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The Animal Bones of Molino San Vincenzo
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The Animal Bones of Molino San Vincenzo

Analyzing the Zooarchaeological material of the Field Campaigns 2011 to 2017

The paper focuses on the zooarchaeological material of the Roman period of the site Molino San Vincenzo and its role in the context of Roman rural sites in the adjacent regions in Tuscany. The basic results of the animal bones' analysis are discussed and set in comparison to other Roman dated sites in this region. Based on these observations, it can be stated that, at Molino San Vincenzo in particular, small ruminants and pigs dominated the picture of animal husbandry. Since sheep represent a relatively high amount, a small livestock husbandry-related agriculture hypothesis can be established.

Keywords: *zooarchaeology; Roman rural settlement; excavation; bioarchaeology; animal husbandry*

1 Introduction

Various fragments of animal bones have been excavated during the last eight fieldwork campaigns at the site Molino San Vincenzo.[1] Except for 2016 and 2017, every excavation has uncovered animal remains, which were analyzed in May 2018 at the depot of the Associazione Archeologica Volontariato Medio Valdarno in Molin Nuovo (Commune Empoli, Province Florence).[2] Animal bones as indicators of human behavioral patterns offer an immense amount of information to be used in various ways within archaeological research. Commonly treated as one of the largest groups of archaeological findings,[3] the study of animal remains is essential for the reconstruction of dietary patterns, human-animal relationships (e.g. animal husbandry

1 The analysis of the zooarchaeological finds of the 2018 campaign has not been completed yet, the data is going to be recorded in summer 2019. In the following analysis it will be explicitly mentioned if the current results of the remaining finds are also included in the investigation and interpretation.

2 Many thanks to Leonardo Giovanni Terreni and the Associazione Archeologica Volontariato Medio Valdarno for the opportunity to work on these zooarchaeological finds and providing a workplace in Tuscany. I want to thank Prof. Dr. Günther Schörner for his support in analysing the find material. Furthermore, I thank Dominik Hagmann for providing the excavation documentation and maps, and for his assistance with understanding the stratigraphy of the site.

3 Czeika – Ranseder 2007, 7.

or resource management), economic production processes, and the handling of discard.[4] Furthermore, zooarchaeological remains offer a wide range of information about the taphonomy of an archaeological site. [5] The quality of the zooarchaeological analysis' results depends on the absolute number of finds and the material's state of preservation; last not least, the quality of the archaeological feature's recording during excavation is essential for providing meaningful results.

This paper focuses on the zooarchaeological material of the Roman period of the site Molino San Vincenzo and its role in the context of Roman rural sites in the adjacent regions in Tuscany. In the first step, the basic results of the animal bones' analysis are discussed. Based on this overview of the zooarchaeological material, including the state of preservation, number and weight of fragments, the range of animal species, Minimum Number of Individuals (MNI), Number of Identified Specimens (NISP), the dispersion of skeletal elements, the range of age and sex, butchery and bite mark traces, an interpretation of the livestock husbandry and diet at Molino San Vincenzo is performed. Besides, the issue of bone measurements will be broached.

In the second step, the bones found in stratigraphic units containing artefacts dating exclusively to the Roman period are presented. In the last step, Molino San Vincenzo's zooarchaeological finds will be compared with data derived from the excavation site Il Monte near San Gimignano (Province Siena).[6] The investigation aims to get first impressions of animal husbandry and meat consumption in the context of Roman rural sites in Tuscany.

2 Methods and general characteristics of the material

Different zooarchaeological methods have been used to trace activities relating to animal resources at Molino San Vincenzo. All the recovered animal remains have been analyzed in a macroscopic and quantitative study based on tabular datasets using Excel and PAST for statistical calculations. After cleaning and counting the zooarchaeological finds, the bones were identified and recorded according to the skeletal element by means of a reference collection supplied by VIAS[7] and by the works i.a. of E. Schmid as well as L. Pales and C. Lambert.[8] When identifying a species was impossible, the fragments were categorized by their size (cattle-sized mammals and sheep/goat/pig-sized mammals). The bones of sheep and goats were identified wherever possible by using the morphological criteria of M. A. Zeder and H. A. Lapham as well as S. Payne;[9] the teeth were specified using the works of E. Thenius and S. Hillson.[10] The

4 Human-animal relationships: Reitz – Wing 2008, 1–7; Benecke 1994, 11s.; economic production processes: Deschler-Erb 2008, 18; handling of discard: Thüry 2001, 3s.

5 See Marom – Bar-Oz 2013, 234s.

6 The site "Il Monte" presents a former field research project of the site supervisor, Prof. Dr. Günther Schörner. The zooarchaeological investigations have been undertaken by Prilloff 2013.

7 VIAS - Vienna Institute for Archaeological Science 2018. Many thanks to Mag. Dr. Günther Karl Kunst for placing the reference collection as well as the equipment for the data survey at my disposal.

8 Schmid 1972; Pales – Lambert 1971.

9 Zeder – Lapham 2010; Payne 1985.

10 Thenius 1989; Hillson 2005.

	2011	2012	2013	2014	2015	2016	2017	2018	Total number / weight (n / g)
Number of single bone fragments (n)	1	184	30	45	15	0	0	48	323
Weight per campaign (g)	50,0	779,9	21,5	121,0	154,9	0	0	252,0	1379,3
Number of samples (n)	1	28	11	16	6	0	0	16	78
NISP n = 215 (66,56 %, OC-Sus included)									

Tab. 1 Summary table on zooarchaeological findings of each field campaign at Molino San Vincenzo (N. I. Kirchengast)

bone measurements were done according to guidelines established by A. von den Driesch (measures in mm) regarding unburned and completely fused bones.[11] Visible modifications of the bone surface, including gnawing and butchery marks, have been recorded separately. Due to the high degree of fragmentation, just a few bones were suitable for measurement and the determination of age and sex. In addition to recording the primary data, digital photographs were taken of each sample to enable further studies off-location since the sample sizes are mainly small and stored in Italy.[12]

All animal bones of the past campaigns from 2011 to 2017 were thoroughly analyzed and recorded. Due to administrative reasons, zooarchaeological remains of 2018 were counted and weighed; further, species and skeletal elements have been identified.[13] The first campaign in 2011 provided only one single find from a test pit (5/2011). The campaigns of the years 2012 to 2015 provided several bone samples each (tab. 1). In contrast, the 2016 and 2017 excavation campaigns did not contain any bone fragments. The total number of examined bone fragments is 323, with a total weight of 1.4 kg, spread across 78 samples.

Compared to other Roman rural sites such as Settefinestre (3033 fragments), Le Colonne (547 fragments), or Il Monte (490 fragments),[14] the total number of 323 fragments at the site Molino San Vincenzo represents the lowest number. Even though, in general, the number of

[11] Von den Driesch 1976.

[12] Thanks to Kristina Klein (photographic laboratory at the Department of Classical Archaeology, University of Vienna) for putting the camera equipment at my disposal.

[13] Further observations on modifications and bone measurements are planned for summer of 2019.

[14] For Settefinestre see King 1985; for Le Colonne King 1999; for Il Monte Prilloff 2013.

