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THE ZOOARCHAEOLOGICAL ANALYSES FROM VETRICELLA (SCARLINO, GROSSETO): AN OVERVIEW OF ANIMAL EXPLOITATION AT THE SITE

INTRODUCTION

The assemblage of animal remains from Vetricella includes 2062 recorded specimens; of these, 1564 were countable (see Methods). The contexts analysed in this study are dated to the second half of the 10th-first half of the 11th centuries AD, and to the mid-11th-mid-12th centuries AD. The earlier period will be referred to in the text as 'Period IV', and the later one as 'Period V+VI' (*tab.* 1). Regarding Period V+VI, the stratigraphic sequence suggests the materials are in secondary deposition; indeed, zooarchaeological results highlight strong similarities with the previous period, suggesting that all faunal remains had been originally deposited during Period IV.

1. METHODOLOGY

1.1 The recording protocol

The recording system adopted in this study abides the principles of the diagnostic zone method outlined by Watson (1979). The recording method follows the protocol created for the faunal assemblage of West Cotton (UK) by Albarella, Davis (1994), although some aspects were adapted to fit the nature of the faunal assemblage from Vetricella.

Diagnostic zones are morphologically distinctive parts present in most anatomical elements, which are defined prior to recording and are the same for all species. Each diagnostic zone is chosen according to its level of differentiability between taxa and to its potential of survival within the archaeological record (Watson 1979; Davis 1992). In this study, each specimen was recorded only when more than 50% of the diagnostic zone was present; this allowed to partly overcome fragmentation biases, with a higher control on specimen interdependence, and a mitigation of the usual underrepresentation of smaller taxa and anatomical elements.

1.2 Taxonomic identification

The identification of animal remains mainly relied on comparisons with the zooarchaeological reference collection held at the Dipartimento di Scienze Storiche e dei Beni Culturali of the University of Siena. The animal bone atlases by Schmid (1972) and Barone (1976) were also used.

Recordable elements were identified to species-level whenever possible; however, in some cases this was not feasible and higher taxonomic ranks had to be assigned. This was the case, for example, for sheep (*Ovis aries*) and goat (*Capra hircus*), whose identification was attempted on a limited set of anatomical elements according to the morphological criteria outlined by Zeder, Lapham (2010) and Zeder, Pilaar (2010). All fragments which could not be identified to species-level were more generally assigned to the sub-family of caprines.

In specific circumstances, Prummel (1988) was used for separating cattle (*Bos taurus)* from red deer (*Cervus elaphus*) remains; when this was not possible, the broader category *Cervus/Bos* was used. Similarly, the category *Ovis/Capra/Capreolus* was used when it was not feasible to identify a specimen as either caprine (sheep/goat) or roe deer (*Capreolus capreolus*).

In the majority of cases, the wild boar (*Sus scrofa*, the ancestor of domestic pigs) cannot be distinguished from the pig (*Sus domesticus*) on the basis of morphological criteria. However, attempts to separate the two species biometrically were made by merging measurements from mandibular teeth into log ratio histograms.

Micromammal bones cannot often be assigned to a species; species-level identification was only attempted on molariform teeth. In most cases, the wider categories Large rodent, *Rattus/Arvicola*, Small rodent, Small Murinae (mice), and Small Microtinae (voles) had to be used.

The distinction between chicken (*Gallus gallus*) and other galliforms similar in size, such as the pheasant (*Phasianus colchicus*) and the helmeted guineafowl (*Numida meleagris*) was only attempted on the most diagnostic elements (proximal coracoid, proximal scapula, distal humerus, ulna, proximal femur and tarsometatarsus) and relied on the atlas by Tomek, Bocheński (2009), as well as on consultation with the reference collection held at the Dipartimento di Scienze Storiche e dei Beni Culturali of the University of Siena.

1.3 Quantification

The number of identified specimens (NISP) was used to establish the relative proportion of each taxon present at the site in the analysed periods; the NISP represents the raw count of all specimens classified as 'countable' (Albarella, Davis 1994).

In addition, to mitigate some of the biases affecting the NISP (e.g. recovery bias, interdependence, variability in the number of bones making up the skeleton of different species; Grayson 1984; Lyman 1994), the Minimum Number of Individuals (MNI) was calculated; this method uses the most frequent anatomical element for each taxon (MNE), adjusted

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Chronology	Period	Countable	Non-countable	Total
9th c. AD	Period II	10	10	20
first half of the 10th c. AD	Period III	8	2	10
second half of the 10th c.-first half of the 11th c. AD	Period IV	862	267	1129
mid-11th c.-mid-12th c. AD	Period V+VI	614	191	805
20th c. AD	Period VII	70	28	98
	Total	**1564**	**498**	**2062**

tab. 1 – Number of recorded countable and non-countable specimens by period.

by the number of such element in the skeleton (MAU, see below), as a predictor of frequencies (Lyman 1994).

