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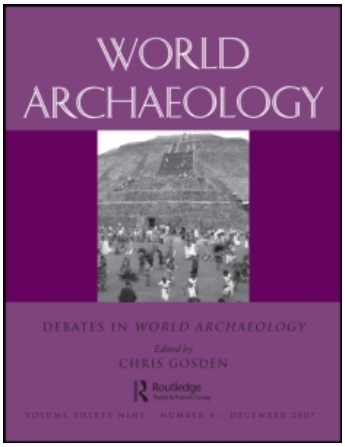

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'Sick as a dog': zooarchaeological evidence for pet dog health and welfare in the Roman world

Michael MacKinnon[a]
[a] Department of Anthropology, University of Winnipeg, Winnipeg

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‘Sick as a dog’: zooarchaeological evidence for pet dog health and welfare in the Roman world

Michael MacKinnon

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Abstract

A survey and analysis of skeletal pathologies from dog remains at Roman archaeological sites in the Mediterranean context reveals patterns of osteological health and welfare that in turn provide an indication of human treatment and care for pet animals during Roman times. Common pathological conditions include dental complications, especially pre-mortem tooth loss, healed limb fractures, osteoarthritis and infection, in patterns and frequencies similar to dog samples from other temporal and spatial contexts. Generally, Roman dogs seem to be in good condition, as regards skeletal health, with minimal osteological evidence for human abuse or maltreatment, but also no conclusive data for splinting any broken bones. Smaller ‘toy’ breeds of dogs in Roman times appear more susceptible to multiple pathological conditions, but also display signs of greater human care, especially in terms of pampering and feeding.

Keywords

Roman Mediterranean; zooarchaeology; palaeopathology; dogs; human care; health.

Introduction

In today’s world, the bond between people and their pet animals is often very strong – so much so that in some cases the pet is treated as though it were human, given all the care, attention and privilege afforded its master (and sometimes even more). The connection may intensify should the animal suffer some stress or illness, to the point where owners might even ‘feel’ their animal’s pain, while simultaneously doing all in their power to treat and hopefully cure what ails their pet. Such powerful bonds of affection may share a universal appeal, crossing both geographical and temporal barriers. Historical and ancient texts, inscriptions and media from various cultural groups contain numerous examples,

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from the simple naming of a pet (arguably a 'humanizing' characteristic) to more extensive and endearing accounts of reciprocal devotion shared between master and pet. Archaeology adds to this picture – animals being the subject of many iconographical works in particular – but also affords, through zooarchaeological research, an opportunity to examine skeletal clues that directly relate to the treatment and care of an animal.

Although not the first people to keep pet animals, the ancient Greeks and Romans perhaps represent some of the earliest cultures to exemplify this concept, especially as regards dogs. Ancient authors, such as natural historians and geographers (e.g. Pliny the Elder, Aristotle, Strabo), agricultural writers (e.g. Cato, Varro, Columella, Palladius) and writers about hunting (e.g. Grattius, Xenophon, Arrian, Oppian, Nemesianus), among others, discuss the roles of dogs in ancient Greek and/or Roman culture. The Romans, it may be argued, have more to say in these matters than the Greeks. Principal categories of dogs in the Roman context include hunting dogs, guard and shepherd dogs, draught and performing dogs and pet dogs. Breeds or varieties of canines suitable for each role are also recognized in the ancient sources; however, as was common practice in antiquity, 'breed' names largely reflect geographic location or point of origin (either known, mythical or assumed) and may not correspond precisely to modern concepts of 'breed' as defined genetically. Roman iconography, through media including painting, sculpture, mosaics and so forth, provides visuals of dog types, although depictions tend to favour scenes with hunting dogs and pets in particular (Bodson 1980), possibly because of popularity, but one might also argue that these groups were inclined to receive greater attention and recognition from their owners, given the elevated status of hunting and pet-keeping in antiquity. Typically, hunting, at least that on horseback and with dogs, was an elite activity in Roman times (Anderson 1985). A similar elitist mentality often underscored the keeping of pet animals, especially small toy breeds of dogs (Bodson 1980).

In addition to describing types of dogs in existence during Roman times, and the duties these animals fulfilled, the ancient sources further provide information about their care. Veterinarian-style treatises, such as Vegetius' *Mulomedicina* and Pelagonius' *Ars Veterinaria* discuss procedures for treating animals, especially equids and cattle, but more generally all animals. Similar veterinarian tactics are also outlined by some of the Roman agricultural writers (Adams 1995).

