Journal of Archaeological Science: Reports 41 (2022) 103299

Contents lists available at ScienceDirect

Journal of Archaeological Science: Reports

journal homepage: www.elsevier.com/locate/jasrep

Who's eating pork? Investigating pig breeding and consumption in Byzantine, Islamic and Norman/Aragonese Sicily (7th-14th c. AD)

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ARTICLE INFO

Keywords:
Zooarchaeology
Medieval Sicily
Pork consumption
Food prohibitions
Islam
Christianity

ABSTRACT

This paper investigates the culture of pork consumption in Sicily by examining a number of archaeological faunal assemblages dated to chronological phases spanning from the Byzantine to the Norman/Aragonese period (7th-14th c. AD). Zooarchaeological analyses reveal substantial diachronic changes in the use of the main domesticates, particularly concerning pig frequencies. In the Islamic period (9th-11th c. AD), pig is poorly represented at urban sites; this is likely to reflect a socio-cultural acceptance of the Islamic religious precepts forbidding pork consumption. By contrast, and in continuity with the Roman and Byzantine periods, pigs are well-represented in rural settlements, thus indicating a more resilient attitude of these communities toward newly imported religious traditions. In the later Norman/Aragonese period, the frequency of pig increases at some urban sites, reflecting the fact that that pork prohibition had been lifted and that new food production and consumption practices were developed. Pig continues, however, to be almost absent at a number of urban sites and castles/fortified villages; this may suggest the persistence of Islamised communities in Sicily after the end of Islamic rule.

1. Introduction

For millennia Sicily's productive lands and strategic position in the Mediterranean Basin have stimulated the interest of different powers; this holds especially true for the Middle Ages when the island became a frontier of the Arab world.

Until the early 9th c. AD, Sicily was under Byzantine administration. In AD 827, the Arab conquest of Sicily began; troops coming from Ifrīqya (modern Tunisia and eastern Algeria) landed in Mazara del Vallo (south-western Sicily) and, after four years, they conquered Palermo, which became the capital of the island. The Arab conquest of Sicily was a rather slow and staged process. A complete conquest of the island was only achieved in AD 848 and was followed by a period of economic prosperity (Amari 1954; Metcalfe 2009; Chiarelli 2011; Nef 2013; Molinari 2019; 2020).

In the second half of the 11th c. AD, the Normans started their own conquest of the island, which took thirty years to complete (CE 1061–1091). In this period, Islamic communities still made up most of the Sicilian population; however, growing religious intolerance resulted in the first mass migration of Islamic people from Sicily to North Africa. When the Norman dynasty died out, political control over Sicily passed by inheritance to the Hohenstaufen (Swabian) dynasty (CE 1198–1266); later, the island fell to the Angevin (CE 1266–1282) and the Aragonese (CE 1282–1516; Bresc 1986; Metcalfe 2011; Bresc 2013). From the end of the Swabian period, Islamic objects are no longer part of the Sicilian archaeological record, indicating that Islamic cultural influence on the island was waning (Molinari 2020).

The centrality of medieval Sicily within the complex economic and political dynamics of the Mediterranean has been the subject of many archaeological and historical studies (e.g. Spatafora 2005; Molinari 2009; Arcifa 2010; Molinari, 2010a; 2010b; Nef and Prigent 2010; Nef 2011; Arcifa et al. 2012; Molinari 2012; 2013; Nef 2013; Pezzini 2013; Spatafora and Canzonieri 2014; Arcifa 2016; Mandalà 2016; Carver et al. 2017; 2018; 2019; Molinari 2019; Arcifa and Sgarlata 2020). Specific categories of archaeological evidence (e.g. pottery, burials) and buildings (especially mosques) have been used as indicators of socio-cultural and economic change across the different political phases of medieval Sicily (e.g. Molinari 1997; Bagnera and Pezzini 2004; Di Salvo 2004; Molinari 2009; Molinari 2010c; 2010d; Molinari 2011; Arcifa and Bagnera 2014; Ardizzone et al. 2014; Sacco 2014; Ardizzone et al. 2016; Bramoullé et al. 2017; Sacco 2018).

Conversely, animal remains have rarely been considered (but see

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https://doi.org/10.1016/j.jasrep.2021.103299
Received 21 August 2021; Received in revised form 29 November 2021; Accepted 29 November 2021
Available online 20 December 2021

Arcoleo and Sineo 2014; Arcoleo 2015; Battaglia et al. 2016; Scavone 2016; 2019; Aniceti 2020; Castrorao Barba et al. 2021; Aniceti, in press).

Yet, zooarchaeological investigations can be highly informative as animal remains are often the result of food consumption, an important cultural identifier. Their potential is especially valuable in a region such as medieval Sicily, which was composed of different ethnic groups contributing to a melting pot of traditions and beliefs. The religions professed by these groups (Christianity, Islam, Judaism and Paganism) were also associated with different dietary habits. Islam and Judaism were and are still characterised by several permanent food taboos, pork avoidance being the most relevant to this study (Insoll 2001; Kocturk 2002; Regenstein et al., 2003; Greenfield and Bouchnick 2011; Morales-Muñiz et al. 2011; Price 2020). Food avoidances are also associated with Christianity, although these tend to be temporary and are usually only followed by restricted groups of people (e.g. clerics) – the only exception being the consumption of horse meat (Simoons 1994; Lauwerier 1999).

Considering the important economic role played by pigs in Roman and Byzantine Sicily (e.g. Scavone 2016; Aniceti 2020; Castrorao Barba et al. 2021; Mackinnon Unpublished report [a]; Unpublished report [b]; Unpublished report [c]; Unpublished report [d]), a potential absence of pigs in Islamic sites cannot be ascribed to environmental constrains. Such a theory would rely on the fact that, because of their inability to sweat, pigs tend to be intolerant of high temperatures (>36 degrees Celsius), unless some water sources, mud or wooded areas are present in the vicinity (Simoons 1994; Diener et al., 1978; Insoll 2001). Palynological analyses from Pergusa Lake (central Sicily) have demonstrated that, despite a long period of aridity before the Arab conquest (AD 750–800) (Sadori et al. 2013), wooded areas survived in the Islamic period (Incarbona et al. 2010). These could have represented refuge areas in medieval times, favouring pig husbandry and the practice of free-range herding. Similarly, recent anthracological studies at Islamic Mazara del Vallo (south-western Sicily) have revealed the occurrence of a mosaic of different ecosystems, including thermo-xerophilous woodland (with a clear incidence of the *Quercus ilex* type) and Mediterranean maquis (Fiorentino et al., in press).

Since environmental factors cannot explain the potential absence of suids in Islamic assemblages, the reason is more likely to be found in the 'social Islamisation process'[1] of the island in medieval times. Since the Byzantine period, Jewish communities also settled in Sicily; in Palermo, at the end of the 10th c. AD, they were established in an area known as *Harat Al-Yahud* (the Jewish quarter) (La Lumia 1984; Vanoli 2012; Mandalà 2013). In Judaism, like in Islam, dietary rules include permanent food taboos, such as the prohibition of consuming pork. In addition, to be *halal* and *kosher* ('consumable' in Arab and Jewish respectively), animals had to be culled in a specific way. Usually, this consists in cutting the jugular vein and the esophagus of the animal with a sharp knife, in order to interrupt the flow of blood to the brain, thus producing an immediate state of unconsciousness. During the Schechita (the Jewish butchery process), the animal sciatic nerve is also removed. Because of the difficulties in removing this nerve, all hind limbs are often considered prohibited (Daróczi-Szabó 2004). The Jewish practice can be detected in the archaeological record (Lisowski 2019) more easily than Muslim butchery (Aniceti 2020). No evidence of Schechita has been detected on the kosher species (e.g. caprines, cattle) analysed from the sites discussed in this paper (Aniceti 2020).

In this paper, for the first time, the pork-taboo issue is analysed by examining a substantial number of faunal assemblages that are contextualised within their historical framework. The main aim of this research is to investigate pork production and consumption in medieval Sicily (7th-14th c. AD) with a specific focus on the Islamic period and placing this phenomenon within its broader husbandry and cultural context.

[1] In this paper, the term 'social Islamization process' refers to the integration of a specific community in the socio-cultural parameters of Islam (Manzano 2006); in this case, it specifically refers to new practices of management and consumption of animal resources.

2. Materials and methods

Animal remains from five urban sites and three rural sites were analysed; most of them are located in the western part of the island (Fig. 1) and are dated to the Byzantine, Islamic and/or Norman/Aragonese period. With the exception of Byzantine Rocchicella, all sites have an Islamic and/or a Norman/Aragonese phase (Tab.1).

Some of the sites were discovered during rescue excavations (Corso dei Mille, Sant'Antonino, the Norman Palace, Mazara del Vallo, and Colmitella) and others as a result of planned archaeological projects (Casale San Pietro, Castello San Pietro, and Rocchicella).

The faunal remains were mainly hand-collected; sieving was occasionally implemented only at Casale San Pietro. Therefore, recovery biases certainly affect the faunal assemblages, and will be considered in the interpretation of the results.

The recording followed a diagnostic zone approach. This means that only selected and highly informative specimens were regularly recorded ('countable specimens'), which allowed the mitigation of many biases that typically occur in zooarchaeological analysis (Albarella and Davis 1994). Specimens that had interesting characteristics (e.g. an unusual species, butchery mark or pathology) but did not belong to any of the pre-defined diagnostic zones were recorded but not used in quantification ('non countable specimens').

The identification of the animal remains was aided by the use of the animal bone atlases by Schmid (1972) and Barone (1976), as well as the small reference collection held in the Department of Animal Biology at the University of Palermo. The separation between sheep (*Ovis aries*) and goat (*Capra hircus*) was attempted on some anatomical elements, according to the morphological criteria outlined by Boessneck (1969), Kratochvil (1969), for postcranial bones and Payne (1985), Halstead et al. (2002) and Zeder and Pilaar (2010) for mandibular teeth; in addition, the morphometric method developed by Salvagno and Albarella (2017) was used. All sheep and goat specimens that could not be attributed to a species were assigned to the sub-family of caprines.

The separation of domestic pigs (*Sus domesticus*) and wild boars (*Sus scrofa*) was attempted through biometrical analyses; these were also used to investigate potential changes in pig size over time. Since most pigs were culled before reaching skeletal maturity, measurements from fused specimens were too few to be used, and biometrical analyses focussed on teeth. Anterior, central and posterior width measurement values from different mandibular and maxillary teeth were merged using a size index scaling technique, calculated through a decimal logarithm (Uerpmann 1979; Meadow 1999; Albarella 2002).

To quantify the relative proportion of each taxon, the number of identified specimens (NISP) was used; this represents the raw count of all specimens classified as 'countable' (Tab. 2) (Aniceti 2020). The faunal samples from Islamic Corso dei Mille and Casale San Pietro are small. For this reason, we invite the readers to treat the results from these two sites with caution as small sample sizes may affect the reliability of interpretations (e.g. Peres 2010). We must, however, also consider that the assemblages from all sites directly recorded by us have benefitted from a diagnostic zone approach, which, being more selective, produces smaller but more reliable counts.

The analysis of the suid sex ratio relied on canines (both loose and in jaws), as well as on alveolar morphology. Suid culling profiles were investigated to detect potential changes in husbandry practices through time. Suid ageing analyses mainly relied on the epiphyseal fusion of post-cranial bones, as few mandibular dental sequences were available. Mandibular tooth wear stages were recorded following Grant (1982), while mandibular wear stages were classified using O'Connor (1988). Fusion stages were organised into three groups (early, middle, and late fusing) according to Reitz and Wing (2008 and references therein). Other evidence obtained from the zooarchaeological analysis of suids

Fig. 1. Map of Sicily with the location of the archaeological sites where the analysed faunal assemblages were recovered: Corso dei Mille, Sant'Antonino, the Norman Palace and Castello San Pietro (Palermo), Casale San Pietro (Castronovo di Sicilia, Palermo), Mazara del Vallo (Trapani), Colmitella (Agrigento), and Rocchicella (Catania).

Table 1
List of the archaeological sites that produced the faunal assemblages analysed in this project. Information about location, chronology, settlement type, and references are provided for each site.