1.4 Taphonomic processes

1.4.1 *Surface preservation*

Surface modifications were analysed under a bright lamp and, when necessary, a magnifying glass was used. Surface preservation was recorded using five stages: excellent, good, medium, bad, and awful; each stage reflects specific conditions of bone preservation. Particular types of exfoliations, corrosions, concretions and/or particular polishing or deformations of the analysed animal remains were always recorded and described in detail.

1.4.2 *Recovery bias*

The faunal assemblage from Vetricella was mainly hand-collected; hence, it is likely to be affected by a recovery bias. In other words, large-sized remains, which are those more clearly visible by the naked eye in the archaeological record, would have been preferentially recovered. This situation would have caused an overall underrepresentation of small-sized mammals, birds, and fishes, as well as of smaller anatomical elements within each taxon.

The recovery bias has been assessed by calculating the proportion of correlated suid anatomical elements of different sizes, namely tibiae and astragali, and metapodials and 1st phalanges. The smaller anatomical elements (i.e. astragali and phalanges) would have had less chances of being recovered during excavation; therefore, their proportions in relation to the larger elements provide an approximate indication of the presence and extent of a recovery bias.

1.4.3 *Anatomical element distribution*

The analysis of the distribution of anatomical elements is based on calculations of the Minimum number of Anatomical Units (MAU); these are calculated by dividing the Minim Number of anatomical Elements (MNE), which represents the minimum number of elements necessary to account for the recorded remains within each taxon, by the number of each element in an animal's skeleton. The recording protocol used in this study considers only one or two diagnostic zones per anatomical element (Albarella, Davis 1994), thus making the calculation of the MNE rather straightforward (e.g. 10 distal humeri would produce an MNE of 10 for that anatomical unit; in turn, as there are two distal humeri in a skeleton, the MAU is in this case 5).

1.4.4 *Butchery*

Butchery marks were recorded as cut marks, chop marks, and saw marks. The anatomical positions of butchery marks on the recorded faunal material were described, as these provide valuable information on animal carcass processing.

1.4.5 *Burning*

Burning evidence on animal remains was classified as burnt (black colouration covering all or most of the bone surface), singed (localised burnt areas), or calcined (white or light grey/blue colouration).

1.4.6 *Gnawing*

Gnawing marks produced by carnivores and/or rodents were systematically recorded. Pig and human gnawing are more difficult to be identified in comparison to those of carnivores and rodents; for this reason, their identification was not attempted here.

1.5 Ageing and sexing

In this study, tooth wear stages were recorded following Wright *et al.* (2014) for pigs, O'Connor (1988) for cattle, and Payne (1973) for caprines. When mandibles (and, in the case of pigs, also maxillae) could not be directly attributed to a wear stage, the tables by Wright *et al.* (2014), Grant (1982) and Payne (1973) were consulted.

Unfortunately, due to the dearth of recovered cattle and caprine mandibles for both periods, tooth ageing analyses could only be carried out for suids.

The analysis of long bone epiphyseal fusion was only carried out for cattle, as for other taxa more detailed analyses are still ongoing. Fusion data were grouped into three stages (early, mid and late fusing) according to Silver (1969).

Analyses of the sex ratio is here limited to suids, and relies on the proportion of male and female canines from preserved jaws and also on the morphology of their alveoli (due to recovery bias issues, loose teeth were not considered).

1.6 Biometry

Bone and tooth measurements were taken after von den Driesch (1976), Payne, Bull (1988), Davis (1992), and Albarella, Payne (2005). In this paper, biometrical analyses focus exclusively on suid mandibular teeth; additional biometrical analyses on the post-cranial bones of suids and cattle are still ongoing. As not enough measurements from individual teeth (e.g. from the M3s) were available, it was decided to merge tooth measurements using the log ratio technique; this was introduced in the 1940s by Simpson (1941), and for the first time applied to archaeological material by Meadow (1981; 1999); it is nowadays the most widely used scaling index technique in zooarchaeology (Albarella 2002). The log ratio technique consists of dividing the archaeological measurements by a standard of the same measurements; these relative values are then converted into logarithms and plotted together on the same scale (Meadow 1999):

$$\text{Plotted value} = \text{Log}_{10}(\text{archaeological measurement}/\text{standard measurement})$$

