It is impossible to tell, whether these animals were buried all at the same time or one after the other. Pragmatic interpretations include a hunting accident when the five animals lost their lives all at the same time. However, the consecutive, regular placement of dead dogs in the feature "marked" by the lynx is also possible. The Zamárdi case is unique, it does not have known parallels, in part because lynx skeletons are hardly ever found. In the absence of broader patterning the roles once assigned to these dogs are impossible to assess;

– Multiple horse-dog burials were noted in various combinations in Germanic deposits across Europe (e.g., Müller 1980: 101-118; Prummel 1989: 86) including specifically identifiable Langobard contexts in Italy (Riedel 1995: 59-65). In Hungary, a similar deposit is also known from Újlőrincfalva – Magyarád where a dog was placed behind the rump of the horse (Szabó 1975: 85). Vörös (1999: 127) mentions the possibility that the ritual killing of horses, putatively at the peak of the hierarchy of domesticates, may have been a substitute for human sacrifice and played an atoning or mediating role in religion regardless of region or time period. While in reality the situation may be more complex, the co-occurrence of horse-dog and human-dog graves in the Dombóvár cemetery formally links these two types of burials, although the real intention behind including large dogs in funerary rites remains unknown;

– Interring dogs with humans is a widely spread custom, cross-cutting cultural boundaries. The inclusion of dogs in human graves may be a fundamental indicator of the dog/human relationship. But the nature of this relationship is open to discussion. The most "jovial opinion" is that beloved pets were laid to rest with their owners (Vörös 1999: 127). According to this narrative, animals buried accompanying or at least simultaneously with people were related to the person in life as pets or property. This view may be influenced by our experience with contemporary companion animals: postmodern conditions have not only facilitated an increase in pet-keeping but also expanded its emotional impact (Franklin 1999: 175), an effect which may have strongly varied in the past.

One may reasonably presume that dogs, especially those interred with humans, retained some agency in afterlife: they accompanied the deceased to the other world, to cooperate with them in much the same way as in earthly existence (Sten 2013). However, dogs were also found buried in the company of young children as well as with adults of both sexes and in various social positions in many cultures. This diversity suggests that not all dogs necessarily belonged to the humans they were interred with (Crockford 2009: 7).

According to a more subtle interpretation (Gräslund 2004: 167) dogs buried with people were liminal creatures, "a medium on the border between the living and the dead, and in all likelihood the archaeological material reflects this important symbolic-mythological meaning in the transformation from life to death". The two possibilities are not mutually exclusive. In certain rites the sacrifice of "a dog" may have been customary without specifications of ownership. In others, being buried with dogs may even have had negative connotations (Vörös 1991: 186, fig. 1). Dogs deposited in the company of other animal species indubitably broaden the possibilities of speculation.

What kind of dog was this?

It must be emphasized that morphotypes do not necessarily correspond to specific functions, although they may indicate intentional choice of specific individuals for ritual purposes. While certain phenotypes of dog may be better fit for particular tasks, most may have been used in diverse ways due to their physical variation and immense adaptability. On the one hand, the variegated dogs interred with the lynx in Zamárdi show mixed individual traits. On the other, individuals found in the company of horses and humans tend to be predominantly large, relatively gracile males. When buried with humans, these invariably large Langobard dogs seem to have been associated with high social standing. Vörös (1999: 126) also characterized the dogs from the Keszthely horse burials as "large-headed and -bodied". Whether these animals were perceived as individuals or constructed through inclusion in the mortuary rite of elites remains a question. Complementary to our present-day perceptions, two analogies from the high Middle Ages regarding animal size are worth quoting here. The mid-14th century sarcophagus of Lopo Fernandes Pacheco, one of the most important personalities during the reign of Afonso IV of Portugal is to be found in the Sé de Lisboa cathedral, in the capital of Portugal. He is depicted on top of the sarcophagus with sword in hand, guarded by a large dog lying by his feet (Bartosiewicz 2011: 221, fig. 17.1). Assuming a continuity in the patriarchal image of valiant warrior, this may be seen as a parallel to the Hegykő and Dombóvár 84 burials in Christian times when dogs themselves were could no longer be included in the mortuary ritual itself.

A fascination with large, that is "strong" individuals was apparent not only in dog keeping. There is written evidence from 12th century Pomerania of a fat, black horse of extraordinary stature that had such a high status that a priest was appointed to care for it (Labuda 1999: 174). Size alone also played a role in keeping large-bodied eagles and even vultures in medieval falconry. Such birds were integral to royal and imperial self-representation, although could hardly be used in hunting. Two notable examples include white-tailed eagle (*Haliaëtus albicilla* L., 1758) and cinereous vulture (*Aegypius monachus* L., 1766; Bartosiewicz 2012: 180, 183).

