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Animal remains from the multi-layered site of Elvas-Kreuzwiese p. f. 574 (South Tyrol, Italy)

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(with 3 figures, 3 tables and 2 appendices)

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Summary

The site of Elvas-Kreuzwiese p. f. 574 is located near Brixen-Bressanone (BZ) on the Natz-Schabs plateau at about 600 m a.s.l. Excavations carried out at the beginning of this century attested the presence of Late Bronze Age, Iron Age and Roman Age materials. Almost 10,000 animal remains from all chronological phases are presented in this paper. Faunal composition is quite similar through all phases: caprines are the most common taxa, cattle is quite abundant and domestic pig is rare. The site stratigraphy allows to detect changes in cattle body size through time: an increase in body size can be observed at the boundary between the Iron Age and the Roman Imperial Age. However, the presence of small individuals could indicate that local forms, probably directly derived from Late Iron Age populations, were not completely replaced during the Roman period. Data indicates an autonomous subsistence economy during the Bronze Age, whilst the site looks to be part of a more complex society during the Roman period.

Keywords: Bronze Age, Roman Age, Zooarchaeology, South Tyrol, Elvas-Kreuzwiese p. f. 574.

Zusammenfassung

Die hier besprochenen Tierknochen stammen aus archäologischen Grabungen, die in Elvas p. f. 574, nahe Brixen/Bressanone (Südtirol/Alto Adige, Norditalien) durchgeführt wurden. Die untersuchten Tierreste stammen aus der Endbronzezeit (Laugener Kultur), der Eisenzeit, der römischen Kaiserzeit und der Spätantike. Die Zusammensetzung der Reste bleibt während aller Perioden ungefähr gleich: durchwegs stark vertreten sind Schaf und Ziege sowie Rind; seltener finden sich Reste von Hausschweinen. Unter den kaiserzeitlichen Resten treten Knochen verschiedener Rinderrassen auf, die sowohl einer großen römischen Importrasse als auch einer kleinen lokalen Landrasse zugeordnet werden können. Die Altersstruktur der häufigsten Haustierpopulationen entspricht in der Bronzezeit einer selbstgenügsamen Ökonomie, in den darauffolgenden chronologischen Phasen wurde die Siedlung von Elvas Teil einer komplexen Gesellschaft.

Schlüsselwörter: Elvas-Kreuzwiese p. f. 574, Bronzezeit, Eisenzeit, Römerzeit, Tierknochen, Südtirol.

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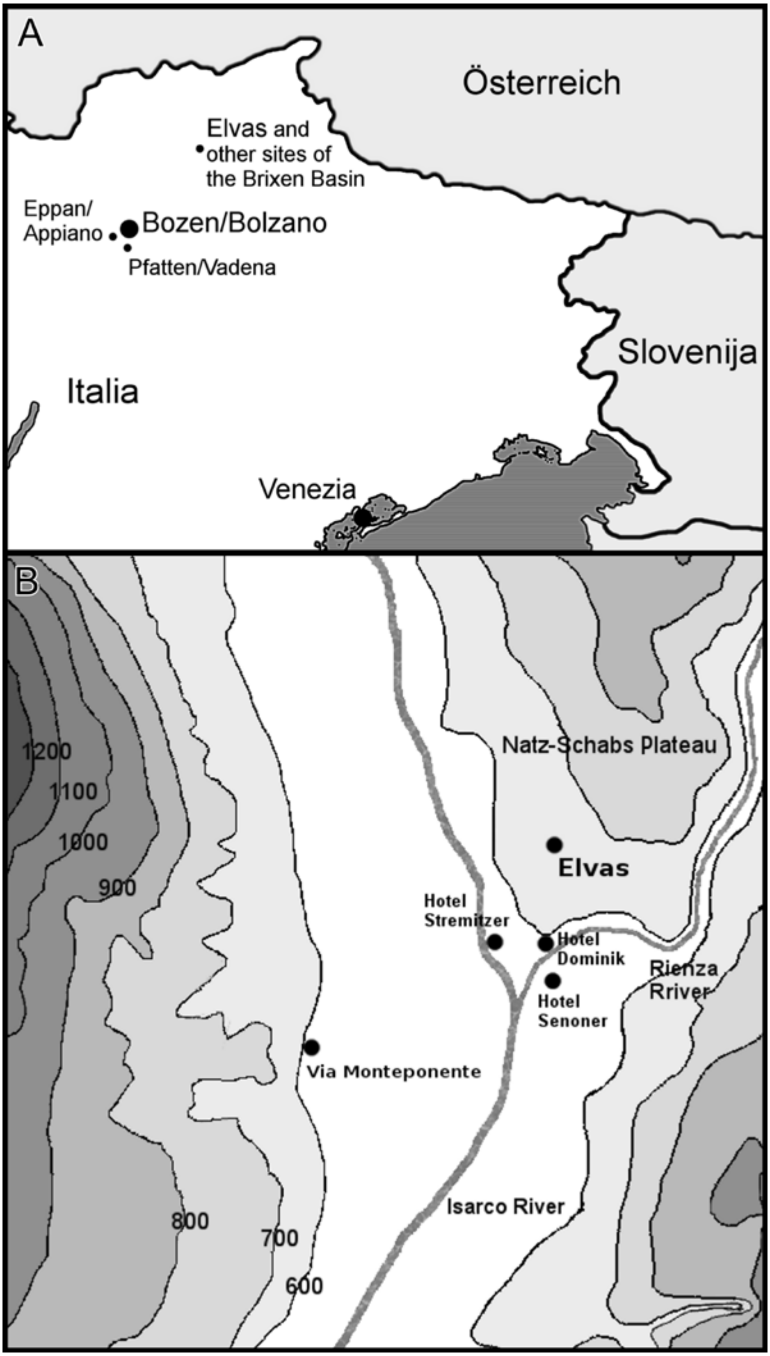


Figure 1. A: Site position in its regional context. B: the sites located in the Brixen Basin.

Introduction

The site of Elvas-Kreuzwiese p. f. 574 is located near the town of Brixen/Bressanone (South Tyrol, Italy) on the plateau of Natz-Schabs at about 600 m above sea level (Fig. 1). The site is close to the confluence between the Rienza and the Isarco rivers, whose valleys have been important commercial and cultural routes across the Alps. In the valley bottom at Stufles, close to Elvas, a number of archaeological sites dated from the early Holocene to the Middle Ages were also discovered, thus confirming the importance of this area for human populations through time (TECCHIATI 2010).