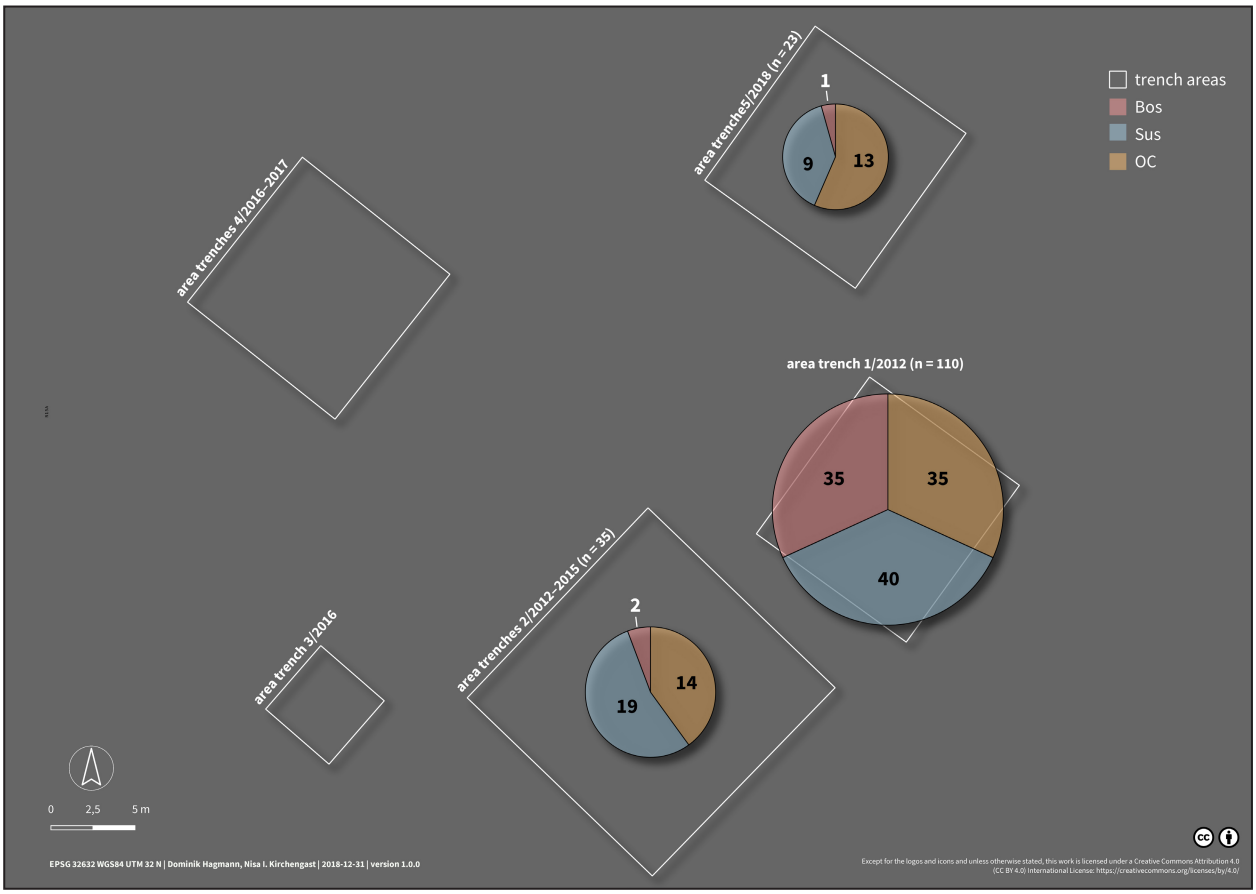

Fig. 1 Map of trenches at Molino San Vincenzo containing bone fragments of the major domestic animals (D. Hagmann and N. I. Kirchengast)

bone fragments from rural sites are much smaller than those from urban sites,[15] Molino San Vincenzo's sample size seems indeed diminutive (average number of bones per sample n = 1.5; average weight of bones per sample g = 6.3), therefore any interpretation of the results must be treated very carefully. The NISP[16] is 215; 108 fragments can only be classified by order of their size but not by any specific species.[17] The animal bones are dispersed in the trenches 1/2012, 2/2012–2015, and 5/2018; trench 1/2012 shows the largest number of fragments simultaneously containing the highest percentage of cattle (fig. 1, 2).

The small sample sizes and the low number of animal bone fragments may be due to preservation issues: while examining the material, it could be observed that a large amount of the bone and tooth surfaces were severely damaged. Regarding the bones and teeth, 61 % of the animal bones show a badly preserved surface. [18] Usually, teeth are much better preserved than bones, but at Molino San Vincenzo, they are almost equally damaged, showing a somewhat

15 Lignereux – Peters 1996, 46s.

16 See i.a. Lyman 2008, 21–82.

17 The classification of sizes is divided in size cattle and size OC-Sus (size sheep/goat-pig).

18 This includes the finds of the campaigns 2011 to 2017.

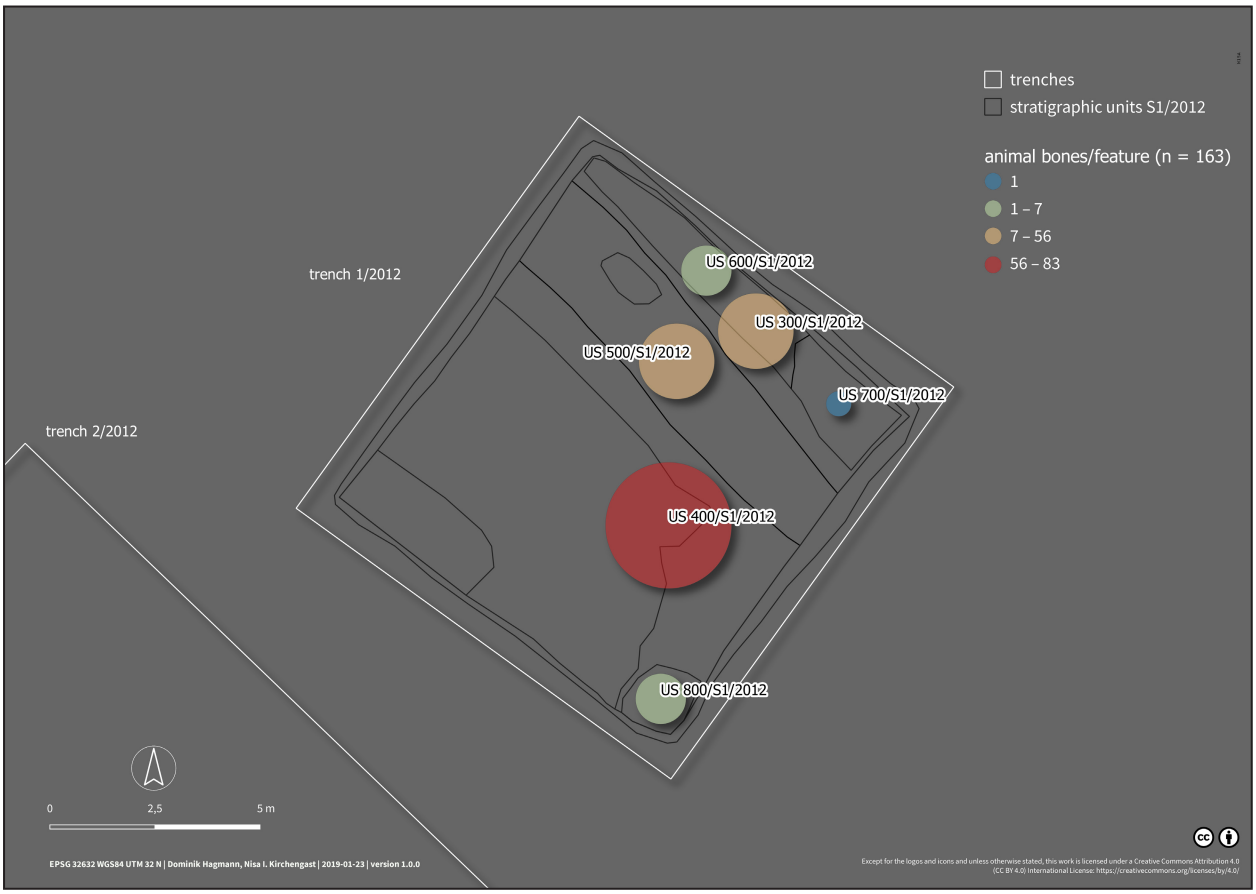

Fig. 2 Map of trench 1/2012 at Molino San Vincenzo containing bone fragments of the major domestic animals (D. Hagmann and N. I. Kirchengast)

soapy and eroded consistency. The surface of the material appears to have been corroded, resulting from soil erosion or the use of fertilizers. Unfortunately, due to the animal bones' damaged surface, modifications such as cut and chop marks, which provide information about food preparation and consumption, are challenging to examine.