Sites	Province	Chronology	Settlement type	Reference(s)
1. Corso dei Mille	Palermo	10th-11th c. AD12th-13th c. AD	urban	Battaglia et al. 2016; Vassallo et al. 2016
2. Sant'Antonino	Palermo	late 9th-11th c. AD	urban	Aleo Nero 2017
3. The Norman Palace	Palermo	early 12th c. AD	urban	Vassallo et al. 2018
4. Castello San Pietro	Palermo	9th c. AD	urban	Arcifa and Bagnera 2014; Arcifa 1998; Arcifa and Lesnes 1997; Di Stefano et al. 1989
5. Mazara del Vallo	Trapani	2nd ½ 10th – 2nd ½ 11th c. AD2nd ½ 12th-late 13th c. AD	urban	Molinari and Meo *in press.*Molinari and Cassai 2006Cassai 2003
6. Casale San Pietro	Palermo	8th-9th c. AD	rural	Carver et al. 2019Carver et al. 2018Carver et al. 2017
7. Colmitella	Agrigento	7th/8th-9th c. AD9th-11th c. AD	rural	Rizzo et al. 2015Rizzo et al. 2014Rizzo et al. 2012Rizzo and Romano 2012
8. Rocchicella	Catania	6th-7th c. AD9th c. AD	rural	Arcifa 2016; Maniscalco 2008Arcifa 2007

Table 2
List of the archaeological sites with the numbers of countable and non-countbale specimens recorded in each period. Countable elements: maxilla and mandible (with at least one tooth); zygomaticus (cranium); atlas, axis, scapula (glenoid cavity); distal humerus; distal radius; C3 or C2 + 3; distal metacarpal (pig and carnivores only III and IV); pelvis (ischial part of the acetabulum); distal femur; distal tibia; astragalus (later half); calcaneum (sustentaculum); scafocuboid; distal metatarsal (pig and carnivores only III and IV); distal metapodial (pig and carnivores only III and IV); proximal 1st; 2nd; 3rd phalanges.

Site	Byzantine period		Islamic period		Norman/Aragonese period		**total**
	countable	*non-countable*	*countable*	*non-countable*	*countable*	*non-countable*	
Casale San Pietro	–	–	192	129	–	–	321
Castello San Pietro	–	–	382	115	–	–	497
Colmitella	871	154	300	192	–	–	1517
Corso dei Mille	–	–	177	215	246	98	736
Mazara del Vallo	72	16	633	190	430	145	1486
Rocchicella	634	151	–	–	–	–	785
Sant'Antonino	–	–	474	138	–	–	612
The Norman Palace	–	–	–	–	286	109	395
Total	**1577**	321	**2158**	979	**962**	352	**6349**

(anatomical element distribution and butchery), and some aspects of cattle ageing are only briefly discussed in this paper. Further details of the full zooarchaeological analysis can be found in Aniceti (2020).

Data on taxonomic frequencies obtained from other published and unpublished studies have been used to complement the evidence primarily collected for this research. The overall dearth of medieval zooarchaeological studies in Sicily has limited large-scale temporal and spatial comparisons within the island; however, the corpus of data recently built (Aniceti 2020) provided new opportunities for the investigation of animal exploitation in medieval Sicily.

The use of data collected by different researchers inevitably raises the issue of the degree of comparability of faunal samples recorded with different approaches (i.e. highly selective, non-selective etc.) (Reitz and Wing 2008). This is made even more difficult by the fact that the published and unpublished faunal reports used here rarely provide information on recording methods. The core research question addressed in this paper, however, largely relies on the presence or absence of pig remains and, if the former, their approximate frequency. As long as an over-interpretation of the data is avoided – for instance a too fine-tuned analysis of differences in pig proportions - differences in recording methods should not affect our interpretations in any substantial way.

The species frequencies of the main domesticates from all assemblages are presented in ternary plots organised by chronological period and site type, though the status of most sites was not easy to define. Contemporary faunal assemblages from Al-Andalus and North Africa have also been considered, though they were not included in the ternary plots. Whenever possible, additional archaeological evidence (e.g. pottery and petrographic analyses, burials, archaeobotanical remains and organic residues) has been integrated in the discussion of the zooarchaeological data.

3. Results

In this section taxonomic frequencies of the main domesticates (cattle, caprines, and pig) from different types of sites and periods are compared. Particular attention is paid to suid presence/absence, as well as frequency, in the Islamic period and, for the sake of comparison, the earlier and later periods.

3.1. Taxonomic frequencies

3.1.1. Byzantine period (7th-9th c. AD)

Caprines prevail at Colmitella and especially at Rocchicella. Like in most of the sites discussed here, most caprine remains identifiable to species belonged to sheep. Suids are also well-represented at both sites, particularly Colmitella, where their incidence is very close to that of caprines. Cattle remains are not uncommon, but they are the third most represented taxon at both sites; their frequency is higher at Colmitella (Tab. 3a and Fig. 2).

3.1.2. Islamic period (9th-11th c. AD)

In the Islamic period, caprines are still predominant at Colmitella, but at Casale San Pietro too. Morphological observations and biometrical analyses suggest that most, if not all, caprines belonged to sheep (Aniceti 2020).

At Colmitella, the frequency of suids decreases in the Islamic period, largely at the advantage of cattle, which is more abundant than at the other rural site of Casale San Pietro. At Casale San Pietro suids and caprines are similarly represented (Table 3b and Figs. 2 and 3).

Caprines, once again mainly represented by sheep, prevail in all urban sites. Corso dei Mille also produced a substantial number of goat horncores (Battaglia et al. 2016; Aniceti 2020). Cattle are well represented at Corso dei Mille and Mazara del Vallo but less so at Castello San Pietro and Sant'Antonino.

Only small numbers of pig remains have been recorded for Corso dei Mille, Sant'Antonino and Mazara del Vallo. The only urban site with a more substantial number of pig remains is Castello San Pietro (Table 3b and Fig. 3).

3.1.3. Norman/Aragonese period (late 11th- late 13th c. AD)

Post-Islamic faunal assemblages were available from Corso del Mille, the Norman Palace and Mazara del Vallo. Collectively, they present a highly diversified scenario in terms of main domesticate frequencies (Table 3c and Fig. 4).

The major role of caprines (mainly sheep) in the economy of the inhabitants of Corso dei Mille, which characterised the Islamic period, is further emphasised in the Norman/Swabian period; suids are still barely present and cattle frequency decreases. At the Norman Palace, on the other hand, suids make up the majority of the three main domesticate remains, while caprines are less well represented and cattle are barely present. Mazara del Vallo has a high frequency of caprines, though not quite as high as at Corso dei Mille, whereas cattle frequency decreases from the previous period. Unlike Corso dei Mille, there is an increase in the frequency of suids in the Norman/Aragonese period (Figg. 3–4).

3.2. Suid culling profiles

Culling profiles suggest that pigs were largely consumed at a young age at Byzantine Colmitella and Rocchicella. At these sites, about half of the early fusing elements had their diaphyses unfused, representing individuals culled before one-two years of age. An additional 20–30% of pigs were culled before their second-third year of age, once they had reached their optimum weight. The presence of sows and boars kept for reproduction purposes is also attested, although most pigs died before their third-fourth year of age, with very few individuals surviving into later adulthood (Fig. 5a). Few mandibular dental sequences were available for Colmitella, corroborating the results from epiphyseal fusion analysis, while none were recorded for Rocchicella (Aniceti 2020).

In the Islamic and Norman/Swabian periods, minor differences in pig husbandry practices can be noticed; these consist of a lower incidence of very young pigs and a higher number of subadult individuals. Younger age profiles have been detected at Colmitella (Islamic period) and the Norman Palace (Norman period), approximately mirroring the pattern seen for the Byzantine period (Fig. 5b-c). It must be noted, however, that some of our sample sizes are small, particularly Islamic Colmitella (see caption of Fig. 5 for details), and therefore can only provide tentative trends.

Perinatal individuals, indicating on-site breeding, are far better attested at rural settlements (Casale San Pietro, Colmitella, and Rocchicella)[2]. This is not surprising, as breeding populations were more likely to be kept in the countryside. The consistent predominance of immature individuals in all sites suggest that most pigs were domestic animals subjected to a planned culling strategy.

3.3. Suid anatomical element distribution and the butchery evidence

In all sites, preservation and recovery biases have substantially affected the representation of suid anatomical elements; denser elements (e.g. distal humerus, proximal radius, distal tibia) are generally the most frequent. Cranial elements (e.g. zygomaticus, mandibles and maxillae) are rather well represented, while small elements (e.g. carpals, tarsals, phalanges) are strongly underrepresented, most probably because they were often overlooked due to the lack of sieving during excavations.

[2] Ten cranial and post-cranial remains belonging to perinatal individuals have been identified at Casale San Pietro; a similar quantity (8) has also been recovered from Rocchicella. At Colmitella, suid perinatal individuals are slightly more abundant than at the other two rural sites, with 25 cranial and post-cranial elements.

Table 3
NISP counts and frequencies of the three main domesticates (cattle, caprines and suids).

a) Byzantine period (7th- 8th/9th c. AD)						
site type	*name*	*cattle*	*caprines*	*suids*	*NISP main domesticates*	*Total NISP*
rural	Colmitella	n:176 – 25%	n:265 – 38%	n:256 – 37%	n:697	n:871
rural	Rocchicella	n:77 – 13%	n:330 – 55%	n:190 – 32%	n:547	n:634
b) Islamic period (9th-11th c. AD)						
site type	*name*	*cattle*	*caprines*	*suids*	*NISP main domesticates*	*Total NISP*
rural	Colmitella	n:95 – 40%	n:97 – 41%	n:47 – 20%	n:239	n:300
urban	Castello San Pietro	n:47 – 14%	n:231 – 69%	n:56 – 17%	n:334	n:382
rural	Casale San Pietro[a]	n:23 – 15%	n:69 – 45%	n:62 – 40%	n:154	n:192
urban	Corso dei Mille	n:54 – 33%	n:106 – 65%	n:2 – 1%	n:162	n:177
urban	Sant'Antonino	n:27 – 7%	n:358 – 92%	n:3 – 1%	n:388	n:474
urban	Mazara del Vallo	n:121 – 28%	n:303 – 70%	n:11 – 3%	n:435	n:546
c) Norman/Aragonese period (second ½ 11th- late 13th c. AD)						
site type	*name*	*cattle*	*caprines*	*suids*	*NISP main domesticates*	*Total NISP*
urban	Corso dei Mille	n:27 – 13%	n:171– 85%	n:4 – 2%	n:202	n:246
urban	The Norman Palace	n:11 – 4%	n:95 – 38%	n:147 – 58%	n:253	n:286
urban	Mazara del Vallo	n:61 – 20%	n:200 – 66%	n:41 – 14%	n:302	n:427

[a] The archaeological excavation at Casale San Pietro is part of the European Research Council (ERC) project: 'The archaeology of Regime Change: Sicily in Transition' (SICTRANSIT). ERC action number: 693600. The project is directed by Martin Carver (University of York, UK) and Alessandra Molinari (University of Rome Tor Vergata, Italy) with the collaboration of Girolamo Fiorentino (University of Salento, Italy) and the support of Stefano Vassallo (Soprintendenza dei Beni Culturali e Ambientali di Palermo, Italy). The materials analysed for this paper refer to the 2015, 2016, 2017 and 2018 archaeological campaigns.

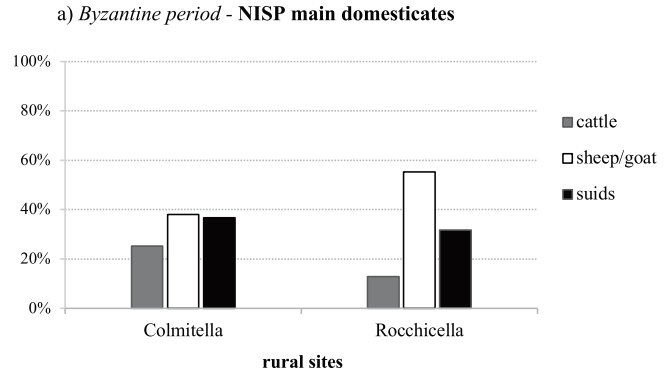

Fig. 2. NISP frequencies for the three main domesticates (cattle, caprines and suids) at Colmitella (n:176;265;256) and Rocchicella (n:77;330;190) in the Byzantine period.