In light of the evidence available, and the topical nature of the subject, it is not surprising that investigations into the roles and varieties of dogs, as well as their care, as presented in Roman textual and iconographical evidence, have been the focus of significant scholarship over the ages (e.g. Brewer et al. 2001; Merlen 1971; Toynbee 1973). Zooarchaeological evidence adds a further dimension to this study in presenting case studies of actual ancient dogs, as reconstructed from their skeletal remains, and, through comparative analyses of these data (using osteometry and DNA data), broader syntheses of size and shape variation among types, as well as investigations of the origin and spread of various breeds. Currently, as regards Roman contexts, most zooarchaeological attention involving dogs has focused upon osteometry, that is measuring various dimensions of the bones to assess development and changes in the morphology and size of these animals over time and space, throughout the Roman world (Britain: Clark 2006; Cram 2000; Harcourt 1974; Gaul: Lepetz 1996; Italy: De Grossi Mazzorin and Tagliacozzo 1997, 2000; Zedda et al. 2006; Germanic provinces: Peters 1998; Pannonia

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and Danube region: Bartosiewicz 2000). Results are generally consistent across all areas of the ancient world: greater size variability among dogs can be found in the Roman period, as opposed to earlier time frames. The Romans also appear responsible for the introduction and spread of various lap-dog breeds across their empire.

Although our understanding of dog morphology during Roman times has been enhanced tremendously by zooarchaeology, considerably less attention has focused upon assessing skeletal pathological evidence for Roman dogs, especially in documenting the incidence and prevalence of signs of injury and stress. Indeed, the ethology, welfare and treatment of Roman dogs (and all ancient animals for that matter), and the relations of these animals with their owners, keepers and healers, is an important but neglected chapter of Roman social history. What was the nature of the human-dog bond in Roman antiquity as regards injured, ill and diseased animals? Did the Romans care for their dogs? Alternatively, did they maltreat or abuse any? And did such actions vary among types or breeds, as recorded in the zooarchaeological evidence? These questions form the basis of investigation here. Attention focuses on the Roman Mediterranean context, the core of the empire and a region where Roman culture first spread.

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Materials, methods and biases

Before assessing the relevant data, it is important to address several key points. First, the concept of 'care' is obviously culturally specific. Not all cultures, or individuals for that matter, practise the same standard, and lines may blur as to what constitutes 'caring' behaviour. Moreover, the ideological, psychological, moral, ritual and social bases of such actions are complex, and not easily interpretable from archaeological data, no matter how much these might be bolstered through the input of other lines of investigation. For example, the association of dog and human burials in Greek and Roman antiquity (see Day 1984; De Grossi Mazzorin and Tagliacozzo 1997; Lepetz 1996; Soren 1999; Trantalidou 2006, for lists and reviews) might be considered an act of 'care', with the deceased being offered a companion, protector or other such role in the accompanying dog. A similar situation might underlie dog sacrifice in Roman cult and ritual. Although quite rare, compared to other animal sacrifices (excluding burial cases), dog sacrifice is recorded in the Roman texts, notably in agricultural rituals (e.g. *Robigalia* and *Lupercalia*), some purification and protection rites and occasionally as foundation offerings (De Grossi Mazzorin and Minniti 2006). For the purposes of analysis here, 'care' will be restricted to examples of the physical health and welfare of dogs, as observed from the available zooarchaeological data. Dogs that show palaeopathological signs, but which may have derived from burial and/or sacrificial contexts are included, but attention focuses on 'care' as measured through canid health and welfare *per se*, as opposed to any contribution to cult and ritual for these dogs.

The nature of the osteological evidence itself leads to the second point to be addressed. In assessing palaeopathology from bones, osteologists are limited to those conditions that leave skeletal traces. Many diseases and pathogens do not, while a focus on macroscopic observation of conditions might create a bias against nutritional or hormonal disorders that might be better observed by microscopic or histological examination of skeletal

remains (Siegel 1976). Moreover, in many instances, signs will not register on the bones themselves until at advanced stages of disease or stress, which in turn often require the animal to live to an older age. Elderly age itself may increase the likelihood of chronic bone deformations, aggravate osteoarthritis and augment the probability of trauma (Bartosiewicz 2008: 76). Mild instances of a disease, or death of the individual at an earlier age, may produce no noticeable effects on the skeleton. Typically then, a bias exists for pathological incidence and prevalence in mature, older dogs. Puppies were important to some Roman cults, notably as sacrifices in infant and children's graves (Soren 1999). Assessing puppy health and welfare on the basis of osteological evidence alone is more difficult than is the case for elderly canines.