3 Species composition

The recovered zooarchaeological material includes almost exclusively mammals. Only 0.6 % of the total number of fragments has been identified as bird remains. Regarding the composition of identified species, pigs (21.1 % of the total number of fragments), followed by ovicaprids (19.2 % of the total number of fragments), represent the major groups of domestic mammals at the site (fig. 3). The latter are mainly composed of sheep, while goats represent only a small proportion of the ovicaprids. Although cattle bones have been recorded in many samples, they merely comprise a relative amount of 11.8 %. In terms of weight, the cattle rank first with 29.4 % of the total weight, followed by ovicaprids (14.3 %) and pigs (13.6 %). In tab. 2, an overview (including the results of the 2018's campaign) of the livestock composition at Molino San Vincenzo is presented.

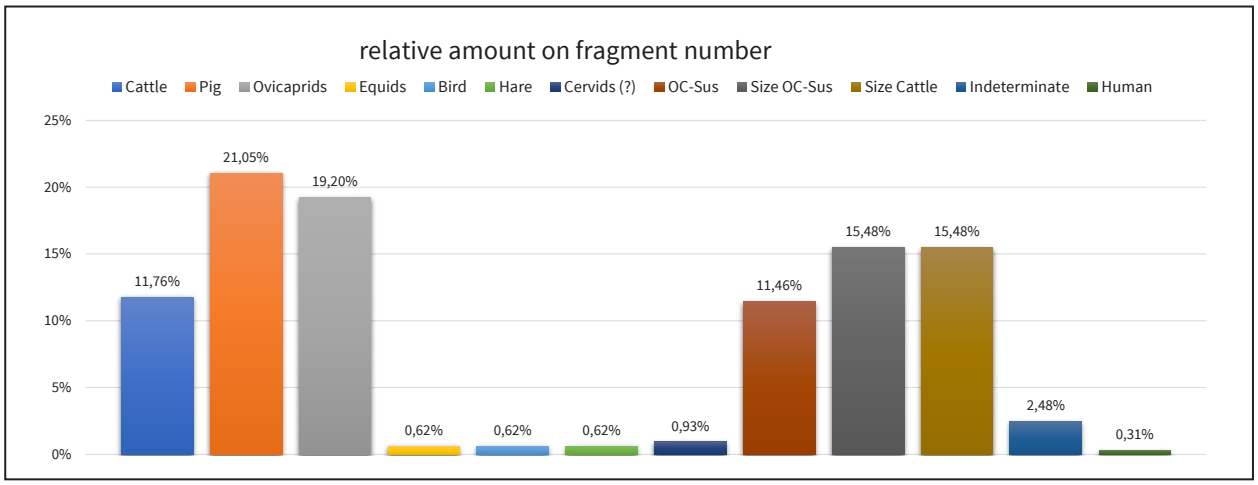

Fig. 3 Animal species composition of all stratigraphic units at Molino San Vincenzo (N. I. Kirchengast)

As a means of illustrating the proportion of the major domestic mammals, the number (NR3) and weight (GR3)[19] of the 'domestic triad' (cattle – pig – sheep/goat) are taken here as 100% to show their respective percentage values. The species distribution proofs that sheep and pigs are the major domestic groups of mammals at the entire site within all periods. The result fits well into other Roman sites' contexts, although the relatively high amount of sheep and goat stands out. Interestingly, just three samples contain all three domestic animals (fig. 4) – other samples present one or two of these species only.

Two fragments from equids (presumable horses) were found independently in the plow soil layer. The bird remains are probably barn fowl, although a precise identification cannot be provided because of the poor state of preservation. Due to the bones' high degree of fragmentation, it is difficult to examine and distinguish between game and domestic animals. A phalange of a hare and two boar canine fragments can very likely be identified as game animals; three fragmented molars might, without certainty, be assigned to cervid. Including these, the amount of game animal bones represents roughly 5 % of the entire site species. One molar collected on the top surface of the field belongs to a human being; therefore, it is not directly connected to any archaeological stratification of Molino San Vincenzo. It appears very likely that this tooth represents a relatively recent find because the molar's surface is in good condition. The MNI[20] can be considered eight (not counting the human tooth), consisting of two sheep/goats, one hare, two pigs, one cattle, one bird, and one equid.

The bone fragments that could not be assigned to an animal species were classified according to their size; together, the categories of cattle-sized and OC-Sus-sized bone fragments represent a relative amount of 15.5 %. Some unidentifiable remains can be narrowed down as probably belonging to pigs or ovicaprids, thus the species classification OC-Sus[21] makes up to

19 See Lepetz 1996, 11.

20 See i.a. Marshall – Pilgram 1993; Lyman 2008, 21–82.

21 OC-Sus represents the group of bone fragments identified either as ovicaprids or pigs.

Taxa	Number	Weight (g)	% NR3	%GR3
Bos	38	404,8	22,62	51,33
Sus	68	187,1	40,48	23,73
Ovis/Capra (OC)	62	196,7	36,90	24,94
NR3-GR3	168	788,6	100,00	100,00

Tab. 2 NR3/GR3 composition at Molino San Vincenzo (N. I. Kirchengast)

