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Short fieldwork report

Animal remains from Musti, Tunisia, 2019–2023

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The city of Musti (today's El Krib, 36°18'00"N, 9°08'00"E, ancient municipium *Iulium Aurelium Mustitanum*) was located on an important route connecting Carthage—the capital of the Roman province—with important centres located inland, such as Theveste and Sufetula. More information about the city and the research of the Tunisian-Polish expedition is provided in Fetner and Waliszewski (2025).

The origins of the town must be linked to the Numidian period, but the city's heyday came during the Roman period, especially in the 2nd–3rd centuries AD. The city functioned throughout late antiquity, and later, during the 7th–12th centuries AD, declined probably to the role of an ordinary rural centre. However, throughout its entire existence, the population living in the city and its rural hinterland engaged in intensive animal husbandry, which we identify mainly on the basis of animal bone finds.

The bone assemblage from Musti offers a valuable opportunity for extended analysis, owing to the broad chronological range of the excavated material. Therefore, the study aims to trace diachronic changes in the animal economy at the site and in its surrounding area, and to understand their origins.

The animal remains analysed in this study come from well-stratified layers within the centre of the ancient city. Musti was intensively studied in 2019–2023 as part of an archaeological project conducted on behalf of the Institut National du Patrimoine (Tunis) and the University of Warsaw (Faculty of Archaeology and Polish Centre of Mediterranean Archaeology), under the AFRIPAL project—"(Reading) African Palimpsest. The dynamics of urban and rural communities of Numidian and Roman Mustis (AFRIPAL)" (National Science Centre, Poland, project no. 2020/37/B/HS3/00348; project implemented in the field in 2021–2023). The project was directed by Jamel Hajji (Institut National du Patrimoine) and Tomasz Waliszewski (University of Warsaw).

The analysed remains were recovered from eight trenches located within the town (T1, T2, T4, T5, T6, T7, T11, and T12). They derive from contexts dated to seven

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Table 1. Identification of animal remains dated to the Numidian to Roman periods.

Taxon	H1		H3–H5	
	n	%	n	%
Cattle (*Bos taurus*)	247	41.9	126	24.1
Sheep (*Ovis aries*)	8	1.4	25	4.8
Goat (*Capra hircus*)	1	0.2	6	1.1
Sheep/goat (*Ovis aries*/*Capra hircus*)	152	25.8	183	35.0
Pig (*Sus domestica*)	140	23.7	162	31.0
Horse (*Equus caballus*)	38	6.4	15	2.9
Donkey (*Equus asinus*)			3	0.6
Dog (*Canis familiaris*)	4	0.7	3	0.6
Domesticated mammals total	590	100.0	523	100.0
Red fox (*Vulpes vulpes*)	1		0	
Large carnivore	1		0	
Cape hare (*Lepus capensis*)			3	
African crested porcupine (*Hystrix cristata*)			1	
Wild mammals total	2		4	
Birds total	3		4	
Turtle (*Testudo sp.*)			3	
Reptiles total	0		3	
Total identified	595		534	
Unidentified	266		106	
Total	861		640	

chronological phases: Horizon 1 (Numidian period), Horizon 3 (Intermediate period), Horizon 4 (Roman period), Horizon 5 (Late Roman period), Horizon 6 (Late Antiquity), Horizon 7 (Islamic period), and Horizon 8 (Modern period). In total, 5,763 bone fragments were excavated, however, two groups were excluded from the present study: remains from the recent strata of Horizon 8 (529 fragments) and material from disturbed or undated contexts (991 fragments). The analysed bone assemblage is housed at the Faculty of Archaeology, University of Warsaw.

The skeletal remains were identified to species and anatomical element, including the use of diagnostic ovicaprine criteria (Schramm 1967; Zeder & Lapham 2010; Zeder & Pilaar 2010), and were analysed following standard archaeozoological methods (Gifford-Gonzalez 2018; Lasota-Moskalewska 2008; Reitz & Wing 2008). Identifications were based on comparisons with the reference collection housed in the Bioarchaeological Laboratory of the Institute of Mediterranean and Oriental Cultures, Polish Academy of Sciences.