Sampling, recovery and taphonomy add further levels of bias. Obviously, in zooarchaeology one is dealing with only a subset (and often a small one) of what animals originally existed. This sample, in turn, is contingent on what preserves, where excavation occurs and other depositional and taphonomic, or post-depositional, factors. Taphonomic biases add a further complication to animal palaeopathology. Certain diseases, such as osteoporosis, that weaken bone mineral content and/or structure may render the specimen more susceptible to post-mortem destruction, thereby leading to selective identification of pathological conditions (Bartosiewicz 2008: 76). Common ailments observed from the animal palaeopathological record in general include inflammation, infection, nutritional deficiencies, joint diseases (e.g. osteoarthritis), trauma (e.g. breaks, dislocations) and dental pathology (Siegel 1976; Baker and Brothwell 1980).

The final aspect to be addressed concerns the notion of 'pet'. Modern concepts of 'pet' imply personal relationships of intimacy and mutual understanding between animals and humans. In contrast to food animals, pets are often permitted access to household rooms, are given names and are not consumed. The Romans did not normally eat dogs. Exceptions to this rule tend to involve continuation of pre-Roman customs, such as earlier Etruscan practices (De Grossi Mazzorin and Tagliacozzo 1997: 437–8), or have ties to indigenous, native practices within the Roman provinces, particularly northern regions (Hriscu et al. 2000; Meniel 1992), as opposed to those provinces bordering the Mediterranean.

While there are certainly cases of pet-keeping in classical antiquity, many of which seem to parallel contemporary notions of the idea, caution should be exercised in linking such relationships too closely with modern pet culture. Gilhus (2006: 29) suggests the label 'personal animals' be used instead of 'pet' in reference to ancient human-animal relationships, to avoid confusions with modern concepts of pet-keeping . The line between 'pet' and 'work animal' may certainly have been blurred in antiquity for some taxa. Sheep dogs, hunting dogs, guard dogs, even draught and performing dogs all may have been named and cared for as pets, in addition to their roles as 'working' animals.

Results and discussion

Recognizing, describing and quantifying pathological conditions provide the crucial first steps in assessing animal health and welfare from osteological remains. Table 1 summarizes the available skeletal palaeopathological data from dog remains across

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Table 1 Summary table of skeletal pathological data for dogs from Roman sites in the Mediterranean context

Site	*Date*	*Context*	*Size (withers height)/breed*	*Pathology*	*Reference*
Naniglio (Italy)	Roman	Villa	2 skeletons Medium-size common	Skeleton 1 (57cm): inflammation and fracture of ulna at olecranum (healed), but probably caused difficulties walking; osteophyte development on carpal; slight periarticular osteophytes on vertebrae	Albarella personal communication
Matrice (Italy)	Early Roman	Villa	Misc. fragments Medium-size common	Fracture of tibia; badly reformed following break, suggestive of no splinting or human treatment	Barker and Clark 1995
Aquileia (Italy)	Second–fifth centuries AD	Urban	At least 8 individuals Range: 39cm–60cm	Periarticular osteophytes and swellings on three lumbar vertebra; two of them joined in a vertebral synostosis	Riedel 1994
Pompeii (Italy)	Roman	Urban	Varying sizes and breeds Several skeletons Medium-size common	Eburnation and osteophyte development on right pelvis, right femur, and right scapula; seriously crippled	Richardson 1994
Rome – Meta Sudans (Italy)	Late Roman	Urban	8 individuals Range: 35/40cm – 60 + cm	Fracture of femur; badly reformed following break Loss of 2nd mandibular premolar, with subsequent alveolar resorption Inflammation and osteophytes on metacarpa Periarticular osteophytes on 2 vertebrae	De Grossi Mazzorin 1995

(*continued*)

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Table 1 (*Continued*)

Site	*Date*	*Context*	*Size (withers height)/breed*	*Pathology*	*Reference*
Ostia – Bath (Italy)	Imperial/ Late Roman	Urban	2 individuals Range: small to medium/large	Dog 1 (small individual): fracture of ulna Dog 2: tooth loss (from a fall?) with subsequent alveolar resorption	IPU 1968
Ostia – House of Jove and Ganimede (Italy)	Imperial/ Late Roman	Urban	Misc. fragments Various sizes Medium-size common	Fusion of distal fibula and tibia	MacKinnon, personal analysis
San Giacomo (Italy)	Early fifth century AD	Villa	2 individuals Medium-sized	Loss of 4th maxillary premolar, with subsequent alveolar resorption	Albarella 1993
San Giovanni (Italy)	Late Roman	Villa	At least 4 individuals, 1 skeleton + misc. bits Range: small to medium/large	Fracture of 2nd, 3rd, 4th and 5th metatarsals in one paw (subsequently well healed) but with arthritic development at proximal ends	MacKinnon 2002
Fidene (Italy)	Second century AD	Cemetery	7 dogs from 4 tombs Range: 37cm–61cm	Skeleton 1, from Tomb 29 (*c*. 37cm): fusion of distal fibula and tibia, and of 2nd and 3rd metatarsal	De Grossi Mazzorin 2001
Castelporziano (Italy)	Roman	Settlement	Misc. fragments Various sizes Medium-size common	Femur with ossified tendon; infection and inflammation	MacKinnon, personal analysis
Forum Novum (Italy)	Roman	Urban	Misc. fragments Various sizes Medium-size common	Loss of 4th mandibular premolar (from periodontal infection), with subsequent alveolar resorption	MacKinnon, personal analysis