Among archaeological excavations done at Elvas in this century, the one carried out in the locality Kreuzwiese p. f. 574 is particularly important, since Neolithic, Bronze, Iron Age as well as Imperial Age and Late Antiquity evidence was brought to light there. Excavation was directed in 2000 by the local heritage office (Amt für Bodendenkmäler, Autonome Provinz Bozen/Ufficio beni archeologici, Provincia Autonoma di Bolzano). The excavated area is more than 1000 square meters.

The Late Bronze Age phase (Laugen/Luco culture, 12th–10th century BC) is characterized by the presence of three terracing structures built up for settlement and agricultural purposes; in the first half of the 1st millennium B.C. the terracing system collapsed and the debris was levelled in order to establishing a new occupation, testified by fireplaces and postholes (TECCHIATI *et al.* 2013).

The presence of some buildings indicates an Iron Age occupation (6th–4th century BC) followed by the arrival of Roman culture. Three Imperial Age phases (1st–5th century AD) were recorded as well as a Late Antiquity one (MARZOLI 2000; TECCHIATI 2001; BOSCHIN & WEISSTEINER 2008).

Animal remains come from all phases with the exception of the Neolithic. Part of the zooarchaeological assemblage recovered at the site was already briefly published by the author in collaboration with colleagues, but a complete analysis was never published (BOSCHIN 2006; BOSCHIN & WEISSTEINER 2008; TECCHIATI *et al.* 2013). In addition it has to be underlined that, thanks to the work carried out by some scholars in the last five decades (*e.g.*, RIEDEL & TECCHIATI 2001; TECCHIATI 2010) there has been an exceptional development in knowledge on zooarchaeological topics regarding the region where Elvas is located.

Considering these points, aim of present paper is to publish the complete zooarchaeological assemblage from Elvas/Kreuzwiese p. f. 574 in its context.

Materials and Methods

As already stated in the previous chapter, faunal remains (actually stored at the heritage office of Bolzano) come from all cultural phases, from the Final Bronze Age to Late Antiquity. A total of 9,774 remains were analysed. Remains were identified according to species, genus or to more generic categories, depending on their integrity. Some remains were only ascribed to categories related to animal body size: in particular the category "small ungulate" comprises remains belonging to individuals similar in size to caprines and pig. The category "large ungulate" comprises remains belonging to individuals similar in size to red deer, equids or cattle. Taxonomic nomenclature of domesticates was used according to GENTRY *et al.* (2004). Minimum Number of Elements (MNE) and Minimum Number of Individuals (MNI) were counted according to LYMAN (1994) and CHAPLIN (1971) respectively. To better evaluate skeletal frequencies MAU (Minimum Number of Animal Units, BINFORD 1984) was used. The standardized value MAU% was obtained dividing each MAU value for the highest MAU value in the assemblage. Measurements were recorded according to VON DEN DRIESCH (1976).

Wear stages were recorded according to GRANT (1982) for cattle and pig and according to PAYNE (1973) for caprines. Age-at-death of horse was inferred according to FERNÁNDEZ & LEGENDRE (2003). Tissues status of diaphysis portions at the moment of breakage (fresh or dry) was analysed using the Fracture Freshness Index (FFI) proposed by OUTRAM (2002).

Abbreviations in text and tables

BA: Bronze Age
Bb: Basal breadth
Bd: Breadth of the distal end
BFp: Breadth of the Facies articularis proximalis
Bp: Breadth of the proximal end
BT: *Bos taurus*
C/O: *Capra hircus* vel *Ovis aries*
CE: *Cervus elaphus*
CF: *Canis familiaris*
CH: *Capra hircus*
CI: *Capra ibex*
d.: distal
Eq: Equid
FFI: Fracture Freshness Index
FC: *Felis catus*
GG: *Gallus gallus*
GL: Greatest Length
GLpe: Greatest length of the peripheral half
IA: Iron Age
LA: Late Antiquity
Lsp: *Lepus* sp.
LU: Large ungulate
MNI: Minimum Number of Individuals
MNE: Minimum Number of Elements
MAU: Minimum Animal Unit
NISP: Number of Identified Specimens
OA: *Ovis aries*
p.: proximal
RA: Roman Age
SD: *Sus domesticus*
SS: *Sus scrofa*
SU: Small ungulate
su: stratigraphic unit
UA: *Ursus arctos*
Unid.: unidentified
Σ: sum

If not clearly expressed, all measurements are given in millimetres. Abbreviations of measurements are from VON DEN DRIESCH (1976).

Faunal composition

The largest samples are that from Late Bronze Age (Luco Culture, phase A) and that from second phase of Roman Imperial Age (2nd–3rd century A.D.) (Tab. 1). In all phases domesticates are much more abundant than wild species, whose abundance ranges from 0.3 % of NISP in the Late Antiquity to 2.6 % of NISP in the second phase of the Roman Imperial Age. Among domesticates, pig (*Sus domesticus*) is always rare when compared to cattle (*Bos taurus*) and caprines (sheep – *Ovis aries* and goat – *Capra hircus*). Among caprines, sheep is more abundant than goat in all phases. Equids (*Equus caballus* and/or hybrid forms) are present with a very small amount of remains in all phases, and so are dogs (*Canis familiaris*) and domestic cats (*Felis catus*).

Peculiar characteristics of the identified taxa

Bos taurus

Bronze age individuals are of a rather small size as attested by bone measurements (Appendix 2, Tab. 10). For instance, length of first phalanx (GLpe) ranges between 45.5 and 54 mm (n = 5), length of metacarpal (GL) is comprised between 162 and 175 mm (n = 3) and corresponds to a withers height of 100–108 cm using the coefficient of MATOLCSI (1970). A radius shows a proximal breath (BFp) of 63.6 mm, whilst length of the lower third molar is between 25.8 and 38.5 mm (n = 16). During the Iron Age individuals are still small (radius, BFp = 55.6, 59.6; lower third molar, GL = 32, 33, 35.5). Roman age cattle is larger in size especially during the three Imperial Age phases. For instance a first phalanx shows a GLpe of 63 mm, whilst proximal radius has a BFp of 82.8 and 90 mm. Third lower molars have a GL between 32.4 and 38.4 mm (N = 3). Both during the Imperial Age and Late Antiquity there are individuals smaller in size, which resemble the ones from the previous phases. For instance, one metatarsal from phase II

Table 1. Faunal composition (NISP).