Bird remains were identified and analysed separately by Krzysztof Wertz (Institute of Systematics and Evolution of Animals, PAS). Rat bones were identified to the species level by David Orton, Sam Greeves and Michelle Feider from the Department of Archaeology, University of York. Quantitative analysis was conducted using NISP (Number of Identified Specimens per species). The assemblage's preservation state was typical of African post-consumption bone materials: the bones were desiccated and brittle, and some exhibited varying degrees of weathering.

Bones of domesticates constituted the majority of remains recovered in contexts dating from the Numidian to Roman periods (**Table 1**, **Figure 1ab**). Game animal remains (wild mammals, birds, and reptiles) were very scarce. There was a clear upward trend in the proportion of smaller domesticates, ovicaprines and pigs, between the Numidian and Roman periods, along with a distinct decline in the proportion of cattle in the latter period (**Figure 1c**). Cattle bones and teeth mostly belonged to morphologically mature animals (less than 5% in both time periods analysed belonged to young animals), remains of young ovicaprines were slightly more numerous (between 5 and 10%), and pig remains were characterised by the highest proportion of juveniles (between 20 and 30%). The small proportion of remains of transport animals is also noteworthy, especially in the Roman period, however, the appearance of a few donkey bones alongside horse remains in contexts dating to this period should be emphasised. The bones of domesticates showed traces of both meat processing (cutting, chopping, dismembering and filleting) and gnawing by carnivorous animals.

In later periods, wild animal remains constituted a slightly higher percentage, although domesticates bones still dominated the material (**Table 2**, **Figure 2ab**). Iso-

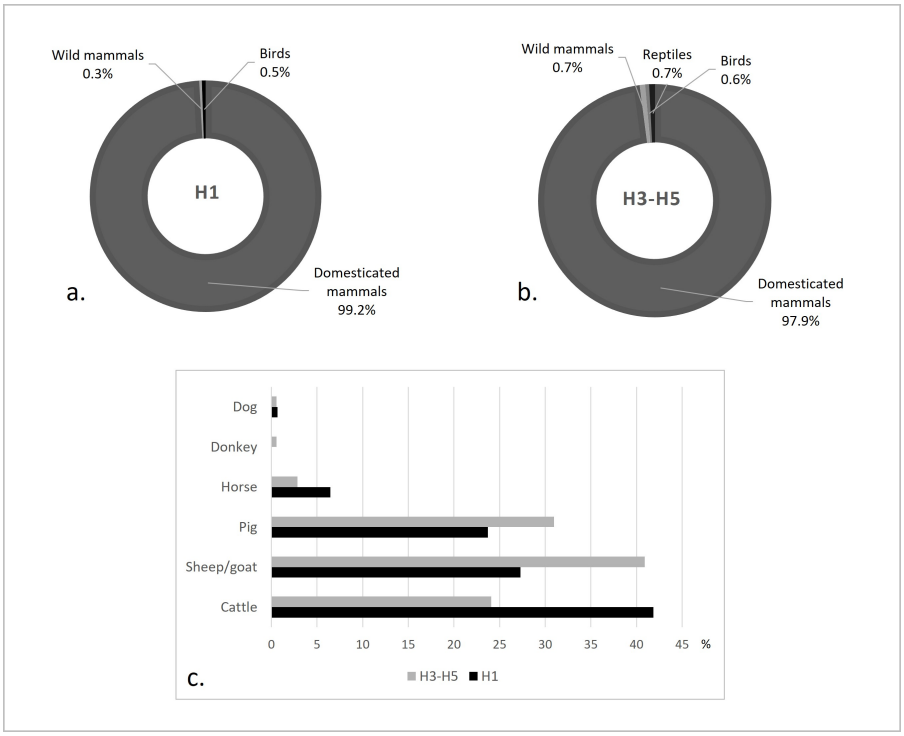

Figure 1. Share of animal remains in contexts dated to the Numidian to Roman periods. Diagram by U. Iwaszczuk.