(*continued*)

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Table 1 (*Continued*)

Site	*Date*	*Context*	*Size (withers height)/breed*	*Pathology*	*Reference*
San Giusto (Italy)	Late Roman	Settlement	1 skeleton, plus fragments Medium-size	Skeleton 1 (*c*. 50–60cm): osteomyelitis on distal humerus, with osteoarthritis at distal margin as well	MacKinnon, personal analysis
Settefinestre (Italy)	Roman Imperial to Late Roman	Villa	3 skeletons (Late Roman), plus fragments from other periods Range: 47 cm–63cm Medium-size common	Skeleton 1 (*c*. 63cm): cranial trauma at top and back of skull (healed) Skeleton 2 (*c*. 52cm): 4th maxillary premolar lost, with subsequent bone resorption; trauma to left femur, with subsequent osteophyte development from poor setting Skeleton 3 (*c*. 4cm): alveolar resorption on maxilla in area around 4th premolar and 1st molar; abnormal wear of maxillary dentition; sacrum and pelvis distortion, fusion and osteophyte development, with consequence that animal probably limped; fracture to 5th metatarsal (healed well); rib fracture (healed with slight bend)	King 1985
Bir el Jebbana (Carthage, Tunisia)	Roman/Late Roman	Suburban bath	Misc. fragments Various sizes and breeds, including brachymel toy breed Medium-size common	Mandibular 4th premolar lost (trauma and periodontal infection), with subsequent alveolar resorption Osteomyelitis on proximal humerus, with osteoarthritis at proximal margin	MacKinnon, personal analysis

(*continued*)

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Table 1 (*Continued*)

Site	*Date*	*Context*	*Size (withers height)/breed*	*Pathology*	*Reference*
Circular Harbour – North Side (Carthage, Tunisia)	Fifth–sixth centuries AD	Urban	Misc. fragments Medium-size common	Dog 1 (*c*. 54cm): radius with periosteal new bone around the edge of the proximal joint, suggestive of an injury to the muscle or tendon attachment	Levine 1994
Yasmina (Carthage, Tunisia)	Second–third centuries AD	Cemetery	1 complete skeleton (toy breed [Maltese?], *c*. 21cm height), plus fragments Mostly medium-sized dogs	Skeleton 1 (*c*. 2cm): all maxillary teeth lost, with extensive remodelling (Plate 1); only left 4th premolar and 1st molar, and right 1st molar remain in mandible, all other teeth lost, again with extensive bone remodelling; advanced abscessing, periodontal disease and advanced calculus on remaining mandibular teeth (Plates 2 and 3); advanced osteoarthritis at articulations of front (scapula/humerus) and back legs (pelvis/femur); dislocation of right femur, with subsequent creation of second acetabular socket on right pelvis; periarticular osteophytes on multiple vertebrae; advanced spondylosis deformans; fusion of rib to vertebra	MacKinnon and Belanger 2006
Leptiminus (Tunisia)	Roman/Late Roman	Cemetery fill	2 individuals, plus misc. fragments (including 2 other crania)	Skeleton 1 (*c*. 63cm): spondylosis deformans on 2 lumbar vertebrae; periarticular osteophytes on 3 thoracic vertebrae	MacKinnon, personal analysis

(*continued*)

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Table 1 (*Continued*)