Vetricella		
Taxa	**Period IV**	**Period V+VI**
Cattle (*Bos taurus*)	51	33
Caprines (sheep – *Ovis aries;* goat – *Capra hircus*)	31	12
Suids (pig – *Sus domesticus*; wild boar – *Sus scrofa*)	295	120
Equids (*Equus* sp.)	14	14
Cervids (red deer – *Cervus elaphus;* fallow deer – *Dama dama*)	12	11
Roe deer (*Capreolus capreolus*)	(2)	(1)
Felids (domestic cat – *Felis catus*; wild cat – *Felis silvestris*)	15	-
Canids (dog – *Canis familiaris*; wolf – *Canis lupus*)	4	2
Lagomorphs (hare – *Lepus* sp.; rabbit – *Oryctolagus cuniculus*)	5	3
Hare (*Lepus* sp.)	(1)	(2)
Mustelids	4	3
European badger (*Meles meles*)	(2)	(1)
Glirids	6	8
Edible dormouse (*Glis glis*)	(3)	(5)
Large/medium-size rodents	100	125
Rattus sp./*Arvicola* sp.	(67)	(55)
Rattus sp.	(4)	(12)
European water vole (*Arvicola terrestris*)	(17)	(25)
Small rodents	220	225
Small voles	(1)	(1)
Small murids	(22)	(21)
Apodemus sp.	(12)	(7)
Insectivores	12	10
Talpa sp.	-	(2)
Crocidura sp.	(11)	(6)
Sorex sp.	(1)	(2)
Galliforms (*Gallus/Numida/Phasianus*)	39	14
Domestic fowl (*Gallus gallus*)	(29)	(10)
Anatids	1	1
Passeriformes	8	2
Gruiformes	3	-
Wood pigeon (*Columba palumbus*)	1	-
Eurasian skylark (*Alauda arvensis*)	5	1
Barn owl (*Tyto alba*)	0	1
Blackbirds and starling (*Turdus* sp./*Sturnus* sp.)	6	6
Testudines (tortoises/turtles)	6	3
Amphibians	12	15
Fish	8	-
Molluscs (terrestrial gastropods)	4	5
Total	862	614

tab. 2 – List of all taxa recorded for Period IV and Period V+VI. Non-countable elements are not included. In case a taxon is only present with non-countable fragment(s), this is indicated with a +.

The standard values used in this research are the measurements of suid mandibular teeth from the Early Anglo-Saxon site of West Stow (Suffolk, UK) (Rizzetto forthcoming).

2. RESULTS

2.1 Species frequency: NISP and MNI

Among the domestic animals, pig, cattle and domestic fowl make up the majority of NISP counts in the two periods (*tab.* 2). Suids (mostly *Sus domesticus* – see Biometry) are the most numerous of the main domestic species in both periods.

Cattle (*Bos taurus*) is represented by ca. 15% of the total NISP in Period IV, and its frequency slightly increases in the following period (ca. 20%) (*fig.* 1).

Caprines (*Ovis aries* and/or *Capra hircus*) are barely present (<10%) (*fig.* 1). On the basis of morphological criteria, most caprine remains were identified as sheep, or were generally recorded as sheep/goat; very few goats were found (i.e. 5 for Period V+VI).

The MNI frequencies of the three main domesticates show a very similar trend to the NISP, and no substantial differences are evident between the two periods[1]. The strong similarity of results from the two quantification methods (NISP and MNI) gives us confidence about the high degree of reliability of the analyses.

Equid remains were present, their incidence being slightly higher in Period V+VI (*tab.* 2). On the basis of morphology and size, it is likely that most of the recorded specimens belong to horse (*Equus caballus*); however, the potential presence of donkey (*Equus asinus*) and/or equid hybrids (i.e. mules, hinnies) cannot be excluded.

Other potential domesticates recorded at Vetricella are dogs (*Canis familiaris*) and cats (*Felis catus*). Most of fused canid remains were quite robust; this would exclude the fox (*Vulpes vulpes*) as a possible identification, but not the wolf (*Canis lupus*).

Felid remains (morphological similarities between the domestic cat (*Felis catus*) and the European wild cat (*Felis silvestris*) did not allow separating the two forms) were quite

[1] The MNI for the main domesticates (cattle, caprines and suids) is in Period IV n: 33 and in Period V+VI n: 43.