Overall, suid remains display a low incidence of butchery marks. Cut marks are better represented than chop marks, possibly a consequence of the small-medium size of pig carcasses, which do not require the same amount of chopping as cattle carcasses. The young age of many animals also means that the carcass could be managed by a single household, without the need to separate it into too many portions.

At all sites there is no evidence of export/import of pig body parts, suggesting that these communities were self-sufficient in this area, and that most suids were likely butchered, processed and consumed locally. No temporal or spatial differences in body part and butchery patterns have been noticed, as intensive or specialised butchery practices were not required given the relative small size of most carcasses (details of body part and butchery quantifications can be found in Aniceti 2020, which has online open access).

3.4. Size

There does not seem to be much difference in suid tooth size between periods; overall, the measurements plot roughly unimodally, with the occasional occurrence of a few large outliers (Fig. 6). The most parsimonious explanation is that the bulk of animal remains belong to the domestic form, and that the outliers represent wild boars. Therefore, all assemblages are mostly represented by domestic pigs; wild boar hunting was only occasionally performed; thus, this animal did not contribute

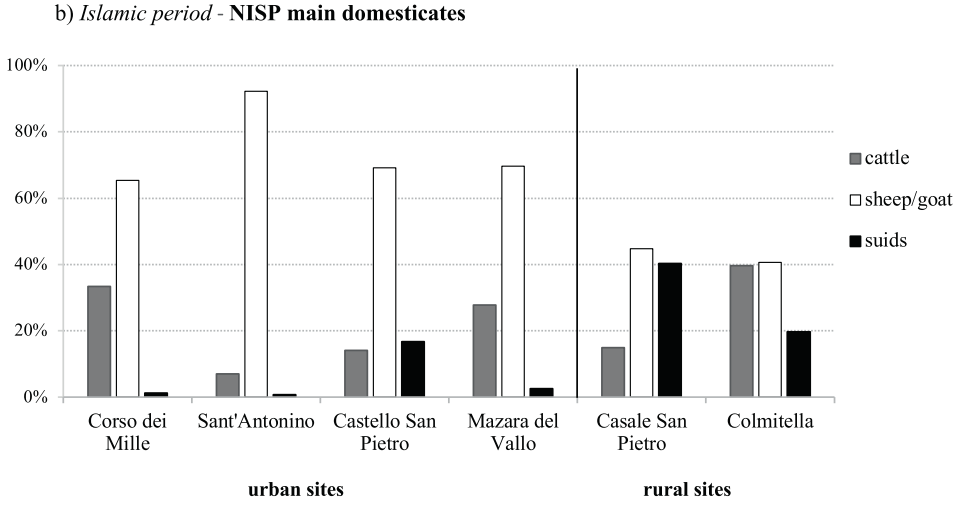

Fig. 3. NISP frequencies for the three main domesticates (cattle, caprines and suids) at the urban sites of Corso dei Mille (n:54;106;2), Sant'Antonino (n:27;358;3), Castello San Pietro (n:47;231;56), and Mazara del Vallo (n:121;303;11) and at the rural sites of Casale San Pietro (n:23;69;62) and Colmitella (n:95;97;47) in the Islamic period.

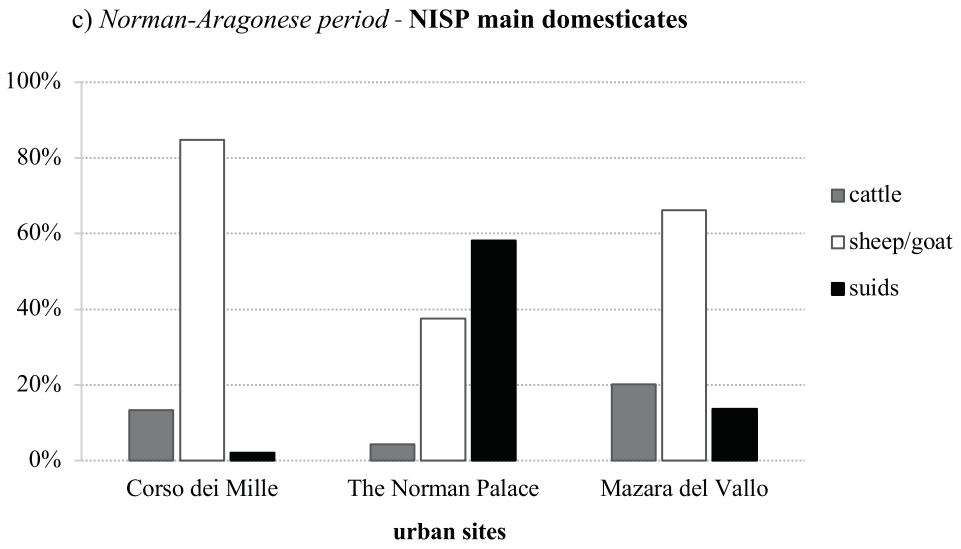

Fig. 4. NISP frequencies for the three main domesticates (cattle, caprines and suids) at the urban sites of Corso dei Mille (n:27;171;4), the Norman Palace (n:11;95;147), and Mazara del Vallo (n:61;200;41) in the Norman/Aragonese period.

substantially to the diet. Parallel work on postcranial bones would, however, be needed, to complement the information deriving from the teeth.

3.5. Integration with previous zooarchaeological studies

This section integrates the zooarchaeological evidence analysed in this paper with that from previous studies on Sicilian faunal material. The aim of this section is not to develop general overviews of husbandry practices in medieval Sicily, but, more specifically, to detect aspects of continuity and discontinuity in dietary habits associated with the period dominated by Islamic governance. To this aim, Islamic faunal samples are compared with the previous Roman-Byzantine, and the later Norman/Aragonese ones; there are three main sections, arranged by chronological period (Roman-Byzantine, Islamic, Norman/Aragonese).

As mentioned before, only recently has an interest in the study of animal remains from medieval Sicilian sites been developed. This has limited zooarchaeological comparisons within the island across the analysed periods but, at the same time, has provided the opportunity to break relatively new ground in our investigation of medieval – Islamic – Sicily.

In the first section, dedicated to the Roman-Byzantine period, the overall dearth of faunal data from Byzantine contexts required the use, for comparative purposes, of Sicilian assemblages more generally dated to the Roman period; this has been done with the aim to provide a wider basis against which to compare data from the Islamic period.

In the second section, on the Islamic period, chronological and site-type differences and similarities are explored. The lack of published zooarchaeological studies from other southern Italian regions affected by Arab incursions, such as Apulia and Calabria, means that a comparison with mainland contemporary sites, potentially of great interest, has not been possible. Comparisons with other Mediterranean regions have mainly relied on zooarchaeological studies from Al-Andalus and North Africa.

In the third section, the zooarchaeological results from Norman/Aragonese contexts are discussed; similarly to the Roman-Byzantine period, faunal samples dating to different chronological phases of the Late Middle Ages (Norman/Swabian/Angevin/Aragonese) were merged in order to provide a broader basis of comparison with the Islamic period.

3.5.1. The Roman Imperial/Byzantine period

Zooarchaeological data from Roma from Imperial/Byzantine contexts exclusively derive from rural settlements and villae (Table 4).

Caprines prevail at most Roman sites, with assemblages being mainly composed of sheep; similar conclusions apply to Byzantine Colmitella and Rocchicella. A small difference in the incidence of sheep can be noticed between Roman villas and Roman rural sites, with the latter engaging more clearly in pastoral activities (Fig. 7a).

In Roman contexts pig is usually the second most common domesticate, which indicates that it was an important source of meat (Fig. 7a; Table 8). The prominence of pigs in Roman sites is consistent with the well-known dietary importance of pork in Roman times (MacKinnon 2004; De Grossi Mazzorin and Minniti 2009; Albarella et al. 2019), but it continues in the Byzantine period.

This sort of continuity with Roman dietary practices is partly detectable also in culling profiles suggesting a general preference toward the consumption of very young pigs.

The generally low incidence of cattle at Byzantine Colmitella and Rocchicella is similar to that of most Roman rural sites in Sicily (Fig. 7a).

Such an overall paucity of cattle may be associated with the overall limited availability of lush lowland pastures, which did not favour large-scale cattle herding. Cattle culling profiles at Byzantine Colmitella and Rocchicella suggest that most bones derive from adult animals (Aniceti 2020); similar results were obtained from Roman rural sites, thus suggesting that the cattle were mainly used as traction force, and only consumed once no longer suitable for work. Still, the presence of a number of subadults suggests that cattle were sporadically reared for their meat at rural sites, and/or their partially processed carcasses marketed as veal in urban centres.

3.5.2. The Islamic period

Zooarchaeological studies of Islamic Sicily include both urban and rural sites, with most focusing on the urban centre of Palermo or its vicinities (Table 5).

The prominent role of caprines (in particular sheep) in the economy of Islamic Sicily is evident from the assemblages studied as part of this research – both those from the urban centre of Palermo (Corso dei Mille, Sant'Antonino, and Castello San Pietro) and Mazara del Vallo - as well as from previous zooarchaeological studies of urban sites (Arcoleo and Sineo 2014; Arcoleo 2015) (Fig. 7b).

Most faunal assemblages from urban sites (i.e. Corso dei Mille, Sant'Antonino, and Mazara del Vallo) show a low incidence (or even a complete absence) of suid remains. Their frequency is generally lower than the 5% of the total NISP of the three main domesticates. A similar pattern has been observed in other contemporary urban contexts from

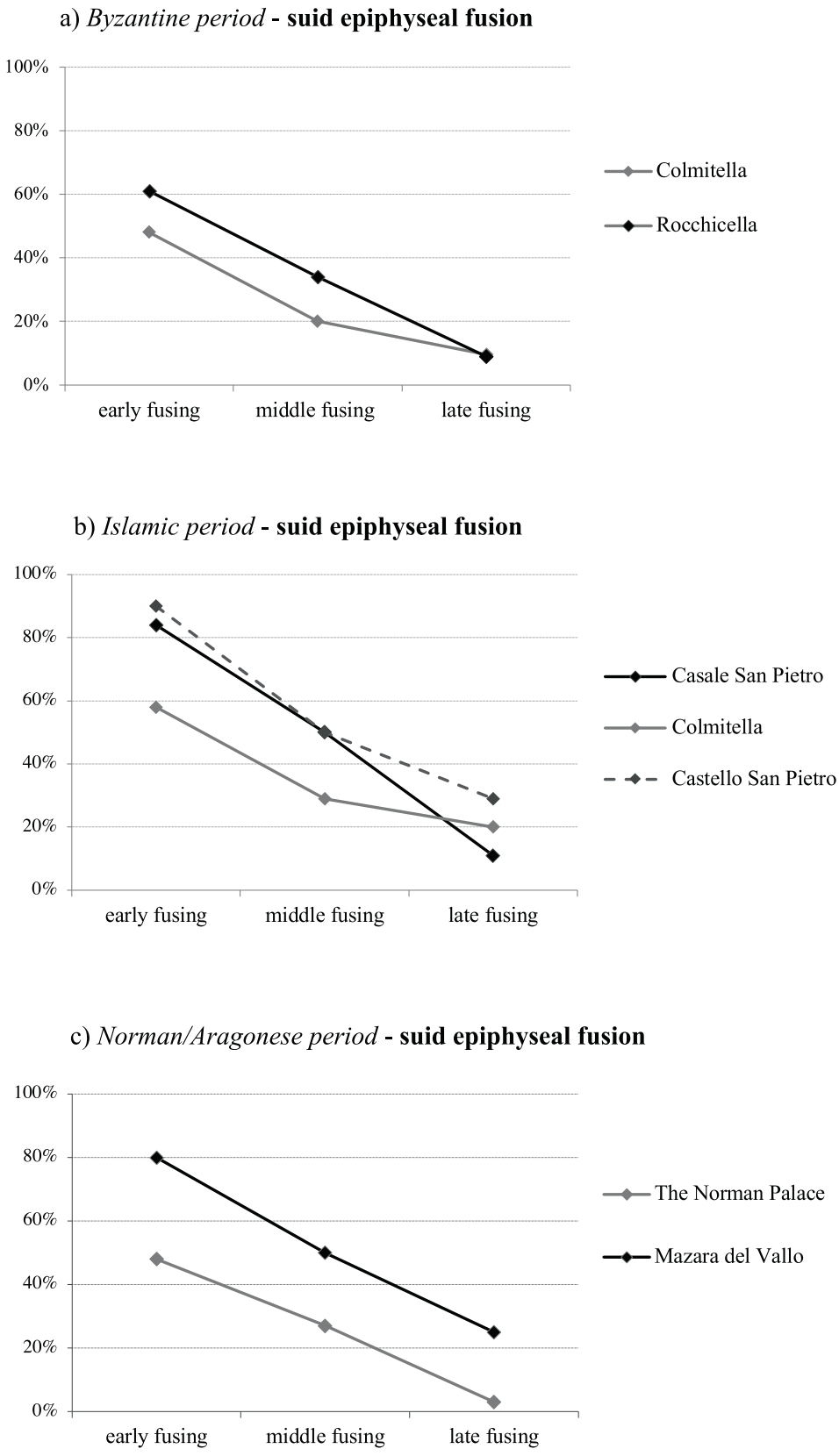

Fig. 5. Percentage of suid fused elements in the three fusion stages proposed by Reitz and Wing (2008) at Colmitella (n:34;12;5) and Rocchicella (n:44;17;5) in the Byzantine period (a), at Casale San Pietro (n:25;18;10), Colmitella (n:7;2;2), and Castello San Pietro (n:18;6;4) in the Islamic period (b), and at the Norman Palace (n:28;9,2) and Mazara del Vallo (n:5;10;12) in the Norman/Aragonese period (c).