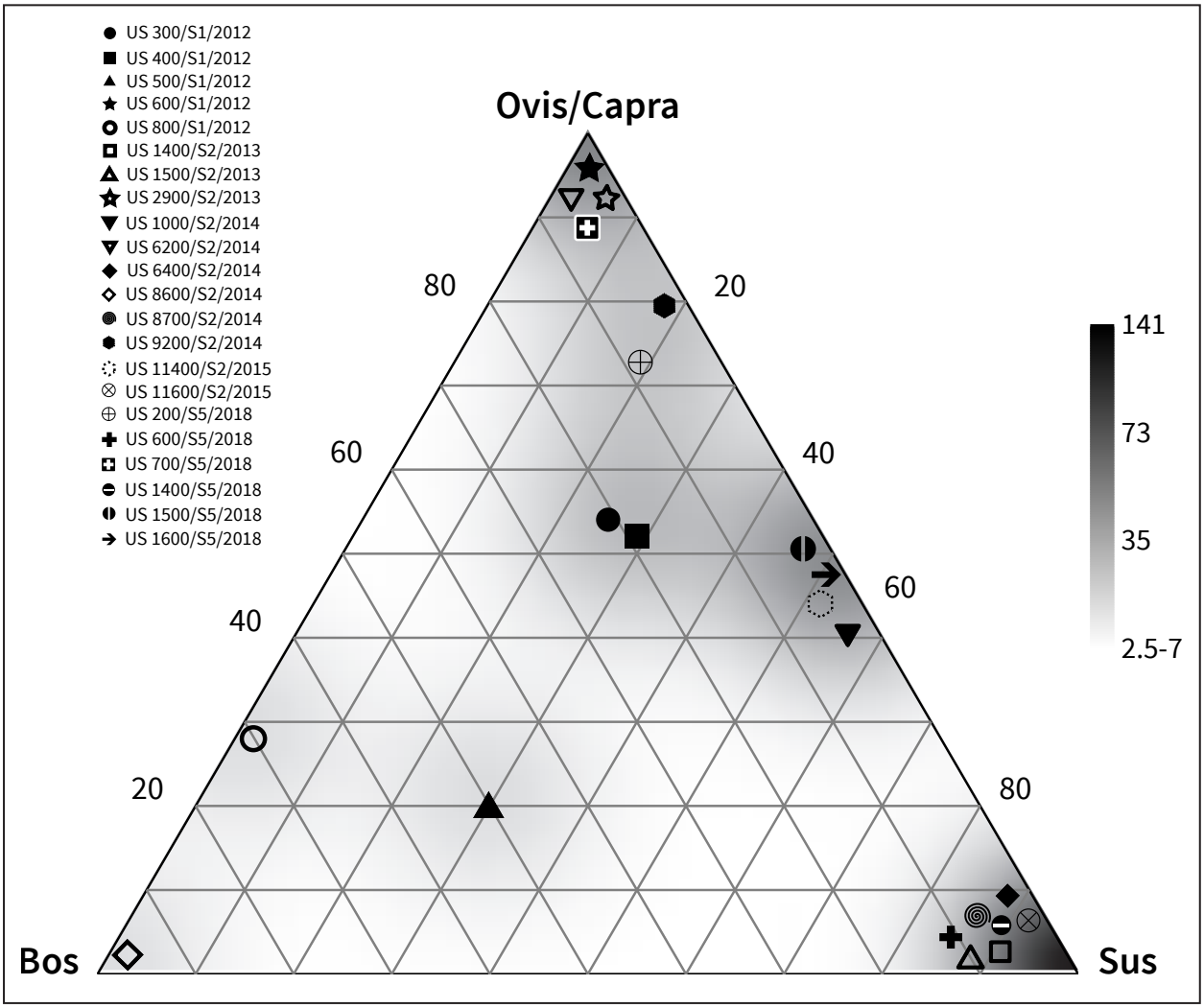

Fig. 4 Distribution of bone fragments between cattle (bos) – sheep/goat (ovis/capra) – pig (sus) (N. I. Kirchengast)

11.5 % of the material. In the case of eight fragments, no size attribution was possible; therefore, they remain as indeterminate.

4 Age range and sexing

In examining the age range of the domestic mammals at Molino San Vincenzo, the epiphyseal fusion stages, tooth eruption, and tooth wear stages have been recorded. The state of fusion was grouped into stages, following the achievements and scheme by O'Connor 1989, which allowed a relative picture of the age at death. Because of the high degree of fragmentation, only a few fusion stages were documented for the main domestic mammals. While the cattle bones have not allowed any examinations, the pig remains' fusion sequence shows a tendency towards younger individuals (fusion stages 'early' and 'intermediate I' are dominant); the ovicaprids tend to be older individuals (intermediate I and II).

While the epiphyseal fusion stages are of limited significance only due to their small number, the more considerable amount of teeth offers a more concise picture of the age structure. The tooth wear stages were examined on the mandibular teeth, according to Grant 1982, and integrated into the eruption and attrition stages by O'Connor 1991. [22] Since there are no cattle teeth fragments in the assemblages left, the age estimation was practiced on the species pig and sheep/goat. Regarding the attrition stages, the age at death of ovicaprids and pigs seems to accumulate in an elder age range. Seven loose pig molar fragments were in an acceptable condition for age estimation. Three teeth were assigned to the groups 'subadult' and 'adult'[23] (tab. 3); one dp4 fragment (milk tooth) with hardly eroded enamel was also recorded.
According to the suggested age at death (after Halstead u. a. 2002), the age at slaughter can be estimated, although an age estimation of loose molar 1 and 2 fragments was difficult, at about two or three years; the pig wearing the dp4 was younger and died very likely before it was 12 months old. An identification of the tooth-bearing individuals as wild boars remains open.

Sheep and goats provide 13 mandibular molars and two dp4 fragments for age estimation; none of the teeth were found in a tooth row. Based on Payne 1985, as many teeth as possible have been distinguished into sheep and goat. Both cover a close range of tooth wear stages, from two fragments in the immature class to four in the subadult and nine in the adult group; [24] the milk teeth fragments, which showed heavy attrition of the tooth surface, are assigned to the group immature. According to the age estimation, the ovicaprids at Molino San Vincenzo died at a relatively high age: Most sheep seem to have died at the age of two to four years (after Halstead u. a. 2002). In general, the average range of slaughter age for meat production is between six months and two years. The estimated age at death could likely correspond to the exploitation stage for the production of milk.[25]

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[22] See also O'Connor 2003, 250 tab. 67.

[23] Two M2 were assigned to subadult I and one M2 to subadult II; one M1 was assigned to adult I, one M3 to adult II and one M3 to adult III.

[24] Three M1 and one M2 were assigned to subadult II; four M2 and two M3 to adult I, one M3 to adult II and one M2 and one M3 were assigned to adult III.

[25] See Blaise 2005; Vigne – Helmer 2007; Vigne u. a. 2011.

	Neonatal	Juvenile	Immature	Subadult	Adult	Elderly
Sus		1		3	3	
Ovis			1	3	7	
Capra			1	1	2	

Tab. 3 Eruption and attrition stages of animal teeth (in absolute numbers) from Molino San Vincenzo classified after O'Connor 1991 (N. I. Kirchengast)

Determining the sex of the animal bones based on the recovered fragments proved to be very difficult due to the high level of fragmentation. Only four canine fragments of boars can be clearly identified; therefore, comparing the sex ratio at this site is not significant enough to estimate.

5 Skeletal part representation

The quantity and representation of skeletal elements in the archaeological assemblages may provide information about the skeletal parts' usage and function in the recycling process of the animal carcass and the handling of animal discard in Roman times. The relative weight distribution of the skeletal elements of the "domestic triad" has been plotted against a comparative skeleton[26] to set the results of the investigations at Molino San Vincenzo in relation to reference weights; these were taken from the IPAS at Basel.[27]

The cattle tibiae are significantly overrepresented (43.6 %), as the phalanges; the metacarpi remain underrepresented (fig. 5). Neither ribs, scapulae, humeri, pelvis, nor femora have been identified, among other important missing skeletal elements. Most of these cattle fragments were excavated in the trench of 2012. Especially in US 500/S1/2012 particularly large skeletal parts remained intact.

The pig skeletal parts' composition differs from that of the cattle: The mandible is significantly overrepresented (46.3 %), as the humeri and tarsals. Vertebrae, ribs, and the metapodials are not represented, where patella, radius/ulna, tibia, fibula, and carpus nearly equal to the reference values. The relatively high amount of mandibles mainly consists of teeth. Among the 42 mandible parts, only one fragment of the caput area has been recorded. The others represent loads of canine and molar fragments. The overrepresentation of the mandible is commonplace in consumption discard at other sites as well. [28] The ovicaprids, like pigs, show an extremely high representation of the mandible (38 %) as well as a high number of scapulae, radius/ulna, and metapodials (fig. 6)

A significant deficit can be stated regarding the ovicaprid tibia, which is absent in the samples, as well as the vertebrae and ribs that are just lowly represented. The high accumulation

[26] For the method see Reichstein 1991; Kunst 2014, 99.

[27] The Integrative Prehistory and Archaeological Science (IPAS) Research Group at the University of Basel (CH) offers reference skeleton weights of the cattle, pig and ovicaprids.

[28] Kunst 2014, 100.