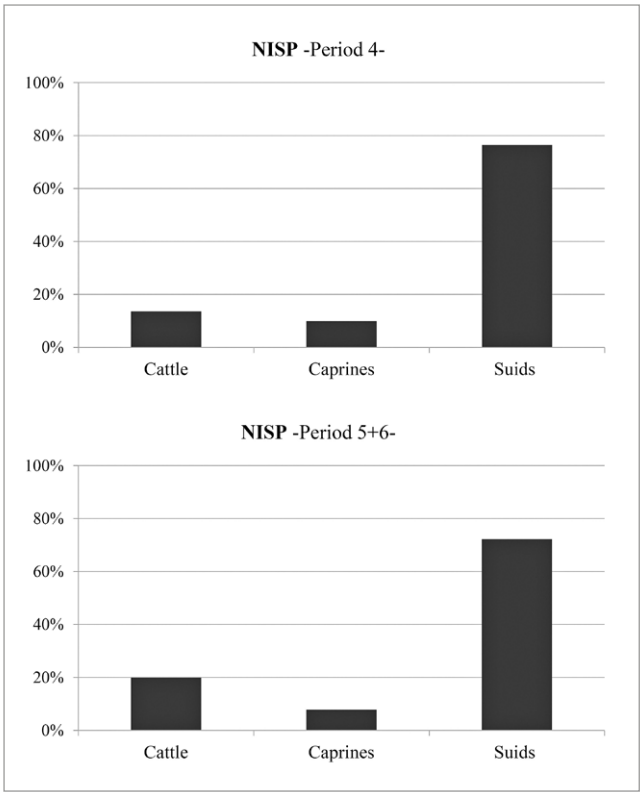

fig. 1 – Percentages of the Number of Identified Specimens (NISP) for the three main domesticates in Period IV (n:377) and Period V+VI (n:165).

abundant in Period IV, while they are completely absent in the following period (*tab.* 2).

Cervids are similarly represented in both periods. Due to the dearth of distinctive morphological differences, most cervid remains were identified as red deer/fallow deer (*Cervus elaphus*/*Dama dama*). Three anatomical elements were directly attributed to the roe deer (*Capreolus capreolus*). In addition, antler fragments (non-countable elements) were also recorded for both periods; among these, one (Period IV) presented clear polishing marks on its surface, suggesting the antler had been worked/used.

A few lagomorph remains were recorded; among these, some could be attributed to the hare (*Lepus* sp.) (*tab.* 2).

Remains of small rodents (small Microtinae and small Muridae) and, to a lesser extent, large rodents (*Rattus* sp./*Arvicola* sp.), mainly recorded from sieved deposits, were abundant in both periods. Small mammals from the group of insectivores, such as moles (*Talpa* sp.) and shrews (*Crocidura* sp. and *Sorex* sp.) were also present (*tab.* 2).

The presence of the European badger (*Meles meles*), as well as of smaller-sized mustelids, is attested in both periods; the same is valid for glirids (e.g. the edible dormouse – *Glis glis*), whose remains are present in both Period IV and Period V+VI.

Bird remains are rather common in both periods, being slightly more abundant in Period IV. Bird remains almost exclusively belong to the *Gallus*/*Numida*/*Phasianus* (domestic fowl/helmeted guinea fowl/pheasant) group of closely related galliforms; among these, some specimens could be directly attributed to the domestic fowl (*Gallus gallus*) (*tab.* 2).

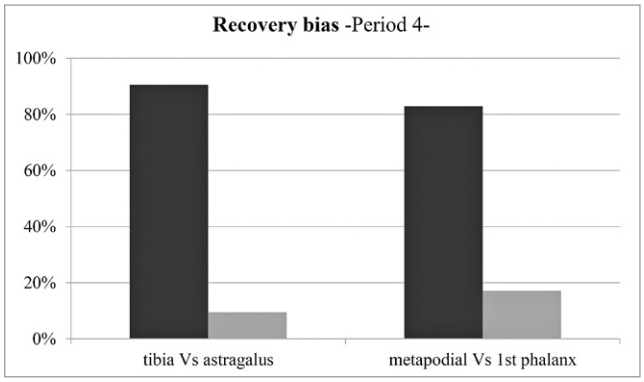

fig. 2 – Proportion of distal tibia and astragali (n:19;2), and metapodials and 1st phalanges (n:19;6) of suids recovered from archaeological contexts dated to Period IV.

