Animal Bones from Aramus, Armenia, Excavation 2004

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1. Introduction

After a preliminary survey in autumn 2003 the site of Aramus, county Kotayk, Armenia (fig. 10) was chosen for an archaeological joint venture project between the University of Innsbruck, Austria and the Yerevan State University, Armenia. The project is planned for a five-year period. The first campaign was carried out in September 2004.

The excavation site is a prehistoric fortress situated on a hilltop 1500 m above sea level, ca. 20 km north-east of Yerevan (fig. 10-11) and a few hundred metres north-west of the present village Aramus. The architecture of the fortress, pottery and a few bronze objects found within the site assign the settlement to the kingdom of Urartu founded in the 1st millenium BC. A cuneiform inscription found in 1960 nearby points to a possible connection between the site and the city of Darani conquered by the Urartian king Argishti I in the 8th century BC (AVETISYAN 2001, 44-46; BAUER-MANNDORF 1984, 119). One major aim of the current project is to shed light on the development and decline of the kingdom of Urartu in relation to the preceding and subsequent social and political structures in the region.

In the planning of the Aramus project environmental archaeology was seen as an important part of the research. The authors took part in the first campaign to assess the potential of specific environmental archaeological methods to produce evidence at the Aramus site. During excavation it became soon obvious that the preservation conditions for organic material in the fine clay soil were excellent. Due to limited resources of time and manpower, efforts in environmental archaeology concentrated on human remains, plant macrofossils and animal bones. This paper will reveal the information retrieved from the animal bones, while the former are dealt with elsewhere in this volume.

Previous archaeological work at the site of Aramus was undertaken by VANZANDYAN in 1966 and by AVETISYAN in 1988 (AVETISYAN 2001, 37). While no archaeozoological data are available from the first excavation, AVETISYAN reports “fragments of large and small horned animals” from the rooms 1 and 3 – 7 in the 1988 excavated area. The find of the “whole skull of a bull” in room 5 is emphasised (AVETISYAN 2001, 39-43). Provided the analyst was familiar with the zoological terminology, this information can be considered as the presence of species of the family Bovidae (cattle, sheep, goat, gazelle). In room 6 “a great number of charred animal bones” was recovered. Additionally one “button from bone” is mentioned from room 7 (AVETISYAN 2001, 42-43, 50).

2. Material and Methods

During the 2004 excavation campaign, 2002 bone fragments were recovered. On site the finds were carefully cleaned with cold water and brushes, then dried, bagged and labelled stratigraphically separated. Matching fragments (n = 217) were glued together with white carpenter glue (Uhu Holz-Expressleim, Bindan-P Propellerleim). This reduced the number of

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bones to a total of 1860. Each bone was labelled with black ink with a code consisting of site-shortcut (AR), year (04), stratigraphic unit and bone number (e. g. AR04/d021/654). The bulk of the material (n = 1645) was sampled by hand collection. Great accuracy can be attested to the students and volunteers, even bones of very small species were found, which is unusual for hand-collected assemblages. An additional amount of 215 very small fragments were extracted from two wet sieved samples from stratigraphic unit d 011 (total volume 20 litres).

The bones were identified by the authors using the reference collections of the Institute of Zoology, Armenian National Academy of Sciences (ANAS), Yerevan, Armenia, the Institute of Anatomy, University of Veterinary Medicine Vienna, Austria and the Archäologisch-Zoologische Arbeitsgruppe Schleswig – Kiel (AZA), Archäologisches Landesmuseum Schleswig-Holstein, Schleswig, Germany with support of Gerhard Forstenpointner and Alfred Galik. Rodents were additionally checked against specimens from the skeletal collection of the Natural History Museum Vienna (NMW)[2]. Fish bones were determined by Alfred Galik. In addition to reference material, identification criteria were employed from the publications of BOESSNECK et al. (1964), BROHMER (1984), COHEN & SERJEANTSON (1996), ENGELMANN et al. (1986, 124-134), PRUMMEL & FRISCH (1986), SCHMID (1972) and SPITZENBERGER (2001). Each specimen was monitored for a set of archaeozoological data (skeletal element, body side, species, age, sex, pathology, anatomic measurements) and taphonomic features (tool marks, traces of fire, animal gnawing, weathering, trampling, root etching). Measurements were taken with callipers according to VON DEN DRIESCH (1976a, 1976b). Data about geographical distribution of species was obtained from ADAMIAN & KLEM (1997), DAL (1954), ENGELMANN et al. (1985), GEPNER & NAUMOV (1972), HEINZEL et al. (1972) and OGANESSYAN (pers. com. 7-10/2005). Applied geographic distribution data relies on the assumption that species distribution has not changed substantially since the time of the site inhabitation. Domestic species were named after the recent ruling of the International Commission on Zoological Nomenclature (ICZN) (GENTRY et al. 2004). The analysed material is stored at the Institute of Zoology, ANAS, Yerevan, under the supervision of Nina Manaseryan, except for two human bones (no. 122, 435) belonging to the skeleton from grave 1, which is stored at the History Museum of Yerevan[3] under the supervision of Armine Sargsian.

The bone finds were excavated from two different areas within the site: from the eastern part of the acropolis (area A, n = 1585) and the western part of the acropolis (area B, n = 275). Area A is a rectangular shaped ditch measuring 41,5 x 5,3 m, area B traced the outline of the rooms 5 and 6 of the 1988 excavation. The volumes of soil of each period moved were different (tab. 1), causing a bias in comparability. Additionally, it has to be mentioned that the layers of period II were removed with less accuracy and coarser tools (e. g. shovel, pick-axe) than the layers of period III, meaning that the probability of overseen finds will be higher in period II. Chronological and cultural data from specific layers was not available at the time of writing. Instead a relative chronology according to the stratigraphy of the site as shown in the Harris-Matrix (fig. 12) was used, which resulted in a grouping of the finds from area A into three distinguishable periods[4] (tab. 1). The bones from area B were not stratigraphically separated during excavation and thus cannot be attributed to a specific cultural or time period.

[2] *Spalax graecus* (NMW 2158), *Spalax microphtalmus* (NMW 2433), *Allactaga major* (NMW no no.), *Cricetulus migratorius* (NMW 18268), *Ellobius fuscocapillus* (NMW 12052).

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[4] Recent Archaeological results open the possibility of a 2nd interpretation with only two different periods.

Tab. 1: Chronological grouping of animal bone finds from Aramus, Armenia, excavation 2004, area A

period	phase	stratigraphic units	volume of soil[1] (m^3)	no. of bones
surface layer		d 001		**110**
I	a - b	s 002, d 002, d 003, d 005, d 007, grave 1	**10**	**525**
II	c	s 006, d 011, d 012, d 018, d 021	**21**	**740**
III	e - f	d 009, d 013, d 014, d 019, d, 022, d 023	**6**	**148**

not yet assigned: d 004 (2 bones), d 016 (51 bones) and Locus DOST IV (9 bones)
1 = approximate values

3. Results

3.1 Archaeozoology

Before presenting the archaeozoological data, it has to be noted that six human bones were found mixed within the animal remains. These include a processus coronideus of a left mandibula (grave1/435), a 1st toe joint of a 2nd toe (phalanx 1 • II posterior, s002/122), a fragment of a left radius (d003/404), a left 5th metatarsus (d012/528), a left 3rd metacarpus (d016/857) and a pelvis fragment (d021/709). The processus coronideus matches with the mandibula of the female skeleton from grave 1. The toe joints of the skeleton are missing and since bone no. 122 was found in the vicinity of the grave and its age status fits to that of the skeleton, this phalanx derives almost certain from the same individual. This does not however hold true for the remaining four human bones. Metatarsus no. 528 belongs to a juvenile individual less than 19 years old. Being younger than the buried woman, it cannot be attributed to grave 1. Bones no. 404, 709 and 857 cannot belong to the skeleton either, as they exist twice (GANTNER personal communication 12/2004 – 1/2005; see also article by GANTNER in this volume). This proves that at least two individuals are extant. If the contextual information is taken into account, revealing that fragment 528 and 709 are from period II, while fragment 404 is from period I, the minimum number of human individuals present is three.

Turning to the animal bones, an overview shows that all vertebrate classes (fish, amphibians, birds, mammals) are represented except reptiles. 867 bones (46,7 %) could be identified at least to order level[5]. Table 2 presents the species representation of the whole assemblage and the distribution over the chronological periods. Tables 3 – 5 show the details for the sub-samples of periods I – III. Not unexpected for a fortified settlement comes the result that domestic mammals comprise the overwhelming part of the bone assemblage. Wild mammals are on second rank, but like all other vertebrates, are represented only by singular bones. The number of bones of each period ranging from 740 to 148 is too low for a reasonable comparative statistical analysis. Therefore it has to be kept in mind that all results concerning species, skeletal element or age distribution are highly susceptible to random bias and have to be valued as tendencies only.

Anatomical measurements could be taken from 136 bones, but only 72 were completely preserved, allowing the whole set of measurements to be taken (tab. 11). 26 of the measurable bones are from species for which not enough comparative data was available to draw further conclusions (6 x hare, 18 x birds, 2 x rodents). The majority of the remaining domestic mammal bones (n = 104) are compact bones of the foot-joints (autopodium, n = 73) or vertebrae (n = 7), for which no analytical data about a direct relation between bone and body size exist at present. Consequently the database for a metrical analysis is very small and does

[5] The number of bones determinable to taxa higher than class is a standard figure in archaeozoology named number of identified specimen (NISP).

not allow a general picture about size, stature or other phenotypical data of the domestic animals bred. Only three bones provided criteria for morphological sexing.