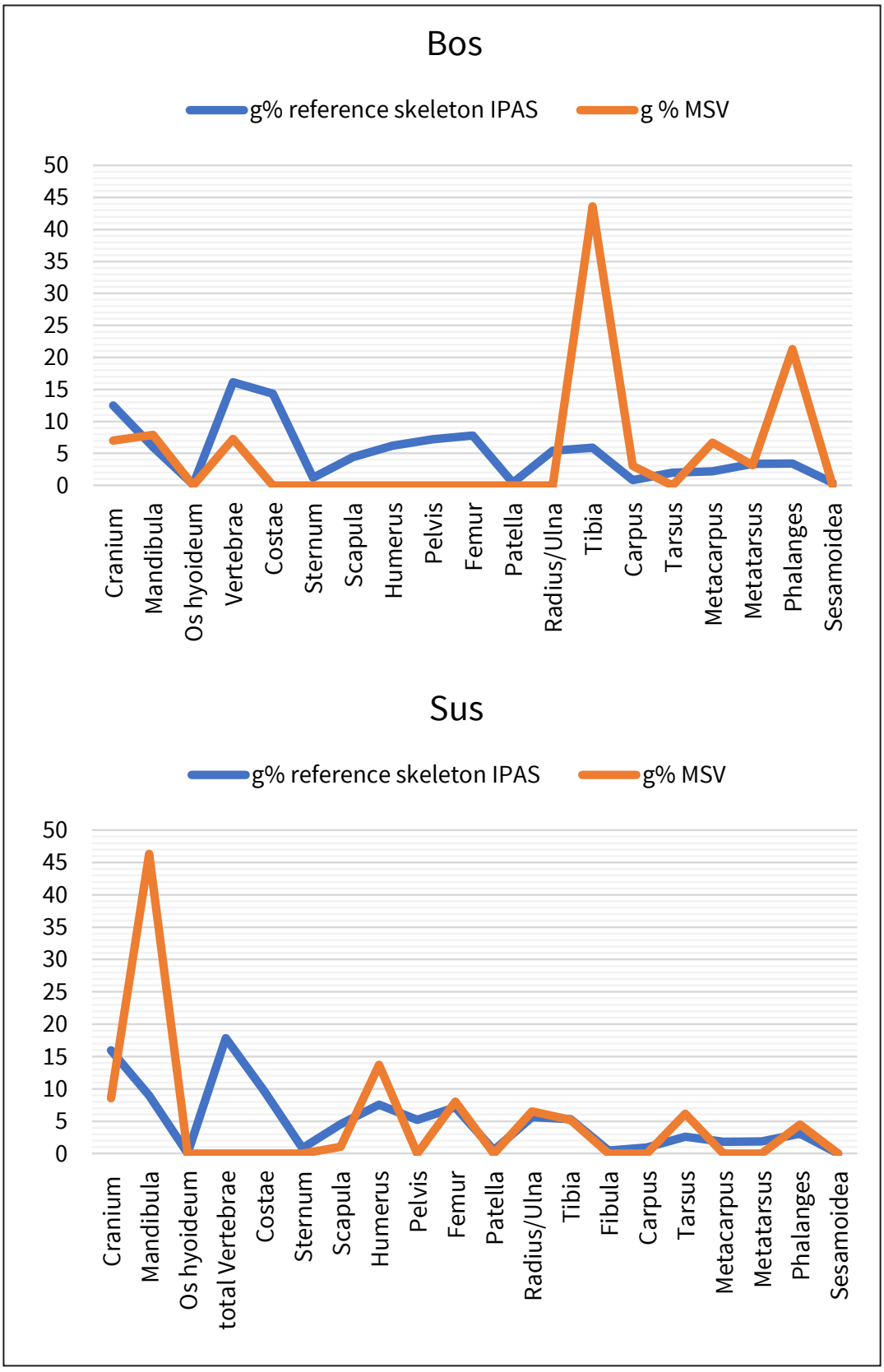


Fig. 5 Cattle and pigs: relative weight distribution of skeletal parts of Molino San Vincenzo compared to a reference skeleton (N. I. Kirchengast)

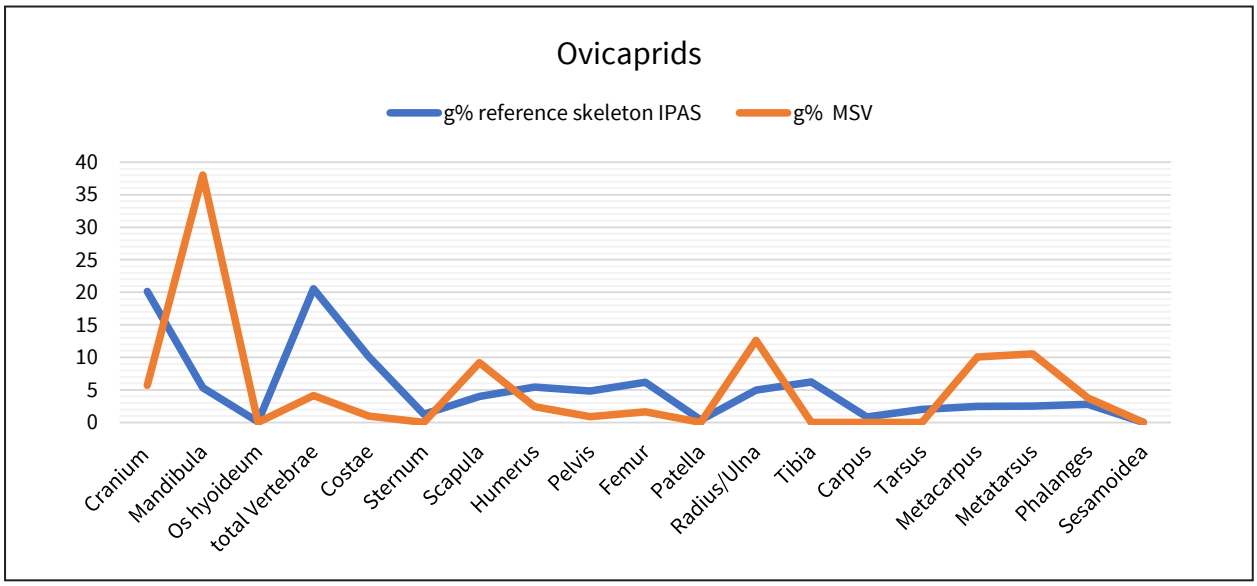


Fig. 6 Ovicaprids: relative weight distribution of skeletal parts of MSV compared to a reference skeleton (N. I. Kirchengast)

of mandibles and metapodials reduces the culinary interpretation of the assemblage. Above all, the long bones, which usually serve as indicators of the findings' nutritional function, are missing. The moderate representation of vertebrae and ribs, similar to the pig's case, is more of a taphonomic loss because these bones are very fragile skeletal parts.

6 Taphonomic observations

From the finds of the entire site, 36 fragments show modifications to their bone surface.[29] Butchery marks as indicators for the consumption of animals by humans (as food or raw material resource) were recorded for 19 fragments as cut and chop marks. These marks primarily appear on cattle fragments (58.3 % of the NR3), followed by pig fragments (25.0 %); only two ovicaprid bones show such modifications. Regarding the skeletal elements, mainly vertebrae and long bones show fractionizing marks at common slaughter positions.[30]

Besides the butchery marks, damages which can be defined as gnaw marks of carnivores have been identified. These marks indicate that the bones may have remained on the ground surface for a long time before they were deposited permanently under the soils. Twelve burned bones have been recorded in the samples: the highly fragmented bones (average weight of 6 g) offer a wide range of burning stages, from light brown to fully calcined. No pathologies have been observed in the analyzed find material.

[29] The results of 2018 are not yet included in this analysis.

[30] Lignereux – Peters 1996, 59-69.

7 Osteometric data

For osteometric analysis, measurements of 15 bone fragments in total have been taken: Therefore, seven cattle fragments (tibia, os ulnare, metacarpi, 1st and 2nd phalange), five ovicaprid fragments (scapula, metacarpus, metatarsus, 2nd phalange), and one each of pig and equid radius, as well as one hare phalange were used. Only a few individual measurements could be taken of the skeletal elements, so a useful comparison with other sites does not appear feasible.[31] Due to the high fragmentation and the small assemblage, it was also impossible to estimate any withers heights.