Table 2. Identification of animal remains dated to the Late Roman/Late Antique to Islamic periods.

Taxon	H5/H6–H6/H7		H7	
	n	%	n	%
Cattle (*Bos taurus*)	384	29.8	139	21.3
Sheep (*Ovis aries*)	42	3.3	49	7.5
Goat (*Capra hircus*)	33	2.6	37	5.7
Sheep/goat (*Ovis aries*/*Capra hircus*)	511	39.6	385	58.9
Pig (*Sus domestica*)	262	20.3	23	3.5
Horse (*Equus caballus*)	41	3.2	12	1.8
Horse/mule	1	0.1		
Arabian camel (*Camelus dromedarius*)	0	0.0	8	1.2
Dog (*Canis familiaris*)	16	1.2	1	0.2
Domesticated mammals total	1290	100.0	654	100.0
Red deer (*Cervus elaphus*)	1			
Cape hare (*Lepus capensis*)			1	
Black rat (*Rattus rattus*)	3			
Small rodent	2			
Wild mammals total	6		1	
Birds total	76		14	
Gilthead seabream (*Sparus aurata*)	1			
Pisces indet.	1		2	
Fish total	2		2	
Turtle (*Testudo sp.*)	1			
Reptiles total	1		0	
Total identified	1375		671	
Unidentified	436		260	
Total	1811		931	

lated fish remains also appeared in the contexts dated to these periods. The only fish bone identified to the species level belonged to gilthead seabream (**Table 2**), a marine fish. In the Late Antique and Islamic periods, there was a further sharp increase in the share of ovicaprines, reaching almost three-quarters of the share of these animals in the domesticates group in the Islamic Period, as well as a decline in the shares of cattle and pigs, including the almost complete disappearance of pig remains in the Islamic period (**Figure 2c**). The age of slaughter of cattle did not differ substantially from that recorded for earlier periods. In contrast, the young slaughter of smaller domesticates (ovicaprines, pigs) increased significantly in the Islamic period, reaching in the case of ovicaprines about 20% and in the case of pigs almost 60%. As in the Numidian and Roman periods, the bones of domesticates showed traces of both kitchen processing and gnawing by carnivores, but their share of the material was higher than in earlier periods.

Diachronic changes in animal husbandry patterns at Musti, focusing on the four principal domestic species from the Numidian to the Islamic periods, reflect both historical events and shifts in environmental conditions. From the foundation of the town through the Roman period, breeding strategies indicate an economy oriented

toward supplying the urban population primarily with meat and, likely, dairy products. The latter is indicated by the importance of cattle during this phase evidenced by their nearly 40% representation in the Numidian assemblage and by the predominance of morphologically mature individuals at slaughter. A similarly high proportion of cattle has been documented at not-so-distant Althiburos, although in the period preceding the dating of the Musti material (10th–9th to early 7th century BC) (Portillo et al. 2012). Such levels were no longer observed there in the Late Numidian period (Valenzuela Lamas et al. 2021).

A shift in livestock composition toward a substantial increase in pigs, already apparent in the Intermediate period and clearly expressed during the Roman period, likely reflects the growing influence of Roman cultural and economic practices (MacKinnon 2001; 2010). The prominent role of pig husbandry during the Roman period is well documented at other contemporary sites (Azaza & Colominas 2020:532–533), including nearby Zama (Azaza 2020). The near-complete disappearance of pig breeding during the Islamic period is most plausibly linked to cultural and religious changes, possibly reinforced by partial population replacement. Neverthe-