Tab. 2: Species representation of animal bones from Aramus, Armenia, excavation 2004, area A & B

species		number of bones						
		area A					area B	total
		surface layer d 001	period I	period II	period III	not assigned features[1]	room 5 + 6	
domestic mammals	**Mammalia**							
cattle	*Bos taurus*	8	53	79	19	8	17	**184**
domestic sheep	*Ovis aries*	7	22	6	4	–	1	**40**
domestic goat	*Capra hircus*	–	4	5	4	–	1	**14**
sheep / goat	*Ovis / Capra*	25	76	55	27	7	37	**227**
domestic pig	*Sus domesticus*	11	50	26	3	2	7	**99**
domestic horse	*Equus caballus*	–	–	3	1	–	–	**4**
donkey	*Equus asinus*	–	–	1	–	–	–	**1**
dog	*Canis familiaris*	–	1	1	2	2	2	**8**
total domestic mammals		**51**	**206**	**176**	**60**	**19**	**65**	**577**
wild mammals	**Mammalia**							
red fox	*Vulpes vulpes*	–	2	–	–	–	3	**5**
hare	*Lepus europaeus*	–	1	–	1	–	6	**8**
family rats and mice	Muridae	–	–	–	1	–	–	**1**
Persian jird, gerbil	*Meriones persicus*	–	4	169	–	–	–	**173**
golden hamster	*Cricetus auratus*	–	1	2	3	–	–	**6**
jerboa	*Allactaga williamsii*	–	4	–	–	–	–	**4**
common vole	*Microtus arvalis*	–	2	–	–	–	–	**2**
order rodents	Rodentia indet.	–	4	32	–	–	19	**55**
total wild mammals		**–**	**18**	**203**	**5**	**–**	**28**	**254**
man	*Homo sapiens*	–	3	2	–	1	–	**6**
total identified mammals	**Mammalia**	**51**	**227**	**381**	**65**	**20**	**93**	**837**
unidentified mammals	Mammalia indet.	57	280	151	79	41	179	**787**
total mammals	**total Mammalia**	**108**	**507**	**532**	**144**	**61**	**272**	**1624**
birds	**Aves**							
domestic cock	*Gallus gallus*	–	1	–	–	–	–	**1**
family pheasants and fowl	Phasianidae	1	5	–	–	–	–	**6**
gadwall	*Anas strepera*	–	–	–	–	–	1	**1**
carrion crow	*Corvus corone*	–	–	–	2	–	–	**2**
black-billed magpie	*Pica pica*	–	1	–	–	–	–	**1**
common starling	*Sturnus vulgaris*	–	7	–	–	1	1	**9**
house sparrow	*Passer domesticus*	–	–	–	–	–	1	**1**
singing birds	Passeriformes	–	3	–	–	–	–	**3**
unidentified birds	Aves indet.	1	1	–	1	–	–	**3**
total birds	**total Aves**	**2**	**18**	**–**	**3**	**1**	**3**	**27**
amphibians	**Amphibia**							
genus toads	*Bufo* sp.	–	–	–	1	–	–	**1**
true frog	*Rana macrocnemis camerani*	–	–	1	–	–	–	**1**
total amphibians	**total Amphibia**	**–**	**–**	**1**	**1**	**–**	**–**	**2**
fish	**Pisces**							
family salmons and trouts	Salmonidae	–	–	1	–	–	–	**1**
family minnows	Cyprinidae	–	–	3	–	–	–	**3**
family perches	Percidae	–	–	2	–	–	–	**2**
unidentified fish	Pisces indet.	–	–	19	–	–	–	**19**
total fish	**total Pisces**	**–**	**–**	**25**		**–**	**–**	**25**
unidentified vertebrates	Vertebrata indet.	–	–	182	–	–	–	**182**
NISP[2]		**52**	**244**	**387**	**67**	**21**	**96**	**867**
total bones		**110**	**525**	**740**	**148**	**62**	**275**	**1 860**

1: stratigraphic units d 004, d 016, Locus DOST IV
2: number of identified specimen = total bones exclusive Mammalia indet., Aves indet., Pisces indet.

3.1.1 Period I

Species and skeletal element representation

Out of a total of 525 bones from period I approximately the half (n = 244; 46,5 %) could be identified to order level or higher (tab. 3). Period I includes the highest amount of domestic mammals (n = 206) with sheep and goat (*Ovis* / *Capra*) ranking first (n = 104), followed by cattle (*Bos taurus*, n = 53) and pig (*Sus domesticus*, n = 50) in equal parts. Judged by the bone weight, cattle is the most important species followed by sheep / goat and pig. In layer d 002 one toe joint (phalanx 1) of a dog (*Canis familiaris*) was found. Of the 18 wild mammal bones 15 were of rodents, none of which can be attributed with certainty to period I as the animals may be intrusive. Four of the rodent bones belong to gerbils (sub-family Gerbillinae), most probably to the species Persian jird (*Meriones persicus*, fig. 3b)[6]. Four hind limb elements belong to jerboas (family Dipodidae). Ecologic habitat needs and geographic distribution restricts these to the species *Allactaga williamsii* (DAL 1954, 162-163; OGANESSYAN, pers. com. 7 - 10 / 2005). A cranium and a mandibula belong to the genus voles (*Microtus*). Since all other species of the genus *Microtus* can be ruled out for morphologic or geographic distribution reasons this belongs almost certainly to the common vole (*Microtus arvalis*) (DAL 1954, 169-172; OGANESSYAN, pers. com. 7 / 2005; 10 / 2005). Another skull is from a golden hamster (*Cricetus auratus*). The remaining three wild mammal bones include a cranium fragment (frontale) and a tooth of a red fox (*Vulpes vulpes*) and an ulna of a hare (*Lepus europaeus*). As several obviously inhabited fox dens could be observed at the site, it cannot be excluded with certainty that these fox bones are modern intrusions too. The hare bone showed carnivore bite marks and therefore it is possible that it was part of a modern fox meal instead of an Urartian dish. Assumed that the fox and hare bones are contemporary with the archaeological layer, this would result in a domestic to wild mammal ratio of 69 : 1 (excluding rodents).
A comparatively high number of bird bones (n = 18) was retrieved from period I layers. Six of these are from members of the family Phasianidae (pheasants and fowl). One pelvis fragment (grave1/448) belongs to a domestic cock (*Gallus gallus*), three others (d002/377, 381, 384) are either Caucasian black grouse (*Tetrao mlokosiewiczi*) or domestic cock. The remaining birds (n = 10) belong to the order singing birds (Passeriformes). Seven of them could be identified as common starling (*Sturnus vulgaris*, fig. 1). The fact that nearly all singing bird bones were from period I layers evokes the question, did they have a special significance in that phase? Have they been selectively harvested or is this just a random bias? Another possible scenario may arise out of the fact that starlings are nesting in cavities of cliffs or buildings (ADAMIAN & KLEM 1997, 136; AGHABABYAN, pers. com 10 / 2005). They might have used the clay brick walls of the fortress (ruins) for accomodation.

A view on the skeletal element distribution of cattle (tab. 7), sheep / goat (tab. 8) and pig shows that all body parts (skull, spinal column, fore limb, hind limb, feet[7]) are present. In cattle and pig an overrepresentation of the feet is visible, while in sheep / goat all body parts are equally distributed. This is expressed also in the low minimum number of individuals (MNI) allowing only evidence of three pigs, two cattle and five sheep / goat.

A selective view at the finds from grave 1 does not reveal any extraordinary features. Apart from the human mandibula fragment, the 15 animal bones comprise a broad spectrum of taxa (cattle, sheep / goat, pig, cock, vole rat) not significantly distinct from the overall pattern.

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[6] Three species of *Meriones* inhabit the region of Kotayk: *M. persicus*, *M. blacklerii* and *M. vinigradovii* (DAL 1954, 167-168; GEPNER & NAUMOV 1972, 167; OGANESSYAN, pers. com. 10 / 2005). The bones match perfectly with *M. persicus*, which is smaller than the latter species. However, since reference skeletons of *M. blackleri* and *M. vinogradovii* were not available, they cannot be ruled out with certainty at present.

[7] Although they are belonging to the limbs in strict sense, the foot bones are separated here because of their specific anatomical properties further explained in chapter 3.2.

Tab. 3: Species representation of animal bones from Aramus, Armenia, excavation 2004, area A
Period I, phase a – b, stratigraphic units s 002, d 002, d 003, d 005, d 007, grave 1

species		**no. of bones**	**relative amount**		**min. no. of individuals**[2] (MNI)	**bone weight**	**relative weight**	
			of no. of bones %	of NISP[1] %		g	of no. of bones %	of NISP[1] %
domestic mammals	**Mammalia**							
cattle	*Bos taurus*	53	10,1	21,7	2	1 122,5	42,7	57,5
domestic sheep	*Ovis aries*	22	4,2	9,0	2	142,0	5,4	7,3
domestic goat	*Capra hircus*	4	0,8	1,6	1	40,5	1,5	2,1
sheep / goat	*Ovis / Capra*	76	14,5	31,1	2	318,0	12,1	16,3
domestic pig	*Sus domesticus*	50	9,5	20,5	3	292,5	11,1	15,0
dog	*Canis familiaris*	1	0,2	0,4	1	0,5	0,02	0,03
total domestic mammals		**206**	**39,2**	**84,4**	**11**	**1 916,0**	**72,9**	**98,2**
wild mammals	**Mammalia**							
red fox	*Vulpes vulpes*	2	0,4	0,8	1	1,5	0,06	0,08
hare	*Lepus europaeus*	1	0,2	0,4	1	1,5	0,06	0,08
Persian jird, gerbil	*Meriones persicus*	4	0,8	1,6	2	2,5	0,1	0,1
golden hamster	*Cricetus auratus*	1	0,2	0,4	1			
jerboa	*Allactaga williamsii*	4	0,8	1,6	1			
common vole	*Microtus arvalis*	2	0,4	0,8	1			
order rodents	Rodentia indet.	4	0,8	1,6	–	1,0	0,04	0,05
total wild mammals		**18**	**3,4**	**7,4**	**7**	**6,5**	**0,2**	**0,3**
man	*Homo sapiens*	3	0,6	1,2	2	14,5	0,6	0,7
total identified mammals	**Mammalia**	**227**	**43.2**	**93,0**	**21**	**1 937,0**	**73,7**	**99,3**
unidentified mammals	Mammalia indet.	280	53,3	–	–	678,5	25,8	–
total mammals	**total Mammalia**	**507**	**96,6**	**93,0**	**21**	**2 615,5**	**99,5**	**99,3**
birds	**Aves**							
domestic cock	*Gallus gallus*	1	0,2	0,4	1	7,0	0,3	0,4
family pheasants & fowl	Phasianidae	5	1,0	2,0	1	5,5	0,2	0,3
black-billed magpie	*Pica pica*	1	0,2	0,4	1	0,5		
common starling	*Sturnus vulgaris*	7	1,3	2,9	1	0,5	0,02	0,03
singing birds	Passeriformes.	3	0,6	1,2	–	0,3	0,01	0,02
unidentified birds	Aves indet.	1	0,2	–	–	0,2	0,01	–
total birds	**total Aves**	**18**	**3,4**	**7,0**	**4**	**14,0**	**0,5**	**0,7**
NISP[1]		**244**	**46,5**	**100,0**	**25**	**1 950,8**	**74,2**	**100,0**
total bones		**525**	**100,0**		**25**	**2 629,5**	**100,0**	

1: NISP = number of identified specimen = total bones exclusive Mammalia indet., Aves indet.

2: MNI greater than 1 are evident by the following skeletal elements:
2 individuals of *Bos* by 2 left metacarpi (proximal end); 2 individuals of *Ovis* by 2 left ulnae (proximal end); 2 individuals of *Ovis / Capra* by 2 right mandibulae (facies articularis), 2 right metacarpi (proximal end), 2 left femora (distal end) and 2 right metatarsi (proximal end); 3 individuals of *Sus* by 3 left humeri (proximal end); 2 individuals of *Meriones* by 2 left pelves

a b

Fig. 1: Common starling (*Sturnus vulgaris*): a) skeletal remains from Aramus; from left to right: right tibiotarsus, right tarsometatarsus, left humerus, right humerus, right ulna, right femur, right coracoid (bone no. 386, 387, 411, 413 - 416; length no. 411 = 27,2 mm) (Foto: Pfisterer); b) habitus (from ADAMIAN & KLEM 1997, 137)

Age, size and sex data

16 cattle, 25 pig and 43 sheep / goat bones allowed age estimation by tooth eruption or epiphysis fusion stages[8] (fig. 2, tab. 9). The assembled data show that most cattle were slaughtered between 1 – 3 years. Sheep and goat were spread over the age classes showing no peak in a certain age, but no specimen over five years was found. Only one bone of a pig older than 4 years was present, while most of the pigs did not survive the age of two years. The already mentioned fox cranium and one of the jird bones belonged to juvenile individuals. Two of the four Phasianidae bones were from juveniles, while all singing birds were adult. None of the bones from period I allowed morphological sexing.
50 bones from period I allowed measurement (tab. 11). Twelve of these were from birds and two from rodents. One ulna (d002/155) and one radius (d002/156) of a single sheep that articulate together were completely preserved. After TEICHERT (1975, tab. 4) this sheep had a withers height of 62,5 cm (GL of radius x factor 4,02). The remaining measurable domestic mammal bones were either foot bones (n = 25) or vertebrae (n = 3) or only partly preserved. As mentioned before, no body size can be calculated from these skeletal elements, but compared with published data from other sites they seem to be from small animals (e. g. KOKABI 1982, 82-83; REICHSTEIN 38-53, 172, 188). Although not measurable, one rib of a pig (s002/119) is quite large and may belong either to a wild boar or to an intruded modern domestic pig. One pig radius (d002/365) is affected by pathology (callus tissue at the lateral side).