8 Animal bones of the Roman period at Molino San Vincenzo

In the features containing exclusively Roman dated pottery,[32] 64 bone fragments have been examined. With an average sample size of 3 fragments and 6.4 g, they show a total weight of 137.2 g. The NISP is 41 (including OC-Sus) with a weight of 114.7 g. They represent 12.7 % of the total number of fragments and 8.3 % of the total weight of the analyzed zooarchaeological finds of this site, consisting of 52 bone fragments and 12 teeth. The composition of species appears similar to that of the entire assemblage (fig. 7), although the relative amount of ovicaprids is higher (28.3 %) and represents the highest amount of all animal identification categories at the site.

The second strongly represented species in terms of weight is pig (27.6 %). Regarding the number of fragments, pig dominates with 20.3 % among the identified domestic animals, followed by sheep/goats with 15.6 %. Cattle and cattle-sized species have a ratio of about 10 % regarding the total number of bones in Roman times. Furthermore, two bird fragments could be identified. The categories of OC-Sus and OC-Sus-sized animals were recorded with a high percentage of 17.2 % and 25.0 %. The MNI has been determined as five individuals (one pig, one cattle, two sheep/goats, and one bird). Regarding the NR3 and GR3 composition (tab. 4), pigs and ovicaprids represent the highest relative number and weight of fragments.

Although cattle often give the largest weight ratio due to their size and innate bone weight, they only count for 23.1% in the Roman samples. It is difficult to extract valuable information for comparisons with other sites due to the small number and weight of the bone fragments with an NR3 of 29 and GR3 of 99.7 g. Considering the distribution of cattle, pig, and sheep/goat per feature at Molino San Vincenzo (fig. 8), only three layers offered a minimum of two animal species. The 'domestic triad' as a whole is not represented in any sample dated to Roman times. Only in two samples cattle fragments could be recorded, ovicaprids in four and pigs in five samples. The majority of bone fragments were recovered in the features US 800/S1/2012 and US 1000/S2/2014. US 800/S1/2012 is the backfill of a pit in the southeastern part

[31] A similar situation presented itself at the site Il Monte, see Prilloff 2013, 96s.

[32] In this analysis, the zooarchaeological finds of 2018 are not included. Dating a feature as 'Roman' refers only to the feature's own ceramic finds which were uncovered together with the bone material in course of the excavations. Relative chronological dating regarding the stratigraphic sequence and absolute dating using scientific dating methods has (yet) not been applied and is therefore not included in the following discussion.

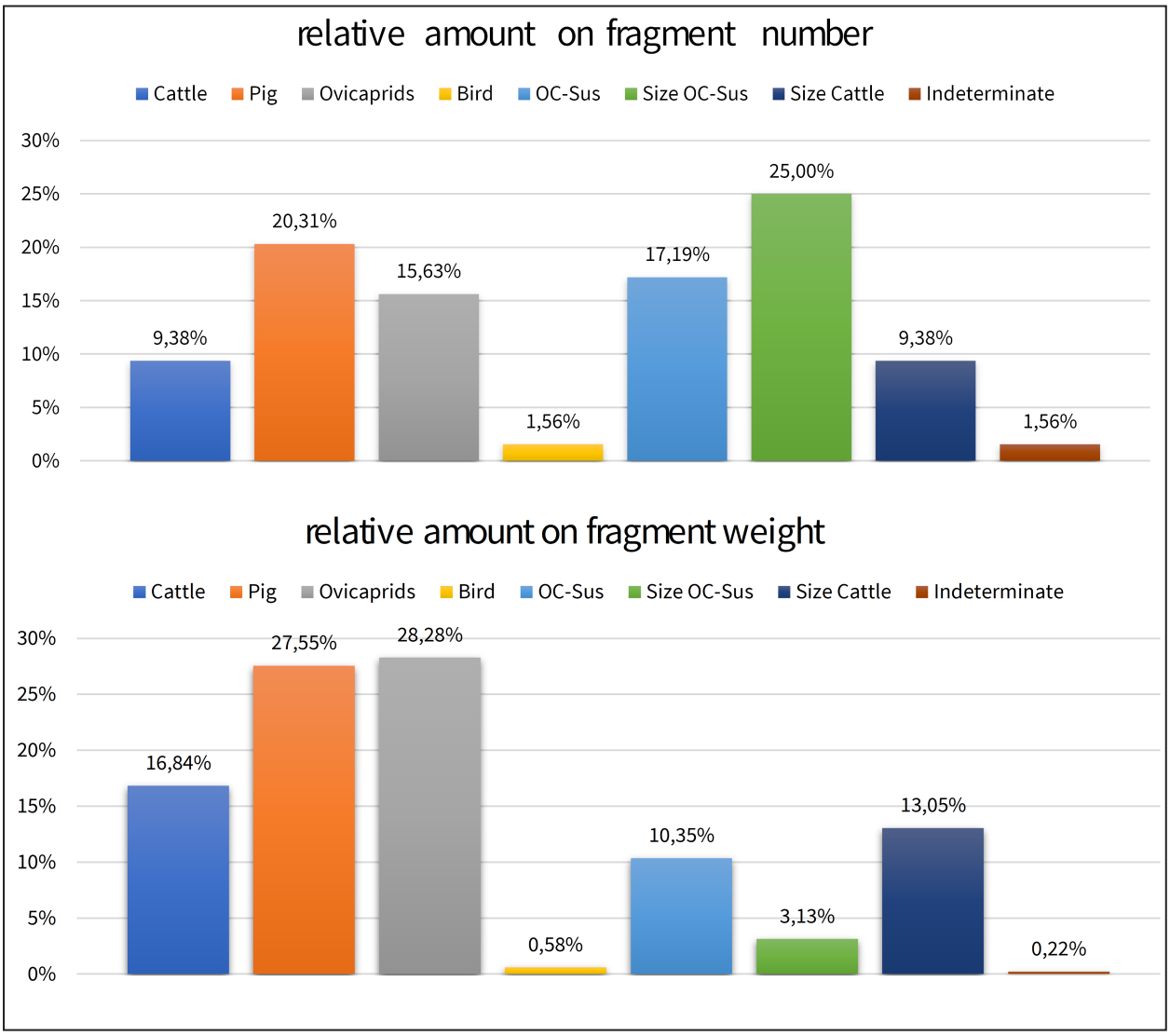


Fig. 7 Animal species composition in stratigraphic units containing exclusively Roman pottery at Molino San Vincenzo (number and weight) (N. I. Kirchengast)

of trench 1/2012, and this feature's zooarchaeological finds consisted exclusively of sheep and bovine bones; long bones, in particular, could be identified here too. These species' presence could indicate a more peripheral character of this area of the site as cattle and sheep bones are often used only as secondary resources instead of predominantly culinary purposes.[33]

US 1000/S2/2014 is part of the working pit's backfilling belonging to the pottery kiln (IF 112/S2/2015) in trench 2. In particular, ovicaprids and pig remains were uncovered here. Regarding the distribution of skeletal elements, the comparatively high number of skull parts is remarkable. Several cranium fragments can be assigned to pig, several fragments of mandibles

[33] For an urban context see Schmidig – Deschler-Erb 2015, 331.