	BT	C/O	CH	OA	SD	Eq	CI	CE	SS	CF	FC	UA	L sp	LU	SU	GG	unid.	Aves	∑
Late Bronze Age	448	513	19	46	115	7	4	17	4	11	0	0	0	463	545	0	1967	1	4160
Iron Age	44	92	13	19	11	2	0	2	0	1	0	0	0	71	218	0	435	1	909
Roman Imperial Age I	23	90	1	8	7	1	0	1	0	0	0	0	0	25	104	0	212	0	472
Roman Imperial Age II	218	346	12	20	44	4	0	15	0	1	0	0	1	169	347	4	1323	3	2507
Roman Imperial Age III	29	81	2	6	4	1	0	0	0	4	0	1	0	25	93	2	338	1	587
Late Antiquity	51	86	7	7	13	2	0	1	0	1	1	0	0	80	128	0	761	1	1139

(su 107) belongs to a quite large individual (Bd = 54.2), whilst a second phalanx from the same phase (su 170) is very small (GL = 38.5, Bp = 26, Bd = 23). Moreover, Late Antiquity layers yielded remains of individuals whose size is similar to that of Bronze Age ones (tibia, Bd = 47; metacarpal, Bp = 49.5).

Ovis aries and *Capra hircus*

Sheep and goat do not show clear diachronic trends in size variation (Appendix 2, Tab. 11–12). Withers height of two Bronze Age sheep individuals, calculated using the coefficient for the metatarsal proposed by Teichert (1975), is 65 and 69 cm respectively.

A similar situation is observed for goat. A horn core from Bronze Age layers is sabre-shaped and not twisted. A similar shape was observed also in a Roman Age specimen.

Equids (*Equus caballus* and/or hybrid forms)

Equid remains were found throughout the sequence. Bronze Age and Iron Age individuals are small sized and teeth show the typical characteristics of *Equus caballus* (Appendix 2, Tab. 14). The greatest length of a Bronze Age metacarpal (GL) is 204 mm. Measurements of Roman Age equids are scarce like the protohistoric ones: the distal breadth (Bd) of a Tibia is 64 mm, and a first phalanx has a proximal breadth (Bp) of 56.4 mm. Even if some teeth were identified as *Equus caballus*, the presence of hybrid forms (mules or hinnies) cannot be excluded.

Other taxa

Domestic pig does not show clear diachronic trends in size variation (Appendix 2, Tab. 13).

Dog (*Canis familiaris*) remains are scarce for all phases. A Bronze Age third metacarpal belongs to an individual with an estimated shoulder height of 50 cm. Roman Imperial Age layers (Phase III) yielded a mandible with a molar row 34.6 mm long and a height of the *ramus* between P/2 and P/3 of 16.4 mm. The latter parameter is 20.4 in another mandible from the same phase (Appendix 2, Tab. 15).

A late antiquity cat (*Felis catus*) tibia has a proximal breadth similar to that of medieval domestic individuals from Verona (Bp = 17) (Riedel 1994).

All chicken remains (*Gallus gallus*) are from the Imperial Age (Phases II and III). Measurements (Appendix 2, Tab. 15) are within the variability of Roman Age and Late Antiquity populations (Thesing 1977; Boschin 2011), in which individuals were larger in size than the Iron Age ones (coracoid, Bb = 13; humerus, Bd = 13.8, 15; 22.3; radius, GL = 64; femur, GL = 78; tibiatarsus Bd = 11).

Body part profiles

Skeletal element representation is probably affected by post depositional disturbance. A number of specimens is affected by weathering (60 % in the Bronze Age, 28 % in the Iron Age, 30 % in the Roman Age/Late Antiquity) and a high proportion of diaphysis fragments show clear dry-bone fractures (FFI values from 3 to 6: 61 % in the Bronze Age, 49 % in the Iron Age, 43 % in the Roman Age/Late Antiquity). Gnawing marks due to dogs always affect less than 2 % of the remains. Bone density values of *Rangifer tarandus* and *Connochaetes taurinus* (LAM *et al.* 1999) have been used to test bone attrition on caprines and cattle respectively (for the use of caribou and wildebeest density values on other species see LAM *et al.* 1999). The test was carried out on Bronze Age and Roman Imperial Age (phase II) samples because of their larger size (Tab. 2). A positive and significant correlation between bone density and abundance of skeletal elements (MAU %) was observed in all of the analysed samples (probability of absence of a correlation: Bronze Age: cattle, p = 0.0001; caprines, p = 0.0001; Imperial Age: cattle,

Table 2. Minimum Number of Elements (MNE) of the most abundant taxa according to site phases.

	BA				IA		RA I		RA II			RA III		LA	
MNE	BT	C/O	SD	CE	BT	C/O	BT	C/O	BT	C/O	SD	BT	C/O	BT	C/O
antler				2											
maxilla	18	20	5	1	3	6	1	3	5	21	1	2	4	1	5
mandible	34	37	7		6	3		4	5	20	2		10	1	2
scapula	6	7				5	1	4	4	3	1	1	2	1	2
humerus p.	0	2	1	1		1		1	1	2					
humerus d.	5	10	2	1	2	2	2	5	7	5			1	2	4
radius p.	4	5	1		2	2	1	4	4	5		1		1	2
radius d.	4	5				1		2		1			1	3	2
ulna p.	4	4	6		2	1	1	1	5	5	2	1	2	3	3
carpal bones	10	4	1			5	1	1	5	3		1	1	2	1
metacarpal p.	3	5	4			2				7	4		2		1
innominate	3	4	1			1	2	4	2	3	2		2	3	4
femur p.	3	4				2		1					3		
femur d.	3	4						2	2	3	1		1	1	
patella		1	1			1									2
tibia p	3	2						2	1	5		1		1	1
tibia d	3	4	2			2		2	2	4		1	1		2
malleolar						1			1						
tarsal bones	13	20	3		4	8	2	8	9	12	1	1	6	3	6
metatarsal p.	5	8	1	3		3	1			5	1				3
metapodial d.	8	12	3	3		4	2	2	8	5	3	1	3		4
phalanx 1	13	19	1	1	3	8		7	6	11	2		2	1	2
phalanx 2	8	13	3		3	1		5	3	7	2		6	2	1
phalanx 3	7	3	4				1	1	2	1	2	2	1		
sesamoidal bones	3								1			1			
Σ MNE	160	193	46	12	25	59	15	59	73	128	24	13	48	25	47

p = 0.0006; caprines, p = 0.0004). Considering the scarcity of limb bones, the high frequency of diaphyses fragments among unidentified fragments or among specimens classified as "Small Ungulate" and "Large Ungulate" has to be underlined. Presence of axial elements (vertebrae and ribs) follows a similar pattern (Appendix 1, Tab. 4–9). Among rarer taxa, red deer (*Cervus elaphus*) is mainly present as antler fragments (especially during the Roman Age) and metapodials.