Site	*Date*	*Context*	*Size (withers height)/breed*	*Pathology*	*Reference*
			Various sizes Medium-size common	Mandibular 4th premolar lost (through root infection), with subsequent alveolar resorption and abscess formation; mandibular 3rd premolar chipped, with subsequent abnormal wear	
Setif (Algeria)	Fifth century AD	Urban	1 skeleton, plus fragments Medium-size common	Skeleton 1 (*c.* 57cm): radius with osteophyte growth spreading irregularly on the lower cranial side of the shaft, probably due to an infected trauma; metapodial with bony growth on medial side of shaft, probably due to infection (same skeleton as previous bone)	King 1991
Mons Claudianus (Egypt)	Roman	Settlement	<10 individuals, some near complete skeletons Various sizes and breeds, including 'round headed' type (*c.* 4cm)	Small 'round headed' type: 'presence of healed and part-healed fractures on many of the bones suggest at least two episodes of traumatic injury. The last incident caused the greatest damage and was survived long enough for most of the fractures to join but not to fully heal. The injuries were on the	Hamilton-Dyer 2001

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Table 1 (*Continued*)

Site	*Date*	*Context*	*Size (withers height)/breed*	*Pathology*	*Reference*
			Medium-size common	limbs, vertebrae and ribs as well as on the skull, which exhibited depress fractures and a possible abscess together with previous, healed fractures in the area of the snout' (Hamilton-Dyer 2001: 274–5)	
Sagalassos (Turkey)	Roman/Early Byzantine	Urban	Misc. fragments; some skeletons Range: 27cm–66cm	Spondylosis deformans present on several individuals; osteoarthritis at distal radius; isolated cases of healed fractures	De Cupere 2001; personal communication
La Bourse, Marseille (France)	Gallo/Roman to Early Christian	Urban	51 individuals; skeletons and misc. fragments Various sizes and breeds, including toy types	Dental pathologies include: dental loss (incisors and 1st molar commonly), chipped and broken teeth (especially 4th premolar and 1st molar), infection and abscessing Cranial pathologies include: fracture of nasal bone, exostosis development on zygomatic, possibly due to a fracture Post-cranial pathologies include: scapula fracture with associated humerus exostosis development, several humerus and femur fractures (poorly reformed after break) often with related osteoarthritic complications, exostosis development on radius,	Jourdan 1976

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Table 1 (*Continued*)

Site	*Date*	*Context*	*Size (withers height)/breed*	*Pathology*	*Reference*
				broken radius with osteoarthritis at articulation (poorly reformed), pelvis fracture (at several points), with deformation of lower lumbar vertebrae (causing considerable mobility complications) Most pathological conditions showed advanced stages of bone healing, indicating that the dogs lived with fractures and other ailments for a considerable time after the events	
Celti (Spain)	Roman/Late Roman	Urban	One skeleton, plus fragments Medium-size common	Skeleton 1 (c. 54cm): loss of mandibular 3rd molar with subsequent alveolar resorption	King 2000
Tourega (Portugal)	Roman	Villa	One skeleton, plus fragments	Skeleton 1 (*c.* 44cm): trauma on lower lumbar vertebrae and pelvis (causing animal to limp); healed rib fracture	Lange and Vaz Pinto 2001

Roman sites in the Mediterranean context. Regions surveyed include Italy, Southern France, Iberia, North Africa, Greece and the Aegean, Turkey, Egypt and the Levant. The time frame for investigation is roughly 300 BC to AD 500. Where possible, information about the size of the dog affected is provided.

Several patterns emerge from the data. First to note is the relatively small sample available. Only thirteen sites in Italy (out of a possible pool of nearly 200 sites with zooarchaeological data for Roman contexts) provided details of pathological dog bones. A similarly low count is noted for Roman sites in the Mediterranean provinces (ten out of a pool of over 170). Granted, dog bones were not always retrieved (or listed) at all of these sites nor were pathological conditions on bones in general reported consistently across contexts, or even initially determined for that matter. It is not always easy to tell whether an absence of recording truly means absence of skeletal abnormalities. Roman faunal samples are especially poor among eastern Mediterranean sites, in part due to an archaeological concentration on earlier temporal periods in this region. Nevertheless, there is perhaps some expectation that remarkable or shocking pathological specimens, especially multiple conditions on any single skeleton, would see some comment, assuming of course that bones were recovered initially. The low frequency of sites reporting pathological dog specimens, therefore, may indeed parallel a relatively low incidence of dog pathologies overall. Less than 3 per cent of the total number of identified dog bones from Roman sites in the Mediterranean region where faunal materials were recovered and reported bear evidence of any pathological condition, while only a few of the complete or near-complete canid skeletons excavated displayed multiple pathologies. In general, Roman dogs in the Mediterranean appear to have been in good health, at least osteologically. A similar rate (i.e. <3 per cent) registers for pathological conditions on total samples of canid bones for pre- and post-Roman archaeological contexts in the Mediterranean as well. In this regard, the Romans appear no different than earlier or later cultural groups. Relative to other domesticates, however, dogs, cattle (especially oxen) and equids tend to display the greatest frequency of skeletal pathologies, a finding also consistent across many areas and time periods (Siegel 1976). A combination of work duties, human investment in veterinarian care and propensity for dogs, oxen and equids to live to, or be kept to, older ages helps explain this finding.