Taxa	Number	Weight (g)	% NR3	%GR3
Bos	6	23,1	20,69	23,17
Sus	13	37,8	44,83	37,91
Ovis/Capra (OC)	10	38,8	34,48	38,92
NR3-GR3	29	99,7	100,00	100,00

Tab. 4 NR3/GR3 composition in Roman times at Molino San Vincenzo (N. I. Kirchengast)

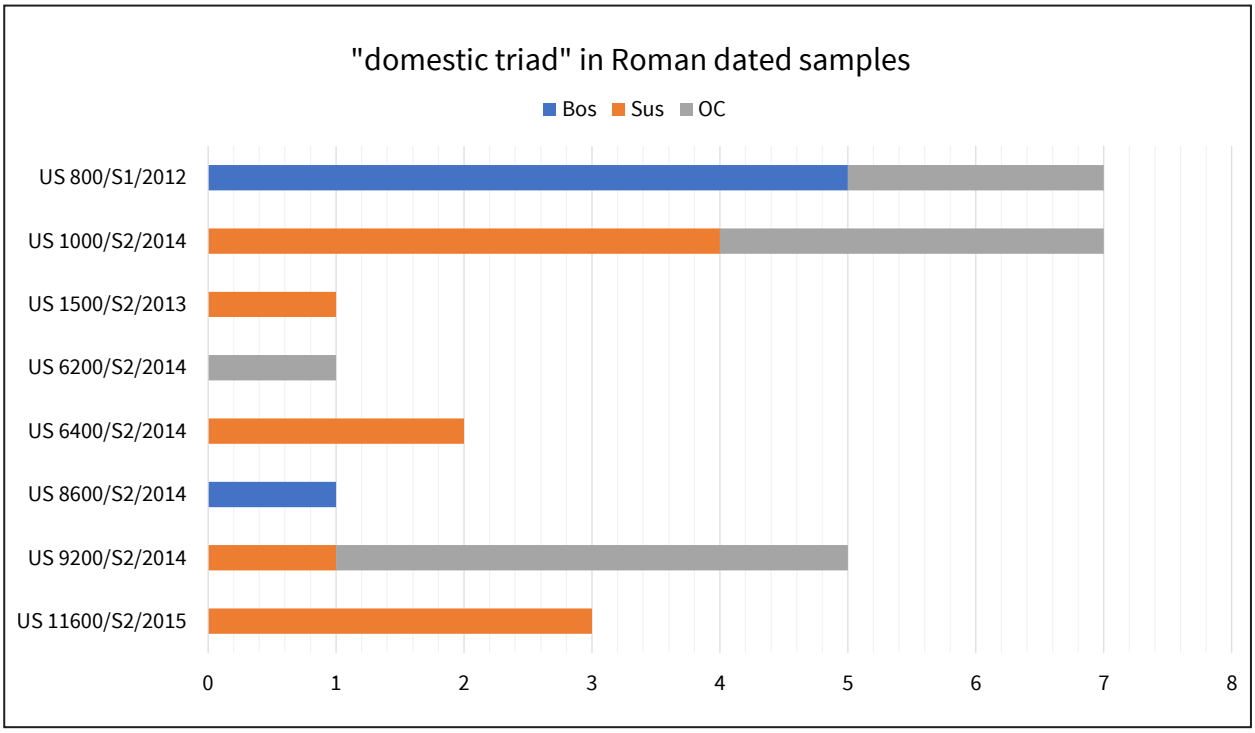


Fig. 8 Composition of the 'domestic triad' in features exclusively containing Roman pottery (N. I. Kirchengast)

to ovicaprids as well. This sample has a more 'domestic' character, as pig bones are more likely to indicate a culinary character of the finds. Regarding the feature's formation process, the skull fragments may have been deposited as refuse from carcass preparation into the former kiln pit after the kiln's abandonment.[34]

As far as the age range of animals in features containing Roman pottery is concerned, the age at death is more likely to be adult or nearly adult. Because of the high fragmentation of the long bones and only one incisive fragment, cattle's age estimation could not be performed for these samples. Regarding the pig fragments, no epiphyseal fusion stage could be estimated. Regarding the mandibular teeth' attrition, the age classes 'juvenile' and 'adult' are present. The

[34] See the contribution by D. Hagmann.

Fig. 9 Example of bone fragments in a find context exclusively containing Roman pottery (N.I. Kirchengast)

ovicaprids show an age range of individuals from under the age of three and, concerning the fusion stage, to 4 years (adult I)[35] based on the attrition of the molars; the (sub-) adult class ratio seems to be dominant. In general, younger individuals cannot be examined in any significant quantity in the assemblages with Roman dated pottery. An estimation of the sex ratio was not possible due to the high degree of fragmentation.

A high percentage (39.1 %) of long bones cannot be identified any further in the skeletal part representation. 17.2 % of the total number of bones in the Roman dated samples have been specified as mandibles of pigs and ovicaprids. Furthermore, the limbs humeri, radii, tibiae, metapodials, and pelvis fragments can be sporadically documented for these two species (fig. 9); vertebrae fragments and femora present the most significant deficits in the samples.

For the cattle, two diaphysis fragments of a metapodial and tibia as well as an incisive fragment have been examined. The single bird bone has been identified as a humerus. Concerning taphonomic observations, on 34 fragments a heavily damaged bone surface has been recorded in the Roman dated assemblages. Besides three burning marks on not further identifiable fragments, two bones obviously show chop marks. On a mandible of a young pig and on a diaphysis fragment of a sheep metacarpus, a flat-angled chop mark is visible in the articular surface in the caput area. On a cattle-sized lumbar vertebra fragment and on a pubis fragment of an ovicaprid, gnaw marks have been recorded. Due to the small number of fragments permitting taphonomic observations, the chance of reaching meaningful conclusions is small.

[35] See Reichstein 1991; Hambleton 1999.

	Cattle	Pig	Ovicaprid	Bird	Dog	Equid	Total
Total number of fragments	125	173	144	2	4	29	477
n % of total fragment number at the site	25,77	35,70	29,87	0,41	0,82	5,98	
Weight	4357,0	571,0	500,0	1	8,5	960,5	6394,0
MNI	5	13	10	2	3	3	30

Tab. 5 Composition of domestic animals at the site Il Monte, San Gimignano (after Priloff 2013 119, tab. 6)

9 A comparison between the site Il Monte and Molino San Vincenzo

A comparison between Molino San Vincenzo to a familiar location in the region nearby has been undertaken to interpret the zooarchaeological results in the context of Roman rural sites. The site of Il Monte near San Gimignano, Tuscany, is used as a comparative example. [36] The University of Jena has excavated this site throughout several campaigns between 2006 to 2010 under the direction of Günther Schörner. The two sites have been compared primarily considering two aspects: on the one hand, the number and identification of animal bones recorded during the excavation campaigns, and on the other hand, the dispersion of bones by animal species.

At the site of Il Monte, 681 fragments of animal bones with a total weight of 6758.5 g have been recovered and analyzed. [37] The NISP of the domestic animals is 477 (tab. 5); eight fragments were identified as game animals. The NR3 distribution appears almost balanced, with all three animal species accounting for about 30%. Pigs represent the highest relative amount of the 'domestic triad' with 39.1 %. In contrast, in the GR3, cattle dominate with 80.3 %, followed by pigs with 10.5 % and sheep/goats with 9.2 %. Compared to Molino San Vincenzo, differences in the composition are apparent. While the NR3 distribution at Molino San Vincenzo is dominated by pigs and sheep, with cattle as the smallest group of the three domestic species, the latter's GR3 amount is reduced to only about 50 % instead of 80%; they are followed by ovicaprids and pigs. Besides the higher quantity of animal remains at Il Monte, the composition of all present species differs from Molino San Vincenzo, but there are paral-

[36] This site was chosen because of the easily accessible data sets as well as the fact that Günther Schörner was the excavation supervisor at both sites. The zooarchaeological investigation was undertaken by J. Prilloff and published in Prilloff 2013.

[37] Prilloff 2013, 119 tab. 6.

lels too (fig. 10). Regarding the other animal species, the game animals are comparable to the number and weight of fragments from the features of Molino San Vincenzo.