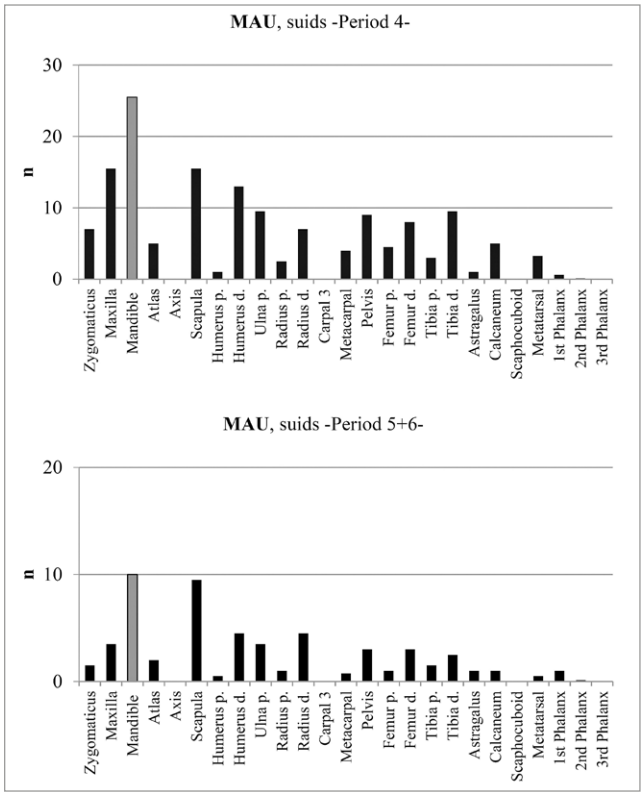

fig. 3 – Distribution of the Minimum number of Animal Units (MAU) for suids in Period IV (n:150) and Period V+VI (n:56). Most represented anatomical element/s in grey.

Other animal taxa present at Vetricella include amphibians and reptiles. These latter refer to turtle/tortoise remains (plastron fragments); as no diagnostic features were present, it was not possible to distinguish between terrestrial and freshwater species (*tab.* 2).

Fishes were exclusively recorded for Period IV (*tab.* 2); in the majority of cases, taxonomic identification was difficult, as most fish remains are represented by caudal vertebrae. The identification and analysis of fish cranial bones is still on going.

2.2 Taphonomic alterations

2.2.1 *Surface preservation*

Most remains from Period IV and Period V+VI (ca. 80%) show a good level of surface preservation. Other remains are

less well preserved, and some are partly covered with concretions or present a heavily weathered surface. Such alterations are likely the consequence of the occasional flooding of the river Pecora, located few metres from the site.

2.2.2 *Recovery bias*

It was only possible to assess the presence and extent of a recovery bias for the assemblage dated to Period IV.

Astragali and 1st phalanges of suids are largely outnumbered by tibiae and metapodials, remaining far from their natural proportion of 1:1 (*fig.* 2). The higher frequency of suid tibiae and metapodials in proportion to astragali and 1st phalanges is likely to represent a recovery bias, which is expected to affect any hand-collected assemblage.

As a result, in the following sections it must be born in mind that some analyses, such as species frequencies and body part distributions, are likely affected by a recovery bias, whereby larger taxa and larger elements are overrepresented; at the same time, it must be highlighted that a considerable number of remains belonging to large and small rodents, amphibians, small-sized birds, reptiles and fishes were recovered, thus attesting for a good level of attention paid by archaeologists during the collection of the faunal material.

2.2.3 *Distribution of anatomical elements*

The distribution of anatomical elements could only be properly analysed for suids in both periods, as an insufficient quantity of remains from other domestic species was available.

Suids – The pattern of body part representation for suids can almost entirely be explained by recovery biases and differential preservation (*fig.* 3). Indeed, small elements, such as phalanges, carpals and tarsals are underrepresented, if not completely absent; this result might be the consequence of the lack of systematic sieving of the archaeological deposits. The most represented body parts are mandibles, followed by scapulae; these elements are known to have better chances to survive in the archaeological record, as they present a higher bone density relative to other body parts; this consideration applies also to the distal humerus and distal tibia. Despite their preferential survival due to high bone density, the number of scapulae is remarkable. The high incidence of mandibles, along with other cranial elements such as the zygomaticus and the maxilla (these latter are especially abundant in Period IV), on the other hand, indicates the introduction and processing of whole suid carcasses at the site.

2.2.4 *Butchery marks*

Ca. 35% and 15% of suid bones present butchery marks in Period IV and Period V+VI respectively. Cut marks are far better represented than chop marks; these are mostly located on the proximal and distal ends of long bones, with some marks also located on rib fragments; some chop marks were recorded on the shaft of long bones, especially along the humerus, radius and tibia. Chop marks are also present on the pelvis and on vertebrae.

For both periods, the presence of specialised butchery activities is attested by the high incidence of chop and cut marks on pig scapulae[2] (the second most abundant anatomical element at the site in both periods, see 2.2.3 Distribution of anatomical elements) (*fig.* 4).

fig. 4 – Vetricella, Period IV. Two suid scapulae recovered from archaeological context US 861, presenting cut and chop marks on their surfaces.

This evidence might suggest the production and consumption on site of cured pig shoulders.

2.2.5 *Burning*

Most specimens presenting burning marks were very small fragments which could not be identified anatomically nor taxonomically. Overall, 17 burnt remains have been recorded for Period IV; among these, four belong to cervids. In the later period, burnt bones are rarer. The type and distribution of burning marks on the animal remains in both periods are compatible with cooking activities taking place at the site.