Age-at-death of individuals

High fragmentation of remains (collected also by means of sieving) does not allow to collect reliable age-at-death data of main domestic populations for all phases (Tab. 3). In the Bronze Age, cattle is represented by a wide spectrum of ages. Young individuals with deciduous dentition, prime age adults and mature individuals with the third molar showing in particular wear stages g–j (Grant 1982) are all present in this phase. Also caprines population structure is characterized by a wide spectrum of ages: among the 25 estimated individuals, classes A, D and E of Payne's system (1973) are equally represented. Even though data on pigs is scarce, the presence of adult (probably reproductive) individuals has to be highlighted (Tab. 3).

During the Roman Age, even if data is scantier, structure of cattle population looks similar to the one from earlier phases. Among caprines, there are more adult individuals in the Imperial Age (age class F). Most of Roman Age pigs are young.

Equid remains are always of adult individuals, with the exception of a Roman Age deciduous tooth, whose abrasion is compatible with a tooth dropped down from a still-living individual. Bronze Age complete teeth (n = 2) have a crown height compatible with that of 10 years old individuals, one Iron Age and one Roman age specimens belong to 15 years old individuals.

Anthropic modifications on bones

Apart from the numerous butchering marks found on bones and possibly related to all phases of carcass reduction, some specimens require special attention: as regard the Bronze Age, two basal portions of red deer antlers were cut, two caprine astragali were drilled and one of them was engraved with a chevron pattern on the ventral side (Fig. 2). One was found near a fireplace in a dwelling (su 71) and one in a layer of organic sediment outside the living structures (su 87). One red deer metatarsal was pierced in the ventral side of the proximal epiphysis and three were pierced in the distal part of the diaphysis. Two of them show polished surfaces, on the dorsal and on the ventral side respectively (Fig. 3). Due to the bad preservation of bone surfaces it has been impossible to analyse the presence of use-wear traces.

Discussion and Conclusions

The study of a multi-layered site like Elvas-Kreuzwiese p. f. 574 clearly highlights the strong economic change occurred in the Brixen Basin through time.

The use of sieves during excavation (resulting in the high percentage of unidentified fragments) allowed the recovery of small specimens, avoiding the under representation of some taxa during anatomical and taxonomic identification of remains. With the exception of red deer, which will be discussed in the following paragraphs, skeletal frequencies of other taxa are influenced by post-depositional attrition and do not show peculiar trends. The overwhelming presence of maxillary and mandible elements (represented by isolated teeth) in all phases is due to post depositional bone destruction. There is no reason to think that the lack or the abundance of other anatomical elements should be related to import/export of specific carcasses parts.

In a previous work (BOSCHIN 2006) it was assumed that faunal composition of the Bronze Age phase could be influenced by environmental constrictions; this is a straight-forward explanation for the low percentage of pig remains in a hilly area placed at a higher altitude than the flatter and more humid valley bottom. However, local traditions or peculiar economic choices also need to be taken into account.

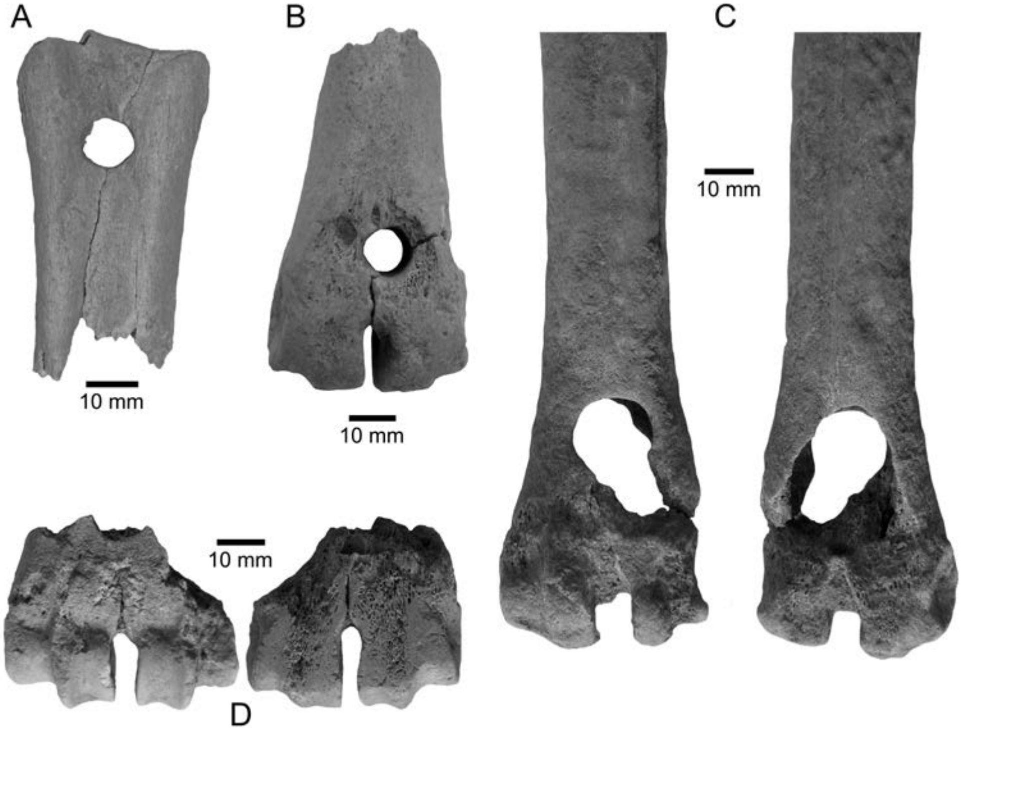
The presence of adult pigs during the Bronze Age at Elvas may be evidence of an autonomous livestock. A wide spectrum of age classes of caprines and cattle can reflect again an autonomous livestock for different purposes (milk, meat, wool, traction). Equid remains, always scarce, belong to mature/old individuals, indicating the importance of this animal for not alimentary scope. During the Final Bronze Age pigs are less represented than caprines and cattle in most of South Tyrol sites. Exceptions are represented by the settlements of Eppan-Appiano and Pfatten-Vadena located south of Bolzano (RIEDEL 1985,

Table 3. Age profiles of main domesticates. Wear stages (WS) of cattle and pigs according to GRANT (1982). Age classes of caprines according to PAYNE (1973).