Further, birds and equids represent a similar number of fragments; dogs, which in Il Monte were recorded four times, are entirely missing from the assemblage of Molino San Vincenzo. The classification category of OC-Sus was not used in the investigations at Il Monte. The differences between these two sites are evident in species composition, especially in the fragments' weight, as is the absence of cattle fragments in Molino San Vincenzo and the smaller amount of pigs and ovicaprid fragments in Il Monte. Regarding the number of fragments, however, the two sites show very similar trends.

The dispersion of skeletal elements has primarily been compared regarding the body parts of heads and legs; these categories were chosen because of the high level of bone fragmentation at both sites and quantitative size reasons. This comparison shows that the cattle correspond within the dominance of hind leg fragments, while pigs in Molino San Vincenzo have a higher number of head fragments than at Il Monte. Regarding the ovicaprids, the head fragments of MSV are more significantly represented (20.0 %) than at Il Monte (1.9 %). A higher amount could be determined concerning the leg fragments at the site Il Monte (70.0 % at MSV, 94.4 % at Il Monte).

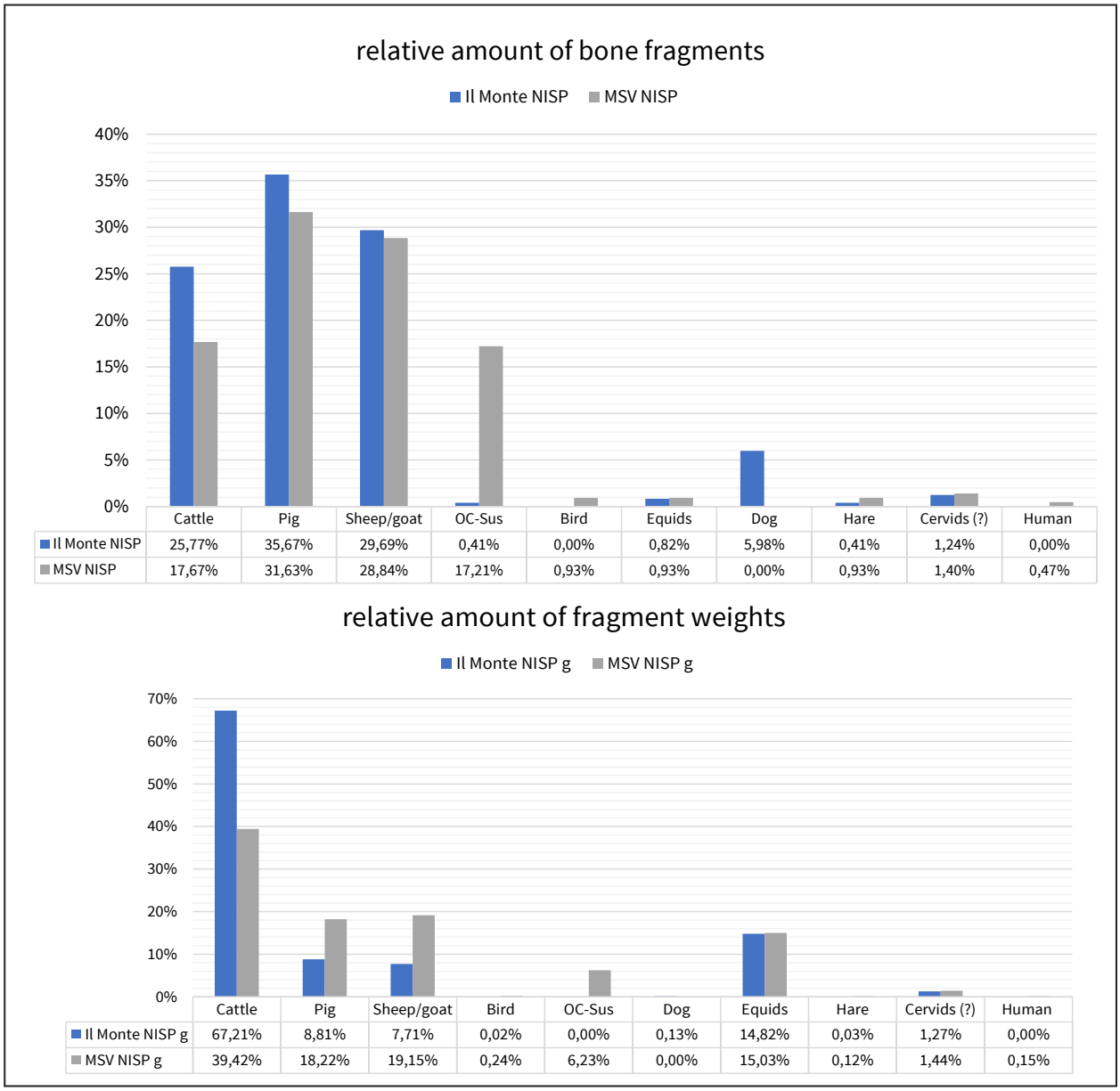
10 Conclusion

In conclusion, analyzing the zooarchaeological finds of Molino San Vincenzo has given us insight into animal husbandry and consumption at this site. The following important observations have been made:

1. The average sample sizes are small, with a high degree of fragmentation of the animal bones.
2. A high amount of the bone surface has been heavily damaged.
3. Regarding the composition of species, pigs and sheep dominate the assemblage; cattle seem underrepresented.
4. Features containing Roman pottery show a slight dominance of sheep fragments in terms of weight.
5. The age range is pointing towards a trend to more adult than juvenile individuals.
6. The determination of sex and the distinction between domestic and game animals proved rather difficult.
7. Compared to the site Il Monte, similarities in the number of fragments and skeletal parts distribution are apparent. However, differences exist regarding their weight.

If we consider that pork has traditionally been regarded as the most important livestock meat in Roman times based on literary evidence, the amount of cattle and sheep fragments at these sites seems surprisingly high. Both specimens seem to have served primarily as resources for milk and wool while the importance of ruminants in Roman diet was minor.[38] Based on these observations, it can be stated that, at Molino San Vincenzo in particular, small ruminants and

[38] Ikeguchi 2017, 7.



	Cattle	Pig	Sheep/goat	OC-Sus	Bird	Equids	Dog	Hare	Cervids (?)	Human
Il Monte NISP	25,77%	35,67%	29,69%	0,41%	0,00%	0,82%	5,98%	0,41%	1,24%	0,00%
MSV NISP	17,67%	31,63%	28,84%	17,21%	0,93%	0,93%	0,00%	0,93%	1,40%	0,47%

	Cattle	Pig	Sheep/goat	Bird	OC-Sus	Dog	Equids	Hare	Cervids (?)	Human
Il Monte NISP g	67,21%	8,81%	7,71%	0,02%	0,00%	0,13%	14,82%	0,03%	1,27%	0,00%
MSV NISP g	39,42%	18,22%	19,15%	0,24%	6,23%	0,00%	15,03%	0,12%	1,44%	0,15%

Fig. 10 Number and weight of fragments, comparison of the relative amounts between Il Monte and Molino San Vincenzo (N. I. Kirchengast)

pigs dominated the picture of animal husbandry. Since sheep represent a relatively high and cattle a relatively small amount, a small livestock husbandry-related agriculture hypothesis can be established. Considering the sheep's comparatively higher age, their use for milk or wool production seems highly likely. As additionally observed at Il Monte, parallels can be seen in other sites as well, for example, at Settefinestre:[39] A similar number of cattle fragments and NR3 distribution can be found there too. By completing the analysis of the finds of the 2018's

[39] MacKinnon 2004, 62-64 tab. 14.

excavation campaign (osteometric data, taphonomic data, age-range), an even more detailed picture will provide more information on animal husbandry and use at the site Molino San Vincenzo.

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