[2] Radiocarbon dating analyses were carried out on three butchered suid scapulae recovered from archaeological contexts US 800, US 1005 and US 1138. The scapula from US 800 was dated to AD 953-1016; that from US 1005 to AD 801-899; and that from US 1138 to AD 865-977. The analyses were carried out at the Dipartimento di Scienze e Tecnologie Ambientali, Biologiche e Farmaceutiche of the University of Campania (L. Vanvitelli) and at the LABEC (Laboratorio di tecniche nucleari per l'Ambiente e i Beni Culturali) of Florence.

2.2.6 *Gnawing marks*

Gnawing marks are rather common in the assemblage from Vetricella. In both periods, ca. 20% of remains show evidence of gnawing by either carnivores (most likely dogs and cats) or rodents. Remains of the animals responsible for the gnawing, namely felids, canids, and rodents, have been recovered from the site (*2.1 Species frequency: NISP and MNI*).

The majority of gnawed remains were suid unfused long bones. Suid bones are usually greasy and porous and, as a result, they are very attractive to scavengers. In addition, as most of the gnawed specimens belong to juvenile individuals, they would have also resulted softer and easier to be chewed on (Albarella, Davis 1994).

Overall, such relatively high incidence of gnawed remains in both periods might be the result of a non-immediate disposal through burial of most of the animal waste.

2.3 Ageing and sexing

The analyses of age-at-death presented here are limited to suids; these rely on mandibular wear stages, as the analyses of post-cranial bone epiphyseal fusions are still ongoing. Brief comments about the age-at-death of cattle, equids, cervids and galliforms are also made.

Information about the sex of animals could be obtained for suids and cervids.

Suids – In Period IV, the distribution of mandibular wear stages suggests that about 35% of suids were killed when sub-adults, presumably once they had reached their optimum weight. Fewer individuals were culled as juveniles (ca. 5%) and ca. 20% as immature individuals (before reaching one-two years of age); the presence of particularly young pigs might attest the consumption of suckling piglets. At the same time, another ca. 40% of suids survived into adulthood; these latter may represent sows and boars kept for reproduction, as well as pigs culled for meat shortly after having reached their optimum weight[3]. No substantial changes in suid culling strategies have been detected for Period V+VI (*fig.* 5).

No neonatal mandibles were recovered, most likely as a result of taphonomic destruction; on the other hand, a considerable number of perinatal post-cranial bones were recorded for both periods (*fig.* 6), suggesting that pig breeding occurred at the site or in its immediate vicinity.

The high incidence of mature pigs is rather intriguing and relatively 'unusual'. Indeed, pig husbandry specifically aims at the production of meat and fat hence, usually most pigs are culled as subadults, namely as soon as they reach their optimum weight. An interpretation of this unusual pattern is proposed in the *Discussions and conclusions*.

In both periods sows are better represented than boars (17;5 and 9;4). These results probably reflect the common practice of keeping mature sows in higher numbers for breeding purposes, while limiting the disruptive presence of too many adult males.

Cattle – The reconstruction of mortality profiles for cattle relies only on post-cranial bones. In Period IV, ca. 20% of individuals were culled before their second-third year of age (middle fusing stage), while another ca. 20% were slaughtered before reaching their third-fourth year of age (late fusing stage); ca. 60% of the individuals survived into late adulthood. Earlier culling events are attested but in very low numbers. Similar results have ben obtained for Period V+VI, at the exception of a minor incidence of cattle slaughtered before reaching their second-third year of age (middle fusing stage) (*fig.* 7).

In sum, these patterns suggest that cattle were mainly exploited for their traction force, with some individuals raised

[3] Similar results have been obtained for the distribution of maxillary wear stages.