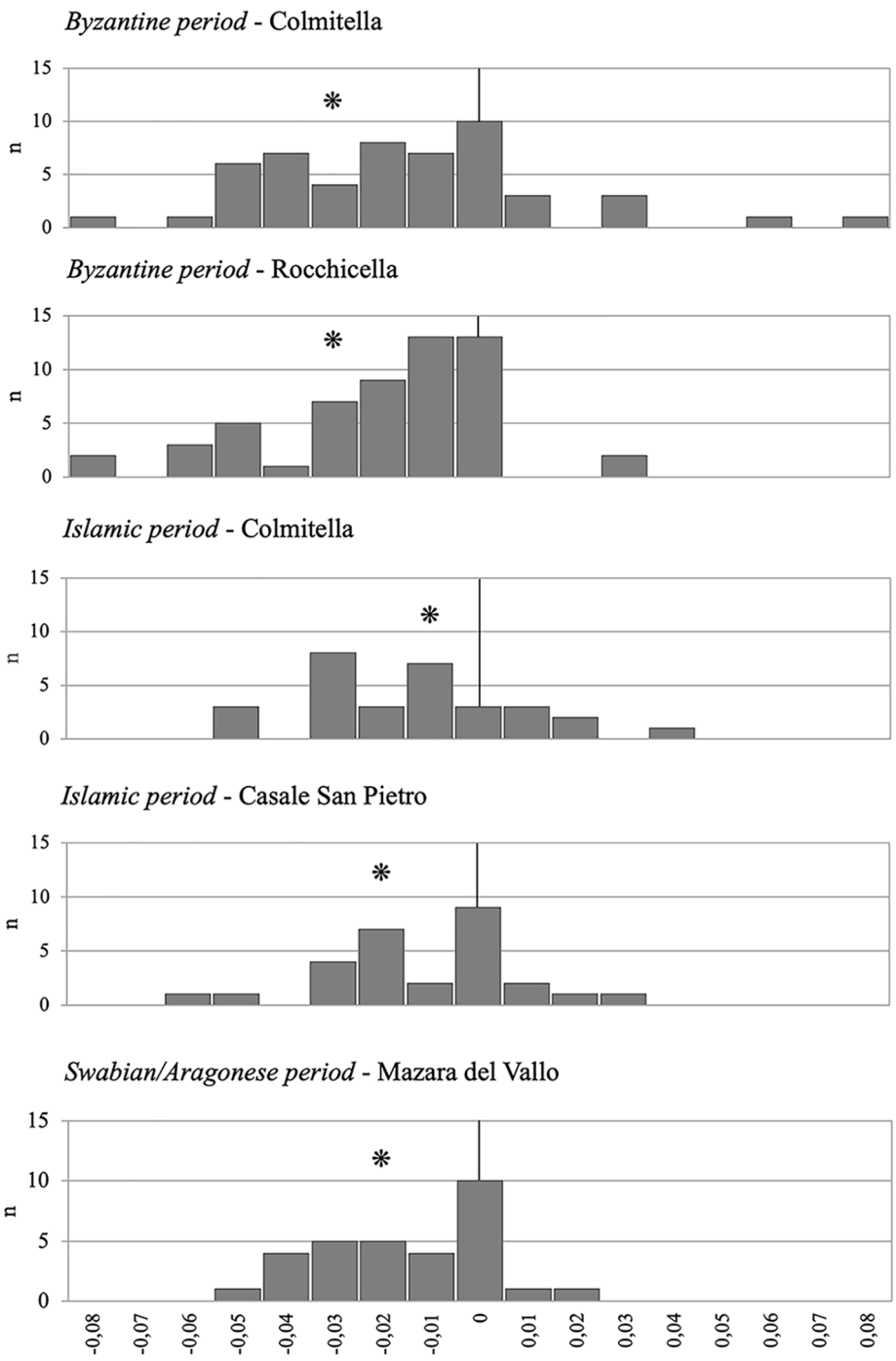

Fig. 6. Suid tooth measurement values (widths) from Colmitella, Rocchicella, Casale San Pietro, and Mazara del Vallo. Byzantine period: Colmitella (n:61) and Rocchicella (n:55); Islamic period: Colmitella (n:30) and Casale San Pietro (n:28); Norman/Aragon period: Mazara del Vallo (n:31). The symbol * indicates the logarithmic mean. The standard used (black line) is the mean of measurements of pig mandibular and maxillary teeth from the Neolithic site of Durrington Walls (UK) (Albarella and Payne 2005).

Palermo (Arcoleo and Sineo 2014; Arcoleo 2015), and also at the agrotown[3] of Villa del Casale (Scavone 2016; 2019) (Fig. 7b; Table 7).

An analogous scarcity or absence of suids has also been detected from Islamic urban settlements in Spain and Portugal[4] (García-García 2019; Moreno-García and Davis 2001; Moreno-García 2004; Morales-Muñiz et al. 2011). Consistently with the zooarchaeological data from urban Sicily and Al-Andalus, North African urban contexts dated to the Arab period (e.g. Carthage-Bir Ftouha, Carthage-Byrsa, Setif, Libyan Valleys, Abu Telis, Quseir al-Qadim and Volubilis; early 9th-16th c. AD) show an overall scarcity or absence of suids (Hamilton-Dyer 2011; MacKinnon 2017; King 2018). As pork is *haram,* such overall dearth of suids is likely to be the result of an on-going or already well-established Islamisation of communities in these urban areas.

In the Islamic period, the agrotown of the Villa del Casale was an extensive economic and administrative centre; here, pig was almost absent as it was at Palermo and Mazara del Vallo. Such similarity between Villa del Casale and other contemporary urban sites (e.g. Palermo) was also observed in the evidence of the material culture (e.g. pottery, glass; Alfano 2019; Colangeli in prep.). However, variability in the presence of suids in the Arab urban contexts of Palermo does exist. A relatively higher incidence of suids is detected at Castello San Pietro in the 9th c. AD. This relative high incidence of suids may be interpreted, along with other archaeological evidence, as an indicator of the presence of Christian communities, who had not (yet?) been influenced by the

[3] A dispersed rural settlement with potential administrative functions.
[4] For a complete list of the sites, see García-García (2019).

Table 4
Roman Imperial/Byzantine period: details of the faunal assemblages reported in the ternary plot (Fig. 7a).

Roman/Byzantine period *a) Previous studies*	*province*	*chronology*	*settlement type*	*reference(s)*
1. Castagna	Agrigento	50/100 - early 6th c. AD	rural	Johnstone 1997
2. Kaukana	Ragusa	5th/6th c. AD	rural	MacKinnon unp. (a)
3. Ganzirri	Messina	5th/6th c. AD	rural	Mangano 2001
4. Sofiana	Enna	1st –7th c. AD 8th-9th c. AD	rural rural	MacKinnon unp. (b;c,d)
5. Contrada Pistunina	Messina	1st – 7th c. AD	villa	Mangano 2001
6. Gerace	Enna	2nd ½ 5th c. AD	villa	Wilson 2021
7. Rocchicella	Enna	1st – 4th c. AD	villa[a]	Di Patti and Lupo 2008
8. Villa del Casale	Enna	1st- 6th c. AD	villa	Scavone 2016
9. Contrada Castro	Palermo	late 7th – 9th c. AD	rural	Castrorao Barba et al. 2021
b) *Our study*				
10. Colmitella	–	–	–	Table 2 in this paper
11. Rocchicella	–	–	–	*ibid.*

[a] In this period, the settlement of Rocchicella was acquired by the owner of the Roman rural villa of Favarotta/Tenuta Grande, located ca. 2.5 km from Rocchicella. During the archaeological excavation, the recovery of a contemporary mill and a kiln indicated that this area was used for craft activities, thus suggesting that it was the *pars rustica* of the villa (Arcifa and Maniscalco 2016).

Islamisation process. A similar interpretation was made for the urban site of Cercadilla (Cordoba, Spain) in both the Emiral and the Late Andalusi periods (mid-8th-mid-10th c. AD; 12th c. AD; García-García 2019), as well as for other urban settlements in southern Portugal, where an unusually high incidence of pig was recorded (Gabriel 2003; Covaneiro and Cavaco 2012). The consumption of pork by a restricted group of Christian communities inhabiting Islamic areas is not atypical, and it finds a direct comparison in modern Egypt[5] (Fahmi and Sutton 2010). Another potential explanation for the relatively high incidence of suids at Castello San Pietro is that most remains may belong to wild boars rather than domestic pigs, as this animal is not specifically mentioned and forbidden in the Koran (possibly because of its wild nature). Zooarchaeological and ethnographical studies have suggested that wild boar meat can occasionally be consumed by Muslims (Simoons 1994; Benkheira 1995; Moreno-García 2004; Redding 2015). However, wild boar consumption would have been a rare opportunity, and probably the exception rather than the norm. Although the presence of wild boar at Castello San Pietro cannot be ruled out with certainty, the predominance of unfused bones indicates a substantial occurrence of young animals. Young wild boars can of course be hunted but the regular slaughtering of immature domestic pigs represents a more likely proposition (Albarella et al. 2007). Such a hypothesis is further supported by the overall low incidence of wild mammals in the assemblage, which attests to the minor role played by hunting (Aniceti 2020). In addition, although not enough postcranial bones were available for biometric analysis, small-medium sized teeth, largely plotting unimodally, indicate a clear prevalence of domestic pigs with very few large wild boar outliers.

[5] In Egypt, ca. 90% of the population is Muslim, and ca. 9% is Christian. Within this minority, the Coptic Christian community of the *Zabaleen* considers pigs an essential source of protein, making use of these animals also for getting rid of food waste.