	Bos taurus							*Sus domesticus*							Caprines					
WS	BA	IA	RA I	RA II	RA III	LA	**WS**	BA	IA	RA I	RA II	RA III	LA	**Age**	BA	IA	RA I	RA II	RA III	LA
D4 a-b	0	1	0	1	0	0	**D4 a-c**	0	0	0	0	0	0	**A**	7	1	1	4	0	1
D4 c-e	4	1	0	1	1	0	**D4 d-e**	1	0	0	0	0	1	**B**	1	2	0	0	0	2
D4 f-j	2	0	0	0	0	1	**D4 f-j**	0	0	0	0	0	0	**C**	0	0	1	0	1	0
D4 k-n	3	0	0	0	0	0	**D4 k-m**	1	0	0	2	0	0	**D**	6	1	0	4	1	1
M3 a-b	2	0	0	1	1	0	**M3 a-b**	2	0	0	0	0	0	**E**	7	1	1	2	0	0
M3 c-f	3	2	0	1	0	1	**M3 c-f**	1	0	0	1	0	0	**F**	4	0	2	7	7	1
M3 g-j	7	1	0	3	0	1	**M3 g-j**	1	0	0	0	0	0	**G**	0	0	0	1	0	1
M3 k-m	1	0	0	2	0	0	**M3 k**	1	0	0	0	0	0							
Σ MNI	22	5	0	9	2	3	**Σ MNI**	7	0	0	3	0	1	**Σ MNI**	25	5	5	18	9	6

Figure 2. Bronze Age perforated caprine talus engraved with a chevron pattern (su 71; n°356).

Figure 3. Bronze Age worked red deer metatarsals. A: perforated on the proximal – ventral extremity (n° 1126); B: perforated on the distal extremity and flattened on the dorsal side (n°1138); C: perforated on the distal extremity (n° 1131); D: perforated on the distal extremity and flattened on the dorsal side (n° 1144).



2002). At Brixen – Via Monteponente, close to Elvas but near the valley bottom, pigs are nonetheless rare (TECCHIATI & NERI 2010). During the Luco cultural phase, the Natz-Schab plateau, where the site is located, was characterized by a high level of anthropization. In fact many settlements without defensive structures have been identified, probably interposed with crops and associated with terraces built up to better exploit the territory. Data suggests a quite stable political situation and a possible "collective" effort to structure this agricultural landscape (MARZATICO & TECCHIATI 2002). If these "scattered" settlements, probably widespread also in other parts of the Brixen Basin, were characterized by autarchic economies like the one hypothesized for Elvas-Kreuzwiese p. f. 574, the scarcity of pig remains in the area could be explained by the absence or scarcity of centres specialized exclusively in handcraft productions. The latter would have needed to acquire food (including meat) from other productive units. At Elvas wild taxa were rare during the Final Bronze Age, as already noted in other sites of the region. From an economic point of view, this indicates the secondary role played by hunting activities. Most of Bronze Age wild animal remains at Elvas belong to red deer and are represented, above all, by antlers or worked metapodials. This could indicate that, in most of the cases, deer skeletal elements were imported from other places.

As regards the worked deer metapodials from su 238, it is difficult to understand the function of such a tool. Flattened surfaces, when present, are located not only on the diaphysis but also on the distal articular surface. Lacking a microscopic analysis due to bad preservation of remains, it is not possible to distinguish flattened surfaces produced during tool shaping phase from those produced by use. For instance, if the tool was used for a working purpose, the articular end may have been a prehensile part and the flattened surface on this area would not have had a functional meaning. Holes are perpendicular to the polished surfaces and they could have been used to fix the bone on a support. In this case these worked bones could not have been used as skates or as elements for a sled, as it was hypothesized for flattened ungulate long bones from other sites (CHOYKE *et al.* 2003). Moreover it has to be underlined that two drilled metatarsals do not show any flattened surface.

Unfortunately Iron Age data are few for a good economic characterization of the site, whilst data are better for the Roman Imperial Age and especially for phase II. Anyway, after the Bronze Age Elvas seems to remain a settlement with an agricultural vocation: faunal composition is quite stable during the Iron Age and later phases and wild animals are always rare. Poultry never became an important resource. As in the Bronze Age, also in the Iron Age and Roman period equids remains belong always to mature/old individuals. Be they a kind of "status symbol" or animals with a functional meaning (transport, traction) equids were not slaughtered at a young age.

Even if biometric data is scarce, size of individuals from Elvas confirms what is known from other sites in the region: Bronze and Iron Age cattle were small sized (less than 110 cm of withers heigh) and the latter were replaced by larger individuals of improved breeds imported from the Italian peninsula during Romanization (RIEDEL 1986a; BOSCHIN & TOŠKAN 2012; PUCHER 2013; TRIXL *et al.* 2017). As already published in a previous work (Boschin & Weissteiner 2008) some small sized cattle are present at Elvas during the Roman Imperial Age (phase II). The presence in the Alpine-Adriatic region of different cattle breeds in Roman sites has been described in North-eastern Italy for the Roman city of Aquileia (Riedel 1979), in western Slovenia at Bukovica (Boschin 2013) and at some sites in Austria (Riedel 1993; Pucher & Schmitzberger 2003; Pucher 2006). This population is probably directly derived from the local small form which never disappeared from the region, thanks to its local survival or to the import of individuals from regions outside the imperial *limes*. No clear diachronic changes have been observed at Elvas for sheep, goat and pig body size, whilst two dog remains from the Imperial Age belong to individuals of different size. A better selection of dog breed for different purposes is well known in the Roman Age, even if a certain variability was observed in the Alpine area also for earlier periods (Riedel 2003; Boschin & Riedel 2011).

During the Roman Imperial Age, the scarcity of adult pig individuals can be indicative of an import of young individuals for meat from other sites, whilst the abundance of adult caprine individuals can be indicative of a more specialized production (wool?) or of exchanges or trades of young animals with other sites.