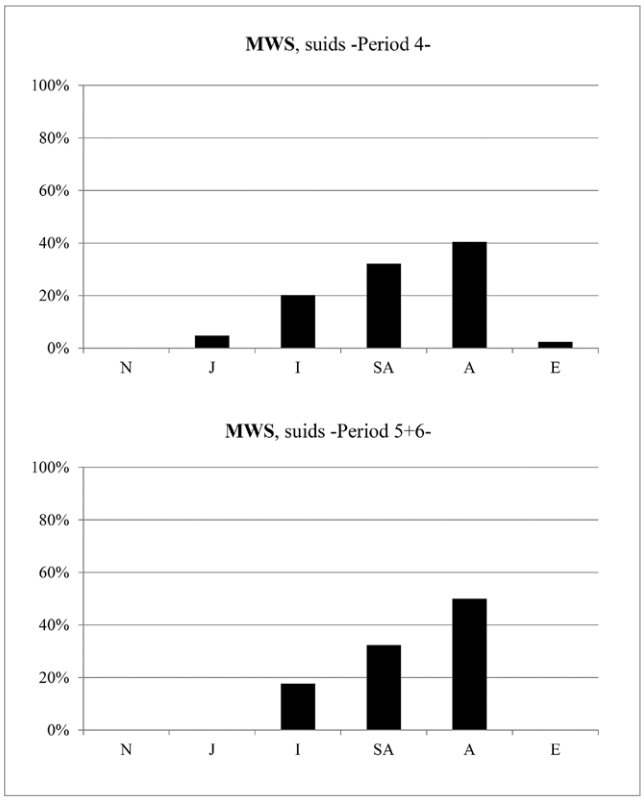

fig. 5 – Suid mandibular wear stages in Period IV (n:43) and Period V+VI (n:26). Age stages follow O'Connor (1988), with N: neonatal stage added. J: juvenile; I: immature; SA: subadult; A: adult; E: elderly.

fig. 6 – Two suid perinatal anatomical elements (humerus and tibia) from Period IV (US 445).

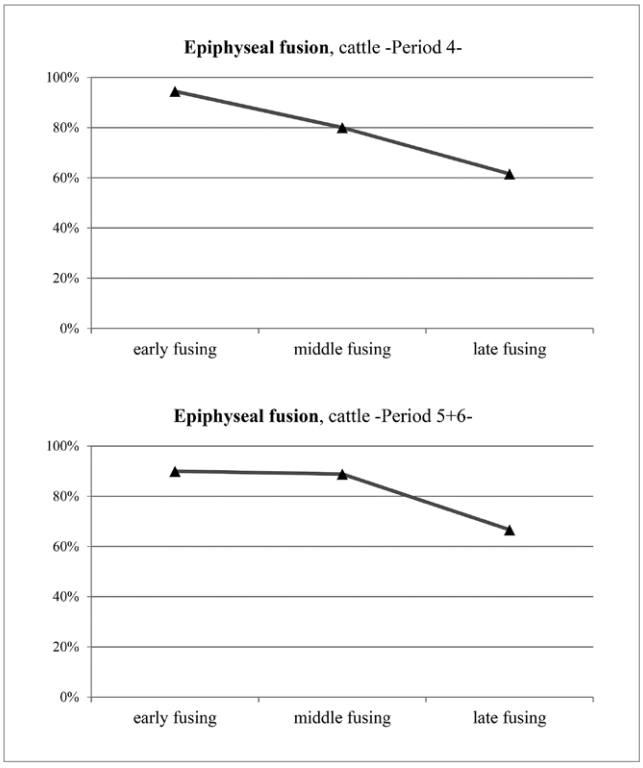

fig. 7 – Percentage of fused bones within each fusion stage in Period IV (n:94;80;62) and in Period V+VI (90;89;67). Epiphyseal fusion stages follow Silver (1969). Early fusing stage: 12-24 months; Middle fusing stage: 24-36 months; Late fusing stage: 36-48 months.

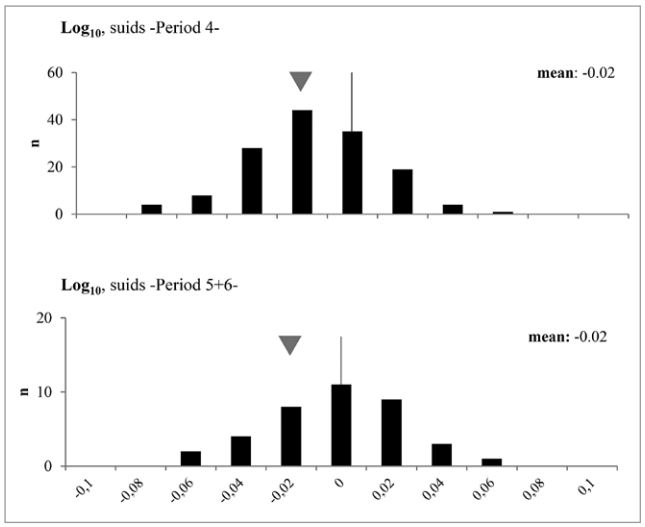

fig. 8 – Log ratio histograms for mandibular tooth lengths and anterior and posterior widths for Period IV (n:165) and Period V+VI (n:38). The grey triangles indicate the logarithmic means. The standard used (black line) is the mean of measurements of pig mandibular and maxillary teeth from the Early Anglo-Saxon site of West Stow (UK) (Rizzetto forthcoming).

specifically for beef production in both periods. Considering the presence, although minimal, of calves (early fusing stage) in Period IV and Period V+VI, it is reasonable to think that cows would have also been exploited for milk.

Equids – Most of equid remains recovered from Period IV contexts are fused. A number of loose teeth with a rather worn occlusal surface have also been recorded, suggesting the expected presence of elderly individuals. Such results might attest the almost exclusive presence of mature equids in this period. The presence of two particularly young long bones (one radius and one humerus), which potentially belong to perinatal animals, might be indicators of on-site equid breeding.