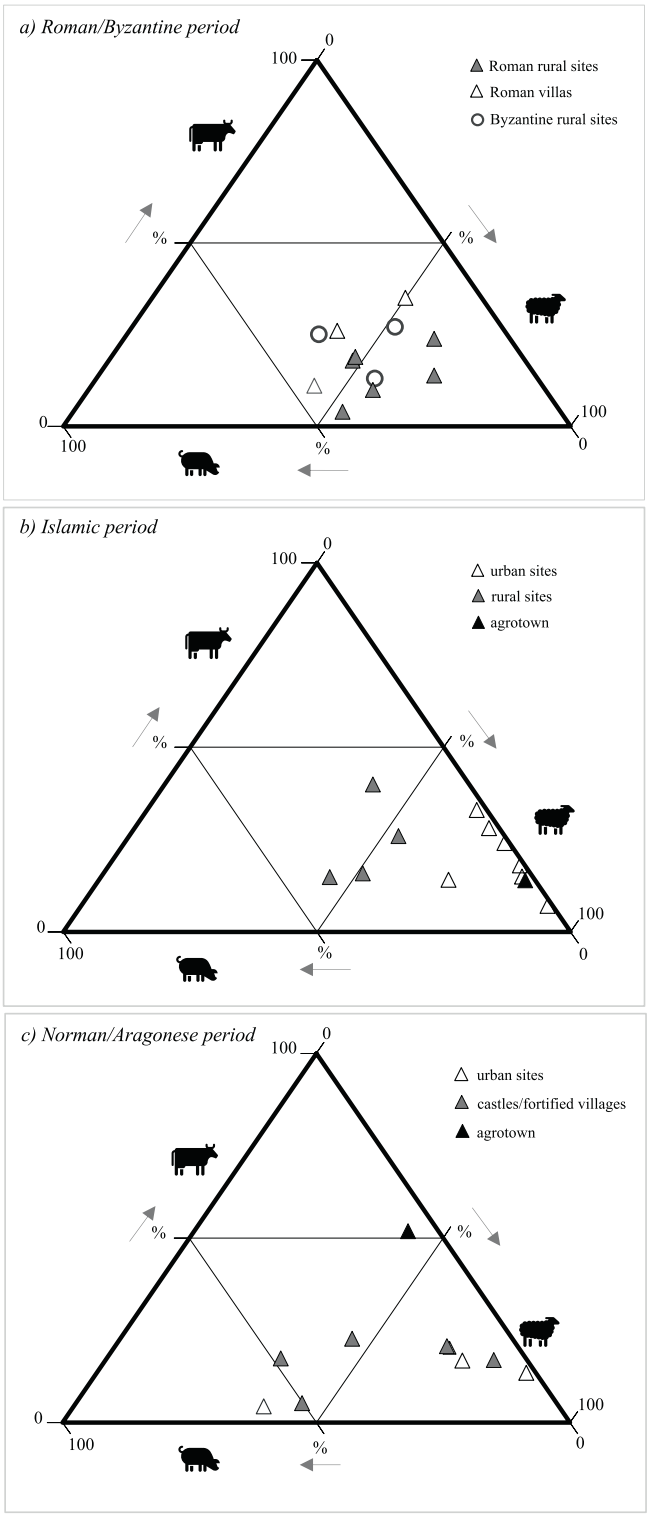

Fig. 7. Ternary plots for the NISP frequencies of cattle, caprines, and suids in the Roman-Byzantine (a), Islamic (b) and Norman/Aragonese (c) periods at the sites included in this study.

Table 5
Islamic period: details of the faunal assemblages reported in the ternary plot (Fig. 7b).

Islamic period *a) Previous studies*	*province*	*chronology*	*settlement type*	*reference(s)*
1. Palazzo Bonagia	Palermo	9th-11th AD	urban	Arcoleo 2015
2. Santa Maria degli Angeli alla Gancia	Palermo	9th-11th AD	urban	Arcoleo 2015
3. Via Imera	Palermo	9th-11th AD	urban	Arcoleo 2015
4. Contrada Castro	Palermo	10th-11th c. AD	rural	Castrorao Barba et al. 2021
5. Sofiana	Enna	10th-12th c. AD[a]	rural	Mackinnon unp. (b;c,d)
6. Villa del Casale	Enna	10th-11th c. AD	agrotown	Scavone 2019Scavone 2016
b) *Our study*				
7. Castello San Pietro				Table 2 in this paper
8. Corso dei Mille	–	–	–	*ibid.*
9. Sant'Antonino	–	–	–	*ibid.*
10. Mazara del Vallo	–	–	–	*ibid.*
11. Casale San Pietro	–	–	–	*ibid.*
12. Colmitella	–	–	–	*ibid.*

[a] The stratigraphic sequence did not allow a chronological separation of this phase; this results in an overlap between the Islamic and Norman periods (Vaccaro pers. comm.).

Alternatively, pork consumption by Muslims could be the result of political actions aimed at social self-segregation[6]. We must also consider that Muslims can occasionally consume pork when they face a dire 'state of necessity'[7].

Additional data provided by human osteology and petrographic studies have allowed to better contextualise and interpret the high incidence of suids at Castello San Pietro in the Islamic phase. Archaeological investigations at the site have revealed the presence of a 9th c. cemetery area with a number of skeletons buried according to the Muslim ritual (Arcifa and Bagnera 2014). Such evidence suggests that at least some of the inhabitants of Castello San Pietro had an Islamic cultural-religious background or were influenced by it. Recent petrographic analyses on pottery remains from 9th c. contexts have suggested that, at this time, Palermo workshops were managed by newly arrived (most likely of Islamic background) *as well as* local potters (most likely of Byzantine background) (Testolini 2018). It therefore seems that in the 9th c., a number of different ethnic groups, maintaining their burial and dietary habits, co-existed.

In sum, it seems that the zooarchaeological, funerary and petrographic evidence are consistent in suggesting that in 9th c. AD Castello San Pietro the local population had only recently become accustomed to the socio-cultural innovations brought to the city by the Islamic rulers. Mixed communities probably provided a diversified response to the new cultural context.

At rural sites, there is a higher proportion of suids (Fig. 7b; Table 7). In the case of Casale San Pietro, the presence of suids in the Islamic period is further corroborated by recent organic residue analyses where porcine fats were detected on some pottery remains (Lundy *et al.* in press.). Biometrical analyses suggest the suid remains from these rural sites mainly belonged to the domestic pig, although a few wild boars were probably also present.

In a recent zooarchaeological review (García-García 2019), an unusually high incidence of suids was also observed in some Spanish rural sites dated to the early-mid and mid-late Islamic periods (8th-14th c. AD). The presence of suids (along with other archaeological evidence) at these rural sites has been interpreted as an indicator of a low degree of Islamisation characterising the countryside (García-García 2019). This hypothesis may also apply to Sicily. However, the case of Colmitella may provide an additional, complementary view on the matter. Here, in comparison to the Byzantine period, a decrease in pig frequency was detected, which may be attributed to increasing Islamisation. Petrographic analyses also indicate cultural change; some ceramic fabrics were similar to those from the Byzantine period, but new techniques also started to appear in the 9th c. AD, either as a consequence of the establishment of new ethnic groups or through their influence on local manufacture (Testolini 2018). These archaeological indicators of cultural change do not suggest a weak degree of Islamisation of the countryside, and the notion of pork avoidance would have easily reached rural locations. It is more likely that the dietary habits of local communities could be less strictly controlled by the central administration, leaving room for a greater degree of pig breeding and pork consumption.

3.5.3. The Norman-Aragonese period

Faunal assemblages dated to the Norman-Aragonese periods were mainly recovered from castles/fortified villages and urban sites (mainly Palermo area) (Table 6).

Caprines (mainly sheep) remain the most represented domesticates at Corso dei Mille and Mazara del Vallo. However, differences in the incidence of the main domestic taxa are evident (Fig. 7c, Table 7). As it has been highlighted before, at the Norman Palace pig makes up the majority of domesticates, although caprines remain well-represented; a similar trend was observed at Calathamet (Di Patti et al. 2013). At Castello di Fiumenidisi, pigs are the second most common species (Villari 1988). To a lesser extent, pigs are also well-represented at Palazzo

Table 6
Norman-Aragonese period: details of the faunal assemblages reported in the ternary plot (Fig. 7c).

Norman-Aragonese period *a) Previous studies*	*province*	*chronology*	*settlement type*	*reference(s)*
1. Brucato	Palermo	11th – 14th c. AD	castle/ fortified village	Bossard-Beck 1984
2. Calathamet	Trapani	12th – 14th c. AD	castle/ fortified village	Di Patti et al. 2013
3. Castello di Fiumedinisi	Messina	13th – 14th c. AD	castle/ fortified village	Villari 1988
4. Rocca di Entella	Palermo	1st ½ 13th c. AD	castle/ fortified village	Bedini 1999
5. Segesta	Trapani	12th – 13th c. AD	castle/ fortified village	Di Martino 1997
6. Palazzo Chiaramonte Steri	Palermo	14th c. AD	urban	Di Patti and Lupo 2012
7. Villa del Casale	Enna	11th-12th	agrotown	Scavone 2019
b) *Our study*				
8. Corso dei Mille	–	–	–	Table 2 in this report
9. Mazara del Vallo	–	–	–	*ibid.*
10. The Norman Palace	–	–	–	*ibid.*

[6] As an example, in modern Maghreb, the meat of pig and/or wild boar is mostly consumed by marginalised communities of rebels (Benkheira 1995; 2000).

[7] However, a 'state of necessity' does not seem in line with the information provided by archaeological and documentary sources for Sicily, which discount a dramatic collapse of commercial and productive activities on the island after the Arab conquest. This holds particularly true for Palermo; here, since the 9th c. AD, important economic investments made by the Arab administration drastically transformed the city from a marginal settlement into a political and administrative centre and international market (Bagnera 2013).

Table 7
Synthesis of species frequency variations of the three main domestic taxa in the Roman/Byzantine, Islamic and Norman/Aragonese periods across different settlement types.

Taxa	*Chronological periods and settlement types*					
	Roman/ Byzantine		*Islamic*		*Norman/Aragonese*	
	villa	rural	urban	rural	urban	rural/ castle
Cattle	marginal role		marginal role		marginal role	
Caprines	major role		major role		major role	
Pig	common (2nd taxon)		mostly absent	common (2nd taxon)	present at most sites absent at sites with a continuity in the presence of Islamic communities	

Chiaramonte Steri (Di Patti and Lupo 2012) and Brucato (Bossard-Beck 1984).

An increase in the frequency of suids has been detected at Mazara del Vallo; such evidence is clearly in contrast with the pattern observed for the Islamic period, in which suids are almost absent.

A high incidence of suids also characterises the Swabian contexts at Segesta (12th-13th c. AD; Di Martino 1997). Here, in the previous Norman period, the excavation of a mosque and the presence of a cemetery area with Muslim burials indicates the presence of an Islamised community; later, in the Swabian period, the site underwent radical structural changes: the mosque was destroyed and a castle, a church and a cemetery area were established. This evidence indicates that, after Frederick II's repression of Muslim communities, Segesta was mostly inhabited by Christians (Molinari 1997).

As far as the Norman Palace, Mazara del Vallo, Calathamet, Segesta and, to a lesser extent, Palazzo Chiaramonte Steri and Brucato are concerned, it seems that the arrival on the island of the Normans and, later, the Swabians, Angevin and Aragonese coincides with a renewed interest in pig husbandry and pork consumption. Such a change is indicative of an ongoing 'de-Islamisation' process of the island, starting in the Norman period, which finds parallels in the information provided by other archaeological evidence and written sources (Abulafia 1994; 1995; Abulafia, 2007; Molinari 2020).

However, exceptions to the higher incidence of pigs in Norman-Aragonese Sicily do exist. Like in the Islamic period, pigs are barely represented at Norman/Swabian Corso dei Mille (Palermo), indicating the persistence of an Islamised community within the city. This is confirmed by the discovery at the site of a contemporary cemetery containing four individuals disposed according to the traditional Muslim burial rite (Battaglia et al. 2016).

A low incidence of pigs has also been observed at Rocca di Entella (12th - mid-13th c. AD, Palermo) (Bedini 1999). At this site, archaeological excavations revealed the presence of a Muslim community inhabiting the site possibly until the arrival of Frederick II (CE 1246) (Corretti et al. 2004). The composition of the faunal assemblage from Norman/Swabian Rocca di Entella recalls that of contemporary Corso dei Mille, with caprines (mainly sheep) being the most abundant animal, and pig scarcely represented.

4. Conclusions

Following the Roman/Byzantine period, food production and consumption practices changed substantially in Islamic Palermo and Mazara del Vallo. Here, the Muslim dietary prohibition of pork was adopted more strictly than at contemporary rural settlements, where a stronger continuity with previous animal husbandry strategies is evident. Such persistence of previous practices in rural areas may suggest that the Islamic administration had insufficient power or motivation to successfully impose dietary taboos in places located far from the main urban political and administrative centres; at the same time, a lower degree of Islamisation of the countryside could also have played a role, and there may have been an interest in tolerating, or even promoting, the coexistence of Christian and Islamic communities in farming areas. Exceptions to this urban/rural contrast do, however, exist, as indicated by the decrease in pig frequency at Islamic Colmitella (although delayed and less pronounced than in urban centres) and by the relatively higher incidence of pigs at urban Castello San Pietro in the 9th c. AD.