[8] The crux with ageing data is that in most cases the epiphyseal fusion stage does only give a terminus ante or post quem. Only in a few occasions (tooth status in juvenile mandibles, visible fusion lines, neonates) an exact age or a time span can be obtained.

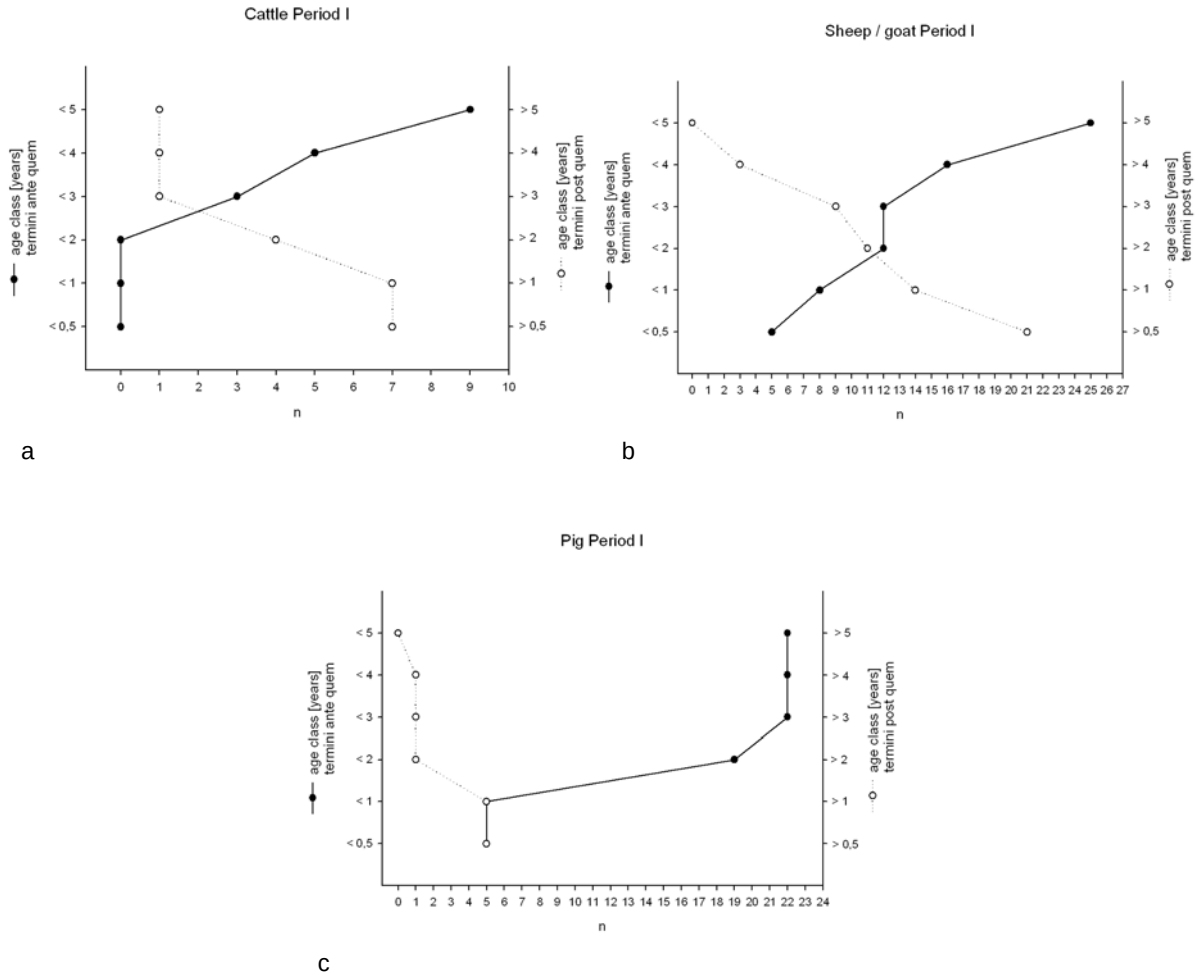


Fig. 2: Age spectrum of the most abundant domestic species from Aramus, area A, **Period I**
a) cattle (*Bos taurus*), b) sheep / goat (*Ovis* / *Capra*), c) pig (*Sus domesticus*)

3.1.2 Period II

Species and skeletal element representation

From period II layers 740 fragments were recovered, of which 387 (52,3 %) were identifiable (tab. 4). The most outstanding figure in period II is the unexpected high amount of wild mammals (n = 203). This is caused by 169 jird bones (*Meriones persicu*s, fig. 3). The majority of these (n = 129, d012/69-113), belonging to a minimum number of three individuals, was found together, partially articulated in a burrow in stratigraphic unit d 012. Breeding burrows of *Meriones* can be over one metre deep (PIECHOCKI 1977a, 342), while layer d 012 is situated approximately half a meter below the surface. These individuals obviously dug themselves into the already stratified layer and died there. Since not enough data about historical gerbil distribution is available at present, it cannot be ruled out, that gerbils were living in Aramus even in prehistoric times. But, although jirds do live in the vicinity of human settlements, they are freeland species and do not follow human civilization into building structures like the rat (*Rattus* sp.) and the house mouse (*Mus musculus*) (PIECHOCKI 1977a, 342-343). All these arguments add weight to the assumption that the gerbils are modern intrusions. For the remaining 34 rodent bones, two of which are of a golden hamster (*Cricetus auratus*, d011/497, d012/535), it cannot be ruled out that they may be intrusive. Except these micro-mammals no other wild mammals were found in period II.

Tab. 4: Species representation of animal bones from Aramus, Armenia, excavation 2004, area A
Period II, phase c, stratigraphic units s 006, d 011, d 012, d 018, d 021

Species		**no. of bones**	**relative amount**		**min. no. of indivi-duals**[2] (MNI)	**bone weight**	**relative weight**	
			of no. of bones %	of NISP[1] %		g	of no. of bones %	of NISP[1] %
domestic mammals	**Mammalia**							
Cattle	*Bos Taurus*	79	10,7	20,4	2	1 737,5	68,1	71,0
domestic sheep	*Ovis aries*	6	0,8	1,6	1	25,0	1,0	1,0
domestic goat	*Capra hircus*	5	0,7	1,3	1	35,0	1,4	1,4
sheep / goat	*Ovis / Capra*	55	7,4	14,2	3	345,5	13,5	14,1
domestic pig	*Sus domesticus*	26	3,5	6,7	2	244,5	9,6	10,0
domestic horse	*Equus caballus*	3	0,4	0,8	1	36,5	1,4	1,5
Donkey	*Equus asinus*	1	0,1	0,3	1	1,5	0,1	0,1
Dog	*Canis familiaris*	1	0,1	0,3	1	6,5	0,3	0,3
total domestic mammals		**176**	**23,8**	**45,5**	**12**	**2 431,5**	**95,4**	**99,3**
wild mammals	**Mammalia**							
Persian jird, gerbil	*Meriones persicus*	169	22,8	43,7	3	7,0	0,3	0,3
golden hamster	*Cricetus auratus*	2	0,3	0,5	1	0,0[3]	–	–
order rodents	Rodentia indet.	32	4,3	8,3	–	1,0	0,04	0,04
total wild mammals		**203**	**27,4**	**52,5**	**4**	**8,0**	**0,3**	**0,3**
Man	*Homo sapiens*	2	0,3	0,5	1	8,0	0,3	0,3
total identified mammals	**Mammalia**	**381**	**51,5**	**98,4**	**17**	**2 447,5**	**96,0**	**100,0**
unidentified mammals	Mammalia indet.	151	20,4	–	–	96,0	3,8	–
total mammals	**total Mammalia**	**532**	**71,9**	**98,4**	**17**	**2 543,5**	**99,7**	**100,0**
Amphibians	**Amphibia**							
true frog	*Rana macrocnemis camerani*	1	0,1	–	1	0,0[3]	–	–
total amphibians	**total Amphibia**	**1**	**0,1**	**–**	**1**	**0,0[3]**	**–**	**–**
Fish	**Pisces**							
family salmons and trouts	Salmonidae	1	0,1	0,3	1	0,0[3]	–	–
family minnows	Cyprinidae	3	0,4	0,8	1	0,0[3]	–	–
family perches	Percidae	2	0,3	0,5	1	0,0[3]	–	–
unidentified fish	Pisces indet.	19	2,6	–	–	0,0[3]	–	–
total fish	**total Pisces**	**25**	**3,4**	**1,3**	**3**	**0,0[3]**	**–**	**–**
unidentified vertebrates[4]	Vertebrata indet.	182	24,6	–	–	6,5	0,3	–
NISP[1]		**387**	**52,3**	**100,0**	**21**	**2 447,5**	**96,0**	**100,0**
total bones		**740**	**100,0**		**21**	**2 550,0**	**100,0**	

1: NISP = number of identified specimen = total bones exclusive Mammalia indet., Pisces indet., Vertebrata indet.
2: MNI greater than 1 are evident by the following skeletal elements:
2 individuals of *Bos* by 2 right humeri (distal end); 3 individuals of *Ovis / Capra* by 3 left third mandibular molars (M 3) and 3 left humeri (distal end); 2 individuals of *Sus* by 2 left 4th mandibular milk praemolars (Pd 4 mandibular); 3 individuals of *Meriones persicus* by 3 crania (incisivum + nasale), 3 right tibiae and 3 left calcanei
3: less than 0,5 g = below scale limit
4: very small bone fragments from wet sieved samples 1 + 2; mainly mammals

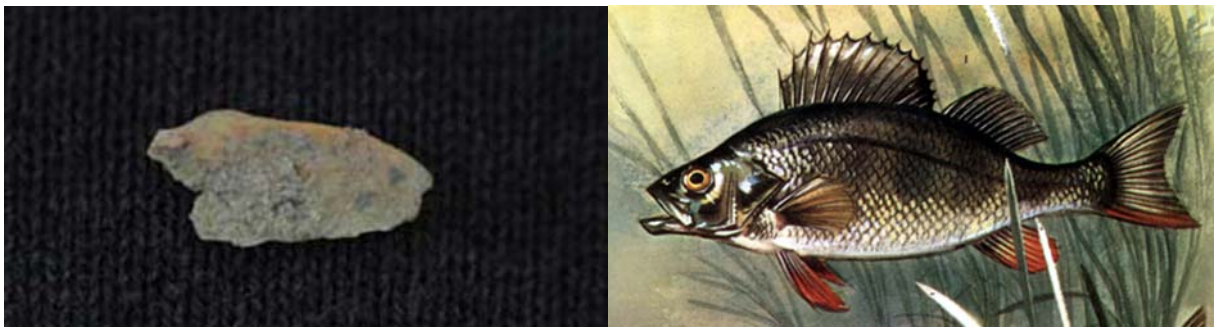
a b

Fig. 3: Persian jird (*Meriones persicus*)
a) skull (d012/69) from Aramus (Foto: Scheffka); b) habitus (Foto: ZZA 2/2003)

Cattle exceed all other species by number (n = 79) and even more explicitly by weight (ca. 70 % of the total bone weight) in period II, ovicaprids rank second (n = 66) followed by pigs (n = 26). Period II produced the first evidence of equids (family Equidae, n = 4). Three of these were from the domestic horse (*Equus caballus*), while one metatarsus (d011/484) belonged to a donkey (*Equus asinus*). One skull fragment proves the existence of dogs in period II.