In Period V+VI, a slightly higher number of equid post-cranial bones are unfused, suggesting the presence of immature individuals; however, also in this case, the majority of bones belong to mature animals.

All in all, adult individuals are far better represented than immature ones in both periods. Such pattern is very common for equids and indicates the use of these animals as beasts of burden; this is further confirmed by the recovery of a number of horse shoes (see Agostini, *infra*).

Cervids – All cervid remains belong to mature individuals in both periods. A few number of antler fragments (non-countable elements), suggesting the presence of male deers, were also recorded; in two cases (Period IV) the antlers had been shed, suggesting that they had been specifically collected for craft purposes.

Galliforms – In Period IV, out of 39 countable elements, eight were not fully ossified, while 31 belonged to mature individuals; among these, 29 could be directly attributed to the domestic fowl. The presence of one particularly small-sized and porous humerus is likely a natural loss and, therefore, would suggest on-site breeding.

In Period V+VI, out of 14 countable anatomical elements, four were not fully ossified, while 10 belonged to adult animals; all these latter were attributed to the domestic fowl. No particularly small-sized and porous elements (i.e. immature individuals) were recorded for this period.

2.4 Biometry

The main aim of the biometrical analyses presented here is the investigation of the nature, domestic and/or wild, of the suid populations present in Period IV and Period V+VI at Vetricella; potential changes in the size of pig trough time are also considered.

Measurements from mandibular teeth (lengths, anterior and posterior crown widths) were merged into log ratio histograms.

The histograms for the two periods display a unimodal distribution and a similar range of values, thus suggesting no substantial variations in size. As teeth are less sexually dimorphic than bones (Payne, Bull 1988), the large and relatively isolated values located at the right end of the graphs in Period IV and Period V+VI are likely to represent wild boars and/or hybrids (*fig.* 8). Considering the distribution of values and their position relative to the standard of early medieval pigs, it seems that most of the suid remains in the assemblage belong to domestic animals, and that wild boar did not contribute substantially to the diet.

3. DISCUSSIONS

Zooarchaeological analyses of the faunal assemblage from Vetricella have revealed the central role played by domesticates, and especially pigs, in the diet of people living at the

site in both the analysed periods. By contrast, wild game was rarely hunted and consumed.

The strong similarity of results obtained for the two periods could suggest a single phase of formation of the faunal sample, which would better date to Period IV (the chronological period of greatest expansion of the site); at the same time, this similarity could be also symptomatic of a diachronic continuity of similar husbandry practices in the two periods.

The high incidence of adult suids in both periods might suggest a free-range type of pig husbandry (pannage), which might have taken place in the Turkey oak woodlands in the vicinities of the site during specific times of the year (autumn-winter).

Numerous butchery marks were recorded on post-cranial bones of suids; their location suggests that both primary and secondary butchery occurred on-site. The scapula is the most processed bone. The high incidence of this element and the high number of butchery marks recorded on it could suggest the consumption (and a production and trade?) of selected parts of pig carcasses as cured products.

When the zooarchaeological results from Vetricella are compared with those available from medieval Italy, it seems that they only partially confirm the trends suggested by the recent work by Salvadori (2015). Indeed, if on one hand in Vetricella pig is the most represented species in the 10th-12th centuries AD, on the other caprines are not as well represented as they should according to Salvadori's study; this contrast is more pronounced for Period V+VI (12th-13th centuries AD), when caprines should even overtake pigs. The zooarchaeological results obtained for Vetricella thus indicate a site with unique characters, which does not entirely fit with the trends so far suggested for medieval Tuscany; the faunal analyses might reflect the high-status character of the site (i.e. of a *curtis regia*).

In addition to domestic animals, a considerable number of micro-mammals, amphibians, fishes and reptiles has also been recorded; these are useful environmental indicators, whose systematic study is still ongoing. So far, preliminary results inform us about the existence of different environments surrounding the site of Vetricella, which mainly refer to woodland areas (suggested by the recording of badger and dormouse remains), grasslands (suggested by the presence of moles and certain birds, such as the lark), and wet lowlands (suggested by the presence of water voles and amphibians).

Thorough and detailed zooarchaeological comparisons of the assemblage here considered with those from other medieval sites in Tuscany are certainly desirable; these comparisons will be carried out by the author in the immediate future. The aim is to obtain a more complete and coherent picture of medieval faunal exploitation in this region in the light of previous archaeological investigations. In addition, these zooarchaeological studies will contribute to promote Tuscany and archaeological research on this region nationally and internationally, by focusing on the study of the human-animal relationship as well as of environmental issues.

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