All in all, such evidence indicates that the Islamisation of Sicily was not a rapid, comprehensive phenomenon but rather a piecemeal and complex process, which affected the native population in a diversified fashion.

Zooarchaeological data from the later Norman-Aragonese period indicate that at some, but by no means all, urban and castle sites, pig frequencies increased. This change was, however, not dramatic, which suggests, in combination with other lines of archaeological evidence, that the de-Islamisation of the island was also not an abrupt process. It took time for the new Christian rulers to impose their own cultural and religious precepts.

To conclude, this paper has highlighted how and why faunal remains can be valuable archaeological indicators of food cultural identity and, more specifically, their potential role in clarifying the complexity of Sicilian medieval history. We have presented clear evidence of the occurrence of a pork taboo in Islamic times but also that it would be wrong to simplify this phenomenon unduly. The power of archaeology in providing genuine evidence from the tangible remains of our past and beyond the filter of historical propaganda is demonstrated very clearly in our paper. The Islamic dietary identity was not monolithic, and it evolved over time, thus providing us with an insight in the multiple and diversified processes of acculturation of Sicily.

5. Submission declaration

The work described in this article has not been published previously, it is not under consideration for publication elsewhere, its publication is approved by all authors and by the responsible authorities where the work was carried out, and, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder.

6. Role of the funding source

The PhD project on which this article is based was funded by the White Rose University Consortium (strategic partnership between the Universities of Leeds, Sheffield and York, United Kingdom) - PhD Scholarship Award 2014-2017, granted to Veronica Aniceti. This sponsor was not involved in the study design, the collection, analysis and interpretation of data, the writing of the report, and the decision to submit the article for publication.

7. Data statement

Raw research data will be made available following acceptance of the article, by depositing a complete dataset in a relevant repository, and linking the finalised article directly to such dataset. Free-to-use, open access repositories will be preferred (e.g., Mendeley Data).

CRediT authorship contribution statement

Veronica Aniceti: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Visualization, Writing – original draft, Writing – review & editing. **Umberto Albarella:** Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This paper presents and discusses part of the results of VA's doctoral project, funded by the White Rose Consortium (Universities of Leeds, Sheffield and York, UK). The PhD project has been the result of a collaboration between the University of Sheffield, the University of York and a number of archaeologists working in Sicily; among these, our gratitude goes to the people of the Soprintendenza per i Beni Culturali ed Ambientali di Palermo (Stefano Vassallo, Giuseppina Battaglia, Carla Aleo Nero, and Monica Chiovaro), Lucia Arcifa (University of Catania), Maria Serena Rizzo (Temple Valley Archaeological Park) and Nuccia Gullì (Soprintendenza per i Beni Culturali ed Ambientali di Agrigento). Special thanks to all members of the research team involved in the European Research Council (ERC) project 'Sicily in Transition' (SICTRANSIT). In particular, we would like to thank Martin Carver (University of York, UK), Alessandra Molinari (University of Rome Tor Vergata, Italy), Milena Primavera and Girolamo Fiorentino (University of Salento, Lecce, Italy) for their invaluable suggestions and comments. We are also deeply grateful to Michael MacKinnon for allowing us to use the unpublished faunal reports of Kaukana and Sofiana; for access to unpublished information about Sofiana we are also grateful to Emanuele Vaccaro. We would like also to thank the reviewers for their thoughtful comments and efforts towards improving our manuscript.

References

Abulafia, D., 2007. The last Muslims in Italy. Dante Studies 125, 271–287.

Abulafia, D., 1995. Federico II: un imperatore medievale. Einaudi, Torino.

Abulafia, D., 1994. Ethnic variety and its implications: Frederick II's relations with Jews and Muslims. Studies in the History of Art 44, 213–224.

Albarella, U., 2002. 'Size matters': how and why biometry is still important in zooarchaeology. In: Dobney, K., O'Connor, T. (Eds.), Bones and the man. Studies in honour of Don Brothwell. Oxbow Books, Oxford, pp. 51–62.

Albarella, U., Davis, S., 1994. The Saxon and medieval animal bones excavated 1985–1989 from West Cotton. Northamptonshire. Ancient Monuments Laboratory Report 17/94.

Albarella, U., De Grossi Mazzorin, J., Minniti, C., 2019. Urban pigs: dietary, cultural and landscape changes in 1st millennium AD Rome. In: Peters, J., McGlynn, G., Goebel, V. (Eds.), Animals: cultural identifiers in ancient societies? Verlag Marie Leidorf, Rahden, pp. 17–30.

Albarella, U., Dobney, K., Ervynck, A., Rowley-Conwy, P., 2007. Pigs and humans: 10,000 years of interaction. In: Albarella, U., Dobney, K., Ervynck, A., Rowley-Conwy, P. (Eds.), Pigs and Humans: 10,000 Years of Interaction. Oxford University Press, Oxford, pp. 1–12.

Albarella, U., Payne, S., 2005. Neolithic pigs from Durrington Walls, Wiltshire, England: a biometrical database. Journal of Archaeological Science 32 (4), 589–599.

Aleo Nero, C. (2017). Palermo. Ceramica da contesti urbani di età medievale, circolazione e consumo. Lo scavo nel Convento di Sant'Antonino (2013). In *Atti del XLVIII Convegno Internazionale della Ceramica, Savona, 2015*, pp. 83–98. Savona: Centro Ligure per la Storia della Ceramica.

Alfano, A. (2019). La ceramica medievale. In P. Pensabene and P. Barresi (eds.) *Piazza Armerina, Villa del Casale: scavi e studi nel decennio 2004-2014. Scavi nella villa e nelle terme sud. Studi e materiali dal tardoantico al medioevo*, Vol. 2, pp. 341-370. Roma: L'Erma di Bretschneider.

Amari, M., 1954. Storia dei musulmani di Sicilia. Felice Le Monnier, Firenze.

Aniceti, V. (2020). Animals and their role in the medieval society of Sicily: from Byzantine to Arabs and from Arabs to Norman/Swabians (7^{th}-12^{th}/13^{th} centuries AD). Unpublished PhD thesis (University of Sheffield, UK). White Rose E-Thesis Online (http://etheses.whiterose.ac.uk/26626/).

Aniceti, V., (in press), 1997. Le risorse animali nella dieta e nella vita degli abitanti di Via Romano (Mazara): tra religione ed incremento produttivo. In Molinari, A. and A. Meo (eds.) Mazara, Mazar: nel ventre della città medievale (secoli VII–XV). Edizione degli scavi, in Via Tenente Gaspare Romano. All'Insegna del Giglio, Firenze.

Arcifa, L., 2016. Per un nuovo approccio allo studio delle città siciliane nell'Altomedioevo: Catania e Siracusa tra VIII e IX secolo. In: C. Giuffrida e M. Cassia,, . (Ed.), *Silenziose rivoluzioni: la Sicilia dalla tarda antichità al primo Medioevo, Atti dell'incontro di studio (21–23 maggio, Catania-Piazza Armerina)*. Edizioni del Prisma, Catania, pp. 415–439.

Arcifa, L., 2010. Nuove ipotesi a partire dalla rilettura dei dati archeologici: la Sicilia orientale. In: Nef, A., Prigent, V. (Eds.), La Sicile de Byzance À l'Islam. De Boccard, Paris, pp. 15–49.

Arcifa, L., Bagnera, A., 2014. Islamizzazione e cultura materiale a Palermo: una riconsiderazione dei contesti ceramici di Castello San Pietro. In: Nef, A., Ardizzone, F. (Eds.), Les dynamiques de l'islamisation en Méditerranée centrale et en Sicile: nouvelles propositions et découvertes récentes. École Française de Rome and Edipuglia, Bari, pp. 165–195.

Arcifa, L., Bagnera, A., Nef, A., 2012. Archeologia della Sicilia islamica: nuove proposte di riflessione. In: Sénac, P. (Ed.), Histoire et archéologie de l'Occident musulman (VIIe-XVe siècles). Al-Andalus, Maghreb, Sicile. CNRS - Université de Toulouse-Le Mirail, Toulouse, pp. 241–274.

Arcifa, L. and E. Lesnes (1997). Primi dati sulle produzioni ceramiche palermitane dal X al XV secolo. In G. Démians D'Archimbaud (ed.) *La céramique médiévale en Méditerranée. Actes du 6 congrès. Aix-en-Provence, 13–18 novembre 1995*, pp. 405–418. Aix-en-Provence: Narrations Ed.

Arcifa, L., Maniscalco, L., 2016. Il perché dopo l'Antico. In: Arcifa, L., Maniscalco, L. (Eds.), Dopo l'Antico: ricerche di archeologia medievale. Regione Siciliana, Palermo, pp. 5–8.

Arcifa, L., Sgarlata, M., 2020. From polis to madina. La trasformazione delle città siciliane tra tardoantico ed alto medioevo. Edipuglia, Bari.

Arcoleo, L., 2015. Indagini archeozoologiche della Palermo antica: la Gancia, Palazzo Bonagia e Via Imera. Studi di Palermo, Palermo). Unpublished PhD Thesis (Università degli.

Arcoleo, L., Sineo, L., 2014. Analisi archeozoologica di due contesti della città antica di Palermo: la Gancia e i Sili di via Imera (Palermo, IX–X secolo D.C.). In: Nef, A., Ardizzone, F. (Eds.), Les dynamiques de l'islamisation en Méditerranée centrale et en Sicile. Nouvelles propositions et découvertes récentes. Edipuglia, Bari, pp. 301–306.

Ardizzone, F., Pezzini, E., Sacco, V., 2016. The role of Palermo in the central Mediterranean: evolution of the harbour and circulation of ceramics (10^{th}–11^{th} centuries). Journal of Islamic Archaeology 2 (2), 229–257.

Ardizzone, F., Pezzini, E., Sacco, V., 2014. Lo scavo della chiesa di Santa Maria degli Angeli alla Gancia: indicatori archeologici della prima età islamica a Palermo. In: Nef, A., Ardizzone, F. (Eds.), Les dynamiques de l'Islamisation en Méditerranée central et en Sicile: Nouvelles propositions et découvertes récentes. École française de Rome, Roma-Bari, pp. 197–223.

Bagnera, A., 2013. From a small town to a capital: the urban evolution of Islamic Palermo (9^{th}-mid-11^{th} century). In: Nef, A. (Ed.), A companion to medieval Palermo. The history of a Mediterranean city from 600 to 1500. Leiden and Boston: Brill, pp. 61–88.

Bagnera, A., Pezzini, E., 2004. I cimiteri di rito musulmano nella Sicilia medievale. Dati e problemi. *MEFRM* 116, 231–302.

Barone, R., 1976. Anatomie comparée des animaux domestiques: ostéologie, Vol. 1. Vigot frères, Paris.

Battaglia, G., L. Riolo and V. Aniceti (2016). Produzioni artigianali nella Palermo islamica. In V. Caminneci, M. C. Parello and M. S. Rizzo (eds.) *La città che produce. Archeologia della produzione negli spazi urbani. Atti delle Giornate Gregoriane, X Edizione (10-11 dicembre 2016)*, pp. 84–91. Bari: Edipuglia.

Bedini E. (1999). I reperti faunistici del palazzo fortificato medievale (SAS 1/2), in AA. VV., Entella. Relazioni preliminari delle campagne di scavo 1992, 1995, 1997 e delle ricognizioni 1998. *Annali della Scuola Normale Superiore di Pisa* 4(1): 1–188.

Benkheira, M., 2000. Islam et interdits alimentaires. Juguler l'animalité. Presses Universitaires de France, Paris.

Benkheira, M., 1995. La nourriture carnée comme frontière rituelle. Archives des Sciences Sociales des Religions 92, 67–88.

Boessneck, J., 1969. Osteological differences between sheep (*Ovis aries* Linné) and goat (*Capra hircus* Linné). In: Brothwell, D.R., Higgs, E. (Eds.), Science in archaeology: a survey of progress and research. Cambridge University Press, Cambridge, pp. 331–358.

Bossard-Beck, C. (1984). Le mobilier ostéologique et botanique. In J. M. Pesez (ed.) *Brucato. Histoire et archéologie d'un habitat médiéval en Sicile. Vol. 2*. Collection de l'École Francaise de Rome 78, pp. 615–671. Rome: École francaise de Rome.