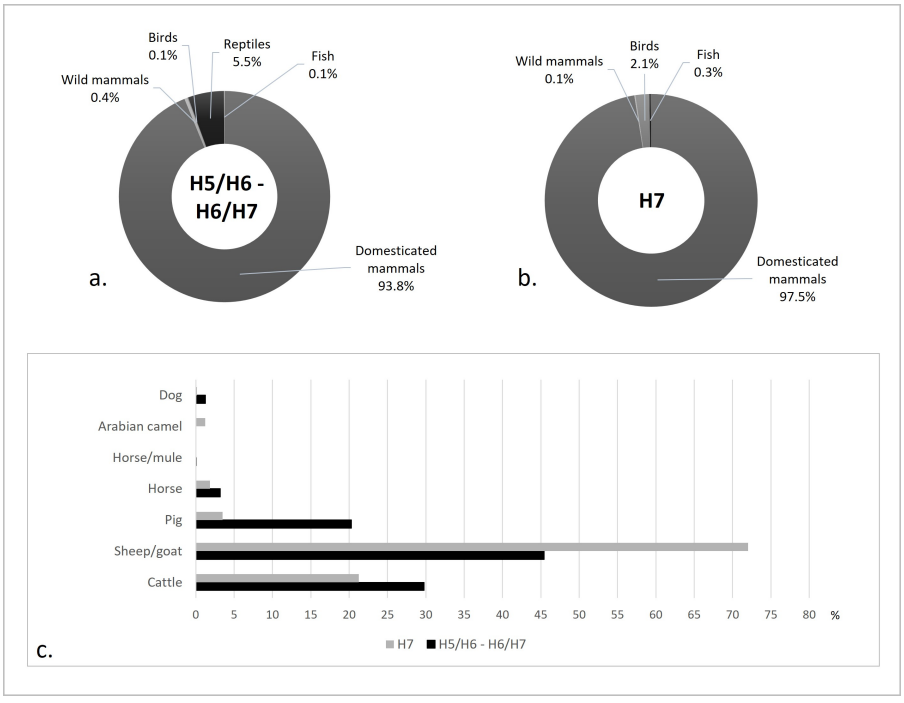

Figure 2. Share of animal remains in contexts dated to the Late Roman/Late Antique to Islamic periods. Diagram by U. Iwaszczuk.

less, the persistence of small pig herds into the Islamic period suggests that some pig breeders, likely rooted in Late Antique or Vandal/Byzantine traditions, continued to reside in the Musti area. A comparable rise in pig husbandry during the Roman period followed by a decline in the Late (Vandal) period has also been observed at Althiburos (Valenzuela Lamas et al. 2021). Due to the limited archaeozoological research focused on the Islamic period, parallels from other sites are lacking; to date, Musti remains the only Tunisian site with analysed animal remains from this period.

The gradual increase in the importance of ovicaprines, culminating in a marked surge during the Islamic period, may be attributed to both environmental and socio-cultural factors. These include the progressive deterioration of climatic conditions—particularly the aridification of zones between the Saharan margin and the Mediterranean coast—as suggested by the presence of wild species adapted to semi-desert environments, such as Cape hare and porcupine, in Islamic-period contexts. This shift may also reflect the arrival of new populations, possibly semi-nomadic groups who occupied the partially abandoned town. For such communities, maintaining livestock with high water requirements, such as cattle or pigs, would have been far more challenging than for earlier sedentary farming populations, especially under the relatively favourable environmental conditions of the Roman period (Kłodziński et al. 2024). Evidence for continued trade contacts with the coast during Late Antiquity is provided by the presence of marine fish remains in assemblages from this period. The possibility of long-distance inland trade can be inferred from camel remains found in Islamic-period contexts.

In summary, two major phases of intensified change in animal husbandry can be identified at Musti. The first occurred at the onset of the Roman period, when livestock management shifted toward more rapid meat production, in part through the increased importance of pigs. The second took place at the beginning of the Islamic period, when a predominantly pastoral economy replaced the earlier mixed farming and livestock system.

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