A second observation, from the data in Table 1, concerns the incidence and prevalence of pathological conditions noted. Fractures, diseases of joint (e.g. periarticular osteophytes, osteoarthritis and related complications) and dental loss (primarily through infection) are the most prevalent ailments. Again, these patterns parallel trends among other contexts, archaeological, modern, Roman or otherwise (Bartosiewicz 2002; Siegel 1976). Leg bone pathologies are common in dogs across sites and time periods. These often coincide with inflammation and osteoarthritis at any affected joints, especially the femur/pelvis articulation. Rib fractures in Roman dogs are rare in relation to other contexts (Teegen (2002) noted that one out of three dogs had this condition in a medieval German sample), but this may be due to poor initial classification. Often ribs cannot be identified clearly to species in zooarchaeological assemblages. Spondylosis deformans, a condition marked by periarticular osteophyte development on the vertebrae, chiefly the lower thoracic and lumbar vertebrae, predominates among vertebral pathologies noted among Roman dogs listed in Table 1, but again this is not unique in a larger comparative

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scope. This condition is frequently found in foxes, wolves and canids (Rothschild et al. 2001). Morgan (1967) found that half of domestic dogs in the 3- to 6-year-old bracket were affected with spondylosis deformans, with 75 per cent of 9-year-old dogs showing the condition. Although advanced stages of spondylosis deformans can be uncomfortable for the dog, especially if the degree of osteophyte formation is so marked as effectively to join vertebrae or to ankylose ribs to vertebrae, many canids with the condition can function without physical handicap (Harris 1977). Finally, as regards dental loss, the fourth premolar and first molar, both maxillary and mandibular, appear particularly susceptible, compared to other teeth. These two teeth (generally referred to as carnassial teeth) often experience the brunt of carnivore chomping and crunching as the animal grinds its food. These actions can result in a higher incidence of tooth fractures, which in turn can lead to cavity development, infection and eventual tooth loss. In most cases, the dog does fine without the tooth, living for sometime afterwards, as shown in the extensive bone remodelling of the alveolar socket that originally housed the tooth. The odd missing tooth, therefore, need not imply direct human care in feeding the animal.

A third point observed from Table 1 concerns correlation of pathological conditions with the ages and sizes of the dogs examined. Complete statistics were not always available, but, overall, pathological conditions become more frequent the older the dog. This is expected, in light of previous research: older animals display more skeletal ailments (Siegel 1976). Perhaps more interestingly, smaller dogs, especially those under 50cm at the withers, tend to show a higher incidence of multiple pathological conditions. 'Round-headed', presumably 'toy' breed types, such as the examples from Yasmina (Carthage, Tunisia) and Mons Claudianus (Egypt), especially exemplify this. Both of these dogs were older, so age could be a factor; however, the temperament of smaller dogs (more energy? getting into more trouble?) could also play a part (Baranyiova et al. 2009), as might a greater degree of human care provided to these 'pets'. Were these animals provided any special treatment? In the case of the Yasmina dog this seems certain. Post-cranially this dog had advanced osteoarthritis, dislocation of the right femur, spondylosis deformans and other conditions that very likely caused it distress, but it was still active and mobile, and indeed survived for a long time with these problems, judging by the advanced stages of bone deformation and remodelling exhibited. Its dentition, however, yields more conclusive evidence of care. This individual had lost all its maxillary teeth, and some, such as the incisors and molars, perhaps years before the animal's death, given the highly developed extent of bony remodelling (Plate 1). The left mandible retained the fourth premolar and first molar (Plate 2), while only the first molar remained in the right mandible (Plate 3). All other mandibular teeth had been lost pre-mortem, again probably at a younger age. Abscessing, alveolar resportion, periodontal disease and calculus added further dental complications for this dog. The heavy build-up of calculus, or tartar, evident as a thick greenish/brown deposit on the left first molar, probably also affected the remaining teeth; however, physical traces of this calculus deposition were lost during post-excavation cleaning, transport and storage of the mandibles (prior to examination by the author). Calculus is not uncommon in dogs, and short muzzle 'toy' breeds, like the Yasmina example, have a greater disposition for this and other dental ailments (Frost 1990). What is abnormal, however, is the extreme degree to which calculus accumulated along all surfaces of the molar teeth, even on root surfaces once below the gum line. Its