CONCLUSIONS

The discussed burials offer tangible evidence that Langobard dogs played roles far beyond the practical and retained some function in afterlife. They could be incorporated in rituals as sacrificial objects, apotropaic actors, or companion animals. These roles should be seen as flexible and possibly interrelated, not necessarily assigned to a specific individual once and for all, although this option must also be considered. They may have also been assigned to any dog depending on the specific sacral needs of the humans conducting the ritual. In the case of inhumations such choices must have been influenced by the dog's status *vis-à-vis* the deceased as well as its biological (age, sex, stature, color) and behavioral traits. When considering their attributes, the potentially dualistic perception of these animals should also be kept in mind (Bartosiewicz 1998: 68). One needs to consider, to what extent might phenotypic traits have influenced human-dog interactions. Results of our research may be summarized as follows:

– the interment of large, strong dogs seems to have been preferred in the studied cases. Consistent ritual, however, is apparent only in the burials with horses;

– while the ritual nature of the lynx deposit is difficult to confirm, the other burials showed a preference for large but not too robust morphotypes;

– Langobard dogs in the studied archaeological contexts tend to represent high status and apparently strength;

– while the use of such dogs in hunting cannot be ruled out, their functions as guards, fighting dogs or tokens of self-representation also need to be considered.

In spite of the apparently homogeneous morphotype of the large Langobard dogs studied in this paper, there is considerable room for contemplating their individual status and mutual belonging with the interred individuals, whether human or non-human animal.

Although difficulties of interpretation remain, on the long run, familiarity with the appearance of Langobard dogs recovered from the discussed burials will contribute to better understanding past animal-human relationships.

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Appendices

Appendix 1 .— Long bone measurements of Langobard dogs (in mm). First principal component (PC1) scores represent synthesized bone lengths. Abbreviations: **Bp**, proximal breadth; **GL**, greatest length; **SD**, smallest diameter; *****, estimates.

	Humerus	Radius		Femur	Tibia		
Individual	**GL**	**GL**	**SD**	**GL**	**GL**	**Bp**	**PC1 score**
Zamárdi 1	181.7	181.0	14.4	193.6	193.2	37.0	–5.3
Zamárdi 2	192.7	198.0*	–	201.9	202.1	–	17.0
Zamárdi 3	167.5	167.0	13.7	183.4	181.7	37.6	–30.1
Zamárdi 4	179.7	184.0	13.2	193.4	195.3	40.5	–3.8
Keszthely 1	203.7	202.2	16.7	222.0*	226.5	41.0	47.5
Keszthely 2	210.0	212.5	17.0	229.0	237.2	43.5	64.7
Keszthely 3	196.2	191.0	15.0	208.0	210.5	38.0	22.9
Ménfőcsanak 262/A	193.2	195.9	15.7	211.3	218.7	37.2	29.9
Ménfőcsanak 262/B	178.1	176.4	13.5	188.5	190.0	35.1	–13.6
Dombóvár 83	190.1	210.4	14.5	218.0*	222.3	38.3	40.8
Dombóvár 84	203.6	207.2	14.9	218.0	233.2	40.0	51.3

Appendix 2 .—Skeletal measurements of extant canines used in this study. First principal component (PC1) scores represent synthesized bone lengths. Size categories (**a**-**e**) after Hornberger (1970). Abbreviations: **GL**, greatest length; **No.**, inventory number of individuals; **WH**, withers height; *****, estimates.

			GL (mm)					
Reference skeletons	**No.**	**WH (cm)**	**Humerus**	**Radius**	**Femur**	**Tibia**	**PC1 score**	**Size category**
Koudelka 1885								
King Charles Spaniel, male	1	23.0	75	78	75	81	–225.8	a
American Naked Dog, male	2	33.5	110	110	115	120	–152.6	a
English Bulldog	3	42.0	120	115	134	132	–129.3	b
Greyhound	4	42.0	138	143	145	156	–89.0	c
Non-identified dog	5	51.0	130	140	155	155	–89.5	d
Fanghund (1)	6	52.0	150	158	168	170	–56.8	d
Non-identified dog	7	56.0	165	193	193	205	–1.5	d
Greyhound (Oceania)	8	59.5	185	200	200	220	22.8	e
Fanghund (2)	9	70.5	212	220	245	250	84.3	e
Newfoundland (1)	10	71.0	205	210	225	232	56.3	e
Great Dane	11	71.0	220	232	248	248	94.4	e
English Mastiff	12	75.0	220	230	250	245	92.9	e
Newfoundland (2)	13	75.0	221	236	254	257	104.6	e
Wolf	14	70.5	210	220	225	227	60.9	e
ORL Stockholm								
Papillon	KO-37	–	83	84	92	95	–202.9	–
Dog, “short tailed”	KO-572	–	121	122	130	135	–126.0	–
Dog, female	AK-102	–	194	195	207	211	23.5	–
Dog, female	KO-715	–	201	204	216	219	40.0	–
Dog, male	AK-101	–	216	217	229	239	70.6	–
Dog, male? (articulated)	–	58.5	187	185	205	203	10.2	e
German Shepherd, female	KO-3	–	177	177	194	199	–6.2	–
Wolf, female	AK-203	–	199	205	217	226	43.8	–
Wolf, male	KO-205	–	232	224	247	252	97.7	–
Wolf, male (articulated)	KO-601	67.5	217	207	225	224	56.3	e