A surprise was the presence of 25 fish bones in sieved samples from layer d 011, six of which could be attributed to three different families: the salmons and trouts (Salmonidae, n = 1), the minnows (Cyprinidae, n = 3) and the perches (Percidae, n = 2). One perch bone could be assigned to the species *Perca fluviatilis* (fig. 4). As it is unlikely for fish to accumulate by natural means on a hilltop, it is a reasonable assumption that they were brought into the site by the inhabitants. This fosters the hypothesis of wetlands in the vicinity of Aramus, which is also supported by the finding of plant macrofossils (see article by HOVSEPYAN in this volume). Only very few fish bones have been discovered from archaeological sites in Armenia so far, including singular remains of carp (*Cyprinus carpio*) and sheat-fish (*Silurus glanis*) from the Urartian city of Argistichinili (MANASERYAN 2003, 101-102). The results of the sieving experiment suggest that the rareness of fish remains in Urartian bone assemblages may be a methodological bias instead of an assumed avoiding of fish diet (MANASERYAN 2003, 102). The samples also contained one pelvis fragment of a true frog (genus *Rana*), for geographical distribution and size reasons this can only be *Rana macrocnemis camerani* (ENGELMANN et. al. 1985, 166-167, 177-179). The remaining small fragments from the sieved samples (n = 182) do not have diagnostic features allowing morphological identification, although most are from mammals, judging by their bone structure, texture and overall appearance. The extraction of fish and amphibian remains from only 20 litres of soil expresses convincingly the potential of the sieving method for the analysis of the site.

Skeletal element distribution shows that all body parts of cattle (tab. 7), sheep / goat (tab. 8) and pig are represented. They are evenly distributed in sheep / goat, while in cattle and pig skull fragments are slightly overrepresented. Multiple existence of skeletal elements proves two individuals of cattle, three ovicaprids and two pigs.



a b

Fig. 4: Perch (*Perca fluviatilis*)
a) right supracleithrum (d011/823; length 10 mm) (Foto: Pfisterer); b) habitus (from BRANDES 1976, 85)

Age, size and sex data

Features for age estimation were preserved on 21 cattle, 21 sheep / goat and 13 pig bones (fig. 5, tab. 10). In period II ovicaprids were evenly distributed in age classes between one and five years, while cattle reached between one to three years and pigs between half a year and two years.

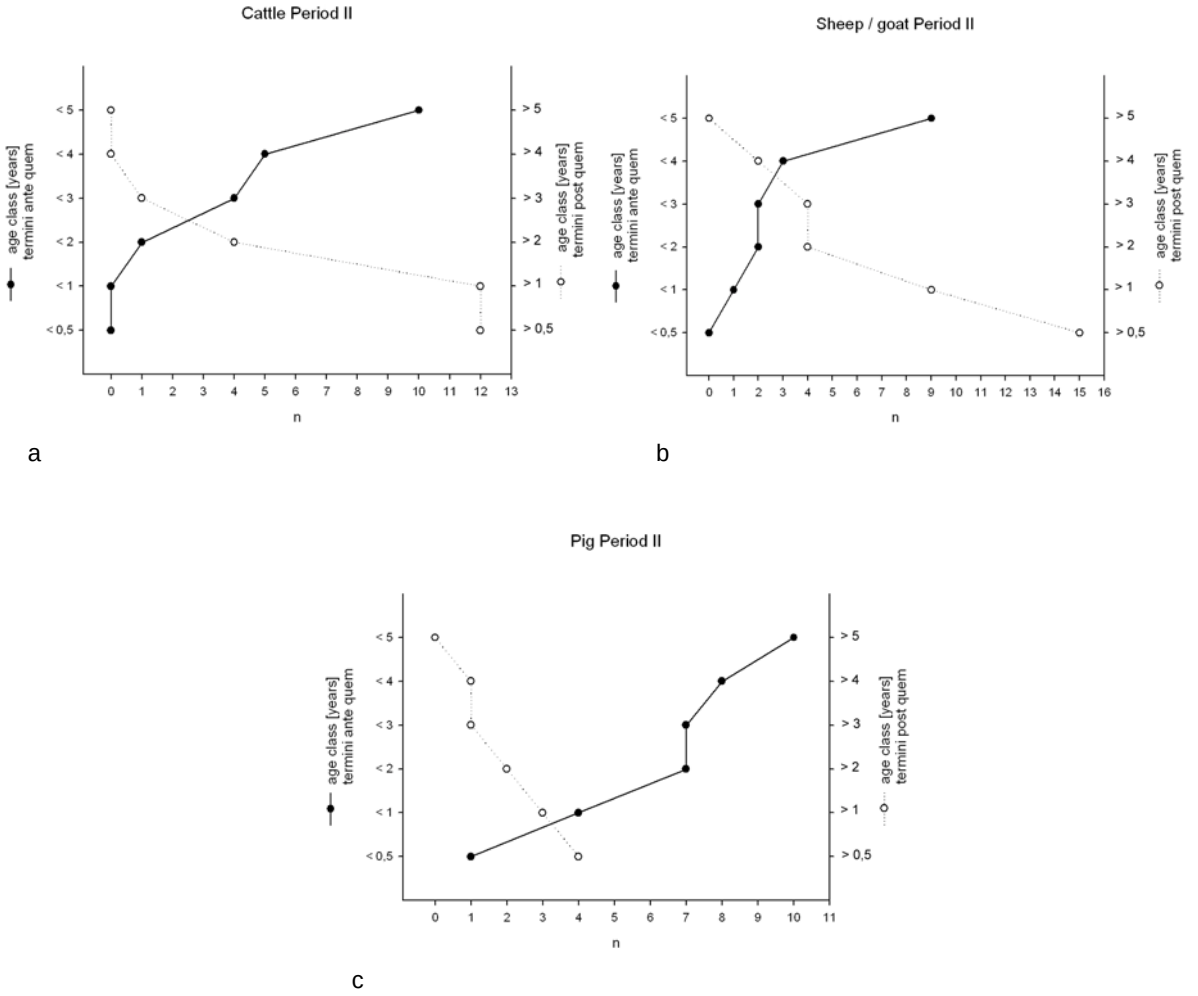


Fig. 5: Age spectrum of the most abundant domestic species from Aramus, area A, **Period II**
a) cattle (*Bos taurus*), b) sheep / goat (*Ovis* / *Capra*), c) pig (*Sus domesticus*)

Measurements could be taken from 30 bones (tab. 11). Two teeth remaining in a dog skull fragment (d021/523) are smaller than the teeth of a skull published by KOKABI (1982, 91-96), which belonged to a dog similar to a Foxterrier in size (withers height 39 cm; HARRIS 1995, 257). All other bones are either fragmented or elements from the feet (n = 19) and do not provide a reliable base for a size analysis. One distal fragment of a cattle metacarpus (d021/580; tab. 11) is rather large and almost certainly belonged to a male animal (KOKABI 1982, 45, 49; REICHSTEIN 1994, 78-80). A pig mandible (d021/650) could be attributed to a sow.

3.1.3 Period III

The number of bones retrieved from period III is 148 with an NISP of 67 (45,3 %). Species representation shows again an abundance of ovicaprids in bone number, while cattle comprise more than 50 % of the bone weight (tab. 5). Pig, horse and dog are present by singular bones. The only wild mammal found is a vertebra of a hare (d009/732), which results in a domestic to wild mammal ratio of 60 : 1 (excluding rodents). The amount of rodent bones declines down to four in period III. Three of these (1 skull, 1 mandible, 1 atlas) belong to one individual of a golden hamster and were still articulated when found. Period III layers contained three bird bones, two of the carrion crow (*Corvus corone*, d014/772, d013/787) and one phalanx that is morphologically close to a heron (family Ardeidae, d009/734).

Tab. 5: Species representation of animal bones from Aramus, Armenia, excavation 2004, area A, **Period III**, phase e – f, stratigraphic units d 009, d 013, d 011, d 019, d 023

species		**no. of bones**	**relative amount**		**min. no. of indivi-duals**[2] (MNI)	**bone weight**	**relative weight**	
			of no. of bones %	of NISP[1] %		g	of no. of bones %	of NISP[1] %
domestic mammals	**Mammalia**							
cattle	*Bos taurus*	19	12,8	28,4	1	252,0	52,4	54,3
domestic sheep	*Ovis aries*	4	2,7	5,8	1	24,0	5,0	5,2
domestic goat	*Capra hircus*	4	2,7	5,8	1	9,0	1,9	1,9
sheep / goat	*Ovis / Capra*	27	18,2	40,3	2	104,5	21,7	22,5
domestic pig	*Sus domesticus*	3	2,0	4,5	1	52,5	10,9	11,3
domestic horse	*Equus caballus*	1	0,7	1,5	1	15,5	3,2	3,3
dog	*Canis familiaris*	2	1,4	3,0	1	3,0	0,6	0,6
total domestic mammals		**60**	**40,5**	**89,6**	**8**	**460,5**	**95,7**	**99,2**
wild mammals	**Mammalia**							
hare	*Lepus europaeus*	1	0,7	1,5	1	1,0	0,2	0,2
golden hamster	*Cricetus auratus*	3	2,0	4,5	1	1,5	0,3	0,3
family rats and mice	Muridae indet.	1	0,7	1,5	1			
total wild mammals		**5**	**3,4**	**7,5**	**3**	**2,5**	**0,5**	**0,5**
total identified mammals	**Mammalia**	**65**	**43,9**	**97,0**	**11**	**463,0**	**96,3**	**99,8**
unidentified mammals	Mammalia indet.	80	54,1	–	–	16,5	3,4	–
total mammals	**total Mammalia**	**145**	**97,8**	**97,0**	**11**	**479,5**	**99,7**	**99,8**
birds	**Aves**							
carrion crow	*Corvus corone*	2	1,4	1,5	1	1,5	0,3	0,2
total birds	**total Aves**	**2**	**1,4**	**1,5**	**1**	**1,5**	**0,3**	**0,2**
amphibians	**Amphibia**							
toad	*Bufo* sp.	1	0,7	1,5	1	0,0[3]	–	–
total amphibians	**total Amphibia**	**1**	**0,7**	**1,5**	**1**	0,0[3]	**–**	**–**
NISP[1]		**67**	**45,3**	**100,0**	**13**	**464,0**	**96,5**	**100,0**
total bones		**148**	**100,0**		**13**	**481,0**	**100,0**	

1: NISP = number of identified specimen = total bones exclusive Mammalia indet., Aves indet.
1: MNI greater than 1 are evident by the following skeletal elements:
2 individuals of *Ovis / Capra* by 2 right mandibulae (ramus) and 2 right pelves (acetabulum)
3: less than 0,5 g = below scale limit

Good preservation conditions were again proved by the find of a toad humerus (*Bufo* sp., fig. 6a). This can only be from the green toad (*Bufo viridis*, d009/733, fig. 6b), since it is the only species of toad living in Armenia (DAL 1954, 300; ENGELMANN et al. 1985, 149, 154). Except for two sheep / goat the MNI is one for all species.