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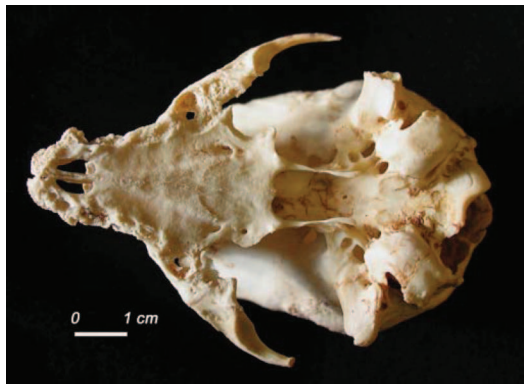

Plate 1 Yasmina dog: inferior view of cranium, showing pre-mortem loss of maxillary teeth.

Plate 2 Yasmina dog: left mandible showing pre-mortem loss of teeth, and heavy calculus deposition on first molar.

Plate 3 Yasmina dog: right mandible showing pre-mortem loss of teeth.

presence on the occlusal margin, moreover, indicates some form of masticatory dysfunction. Ante-mortem loss of maxillary teeth would have negated any counter friction during chewing. Consequently, there would be no natural dental cleaning from mastication, and calculus might build up more rapidly. Human care was probably required for feeding this dog. The tooth loss and excessive tartar could have caused the dog to reject hard foods, which it would not be able to crunch effectively. It would have

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required soft foods, probably ground up by its human caregivers. Such a diet, in turn, may have led to further bacterial-related troubles such as calculus build up, infection and caries (although there are no visible signs of the latter). Even the long hair, characteristic around a Maltese dog's mouth (the modern breed most closely resembling this Yasmina example), may have accelerated dental infection and plaque accumulation, since the constantly moistened hair would harbour bacteria, which in turn could be easily transferred to the mouth. Modern clinical data support that the most severe calculus problems occur in those pampered pet dogs fed strictly soft foods or table scraps (Frost 1990: 24)

The dog's diet may have contributed to further dental troubles. Although the ancient Roman authors list bread, milk, liver and bone broth among the foods recommended for farm dogs (Merlen 1971: 66), it seems likely that the Yasmina dog enjoyed more meat-rich meals, since these might be easily ground up and prepared, as well as rapidly and effortlessly devoured by the dog. Stable nitrogen isotope figures obtained from bone collagen add some support. The Yasmina dog yielded an average δ^{15}N value of 12.5, which is among the highest nitrogen figures recorded for dogs from Roman sites in the Mediterranean, and denotes an elevated trophic dietary level, presumably due to a greater proportion of meat, which may also include fish. Comparative isotopic data from Leptiminus (Tunisia) and Isola Sacra (Italy) produced δ^{15}N values under 11.5 for dogs (Keenleyside et al. 2009). A meat-rich diet might also symbolize wealth and ostentation. If one has a special, pampered pet, it should deserve a distinctive and somewhat expensive diet. Nevertheless, dogs fed strictly organ and muscle meat as their sole nutrition are also very susceptible to periodontal disease because of the high phosphorus and low calcium levels found in these diets (Frost 1990: 25). This imbalance may lead to demineralization of the alveolar bone that supports the roots of the teeth, resulting in gum recession, periodontal disease and eventually loosening and loss of dentition (Frost 1990: 25).

While human therapeutic intervention for the Yasmina dog seems assured, especially as regards its feeding, are such actions observable from the skeletal data for the other canids listed in Table 1? Some care may be assumed for those dogs with mobility problems (e.g. Settefinestre-skeleton 3, Pompeii, Marseille), since, if not otherwise kept as 'pets', these handicapped, limping and arthritic individuals might not have been able to forage for food successfully without human intervention. Harcourt (1967) concludes a similar situation of owner empathy and aid for a fox-terrier-sized 'house' dog from a Romano-British site in Suffolk, England, who had osteophytic lipping and ankylosis on several lumbar vertebrae and severe osteoarthritis in both its left and right elbow and knee joints.

Human supervision may have simplified the feeding routines for many Roman dogs, injured or otherwise, but did this also extend into treatment of the ailments themselves? Ancient Roman veterinary writings outline remedies for various ailments in livestock, including splinting and bandaging for broken bones and injured legs. In the case of those dogs listed in Table 1 as displaying fractures, human intervention seems unlikely, at least using any type of split or other osteologically observable veterinarian tactic. Examples of poorly set bones (e.g. Matrice, Settefinestre-skeleton 2, Rome-Meta Sudans, Yasmina, Marseille) suggest no human intervention in treating the broken or dislocated bone itself, although this does not discount other acts of care in feeding or tending to the animal. Examples of fractured bones that healed more or less in natural alignment, without dramatic displacement (e.g. metatarsals from San Giovanni, fifth metatarsal from

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Settefinestre-skeleton 3) do not necessarily imply human intervention, as healed fractures of these sorts can result from natural anatomical splinting (Udrescu and Van Neer 2005).