It is interesting to note that during the Iron Age, the Roman Age and Late Antiquity, pigs became more abundant in those sites located in the Brixen Basin, not far from Elvas but in the valley bottom. At Stufles – Hotel Stremitzer pig remains reached the 13.3 % of NISP. This percentage increases during the Roman Age at Stufles – Hotel Dominik (25.7 %) and Hotel Senoner (25.6 %) and decreases again in Late Antiquity at Hotel Stremitzer (15.4 %) (Riedel 1979, 1984, 1986b). This variation may reflect peculiar culinary habits and/or important cultural changes toward a more complex society: the development of urban contexts in the area, a possible increase in human population density and the presence of productive units specialized in handcraft activities, thus not independent for food, can be the reason for the presence of sites where pigs were more intensively bred. Also the change in caprine population structure during the Roman Age can be indicative of the fact that Elvas Kreuzwiese p. f. 574, even if maintaining agricultural characteristics, was placed in a more complex network of settlements with different vocations.

Reduction of cattle body size during Late Antiquity was already observed in Central Europe (for instance Riedel 1979; Toškan & Dirjec 2011; Boschin & Toškan 2012) and is interpreted as a husbandry based on local forms of pre-Roman origins (Bökönyi 1974). Available data highlights that this phenomenon took place in the peripheral part of the Roman Empire first, and only in later periods it can be detected in the lowlands of Northern Italy (Riedel 1979; Toškan & Dirjec 2011). Political and economic instability is supposed to be the reason for a return to a more autonomous food production which favoured again the breed of local cattle populations, but the few data available for Elvas do not permit to detect any change in subsistence economy at the boundary between the Imperial Age and Late Antiquity.

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Online Supplementary Material

Supplementary data associated with this article can be found, in the online version, at http://www.nhm-wien.ac.at/verlag/wissenschaftliche_publikationen/annalen_serie_a/120_2018

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Appendix 1 – Skeletal elements identified at the site (NISP)

Table 4. Bronze Age skeletal elements (NISP).

Bronze Age	BT	C/O	OA	CH	SD	Eq	CF	CE	CI	SS	LU	SU	unid.	Aves
antler								7						
horn core	5		1	4									1	
skull	25	16	1	1	11		1	1			18	7	48	
mandible	51	32	2		13					1	10	3	5	
isolated teeth	150	208	2	1	49	2	2			1	3		18	
hyoid												1		
cervical vertebrae	6	18			2		2			1	9	7		
thoracic vertebrae	2	22			1						11	5		
lumbar vertebrae	8	11									7	6	2	
sacral vertebrae	1	1									1			
caudal vertebrae													1	
unid. vertebrae											3	7	9	
ribs	2	3			1						90	97	23	
sternum											2	1		
coracoid														1
scapula	15	11	2	1		2	1			1	19	6	5	
humerus	19	19	6		5			2			16	14	1	
radius	19	32		1	2	1	1		1		3	9	2	
ulna	11	9		1	6				2		2		1	
carpal bones	10	3		1	1								1	
metacarpal	7	11	1	1	4	1	2				1	3		
innominate	17	7	2		2				1		7	1	3	
femur	9	9	2		1						6	12	1	
patella		1			1									
tibia	12	20			2		1	1			7	1		
tarsal bones	16	15	10	1	3						7	2	1	
metatarsal	15	15	4	1	1		1	4				1		
metapodials	6	16			2	1		1			8	4	2	
phalanx 1	18	19	7	6	1			1			1	1		
phalanx 2	11	13	4		3									
phalanx 3	10	2	2		4									
sesamoidal bones	3										1	1		
diaphyses											231	356	150	
unidentified													1693	
Σ NISP	448	513	46	19	115	7	11	17	4	4	463	545	1967	1

Table 5. Iron Age skeletal elements (NISP)

Iron Age	BT	C/O	OA	CH	SD	Eq	CF	CE	LU	SU	unid.	Aves
antler								1				
horn core												
skull		3	1	2					6	5	1	
mandible	5	6		1	1				2	3		
isolated teeth	16	50	1		5	2	1			18		
hyoid									1			
cervical vertebrae	3	3							1	4		
thoracic vertebrae									1	7		
lumbar vertebrae									1	3	1	
sacral vertebrae												
caudal vertebrae												
unid. vertebrae									1	4		
ribs									12	55		
sternum												
coracoid												
scapula		2	3						2	5	1	
humerus		2	2		1				1	2		1
radius	2	5								7		
ulna	3	1			1							
carpal bones		1	3	1								
metacarpal	2	1		2						1		
innominate		2							4	3		
femur		2	1						3	2	1	
patella			1									
tibia		4			1					1		
malleolar		1										
tarsal bones	5	3	3	2	1				1	1		
metatarsal		3	1							2		
metapodials		2			1					4		
phalanx 1	5		2	5						1		
phalanx 2	3	1	1					1				
phalanx 3												
sesamoidal bones												
diaphyses									35	90	86	
unidentified											345	
Σ NISP	44	92	19	13	11	2	1	2	71	218	435	1

Table 6. Roman Age (Phase I) skeletal elements (NISP)

Roman (phase I)	BT	C/O	OA	CH	SD	Eq	CE	LU	SU	unid.
antler							1			
horn core										
skull		9			1				1	
mandible	2	4			1					
isolated teeth	3	17			3	1				10
hyoid									1	
cervical vertebrae	1	4							6	
thoracic vertebrae		3						1	6	
lumbar vertebrae		1							5	2
sacral vertebrae								2	1	
caudal vertebrae		1								
unid. vertebrae									2	1
ribs								14	57	10
sternum										
coracoid	1	4						2	2	
scapula	2	6			2			1	1	
humerus	1	9								
radius	2	1							1	
ulna	1	1								
carpal bones										
metacarpal									1	
innominate	3	7								
femur		3						1	1	
patella										
tibia		5							1	
tarsal bones	2	4	4						1	
malleolar										
metatarsal	2	1		1					1	
metapodials	2									
phalanx 1		5	3							1
phalanx 2		4	1							
phalanx 3	1	1								
diaphyses								4	16	46
unidentified										142
Σ NISP	23	90	8	1	7	1	1	25	104	212

Table 7. Roman Age (Phase II) skeletal elements (NISP).