No bones of the forelimb of cattle are preserved, while most specimen belong to the skull (n = 7) or the feet (n = 6) (tab. 7). A similar picture can be seen in ovicaprids (12 x feet, 10 x skull, 2 x fore limb, 7 x hind limb) (tab. 8). The number of pig bones is too small to compare skeletal elements.

a b

Fig. 6: Green toad (*Bufo viridis*)
a) humerus (d009/733) (Foto: Scheffka); b) habitus (from ENGELMANN et al. 1985, 153)

Age, size and sex data

Only three cattle bones from period III allowed age estimation, all belonging to individuals older than one year. Of the eight ovicaprid bones with preserved ageing criteria, seven were at least half a year old and one was older than four years. One phalanx of a dog (d014/762) must be older than five months.

Only 15 bones of the autopodium of cattle (n = 5), sheep / goat (n = 8), horse (n = 1) and dog (n = 1) were measurable. No bone with sexing criteria is preserved from period III.

3.1.4 Bones from features not assigned to a chronological period

These comprise 172 specimen out of area A from the stratigraphic units d 001 (n = 110), d 004 (n = 2), d 016 (n = 51) and Locus DOST IV (n = 9) plus 275 specimen out of area B from room 5 (n = 263) and room 6 (n = 12).

Because the finds from the surface layer d 001 are a mixture of modern and archaeological finds, they can only add an impression of the species represented (tab. 2). This impression is consistent with the general picture and will not be discussed here any further. Worth mentioning is a fragment of a cattle rib (d001/51) with callus tissue at its distal end, indicating a fracture or an inflammation.

From stratigraphic unit d 004 two bones – a vertebra of a cattle and a humerus of a common starling – were recovered. The few identifiable bones from stratigraphic unit d 016 showed the same pattern as periods I to III with sheep / goat (n = 7), cattle (n = 5) and pig (n = 2). Apart from five undetermined mammals Locus DOST IV contained two cattle fragments (1

mandible, 1 radius), a nearly complete right mandible of a dog (DOST IV/836, fig. 7) and a fragment of a dog canine belonging to another mandible. Although the mandible 836 is broken into three pieces, several measurements could be taken (tab. 11). Compared with the dog mandibles found at the site of Beniamin, Armenia (1st illennium BC, n = 12) this individual was at the lower margin of the size range represented there (MANASERYAN 2000; MANASERYAN & MIRZOYAN, in prep.). According to KOKABI (1982, 92–95) individual 836 was bigger than a Foxterrier (withers height 39 cm; HARRIS 1995, 257), but slightly smaller than a German Shepherd (withers height ca. 55 – 65 cm; HARRIS 1995, 243).

Fig. 7: Dog mandible (DOSTIV/836) from Aramus (Foto: Scheffka)

Area B is identical with room 5 and 6 of the area excavated by AVETISYAN. These rooms were filled up with the excavated soil when the dig was closed in 1988. Hence, most finds from area B (n = 252) are from disturbed layers and cannot be assigned to a cultural period. These bones can only contribute to the species representation, which is consistent with the other assemblages (tab. 2). Six hare bones, one common starling, one gadwall (*Anas strepera*) and one house sparrow (*Passer domesticus*) may be mentioned. Measurements could be taken from the 5th metatarsus of a dog (room5/951, tab. 11) from room 5 (southeast corner). Compared with the data given by RATJEN & HEINRICH (1978, 38), this bone fits in the range of the modern breeds German Boxer, Airedale Terrier, Chow Chow and Standard Poodle, which are all medium-sized breeds between 45 and 63 cm withers height (GOERTTLER 1972, 212-219; HARRIS 1995, 194, 223, 233, 240). A dog mandible (room5/887) belonged to an individual larger than a German Shepherd. This dog was at the upper size range of the Beniamin dogs (MANASERYAN 2000; MANASERYAN & MIRZOYAN, in prep.). It has to be stated that these single measurements should be viewed with care and should not be used as a base for further conclusions concerning the phenotype of the dogs inhabiting ancient Aramus.

Apart from these unstratified finds, 23 bones were recovered from an undisturbed feature in room 5, which has been preliminary assessed as a storage silo pit and will probably be datable. The identifiable part of this sub-sample (n = 11) consists of two sheep / goat, three fox, five rodent and one singing bird bone. According to the data given in RATJEN & HEINRICH (1978, 26, 39) one metacarpus III of a fox (958, tab. 11) fits in size and proportions into the range of a female. No age data could be drawn from bones of the silo filling.

3.2 Taphonomy

While the general preservation status of the bone material is excellent, only 193 out of the total of 1860 bones are completely preserved (degree of fragmentation = 89,6 %). These mainly consist of rodents (n = 94) and the compact bones of the autopodium of domestic ungulates (n = 70). A closer look at the domestic mammals shows that 81 (14,0 %) of the total of 577 are not fragmented. This is consistent with the generally accepted thesis of meat processing refuse, showing a high degree of fragmentation. The bones of the autopodium only contain a small amount of consumable tissue and therefore are often thrown away without processing (fig. 8). Further, they are more resistant to fragmentation than other bones due to their bone structure. Direct evidence of meat procurement as proved by tool marks (impact marks, cut and scraping marks) could be observed on 5 to 10 % of the sub-samples from the different periods (tab. 6). Tool marks found on the identified bones only appeared on domestic species (31 x cattle, 47 x ovicaprids, 9 x pig, 1 x horse, 1 x cock). In cattle and ovicaprids tool marks were evident on all body parts, but were not analysed for location patterns. Traces indicating the use of bones as handcraft raw material or artefacts (e. g. sawing marks, polish, use wear) have not been found. Evidence for the influence of fire could be observed on 71 bones (tab. 6). While 62 of these were charred and can be interpreted as cooking remains, only 9 were calcined[9]. The charred specimens are distributed over the different periods ranging from 8 (9,2 %) in period III, over 14 (4,2 %) in period I to 24 (7,2 %) in period II. In relation to species, charring also appears only on domestic animals (13 x cattle, 10 x sheep / goat, 1 x pig, 2 x dog). Noteworthy are two charred first toe joints from dogs from period I and III (d002/376, d014/762), raising the question whether dogs in Aramus were eaten. Calcined bones were only found in period I and II and the identifiable ones are an astragalus of a goat (d011/491) and a 1st phalanx of a sheep (d011/492).

a b

Fig. 8: a) Slaughtering of a sheep at the Geghard monastery (Foto: Küchelmann)
b) Foot of a goat (*Capra hircus*) left by villagers on the path leading to the excavation site. A piece of rope used for hanging the body head down during the slaughtering process is still attached. (Foto: Küchelmann)

[9] The term "calcination" defines bones that have been affected by great heat for a prolonged time period resulting in a total loss of the organic component, leaving only the anorganic component with a grey or white, cracked appearance.

Between 10 and 15 % of the sub-samples showed carnivore bite marks adding to a total of 127 (tab. 6). Distribution on species is proportional to the found taxa (40 x sheep / goat, 34 x cattle, 20 x pig, 3 x hare, 3 x singing bird, 1 x horse, 1 x rodent). The real percentage of carnivore bite marks is in fact higher because 435 small unidentifiable fragments have not been, because of practical reasons, monitored for bite marks, weathering and root etching. 0ne specimen (d016/850; fig. 9) shows marks of ungulate gnawing (KÜCHELMANN 1997, 130-134; SUTCLIFFE 1973). Weathering is by definition, visible damage on bone surfaces lying exposed on the ground and caused by repeated climatic changes (BEHRENSMEYER 1978[10]). The specific destruction patterns that develop on weathered bones could be observed on a relatively high number of finds (n = 573) with an abundance between 41 % in period II and 71 % in period I (tab. 6). This reveals that a significant part of the bones had been lying on the soil surface for several years, before the following layer formed. Root etching is caused by acids secreted from the roots of several plant species growing adjacent to bones embedded in the soil. These traces are visible on 225 specimens with the lowest value in period II (12 %) and the highest in period I (32 %). A conclusion from these features is that the bones remained on or just underneath the soil surface for a longer time span in period I than in period II. This indicates that the formation of period II was a faster process than that of the period I. In the case of period III the values lie between those of period I and II, but here again the number of bones found is very small.

Tab. 6: Occurence of taphonomic features on bones from Aramus, excavation 2004, area A and B

taphonomic feature	**surface layer d 001**		**period I**		**period II**		**period III**		**not assigned features**[1]		**room 5 + 6**		**total**	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
impact marks	6	9,0	32	9,6	16	4,8	6	7,0	2	6,7	2	1,4	64	6,5
cut marks	4	6,0	25	7,5	26	7,8	8	9,2	1	3,3	5	3,5	69	7,0
scraping marks					2	0,6			2	6,7			4	0,4
charred	1	1,5	14	4,2	24	7,2	8	9,2	2	6,7	13	9,2	62	6,3
calcined			4	1,2	4	1,2					1	0,7	9	0,9
carnivore bite marks[2]	7	10,4	39	11,7	47	14,2	9	10,3	11	36,7	14	9,9	127	12,8
rodent gnawing marks			7	2,1	2	0,6							9	0,9
digestive acid corrosion			2	0,6							2	1,4	4	0,4
weathered[2]	34	50,7	238	71,3	136	41,0	52	59,8	20	66,7	93	65,5	573	57,8
trampling	1	1,5											1	0,4
root etching[2]	11	16,4	108	32,3	40	12,0	24	27,6	7	23,3	35	24,6	225	22,7
total monitored of sub-sample	**67**		**334**		**332**		**87**		**30**		**142**		**992**	

1: stratigraphic units d 004, d 016, Locus DOST IV
2: 435 fragments of unidentified mammals have not been monitored for carnivore bite marks, weathering and root etching

[10] The study of BEHRENSMEYER (1978) was conducted in Kenya and has to be viewed as a preliminary indication since it is not applicable to every climatic situation (see e. g. ANDREWS 1990, 10–17; TAPPEN 1990).