Although evidence is speculative, in many cases, and available osteological evidence piecemeal, the data nonetheless offer some convincing examples of human treatment and care of Roman dogs, especially smaller 'toy' and 'house' ones. Does this extend the other way? In other words, what might the zooarchaeological data inform us about human maltreatment of dogs? Diagnosing the cause of skeletal pathological conditions is not easy, especially in light of the fact that osteological markers are often nonspecific and can result from multiple agents and pathogens. Accidents, as well as intra-specific (e.g. dogs fighting dogs) and inter-specific (e.g. dogs and other animals; dogs and humans) aggression should all be considered, particularly in assessing trauma. Bartosiewicz and Gal (2008) highlight the complications of ethological interpretations from bone remains, with special regard to violent interactions. Domestic animals, especially dogs, tend to display more signs of bone trauma than do their wild counterparts (Bartosiewicz and Gal 2008: 18–21), presumably because of greater human abuse. Baker and Brothwell (1980: 93–4) noted, in a sample of dog skulls from Neolithic to Roman times, a propensity for traumatic injury to the facial area, from above the eyes to the front of the snout. Such injuries could hypothetically be attributed to beating, or staving off an aggressive dog. Healed and healing fractures of the ribs and spinous processes of the vertebrae might also be attributed to human abuse, particularly when multiple fractures at different healing grades are observed (Teegen 2002: 36–7); however, biting by other dogs and kicking and trampling by livestock may also factor. Overall, cranial, rib and vertebral fractures are very rarely displayed in the available zooarchaeological data for Roman dogs in Table 1, and no instances of multiple rib and vertebrae fractures at different healing stages are recorded. The impression is that most of these animals were not maltreated, at least not to an extent leading to broken bones. Nevertheless, as noted earlier, vertebral and rib pathologies may be under-reported due to insecurity in assigning these elements to species, but this should not be the case for whole dog skeletons, where rib and vertebrae identification by association is assured. Such skeletons form a sizeable proportion of the dog remains recovered from Roman sites. It is possible that some of the trauma exhibited on leg bones, such as fractured tibiae, ulnae and femora resulted from human abuse of dogs, but such injuries could be sustained from an accidental fall as well.

Conclusions

On the basis of available zooarchaeological data, Roman dogs from the Mediterranean context largely parallel patterns observed for pre- and post-Roman sites in the larger Old World region, in terms of skeletal pathologies. Common pathological conditions include dental complications, especially pre-mortem tooth loss, healed limb fractures, osteoarthritis and infection. Generally, these Roman dogs seem to be in good condition as regards skeletal health, with minimal osteological evidence for human abuse or maltreatment, but also no conclusive data for splinting any broken bones, despite the

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capability to perform such operations as outlined in the ancient Greek and Latin texts. Active care towards dogs in the Roman Mediterranean context is indicated especially in terms of facilitation for feeding. Propensity for injury and illness, and in turn treatment of such ailments, may have varied depending on dog breed, size and role as 'pet'. Smaller 'toy' breeds of dogs in Roman times appear more susceptible to multiple pathological conditions, but also display signs of greater human care, especially in terms of pampering and feeding. Nevertheless, while this zooarchaeological survey and analysis helps illuminate some aspects about dog health and welfare in Roman times and the interactions of pets with their human providers and care givers, it also addresses concerns about insufficient reporting of skeletal anomalies and ailments. Greater attention to describing and recording pathological conditions in archaeological animal bones is encouraged, so a more accurate picture of human-animal relationships may be reconstructed.

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Department of Anthropology, University of Winnipeg, Winnipeg
m.mackinnon@uwinnipeg.ca

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Michael MacKinnon is an Associate Professor of Anthropology at the University of Winnipeg, Canada. As a zooarchaeologist who specializes in the archaeology of the ancient Greek and Roman Mediterranean worlds, he has worked for more than thirty different projects at sites in Italy, Tunisia, Greece, Portugal, Spain, Egypt and Romania. He is the author of *Production and Consumption of Animals in Roman Italy: Integrating the Zooarchaeological and Textual Evidence* (2004, *Journal of Roman Archaeology* Supplementary Series 54).