Bramoullé, D., Richarté-Manfredi, C., Sacco, V., Garnier, N., 2017. Le mobilier céramique dans la Méditerranée des X^{e}-XII^{e} siècles. Annales Islamologiques 51, 191–221.

Bresc, H., 2013. Religious Palermo: A Panorama between the 12^{th} and the 15^{th} Centuries. In: Nef, A., Ardizzone, F. (Eds.), Les dynamiques de l'islamisation en Méditerranée centrale et en Sicile. Nouvelles propositions et découvertes récentes. Edipuglia, Bari, pp. 349–382.

Bresc, H., 1986. Un monde méditerranéen: économie et société en Sicile (1300–1460). École Française de Rome, Rome.

Carver, M., A. Molinari, V. Aniceti, C. Capelli, F. Colangeli, L. Drieu, G. Fiorentino, F. Giovannini, M. Hummler, J. Lundy, A. Meo, A. Monnereau, P. Orecchioni, M. Primavera and A. Ughi (2019). Sicily in transition. New research on early medieval Sicily, 2017-2018. *The Journal of Fasti Online* 437.

Carver, M., Molinari, A., Aniceti, V., Colangeli, F., Giannini, N., Giovannini, F., Hummler, M., Mangiaracina, C.F., Meo, A., Orecchioni, P., 2018. Sicily in transition. Interim report of investigations at Castronovo di Sicilia 2016. *The Journal of Fasti Online* 412.

— (2017). Ricerche 2016 a Castronovo di Sicilia, Sicily in Transition (Progetto ERC advanced grant 2016-693600). *Notiziario archeologico della Soprintendenza di Palermo* 23.

Cassai, D. (2003). La vita quotidiana a Mazara del Vallo (TP) in età islamica: i "pozzi di butto" di via Tenente Romano. Unpublished PhD Thesis (Università degli Studi di Siena, Italy).

Castrorao Barba, A., C. Speciale, R. Micciché, F. Pisciotta, C. Aleo Nero, P. Marino and G. Bazan (2021). The Sicilian Countryside in the Early Middle Ages: Human-Environment Interactions at Contrada Castro. *Environmental Archaeology*.
Chiarelli, L. C. (2011). *A history of Muslim Sicily*. Venera: Midsea Books.
Colangeli, F. (in prep.). Il riflesso di vetri e metalli: oltre alla cermaica per la comprensione dei mutamenti culturali ed economici. Il caso della Sicilia nei secoli VI–XIII. Unpublished PhD Thesis (Università di Roma – Tor Vergata, Italy).
Corretti, A., M. Gargini, C. Michelini and M. A. Vaggioli (2004). Tra Arabi, Berberi e Normanni: Entella ed il suo territorio dalla tarda Antichità alla fine dell'epoca sveva. *MEFRM* 116: 145–190.
Covaneiro, J., Cavaco, S., 2012. Proibições e tolerâncias. Os hábitos alimentares das populações em época islâmica (Tavira). In: Memória dos Sabores do Mediterrâneo. Campo Arqueológico de Mértola-Centro de Estudos Arqueológicos das Universidades de Coimbra e Porto, Mértola, pp. 141–152.
Daróczi-Szabó, L., 2004. Animal bones as indicators of kosher food refuse from 14th century AD Buda, Hungary. In: O'Day, J., Van Neer, W., Ervynck, A. (Eds.), Behaviour Behind Bones. The Zooarchaeology of ritual, religion, status and identity. Oxbow Books, Oxford, pp. 252–261.
De Grossi Mazzorin, J. and C. Minniti (2009). L'utilizzazione degli animali nella documentazione archeozoologica a Roma e nel Lazio dalla preistoria recente all'età classica. In L. Drago Troccoli (ed.) *Il Lazio dai Colli Albani ai Monti Lepini tra preistoria ed età moderna*, pp. 39–68. Roma: Edizioni Quasar.
Diener, P., Robkin, E.E., Anderson, E.N., Barclay, H.B., Bertocci, P.J., Brown, K.L., Centlivres, P., Ghani, A., Grivetti, L.E., Harris, M., Leeds, A., Orans, M., Patai, R., Raum, J.W., Simoons, F.J., Vayda, A.P., Wagner, P.L., Webb, M.C., 1978. Ecology, evolution, and the search for cultural origins: the question of Islamic pig prohibition [and comments and reply]. Current Anthropology 19 (3), 493–540.
Di Martino, S. (1997). Le analisi archeozoologiche. In A. Molinari (ed.) *Segesta II. Il castello e la moschea (scavi 1989-1995)*, pp. 259–268. Palermo: Flaccovio.
Di Patti, C., Di Salvo, R., Di Trapani, F., Schimmenti, V., 2013. Les restes faunistiques. In: Lesnes, E., Poisson, J.-.-M. (Eds.), Calathamet. Archéologie et histoire d'un château noemand en Sicile. École Française de Rome, Rome, pp. 271–286.
Di Patti, C. and F. Lupo (2012). Analisi del complesso faunistico di palazzo Steri (PA): dai Normanni ai Vicerè spagnoli (IX–XV sec.). In J. De Grossi Mazzorin, D. Saccà and C. Tozzi (eds.) *Atti del VI Convegno Nazionale di Archeozoologia*, pp. 267–274.
Di Salvo, R., 2004. I Musulmani della Sicilia occidentale: aspetti antropologici e paleopatologici. MEFR 116 (1), 389–408.
Di Stefano, C.A., De Floris, M.H., Arcifa, L., Pesez, J.-M., 1989. Palerme, quartier Castello San Pietro. MEFRM 101 (1), 332–350.
Fiorentino, G., Porta, M., Primavera, M., A. Sellitto (in press), 1997. Mazara tra innovazione e continuità: il contributo dell'archeobotanica alla ricostruzione dei paesaggi, dei sistemi agricoli e delle abitudini alimentari tra fase bizantina ed età moderna. In A. Molinari and A. Meo (eds.) Mazara, Mazar: nel ventre della città medievale (secoli VII–XV). Edizione degli scavi, in Via Tenente Gaspare Romano. All'Insegna del Giglio, Firenze.
Gabriel, S., 2003. Estudo dos restos faunísticos do Silo I dos Paços do Concelho de Torres Vedras. Instituto Portugues de Arqueología, Lisbon.
García-García, M. (2019). Explotación y consumo de los animales en el sudeste de la península ibérica durante la Alta Edad Media (ss. VII–XII): perspectivas históricas y arqueozoológicas. Unpublished PhD Thesis (Universidad de Granada, Spain).
Grant, A., 1982. The use of tooth wear as a guide to the age of domestic ungulates. In: Wilson, B., Grigson, C., Payne, S. (Eds.), Ageing and sexing animal bones from archaeological sites. Archaeopress, Oxford, pp. 91–108.
Greenfield, H. and R. Bouchnick (2011). Kashrut and Shechita: The relationship between dietary practices and ritual slaughtering of animals on Jewish identity. In L. Amundsen-Meyer, N. Engel and S. Pickering (eds.) *Identity Crisis: Archaeological Perspectives on Social Identity. Proceedings of the 42thannual Chacmool Archaeology Conference, University of Calgary, Calgary, Alberta*, pp. 106–120. Calgary: Chacmool Archaeological Association.
Halstead, P., Collins, P., Isaakidou, V., 2002. Sorting the sheep from the goats: morphological distinctions between the mandibles and mandibular teeth of adult *Ovis* and *Capra*. Journal of Archaeological Science 29 (5), 545–553.
Hamilton-Dyer, S., 2011. Faunal remains. In: Peacock, D., Blue, L. (Eds.), Myos Hormos-Quseir al-Qadim. Roman and Islamic ports on the Red Sea. Archaeopress, Oxford, pp. 245–288.
Incarbona, A., Zarcone, G., Agate, M., Bonomo, S., Stefano, E., Russo, F., Sineo, L., 2010. A multidisciplinary approach to reveal the Sicily climate and environment over the last 20 000 years. Open Geosciences 2 (2), 71–82.
Insoll, T., 2001. Archaeology and World Religion. Routledge, London and New York.
Johnstone, J., 1997. Technical report: Preliminary results from the investigation of vertebrate remains from Castagna, Sicily (site code: CA94). Reports from the Environmental Archaeology Unit, York.
King, A., 2018. The Faunal Remains. In: Fentress, E., Limane, H. (Eds.), Volubilis après Rome. Brill, Leiden and Boston, pp. 349–365.
Kratochvil, Z., 1969. Species criteria on the distal section of the tibia in *Ovis ammon* f. *aries* L. and *Capra aegagrus* f. *hircus* L. Acta Veterinaria 38, 483–490.
Kocturk, T.O., 2002. Food rules in the Koran. Food, Nutrition Research 46 (3), 137–139.
La Lumia, I., 1984. Gli ebrei siciliani. Sellerio Editore, Palermo.
Lauwerier, R., 1999. Eating horse meat: the evidence in the Roman Netherlands. Archaeofauna 8, 101–113.
Lisowski, M. W. (2019). The identification of Jewish patterns of food preparation and consumption: a zooarchaeological approach to the Medieval and early Modern evidence from Central-Eastern Europe. Unpublished PhD thesis (University of Sheffield, UK).
MacKinnon, M., 2017. Animals, acculturation, and colonisation in ancient and Islamic North Africa. In: Albarella, U., Rizzetto, M., Vickers, K., Russ, H., Viner-Daniels, S. (Eds.), The Oxford Handbook of Zooarchaeology. Oxford University Press, Oxford, pp. 466–478.
MacKinnon, M., 2004. *Production and consumption of animals in Roman Italy: integrating the zooarchaeological and textual evidence*. Portsmouth, RI: Journal of Roman. Archaeology.
— (Unpublished report [a]). Kaukana: Preliminary Zooarchaeological Report.
— (Unpublished report [b]). Sofiana (Sicily) – Some notes on the faunal remains from the 2012 campaign.
— (Unpublished report [c]). Sofiana (Sicily) – Some notes on the faunal remains from the 2013 campaign.
— (Unpublished report [d]). Sofiana (Sicily) – Preliminary notes on faunal materials from the 2014-16 excavation season (with some comparisons to earlier years).
Mandalà, G., 2016. The Sicilian questions. Journal of Transcultural Medieval Studies 3, 3–32.
Mandalà, G., 2013. The Jews of Palermo: from Late Antiquity to the expulsion (598–1492/3). In: Nef, A., Ardizzone, F. (Eds.), Les dynamiques de l'Islamisation en Méditerranée central et en Sicile: Nouvelles propositions et découvertes. École française de Rome, Rome and Bari, pp. 437–485.
Mangano, G. (2001). Le faune di Ganzirri. In G. Bacci and G. Tigano (eds.) *Da Zancle a Messina*, pp. 261–261. Messina: Sicania.
Maniscalco, L., 2008. Le fasi di vita attestate nell'area davanti alla grotta. In: Maniscalco, L. (Ed.), Il santuario dei Palici: un centro nella valle dei Margi. Regione Siciliana, Palermo, pp. 66–128.
Manzano, E., 2006. Conquistadores, emires y califas. Los omeyas y la formación de al-Andalus. Crítica, Barcelona.
Meadow, R. (1999). The use of size index scaling techniques for research on archaeozoological collections from the Middle East. In C. Becker, H. Manhart, J. Peters and J. Schibler (eds.) *Historia animalium ex ossibus. Beiträge zur Paläoanatomie, Archäologie, Ägyptologie, Ethnologie und Geschichte der Tiermedizin. Festschrift für Angela von den Driesch*, pp. 285–300. Rahden: Verlag Marie Leidorf GmbH.
Metcalfe, A., 2011. Muslims and Christians in Norman Sicily: Arabic speakers and the end of Islam. Routledge, London and New York.
Metcalfe, A., 2009. The Muslims of medieval Italy. Edinburgh University Press, Edinburgh.
Molinari, A., 2020. Sicily. In: Walker, B.J., Insoll, T., C. Fenwick and,, . (Eds.), The Oxford Handbook of Islamic Archaeology. Oxford University Press, Oxford, pp. 335–354.
Molinari, A., 2019. Sicily from Late Antiquity to Early Middle Ages: resilience and disruption. In: Cau Ontiveros, C.M.F.M. (Ed.), Change and resilience: the occupation of Mediterranean islands in Late Antiquity. Oxbow books, Oxford, pp. 87–110.
Molinari, A., 2013. Sicily between the 5th and the 10th century: villae, villages, towns and beyond. Stability, expansion or recession? In: Pergola, P., Zanini, E. (Eds.), The insular system of Early Byzantine Mediterranean: archaeology and history. British Archaeological Reports, Oxford, pp. 97–114.
Molinari, A., 2012. Migrazione, acculturazione, convivenza/conflitto, stato ed economie: problemi di metodo nell'archeologia della Sicilia islamica. In: Senac, P. (Ed.), Histoire et archéologie de l'Occident Musulman VIIe-XVe siècle. Al-Andalus, Maghreb, Sicile. Université de Toulouse-Le Mirail, Toulouse, pp. 221–240.
Molinari, A., 2011. La ceramica altomedievale nel Mediterraneo occidentale islamico: uno sguardo dalla "periferia". In: Patrice, C., Fentress, E. (Eds.), La céramique maghrébine du haut Moyen Âge: état des recherches, problèmes et perspectives. École Française de Rome, Rome, pp. 267–291.
Molinari, A., 2010. Paesaggi rurali e formazioni sociali nella Sicilia Islamica, normanna e sveva (secoli X-XIII). Archeologia Medievale 37, 229–246.
Molinari, A., Cassai, D., 2006. La Sicilia ed il Mediterraneo nel XIII secolo: importazioni ed esportazione di ceramiche fini e da trasporto. In: Lavagna, R. (Ed.), Atti XXXVII Convegno Internazionale della Ceramica, Albisola. All'Insegna del Giglio, Florence, pp. 37–38.
Molinari, A., Meo (in press), A., 1997. Mazara, Mazar: nel ventre della città medievale (secoli VII-XV). Edizione degli scavi, in Via Tenente Gaspare Romano. All'Insegna del Giglio, Firenze.
Morales-Muñiz, A., Moreno-García, A., Izquierdo, R., Llorente-Rodriguez, L., Morales-Muñiz, D.C., 2011. 711 AD: ¿El Origen de una Disyunción Alimentaria? Zona Arqueologica 15, 301–319.
Moreno-García, M., 2004. Hunting practices and consumption patterns in rural communities in the Rif mountains (Morocco) – some ethno-zoological notes. In: O'Day, J., Van Neer, W., Ervynck, A. (Eds.), Behaviour behind bones. The zooarchaeology of ritual, religion, status and identity. Oxbow Books, Oxford, pp. 319–327.
Moreno-García, M., Davis, S., 2001. Estudio de las asociaciones faunísticas recuperadas en Alcácer do Sal, Convento de São Francisco, Santarém y Sé de Lisboa. In: Gaspar, A., Gomes, A.S., Dias, M.I. (Eds.), Garb, Sítios Islâmicos do Sul Peninsular. Ministério da Cultura/ IPPAR, Junta de Extramadura, pp. 231–255.
Nef, A., 2013. Islamic Palermo and the dār al-islām: politics, society and the economy (from the mid-9th to the mid-11th century). In: Nef, A. (Ed.), A companion to medieval Palermo from 600 to 1500, Vol. 5. Brill: Brill's Companions to European History, pp. 39–59.
Nef, A., 2011. Conquérir et gouverner la Sicile islamique aux XIe et XIIe siècles. École française de Rome, Rome.
Nef, A., Prigent, V., 2010. La Sicile de Byzance à l'Islam. De Boccard, Paris.
O'Connor, T., 1988. Bones from the General Accident side, Tanner Row. Council for British Archaeology, London.
Payne, S., 1985. Morphological distinctions between the mandibular teeth of young sheep, *Ovis*, and goat. *Capra. Journal of Archaeological Science* 12 (2), 139–147.