Roman (phase II)	BT	C/O	OA	CH	SD	Eq	CE	CF	Lsp	LU	SU	unid.	GG	Aves
antler							15							
horn core	1	2		3										
skull	28	10		3						7	2	16		
mandible	5	17			4			1		2				
isolated teeth	45	159	3		15	1				4		1		
hyoid	1	2									1			
cervical vertebrae	6	4			1					2	3			
thoracic vertebrae	10	14			1					2	9			
lumbar vertebrae	16	10								5	10	2		
sacral vertebrae	2	1												
caudal vertebrae	1	1									1			
unid. vertebrae	4									1	8	9		
ribs	11	11								40	122	29		
sternum		1								1				
coracoid	5	7			4					6	4	1		
scapula	11	13								6	7		1	2
humerus	4	10	2							1	5			
radius	7	10	2		2									
ulna	5	3												
carpal bones													1	
metacarpal	3	15		1	4					1				
innominate	4	7	1		3						1	1		
femur	3	2	1		2				1	1	5		1	1
patella														
tibia	3	13				1					4			
tibiotarsus													1	
tarsometatarsus														
tarsal bones	13	10	3		1						1			
malleolar	1													
metatarsal	5	7	1	1	1					1				
metapodials	9	3	1			1				1	3			
phalanx 1	8	7	3	3	2							1		
phalanx 2	4	6	3	1	2	1								
phalanx 3	2	1			2									
sesamoidal bones	1									1				
diaphyses										87	161	434		
unidentified												829		
Σ NISP	218	346	20	12	44	4	15	1	1	169	347	1323	4	3

Table 8. Roman Age (phase III) skeletal elements (NISP).

Roman (phase III)	BT	C/O	OA	CH	SD	Eq	CF	UA	LU	SU	unid.	GG	Aves
antler													
Horn core				1									
skull	1	3		1					1	4	1		
mandible	1	6					2			4			
isolated teeth	10	33			2	1	2		1		1		
hyoid										1			
cervical vertebrae		1								2			
thoracic vertebrae	1	2								2			
lumbar vertebrae	2	1								6			
sacral vertebrae									1				
caudal vertebrae													
unid. vertebrae									2	3	3		
ribs	3								8	34			
sternum													
coracoid	1	4								2	1		
scapula		1			1				1			2	
humerus	1	1											
radius	1	3											
ulna	1	1									1		
carpal bones													
metacarpal		4	1		1								
innominate		6								1			
femur		2	1										
patella													
tibia	2	1							1		1		
tibiotarsus													
tarsometatarsus													1
tarsal bones	1	4	3					1					
malleolar													
metatarsal									1				
metapodials	1	1							1				
phalanx 1		1		1									
phalanx 2		5	1										
phalanx 3	2	1											
sesamoidal bones	1												
diaphyses									8	34	83		
unidentified											247		
Σ NISP	29	81	6	2	4	1	4	1	25	93	338	2	1

Table 9. Late Antiquity skeletal elements (NISP).

Late Antiquity	BT	C/O	OA	CH	SD	Eq	CE	CF	FC	LU	SU	unid.	Aves
antler							1						
horn core	1												
skull		2			4						1	18	
mandible	2	7			1			1					
isolated teeth	7	22			4	1						323	
hyoid													
cervical vertebrae	2	2			1					1	3		
thoracic vertebrae		4								1	4		
lumbar vertebrae	2	3								2	7	1	
sacral vertebrae													
caudal vertebrae		1											
unid. vertebrae	2										1	3	
ribs	1									26	66		
sternum													
coracoid	2	1	1							2	2	2	
scapula	4	9								3	4	1	
humerus	4	6	1							1	1		
radius	5	3		1						1			
ulna	2	1										16	
carpal bones													
metacarpal			1	1	3								
innominate	6	9								1			
femur	1									1			
patella		1	1										
tibia	3	5							1				
tibiotarsus													
tarsometatarsus													
tarsal bones	3	4	2									57	
malleolar													
metatarsal		5		3									
metapodials		1									1		
phalanx 1	2			2		1				2	1		1
phalanx 2	2		1										
phalanx 3													
sesamoidal bones													
diaphyses										39	37	72	
unid.												268	
Σ NISP	51	86	7	7	13	2	1	1	1	80	128	761	1

Appendix 2 – Measurements

Table 10. *Bos taurus* measurements.

Bos taurus

Lower third molar

Phase	BA	BA	BA	BA	BA	BA	BA	BA	BA	BA	BA	BA	BA	BA	BA
GL	38.5	35.5	31	35.3	25.8	35.5	34.5	30	33.5	31	34.2	34.4	34.5	34.6	32.8
Phase	BA	IA	IA	IA	RA II	RA II									
GL	33.7	32	35.5	33	32.4	34.8									

scapula

Phase	BA	BA	BA	BA	BA	BA	RA I	RA II	RA II
SLC	43.5		43.5			36.8	50	53.7	47.6
LG	47.4	50		42.3	42	43.4	53.3		65
BG		34.7		37.2	34.5	34.2	44.1		48.6

humerus

Phase	RA II
BT	69.7

radius

Phase	BA	BA	BA	IA	RA II	LA	LA
Bp	69.4			60.6		90	
BFp	63.6			55.6	82.8	84	
Bd		61	67.2				66

metacarpal

Phase	BA	BA	BA	BA
GL	175	162	169	
Bp	55	44.5	51.4	
Dp	32.8	26		
SD		25.7	28.8	
Bd		47	58.4	46
Td	28.8	25		24.6
DD	19.6	17.6		

tibia

Phase	BA	BA
Bd	58.2	47.4

talus

Phase	BA	BA	BA	BA	RA II	RA II	LA
GLl	55.7	52.4		62	72.4		65.3
GLm	50.5	47.2	48.3		65.8	59.2	61.3
Dl	31.7	29.4			39.7		36.6
Bd	35.2	36.6	36.3		43.5		40

calcaneum

Phase	IA
GL	109

metatarsal

Phase	BA	BA	BA	BA	RA II	RA II
Bp			42.7	40		
SD	25.4			23.2	26.4	
Bd		42.6			52.2	54.2

first phalanx										
Phase	BA	BA	BA	BA	BA	BA	BA	BA	BA	RA II
GLpe	49.2	45.5	48.5	50	54					63
Bp	29.7	24.5	22.4	31	26.4	27				34.8
SD	26.7	20	17.5	26.3	22	20.5		19	20	27.2
Bd		22.4	20	30.2	24.5	22.2	21	20.5	21.5	30

second phalanx										
Phase	BA	BA	BA	BA	BA	BA	BA	RA II	RA II	LA
GL	31.6		31.7	31	38.5				38.5	45
Bp	27.5	20.1	23.3	22.5	29	24	21.6	23.2	26	34.2
SD	21.4	16	18.5	19	22.5	18.6	16.8		20.6	27.1
Bd		16.3		18.9	24	20.2	18.1		23	29.1

third phalanx									
Phase	BA	BA	BA	BA	BA	BA	BA	RA II	RA III
DLS	48.5	88.4	49	52.4	42.8		58.8	72	48.4
LD	39.4	65.8			37.8		43.4	54.8	37.8
MBS	17.3	28.4	15.8	15.4	14		18.9	22	14.2

Table 11. *Ovis aries* measurements.