Fig. 9: Sheep radius (d016/850) with ungulate gnawing marks. (Foto: Scheffka)

3.3 Other results

One fragment of a cattle metacarpus from stratigraphic unit s 002 (s002/126) matches with a fragment from stratigraphic unit grave 1 (grave1/437). The breakage is old and not a digging artefact. Possible implications of this correlation are that either both layers were formed in the same time period or grave 1 was dug into layer s 002.

In the case of a cattle mandible (d002/141) bite marks superimposing cutmarks were visible thus proving the secondary use of human meat processing refuse by carnivores, most probably dogs.

4. Synthesis

The animal bone material from the 2004 excavation at Aramus consists of 1860 fragments, of which 867 (46,7 %) were identifiable (NISP). Except reptiles, species of all vertebrate classes were found (tab. 2–5). While the vast majority of the material comes from mammals (n = 1625), birds (n = 26), fish (n = 25) and amphibians (n = 2) are present in small numbers. As to be expected in a settlement of a society with a highly developed agricultural system, the bulk of the assemblage (n = 577; 66,6 % of NISP) consists of domestic mammals (cattle, sheep, goat, pig, horse, donkey and dog). Apart from 241 rodent bones, wild mammals are underrepresented with only eight hare and five fox bones and even these may be intrusive. Assumed they are not, the domestic to wild mammal ratio is 44,4 : 1.

Species distribution over the three time periods I – III shows a predominance of the small ruminants (sheep and goat) followed by cattle and pig, except for period II, where the number of cattle bones exceeds the ovicaprids (tab. 2). With over 50 % of the bone weight, cattle are most important in all periods (tab. 3–5), especially in period II, where they reach 71 % of the total weight. Single bones of dogs were found in all periods, horses only appear in period II and III, and one donkey bone was found in period II.

Rodents are present in all periods, with the broadest spectrum of species (Persian jird, common vole, golden hamster, jerboa) in period I and the highest number of bones (n = 203) in period II (tab. 2–5). Since all 182 identified rodent bones are from burrow-building species (PIECHOCKI 1977a, 342; 1977b, 397; VAN DEN BRINK 1957, 83-104), it cannot be decided in

each case, if the found animals were contemporary with the formation of the archaeological layers, or if they intruded into the strata by burrowing. In the former case they may have been commensal or a pest for the people living in the ancient settlement. In the latter they are modern inhabitants of the site and should be excluded from the archaeological analysis. In some cases contextual information provides clues, as with the gerbils from period II.

Bird species identified comprise domestic cock, gadwall, black-billed magpie, carrion crow, common starling and house sparrow (tab. 2–5). Unexpectedly the most abundant species (n = 9) is the common starling, ranking even before fowl (n = 7). Most bird bones (n = 18) were found in period I, raising the question if this uneven distribution is just a random bias or if birds in general and starlings in particular had a significance in that period.

The 25 fish bones from period II are undoubtly a methodological bias caused by the more accurate sieving methods employed. Six of the fish bones could be assigned to the families Cyprinidae, Percidae and Salmonidae.

Skeletal element distribution in cattle (tab. 7), ovicaprids (tab. 8) and pig reveals that all body parts (skull, spinal column, fore limb, hind limb, feet) are present in period I and II. In period III sheep / goat are represented by all body parts as well, whereas cattle are missing the forelimb. A slight overrepresentation of the skull in period II and III and of the feet in Period I and III is visible in cattle. In sheep / goat body parts are evenly distributed in period I and II, while in period III feet and skull are overrepresented. The pig feet elements are overrepresented in period I and skull fragments in period II. In general the bone numbers for each period are too small for statistical analysis and hence the distribution data does not allow wide ranged conclusions.

Monitoring the age spectrum (tab. 9–10, fig. 2, 5) of period I – II reveals that cattle were killed at an age of 1 – 3 years. Sheep and goat found between one and five years old were evenly distributed. Most pigs were aged between half a year and two years. This pattern indicates that pigs as well as cattle were mainly raised for meat production, while a certain proportion of sheep and goats were kept longer e. g. for breeding, milking or wool production. Generally this becomes even more evident when the sex ratio is taken into account – usually in such circumstances the portion of females kept is higher than the portion of males – but unfortunately not enough bones allowed morphological sexing.

The data basis for a metrical analysis of the bone assemblage is very small. Only two long bones of adult domestic mammals were completely preserved allowing the application of the available standard factors for the calculation of body size. These two bones belong to one individual of a sheep from period I with a withers height of 62,5 cm. A skull fragment of a small dog was recovered from period II. A dog mandible slightly smaller than a German Shepherd was found in Locus DOST IV. Another mandible fragment of a large dog (larger than a German Shepherd) and a metatarsus of a medium sized dog were excavated in room 5. The abundant complete compact foot bones of domestic mammals (n = 91) allow only a relative estimation of size in comparison with populations where a larger series of data is available. This intensive research task could not be undertaken because of the limited time and financial resources available to the first campaign and has had to be left for the future.

Except for three pigs in period I, three sheep / goat and three jirds in period II the MNI never exceeds two individuals (tab. 3–5). Only three bones allowed morphological sexing: one mandible of a sow, one metacarpus of a male cattle and one metacarpus of a female fox. Two bones show pathologic changes in the form of callus tissue.

Close examination for traces of taphonomic processes revealed a high degree of fragmentation, frequent tool marks and charring on bones of domestic animals. These features are in accordance with the expectation of an assemblage of daily meat consumption refuse from a highly developed agricultural and stock rearing society. Worth mentioning are two

charred dog bones indicating possible dog consumption. Calcinated bones are rare, bone-working traces were not observed. Non-human agents leaving their traces on the bone finds were carnivores (frequent), rodents, ungulates, plants and weathering.

5. Outlook

As the preservation conditions for animal bones could be proved to be excellent, a high amount of additional bone finds can be expected for forthcoming excavations in Aramus. The successful results from the tests with the wet sieving method show that an intensification of soil sampling and sieving would be desirable in future. A further suggestion is the use of the flotation method for the regular processing of soil samples, which would greatly increase efficiency. This would probably result in the extraction of more fish bones, highlighting the fish diet of the inhabitants of the settlement. Special attention should be paid to future finds of singing bird bones and their distribution in the stratigraphy to verify or falsify a possible significance for the people of ancient Aramus. The finds of singular human bones on the eastern acropolis (area A) make it probable that further graves will be found in the vicinity of grave 1.

Provided adequate funding is available more effort could be invested in the metrical analysis of the bone assemblage, especially in the case of dogs. Further, there is the possibility to analyse tool mark patterns to get an indication of craftsman's methods and handicrafts conducted in Aramus.

Future ideas include a comparative analysis between Aramus and material from other archaeozoologically examined Urartian sites like Argistichinili (Armavir) (MARTIROSJAN 1974, 121, 142-144; SALVINI 1995, 132), Akhtamir (GAUTIER & VANDENBRUANE 1997), Bastam (BOESSNECK & KOKABI 1988; KROLL 1988; KRAUß 1975; ZIMANSKY 1988), Horom (BADALJAN et al. 1994; 1997, 191-193; MANHART in prep.), Arin-Berd (Erebuni) and Karmir-Blur (Teishebaini) (MARTIROSJAN 1974, 144). Further the bone finds need to be compared with iconographic, written and material evidence related to animals in Urartu (see e. g. ARUTUNJAN 1964, 139-204).

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8. Appendix

Tab. 7: Skeletal element distribution of cattle (*Bos taurus*) from Aramus, area A, period I – III

skeletal element	period I	period II	period III	total
Cornu			1	**1**
Cranium	1	4	1	**6**
Mandibula	1	2	2	**5**
Dentes	6	4	3	**13**
Hyoid				**0**
Atlas	1			**1**
Axis	1			**1**
Vertebrae	5	2		**7**
Sacrum	1	1	1	**3**
Costae	5	1	2	**8**
Scapula	2			**2**
Humerus	1	1		**2**
Radius	1	2		**3**
Ulna		2		**2**
Carpalia				**0**
Metacarpus	7			**7**
Pelvis	5	1	2	**8**
Femur		1	1	**2**
Patella	1			**1**
Tibia	3	1		**4**
Fibula				**0**
Astragalus	2		1	**3**
Calcaneus	1			**1**
Tarsalia	2		1	**3**
Metatarsus		1		**1**
Metapodium	3			**3**
Phalanx 1	1	3	1	**5**
Phalanx 2	2		2	**4**
Phalanx 3	1			**1**
Sesama			1	**1**
total	**53**	**26**	**19**	**98**

Tab. 8: Skeletal element distribution for sheep (*Ovis aries*) and goat (*Capra hircus*) from Aramus, area A, period I – III

skeletal element	period I	period II	period III	total
Cornu				**0**
Cranium	7	3	1	**11**
Mandibula	4	1	3	**8**
Dentes	10	10	6	**26**
Hyoid		1		**1**
Atlas		1		**1**
Axis		1		**1**
Vertebrae	15	4		**19**
Sacrum		1		**1**
Costae	11	7	3	**21**
Scapula	1	4	1	**6**
Humerus	1	4	1	**6**
Radius	4	2		**6**
Ulna	5	2		**7**
Carpalia				**0**
Metacarpus	6	1	2	**9**
Pelvis	1	1	4	**6**
Femur	5	6	2	**13**
Patella				**0**
Tibia	6	3	1	**10**
Fibula				**0**
Astragalus		3		**3**
Calcaneus	2	1		**3**
Tarsalia				**0**
Metatarsus	6	2		**8**
Metapodium	4	3	2	**9**
Phalanx 1	9	1	4	**14**
Phalanx 2	2	4	2	**8**
Phalanx 3	2		2	**4**
Sternum	1		1	**2**
total	**102**	**66**	**35**	**203**

Tab. 9: Age spectrum of cattle, sheep / goat and pig from Aramus, area A, **Period I**

species	age class						total
cattle *Bos Taurus*	**> 0,5 years**	**> 1 year**	**> 2 years**	**> 3 years**	**> 4 year**	**> 5 years**	**16**
	7	7	4	1	1	1	
	< 0,5 years	**< 1 year**	**< 2 years**	**< 3 years**	**< 4 year**	**< 5 years**	
	–	–	–	3	5	9	
sheep / goat *Ovis / Capra*	**> 0,5 years**	**> 1 year**	**> 2 years**	**> 3 years**	**> 4 years**	**> 5 years**	**43**[2]
	21	14	11	9	3	–	
	< 0,5 years	**< 1 year**	**< 2 years**	**< 3 years**	**< 4 year**	**< 5 years**	
	5[1]	8	12	12	16	25	
pig *Sus domesticus*	**> 0,5 years**	**> 1 year**	**> 2 years**	**> 3 years**	**> 4 years**	**> 5 years**	**25**[4]
	5	5	1	1	1	–	
	< 0,5 years	**< 1 year**	**< 2 years**	**< 3 years**	**< 4 years**	**< 5 years**	
	5[3]	5	19	22	22	22	

1: all neonatus
2: 3 specimen gave a time span and were counted twice.
3: 4 x neonatus
4: 2 specimen gave a time span and were counted twice.