Peres, T.M., 2010. Methodological issues in Zooarchaeology. In: Van Derwarker, A.M., Peres, T.M. (Eds.), Integrating Zooarchaeology and Paleoethnobotany: a consideration of issues, methods and cases. Springer, New York, pp. 15–36.
Pezzini, E., 2013. Palermo in the 12th Century: transformations in forma urbis. In: Nef, A. (Ed.), A companion to medieval Palermo from 600 to 1500, Vol. 5. Brill's Companions to European History, Brill, pp. 195–232.
Price, M.D., 2020. Evolution of a taboo. Pigs and people in the ancient Near East. Oxford University Press, Oxford.
Redding, R., 2015. The pig and the chicken in the Middle East: modelling human subsistence behaviour in the archaeological record using historical and animal husbandry data. Journal of Archaeological Research 23, 325–368.
Regenstein, J., Chaudry, M., Regenstein, C., 2003. The Kosher and Halal food laws. Comprehensive Reviews in Food Science and Food Safety 2 (3), 111–127.
Reitz, E.J., Wing, E.S., 2008. Zooarchaeology. Cambridge University Press, Cambridge.
Rizzo, M.S., Romano, D., Scibona, M., 2015. Il villaggio di Colmitella (Racalmuto, AG): le fasi altomedievali. In: Arthur, P., Imperiale, M.L. (Eds.), VII Congresso Nazionale di Archeologia Medievale, Palazzo Turrisi, Vol. 2. All'Insegna del Giglio, Firenze, pp. 419–424.
Rizzo, M.S., Danile, L., Zambito, L., 2014. L'insediamento rurale nel territorio di Agrigento: nuovi dati da prospezioni e scavi. In: Nef, A., Ardizzone, F. (Eds.), Les dynamiques de l'islamisation en Méditerranée centrale et en Sicile : nouvelles propositions et découvertes récentes. École Française de Rome and Edipuglia, Rome and Bari, pp. 351–363.
Rizzo, M. S., L. Danile, D. Romano, M. Scibona and L. Zambito (2012). Il villaggio di Colmitella (Racalmuto, AG): primi dati dallo scavo archeologico di un insediamento rurale di età altomedievale e medievale. In F. Redi and A. Forgione (eds.) *VI Congresso Nazionale di Archeologia Medievale*, pp. 419–424. Florence: All'Insegna del Giglio.
Rizzo, M.S., Romano, D., 2012. I butti del villaggio rurale di Colmitella (Racalmuto, AG). Archeologia Postmedievale 16, 99–107.
Sacco, V., 2018. Produzione e circolazione delle anfore palermitane tra la fine del IX e il XII secolo. Archeologia Medievale 45, 171–192.
Sacco, V., 2014. L'islamizzazione a Palermo attraverso due contesti di Palazzo Bonagia (scavi Di Stefano). In: Nef, A., Ardizzone, F. (Eds.), Les dynamiques de l'islamisation en Méditerranée central et en Sicile: nouvelles propositions et découvertes récentes. École française de Rome and Edipuglia, Bari and Rome, pp. 225–231.
Sadori, L., Ortu, E., Peyron, O., Zanchetta, G., Vannière, B., Desmet, M., Magny, M., 2013. The last 7 millennia of vegetation and climate changes at Lago di Pergusa (central Sicily, Italy). Climate of the Past Discussions 9 (2), 2059–2094.
Salvagno, L., Albarella, U., 2017. A morphometric system to distinguish sheep and goat postcranial bones. PLoS One 12 (6), e0178543.
Scavone, R. (2019). Resti faunistici dai pozzi medievali della Villa del Casale e dai butti del Saggio II (area delle Terme Meridionali): alimentazione ed economia tra la fine del X e la metà del XII secolo. In P. Pensabene and P. Barresi (eds.) *Piazza Armerina, Villa del Casale: scavi e studi nel decennio 2004-2014. Scavi nella villa e nelle terme sud. Studi e materiali dal tardoantico al medioevo, Vol. 2*, pp. 341–370. Rome: L'Erma di Bretschneider.
— (2016). Economia, alimentazione e cultura fra Tardoantico e Medioevo nella Villa del Casale di Piazza Armerina. Il contributo dell'archeozoologia. Unpublished PhD Thesis (Università di Verona, Italy).
Schmid, E., 1972. Atlas of animal bones: for prehistorians, archaeologists and Quaternary geologists. Elsevier Publication, Amsterdam and New York.
Simoons, F.J., 1994. Eat not this flesh: food avoidances from prehistory to the present. University of Wisconsin Press, Madison.
Spatafora, F., 2005. Da Panormos a Balarm: nuove ricerche di archeologia urbana. Regione siciliana, Palermo.
Spatafora, F., Canzonieri, E., 2014. Al-Khalisa: alcune considerazioni alla luce delle nuove scoperte archeologiche nel quartiere della Kalsa. In: Nef, A., Ardizzone, F. (Eds.), Les dynamiques de l'islamisation en Méditerranée centrale et en Sicile: nouvelles propositions et découvertes récentes. Brill, Leiden and Boston, pp. 233–245.
Testolini, V. (2018). Ceramic technology and cultural change in Sicily from the 6th to the 11th century AD. Unpublished PhD thesis (University of Sheffield, UK). White Rose E-Thesis Online (https://etheses.whiterose.ac.uk/24131/).
Uerpmann, H.P., 1979. Probleme der Neolithisierung des Mittelmeerraums. Reichert, Wiesbaden.
Vanoli, A., 2012. La Sicilia musulmana. Il mulino, Bologna.
Vassallo, S., C. Aleo Nero, G. Battaglia, M. Chiovaro and R. M. Cucco (2018). Attività 2016 della sezione per i Beni Archeologici della Soprintendenza di Palermo. *Notiziario Archeologico della Soprintendenza di Palermo* 33.
Vassallo, S., C. Aleo Nero, G. Battaglia, G. Calascibetta, M. Chiovaro, R. M. Cucco and R. Sapia (2016). Attività 2015 della sezione per i Beni Archeologici della Soprintendenza di Palermo. *Notiziario Archeologico della Soprintendenza di Palermo* 9.
Villari, P., 1988. Resti faunistici da uno scavo medievale del Castello di Fiumedinisi (Messina). Archeologia Medievale 15, 609–642.
Wilson, R.J.A., 2021. UBC Excavations of the Roman Villa at Gerace, Sicily: Results of the 2018 Season. Mouseion 17, 95–212.
Zeder, M.A., Pilaar, S.E., 2010. Assessing the reliability of criteria used to identify mandibles and mandibular teeth in sheep, *Ovis*, and goat, Capra. Journal of Archaeological Science 37 (2), 225–242.

Further reading

Ceramiche città e commercio in Sicilia: il caso di Palermo. In S. Gelichi (ed.) *Ceramiche, città e commerci nell'Italia tardo-medievale. Ravello, 3–4 Maggio 1993*, pp. 89-107. Ravello: Società Archeologica.
Lundy, J., Drieu, L., Meo, A., Sacco, V., Arcifa, L., Pezzini, E., Aniceti, V., Fiorentino, G., Alexander, M., Orecchioni, P., Mollinari, A., Carver, M.O.H., Craig, O.E., Hardy, K., 2021. New insights into early medieval Islamic cuisine: organic residue analysis of pottery from rural and urban Sicily. PLoS One 16 (6).
— (2010b). Archeologia e mobilità sociale. In *La mobilità sociale nel medioevo: rappresentazioni, canali, protagonisti, metodi d'indagine, Atti del Convegno, Roma (28-31 maggio 2008)*, pp.117–144. Rome: École Française de Rome.
(2010c). La ceramica siciliana di età islamica tra interpretazione etnica e socio-economica. In P. Pensabene (ed.) *Piazza Armerina: Villa del Casale e la Sicilia tra tardoantico e medioevo*, pp. 197–228. Rome: L'Erma di Bretschneider.
(2010d). La ceramica siciliana di X e XI secolo tra circolazione internazionale e mercato interno. In S. Gelichi and M. Baldassarri (eds.) *Pensare/Classificare: Studi e ricerche sulla ceramica medievale per Graziella Berti*, pp. 159–170. Firenze: All'Insegna del Giglio.
— (2009). La Sicilia e lo spazio mediterraneo dai bizantini all'Islam. In *Symposium internacional: poder y simbología en la Europa altomedieval. Siglos VIII-X*, pp.123–142. Oviedo: Ediciones TREA.
— (1997). *Segesta II. Il castello e la moschea (scavi 1989–1995)*. Palermo: Flaccovio.