Ovis aries

scapula					
Phase	BA	BA	IA	IA	LA
SLC	20.2		20.5	17.7	20.5
LG	29.6	27.6	24.7		25.3
GLP	37.4				33.7
BG	24.2	21	20.9		22

humerus			
Phase	BA	BA	BA
Bd	32	32.5	34.4
BT	29	30	31

radius		
Phase	RA II	RA II
Bp	36.4	33.6
BFp	34.8	31.6

metacarpal		
Phase	BA	RA III
Bp	27	24.1
Dp	19.5	

femur	
Phase	RA III
GLl	190
GLC	185
Bp	38.8
SD	17
Bd	36.7

calcaneum		
Phase	BA	RA I
GL	59	58.8

talus									
Phase	BA	BA	BA	BA	BA	BA	BA	BA	IA
GLl		33.6	29.3	28.7	30.2	28.6	29.4	31.4	31.5
GLm	28	32	28		28.5	28.2		30	30
Dl			16	16	16.8	16		17.8	17.6
Bd			19		19.2	19.2		20.3	20.8
Phase	RA I	RA I	RA II	RA II	RA III	RA III	RA III	LA	LA
GLl	31.1	28.3	26.3	29.7	29.5	29	31.6	29.5	32.3
GLm	30.1	26.7	25.2	28.4	27.4	27.4	30	28	
Dl	17.5	16.2	15	17.5	16	16	17.2		17.8
Bd	20.5	20.6	17.9	20.9	19.7	19.4	20.4	18.7	

metatarsal				
Phase	BA	BA	BA	RA II
GL	152	143		
Bp	21.1	25	22.5	20
Dp	20.5	19		
SD	12.2	14.3		
Bd	25			
Td	17.2			
DD		10.8		

first phalanx											
Phase	BA	BA	BA	BA	BA	BA	IA	RA I	RA I	RA I	RA II
GLpe	32.6	29.3	44.4	34.8	34.6		39.9	37	34.3	38.9	34.6
Bp	12	14	15.3	12.4	13			12.6	13.2	13.5	12
SD	10.3	12.4	12.3	10	10.9	11.5		9	10.6	10.4	9
Bd	10.9	13	14.6	12.2	12.4	14.3	9.2	11.5	12	12.3	11

second phalanx									
Phase	BA	BA	BA	RA I	RA II	RA II	RA II	RA III	LA
GL	24	21	25	25	22.5	26.6	22.1	22.7	22
Bp	13.2	11.8	13	12	12	10	10.7	12	10.1
SD	10.2	8.7	10	8.5		7	7.4	9	7.7
Bd	10.8	9.2	10.2	9.6	9.7		8.4	10	9

Table 12. *Capra hircus* measurements.

Capra hircus

horn core	
Phase	BA
41	28.5
42	19.7

metacarpal		
Phase	BA	RA II
GL	110	116.7
Bp	25	23
Dp	18	
SD	16.6	14
DD	10.3	
Bd	28	26.8

talus	
Phase	IA
GLl	30.3
GLm	27.5
Dl	17
Bd	20

metatarsal					
Phase	RA I	RA II	LA	LA	LA
GL		124.5	131	132	131
Bp	19.3	19.6	20.4	19.5	20.2
SD	11.2	12.7	12.4	12.6	12
Bd	23.6	23.4	24.3	24.6	24

first phalanx								
Phase	BA	BA	BA	RA II	RA II	RA II	RA III	LA
GLpe	41	35	35.6	39.4	39	38.8	39.3	39.4
Bp	13	13.4	12.7	13	12.9	13.5		
SD	11.2	10.4	9.4	10.4	10.3	11.8		10.3
Bd	12.7	12.6	11	12.5	12.7	13	12.6	13.2

second phalanx	
Phase	RA II
GL	25
Bp	13.3
SD	9.5
Bd	10.5

Table 13. *Sus domesticus* measurements.

Sus domesticus

Upper third molar		
Phase	BA	BA
GL	30.2	35.4

Lower third molar						
Phase	BA	BA	BA	BA	BA	BA
GL	34.7	33.5	34.2	32	35.9	32.6

talus		
Phase	BA	RA II
GLl	38	36.6
GLm	35	35
Bd	23	21.3

first phalanx	
Phase	RA II
GLpe	38.6
Bp	16.4
SD	12.4
Bd	15.5

second phalanx				
Phase	BA	BA	BA	RA II
GL	25.2	23.1	21.4	20.4
Bp	16.5	15.8	15.4	14.4
SD		12.4	11.8	
Bd		12		

Table 14. Equids measurements

Equus caballus metacarpal	
Phase	BA
GL	204
GLl	201
Ll	198
Bp	41.3
SD	26.2
Bd	45
DD	18.9

Equus sp. tibia	
Phase	RA II
Bd	64

Equus sp. second phalanx	
Phase	RA II
GL	42.4
Bp	48.6
SD	42.6
Bd	48.1

Table 15. *Canis familiaris*, *Ursus arctos, Felis catus* and *Gallus gallus* measurements.

Canis familiaris – mandible

Phase	RA III	RA III
1	121.8	
2	124.5	
3	116.2	
4	104.3	
5	98.7	
6	102.6	
7	71.2	
8	66.2	
9	57.5	
10	34.6	
11	33.5	
12	29.7	
14	19.3	
17	10.8	
18	51	
19	21.9	
20	16.4	20.4

Canis familiaris – metacarpal III

Phase	BA
GL	62.5

Ursus arctos – talus

Phase	RA III
GL	47

Felis catus

Phase	LA
Bp	17

Gallus gallus – humerus

Phase	RA II	RA III	RA III
SD		6.2	
Bd	22.3	15	13.8

femur

Phase	RA II
GL	78

tibiotarsus

Phase	RA II
Bd	11