Tab. 10: Age spectrum of cattle, sheep / goat and pig from Aramus, area A, **Period II**

species	age class						total
cattle *Bos taurus*	**> 0,5 years**	**> 1 year**	**> 2 years**	**> 3 years**	**> 4 year**	**> 5 years**	**21**[1]
	12	12	4	1	–	–	
	< 0,5 years	**< 1 year**	**< 2 years**	**< 3 years**	**< 4 year**	**< 5 years**	
	–	–	1	4	5	10	
sheep / goat *Ovis / Capra*	**> 0,5 years**	**> 1 year**	**> 2 years**	**> 3 years**	**> 4 years**	**> 5 years**	**21**[2]
	15	9	4	4	2	–	
	< 0,5 years	**< 1 year**	**< 2 years**	**< 3 years**	**< 4 year**	**< 5 years**	
	–	1	2	2	3	9	
pig *Sus domesticus*	**> 0,5 years**	**> 1 year**	**> 2 years**	**> 3 years**	**> 4 years**	**> 5 years**	**13**[1]
	4	3	2	1	1	–	
	< 0,5 years	**< 1 year**	**< 2 years**	**< 3 years**	**< 4 years**	**< 5 years**	
	1	4	7	7	8	10	

1: 1 specimen gave a time span and was counted twice
2: 3 specimen gave a time span and were counted twice.

Tab. 11: Measurements of animal bones from Aramus (according to VON DEN DRIESCH 1976a, 1976b)

species	skeletal element	measurements	n	range	mean	bone no.	stratigraphic unit
Period I							
Bos taurus	Astragalus	Bd 42,2	1			137	d 002
	Os tarsale 2 + 3	GB 29,4	1			151	d 002
	Scaphocuboid	GB 49,2	1			436	grave 1
	Patella	GB 60,0	1			139	d 002
	Phalanx 1	GLpe 57,1; Bp 31,4; (Bd 27,0); SD 26,0	1			144	d 002
	Phalanx 2	GL 40,3; Bd 23,2 Bp SD	1 2 2	 27,3 – 28,4 23,0 – 21,8	 27,9 22,4	146, 227	d 002
	Phalanx 3	GLS 56,3; Ld 43,0; MBS 18,5	1			147	d 002
Ovis aries	Radius	GL 155,5; LI 146,4; Bp 33,5; Bd 30,2; BFd 26,5; SD 15,9	1			156	d 002
	Ulna	GL 174,2; LO 39,9; DPA 29,6; SDO 23,7	1			155	d 002
	Metacarpus	Bp 22,9	1			158	d 002
	Tibia	Bd 27,8	1			170	d 002
	Calcaneus	GL GB	2 2	58,2 – 57,2 19,7 – 20,2	57,7 20,0	167 168	d 002
	Phalanx 1 anterior	GLpe 34,4; Bp 11,8; Bd 1,5; SD 10,5	1			245	d 002

species	skeletal element	measurements	n	range	mean	bone no.	stratigraphic unit
	Phalanx 1 posterior	GLpe Bp Bd SD	3 3 3 3	32,7 – 34,8 11,2 – 12,6 10,6 – 11,1 9,3 – 9,8	33,6 11,8 10,8 9,6	182, 186 420	d 002, d 005
	Phalanx 2	GL Bp Bd SD	2 2 2 2	20,4 – 23,0 9,4 – 11,5 7,1 – 8,1 6,5 – 8,0	21,7 10,5 7,6 7,3	187 246	d 002
	Phalanx 3	Ld 22,2; DiLS 28,3 MBS	1 2	 5,9 – 6,7	 6,3	189 421	d 002 d 005
Capra hircus	Scapula	BG 23,1; SLC 20,8	1			173	d 002
	Metacarpus	Bp 24,4	1			159	d 002
	Tibia	Bd 29,8	1			169	d 002
Sus domesticus	Radius	Bp 25,9	1			218	d 002
	Phalanx 2 • III or IV	GL Bp Bd SD	2 2 2 2	21,4 – 21,5 14,2 – 14,5 11,8 – 12,9 11,3 – 12,4	21,5 14,4 12,4 11,9	127 204	s 002 d 002
	Phalanx 3 • III or IV	Ld 24,5; DiLS 26,7; MBS 10,3	1			128	s 002
Canis familiaris	Phalanx 1	GL 11,3; Bd 5,8; SD 4,3	1			376	d 002
Homo sapiens	Phalanx 1 • II post.	GL 28,4; Bp 12,4; Bd 9,0; SD 6,3	1			122	s 002
Allactaga williamsii.	Metatarsus	length (18,9); Bp 3,3; SD 2,2	1			388	d 002
Gallus gallus	Pelvis + Sacrum	DiA 7,3	1			448	grave 1
Tetrao mlokosiewiczi or *Gallus gallus*	Tarsometatarsus	Bp 12,9	1			381	d 002
Sturnus sp.	Coracoid	GL 24,3	1			416	d 003
	Humerus	GL 27,2; Bd 6,9; SC 2,6 Dip	1 2	 8,4 – 8,8	 8,6	411 413	d 003
	Ulna	Did 4,2; SC 2,0	1			414	d 003
	Femur	Bp 4,5	1			415	d 003
	Tibiotarsus	Dip 6,2	1			386	d 002
	Tarsometatarsus	GL 30,4; Bp 4,3; Bd 3,2; SC 1,8	1			387	d 002
Period II							
Bos taurus	Humerus	Bd 63,1; BT 63,6	1			570	d 018
	Metacarpus	Bd 68,5	1			580	d 021
	Phalanx 1	GL Bp Bd SD	3 3 2 2	49,0 – 52,6 22,9 – 30,4 22,5 – 29,0 19,7 – 24,4	51,0 27,8 25,8 22,1	586 587 588 589	d 021
	Phalanx 2	GL 37,5; (Bp 27,8); Bd 22,4; SD 21,1	1			592	d 021
Bos taurus	Phalanx 3	Ld 51,3; DiLS 61,7 MBS	1 2	 13,2 – 20,4	 16,8	590 591	d 021
Ovis aries	Tibia	Bd 25,8	1			623	d 021
	Astragalus	GLm 27,8; Bd 18,3; Dm 16,0	1			524	d 012
	Calcaneus	GL 57,1; GB 20,1	1			622	d 021
	Phalanx 2 anterior	GL Bp Bd SD	2 2 2 2	23,4 – 24,4 11,7 – 12,3 8,8 – 9,6 8,6 – 8,8	23,9 12,0 9,2 8,7	492 629	d 011 d 021
	Phalanx 2 posterior	GL 22,7; Bp 9,9; Bd 7,6; SD 7,4	1			527	d 012
Capra hircus	Radius	Bp 26,4	1			618	d 021
	Metacarpus	Bd 26,3	1			624	d 021
	Femur	Bp 41,6	1			617	d 021
	Astragalus	(GLl 26,3); GLm 25,2; Bd 16,7; Dl 14,2; Dm 14,5	1			491	d 011
	Phalanx 2 posterior	GL 24,8; Bp 10,8; Bd 9,0; SD 8,0	1			628	d 021
Sus domesticus	Phalanx 1	GLpe 31,0; Bp 15,2; Bd 13,1; SD 12,2	1			653	d 021
	Vertebra lumbalis	PL 31,8; BFcr 35,8; BFcd 31,6	1			685	d 021
Canis familiaris	Cranium	18 = 15,8; 20a = 11,3 ; B P4 = 6,9; 18a = 8,6; 20b (M1: B) = 13,2	1			523	d 012
Period III							
Bos taurus	Astragalus	GLl 55,0; GLm 50,1; Bd 35,8; Dl 30,2; Dm 28,9	1			738	d 014
	Phalanx 1	GLpe 53,6	1			806	d 019
	Phalanx 2	GL 37,4; 39,4 Bp 23,4; 29,4 Bd 20,8; 24,7 SD 19,5; 24,3	2 2 2 2	37,4 – 39,4 23,4 – 29,4 20,8 – 24,7 19,5 – 24,3	38,4 26,4 22,8 21,9	777 778	d 013
	Scaphocuboid	GB 51,0	1			739	d 014
Ovis aries	Scapula	SLC 22,2	1			748	d 014
	Phalanx 1 posterior	GLpe 35,2; Bp 11,9; Bd 10,4; SD 9,4	1			730	d 009
	Phalanx 3	Ld 24,6; DiLS 30,3; MBS 6,7	1			731	d 009
Capra hircus	Phalanx 1 anterior	Bd 12,3 GLpe Bp SD	1 2 2 2	 34,8 – 36,0 12,2 – 12,5 10,6 – 11,0	 35,4 12,4 10,8	757 782	d 014 d 013
	Phalanx 2 posterior	GL pe19,4	1			786	d 013
	Phalanx 3	Ld 21,8; DiLS 28,0; MBS 4,4	1			792	d 019

species	skeletal element	measurements	n	range	mean	bone no.	stratigraphic unit
Equus caballus	Os carpi radiale	GB 37,5	1			801	d 019
Canis familiaris	Phalanx 1	Bp 8,5; SD 5,6	1			762	d 014
Corvus corone.	Ulna	Bp 9,8; Dip 11,1	1			787	d 013
Sturnus vulgaris.	Humerus	GL 26,9; Bp 8,7; Bd 6,5; SC 2,7	1			728	d 004
not assigned features							
	Radius	Bp 40,7	1			846	d 016
Bos taurus	Phalanx 1	GLpe 53,2; Bp 23,7; Bd 22,0; SD 19,4	1			868	room 5
Ovis aries	Scapula	GLP 31,9; LG 23,8; BG 20,0	1			892	room 5
	Humerus	Bd 29,4	1			3	d 001
	Metacarpus	Bd 23,7	1			13	d 001
	Astragalus	GLm 29,2; GLl 30,0; Bd 19,0; Dl 17,0; Dm 17,0	1			15	d 001
	Phalanx 1 anterior	Bp 13,5 GLpe Bd SD	1 2 2 2	 35,8 – 37,2 12,5 – 12,9 10,7 - 10,7	 36,5 12,7 10,7	7 8	d 001
	Phalanx 1 posterior	GLpe 33,3; Bp 11,2; Bd 10,1; SD 9,0	1			9	d 001
Sus domesticus	Atlas	GL (36,5); GB (64,5), BFcr 40,2; BFcd 51,2; H 37,5	1			928	room 5
	Phalanx 2	GL 23,5; Bp 13,0; Bd 10,0; SD 10,4	1			43	d 001
Canis familiaris	Mandibula	7 = 87,2; 8 = 80,2; 9 = 74,9; 10 = 39,6; 11 = 42,3; 12 = 36,9; 14 = 24,5; 20 = 22,8	1			887	room 5
	Mandibula + C + P2-M3	(1 = 133,0); (2 = 134,0); (3 = 126,5); (4 = 114,0); (5 = 109,0); (6 = 113,3); 10 = 34,5; 13 = 21,3; 18 = 56,4; 19 = 22,6;	1			836	DOST IV
	Metatarsus 5	Bd 8,6; SD 5,6	1			951	room 5
Homo sapiens	Metacarpus 3	Bp 12,5	1			857	d 016
Vulpes vulpes	Metacarpus 2	GL 42,7; Bp 4,1; Bd 6,4; SD 4,0	1			958	room 5
	Metacarpus 5	Bp 6,5; SD 4,9	1			959	room 5
	Phalanx 1	GL 19,7; Bp 5,6; Bd 4,8; SD 3,8	1			960	room 5
Lepus europaeus	Metatarsus 2	GL 55,5; Bp 8,0; Bd 6,6; SD 4,4	1			896	room 5
	Metatarsus 3	GL 56,6; Bp 5,1; Bd 6,6; SD 4,0	1			897	room 5
	Metatarsus 4	GL 54,7; Bd 6,0; SD 3,8	1			898	room 5
	Phalanx 1	GL 26,5; Bp 6,3; Bd 4,2; SD 3,2	1			899	room 5
	Phalanx 1	GL 21,4; Bp 6,0; Bd 4,3; SD 3,3	1			900	room 5
	Phalanx 1	GL 19,1; Bp 4,8; Bd 3,8; SD 2,6	1			901	room 5
Anas strepera	Ulna	SD 5,0	1			952	room 5
Sturnus vulgaris	Femur	GL 25,8; Lm 24,7; Bp 4,7; Bd 4,6; SD 2,1	1			891	room 5

Tab. 12: List of taxa and breeds mentioned

English name	scientific name	German name
Mammals	**Mammalia**	**Säugetiere**
domestic mammals	Mammalia	Haussäuger
wild mammals	Mammalia	Wildsäuger
order even-toed ungulates	**Artiodactyla**	**Ordnung Paarhufer**
cattle	*Bos taurus*	Hausrind
domestic sheep	*Ovis aries*	Hausschaf
domestic goat	*Capra hircus*	Hausziege
domestic pig	*Sus domesticus*	Hausschwein
wild boar	*Sus scrofa*	Wildschwein
order odd-toed ungulates	***Perissodactyla***	**Ordnung Unpaarhufer**
domestic horse	*Equus caballus*	Hauspferd
donkey	*Equus asinus*	Esel
order carnivores	**Carnivora**	**Ordnung Raubtiere**
dog	*Canis familiaris*	Hund
Foxterrier	*Canis familiaris*	Foxterrier
German Shepherd	*Canis familiaris*	Deutscher Schäferhund
German Boxer	*Canis familiaris*	Deutscher Boxer
Airedale Terrrier	*Canis familiaris*	Airedale Terrier
Chow Chow	*Canis familiaris*	Chow-Chow
Standard Poodle	*Canis familiaris*	Großpudel
red fox	*Vulpes vulpes*	Rotfuchs
order lagomorphs	**Lagomorpha**	**Ordnung Hasentiere**
Hare	*Lepus europaeus*	Feldhase
order rodents	**Rodentia**	**Ordnung Nagetiere**
family old world rats and mice	Muridae	Familie Mäuse
sub-family rats and mice	Murinae	Unterfamilie Echte Mäuse
family cricetid rats and mice	Cricetidae	Familie Wühler
golden hamster	*Cricetus auratus*	Syrischer Goldhamster
migratory hamster	*Cricetulus migratorius*	Grauer Zwerghamster
sub-family voles	Microtinae	Unterfamilie Wühlmäuse
genus voles	*Microtus*	Gattung Feldmäuse
common vole	*Microtus arvalis*	Feldmaus
sub-family gerbils	Gerbillinae	Unterfamilie Rennmäuse, Gerbils
genus jirds	*Meriones*	Gattung Sandmäuse
Persian jird	*Meriones persicus*	Persische Wüsten- oder Rennmaus
family jerboas	Dipodidae	Familie Springmäuse
jerboa	*Allactaga williamsii*	Pferdespringer
genus mole rats	*Spalax*	Gattung Blindmäuse
afghan mole lemming	*Ellobius fuscocapillus*	Südlicher Mull-Lemming
Birds	**Aves**	**Vögel**
family pheasants and fowl	Phasianidae	Familie Fasanenartige
Caucasian grouse, Caucasian blackcock	*Tetrao mlokosiewiczi*	Kaukasisches Birkhuhn
domestic cock	*Gallus gallus*	Haushuhn
gadwall	*Anas strepera*	Schnatterente
black-billed magpie	*Pica pica*	Elster
carrion crow	*Corvus corone*	Aaskrähe
order singing birds	**Passeriformes**	**Ordnung Singvögel**
common starling	*Sturnus vulgaris*	Star
house sparrow	*Passer domesticus*	Haussperling, Spatz
Amphibians	**Amphibia**	**Amphibien**
green toad	*Bufo viridis*	Wechselkröte
	Rana macrocnemis camerani	Kleinasiatischer Frosch
Fish	**Pisces**	**Fische**
family salmons and trouts	Salmonidae	Familie Lachse und Forellen
family minnows	Cyprinidae	Familie Karpfenfische
carp	*Cyprinus carpio*	Karpfen
family perches	Percidae	Familie Barsche
perch	*Perca fluviatilis*	Flussbarsch
sheat-fish	*Silururus glanis*	Flusswels

Fig. 10: above: map of super-region; below: map of Armenia
(from University of Texas Libraries, http://www.lib.utexas.edu/maps/armenia.html)

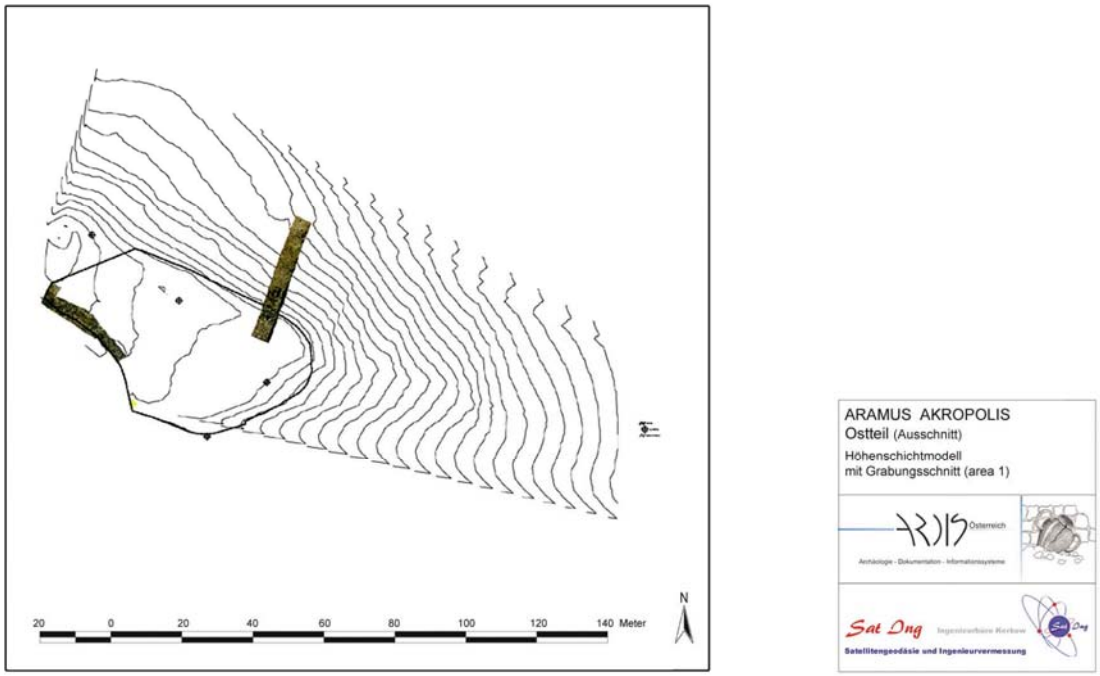

Fig. 11: site map of Aramus, excavation 2004; area A marked

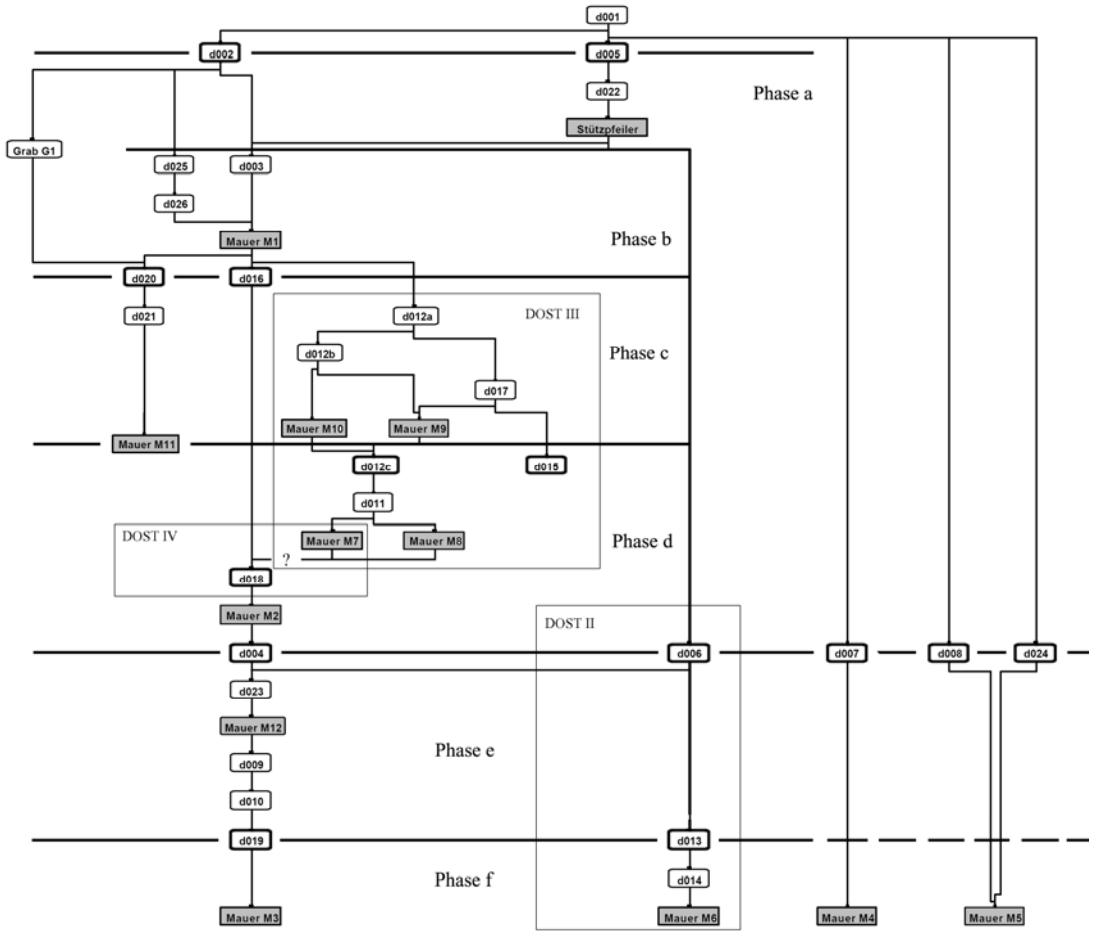

Fig. 12: Stratigraphy (Harris-Matrix) of Aramus, excavation 2004, area A (after KUNTNER 11/2004)