THE ETRUSCANS AND THEIR ANIMALS

The zooarchaeology of Forcello di Bagnolo San Vito (Mantova)

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ABSTRACT

The Etruscan city at Forcello was a prominent settlement in the *Val Padana* between the sixth and fourth centuries BC. Located at the northernmost periphery of Etruscan influence, Forcello lay along important trade routes connecting Etruria, the Adriatic, and central Europe. In addition to a rich array of material culture recovered from over thirty years of excavation, Forcello has also produced an exceptional quantity of animal remains, a volume that offers an unparalleled opportunity to study animal exploitation in Etruscan society. Using this abundant faunal assemblage as a starting point, this dissertation examines human–animal relationships at Forcello and more broadly within Etruscan Italy.

To provide a foundation for further study, previous zooarchaeological research on northern and central Italy is synthesized into a single narrative. Faunal analysis at Forcello then reconstructs livestock husbandry strategies, assesses the contribution of wild taxa, and investigates the role of other animals not normally consumed. Results are compared regionally and chronologically to place Forcello in a broader context, building an inter-site picture of Etruscan–animal relations. With the evolution of Etruscan cities in the Po Plain, livestock management strategies break from Bronze Age practices. Animal remains indicate a thriving network of northern Etruscan cities linked to, but partly independent from, central Italy, and northern Etruscan centers embrace swine husbandry earlier than Etruria. Within Forcello, faunal analysis illustrates well-developed husbandry systems and the presence of non-Etruscan culinary traditions. The recovery a significant number of perinatal human remains from the faunal assemblage is an important find.

This project produces new data on subsistence strategy and urban life in an underrepresented region of Etruscan civilization, and it clarifies chronological and regional trends in animal management in Etruscan Italy during the first millennium BC, creating an integrated picture of Etruscan–animal relationships that encompasses both Etruria and Etruria Padana.

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CHAPTER 1

THE ETRUSCANS AND THEIR ANIMALS

1.1 INTRODCTION

The eighth and seventh centuries BC witnessed a tremendous shift in the organization of all aspects of society in central Italy. Iron Age villages coalesced into influential centers along Tuscany's coastal plains. These settlements evolved to form a powerful and enduring network of Etruscan cities that re-defined both the cultural and physical landscape of Italy. Dramatic economic, social, and political transformations moved society from subsistence to a more specialized economy; habitations from modest settlements to urban centers; and graves from nearly egalitarian burials to monumental princely tombs. By the sixth century BC Etruscan civilization was flourishing across northern and central Italy, and their influence stretched from Latium to the Po Plain. It is during this period that the Etruscan city located at Forcello (Bagnolo San Vito, Mantova) emerged. Although situated at the northernmost periphery of the Etruscan world, active trade routes linking Etruria, the Adriatic, and central Europe ran through the site and, together with neighboring Mantova, Forcello formed part of an influential network of northern Etruscan cities that mediated inter-regional exchange. Today, the archaeological site at Forcello provides a detailed snapshot of urban Etruscan life. The subject of systematic study for over thirty years, the city is one of a relatively small number of Etruscan settlements subject to long-term excavation. Furthermore, its history is uncomplicated by the problems of residuality and subsequent re-development that often complicate archaeological investigation of urban contexts.

This significant period of archaeological research combined with the site's limited habitation chronology, provides a rare view of a dynamic Etruscan city, and this image of Archaic life is one in which we should be interested. Etruscology is historically biased against settlement archaeology because of a focus on funerary and religious sites. Until recent decades archaeologists and art historians concerned themselves primarily with the elaborate wealth and architectural richness of Etruscan tombs, constructing a detailed picture of the Etruscan aristocracy's aspirations for the afterlife. Missing, however, has been an equally precise picture of the world of the living and of the forces behind the significant changes in power structure, economic scale, and land use that also define Etruscan development. Funerary archaeology clearly presents an extremely important body of knowledge, but in tombs we see the result of wealth accumulation rather than the process of wealth creation. In comparison, exploration of the development of craft and agricultural production has been limited (Nijober 1998 and Gleba 2008b are notable exceptions). As Gleba (2008b:xxiii) points out, "publications that deal with the transitions in Italy during the first millennium BC often mention technological development as a fact… but our understanding of the underlying steps is incomplete." The situation is further complicated a historic view of the Etruscans as peripheral consumers of Greek innovations (Stoddart 1990; Izzet 2007b) and by reliance on Roman texts – sources which obscure indigenous developments in central Italy (Riva 2010:4) and cultural interaction in the Apennines and *Val Padana* (Williams 2001; Bourdin 2012:593–600).

Zooarchaeology is uniquely poised to expand our knowledge of Etruscan society. As food, property, transportation, sacrifices, and symbols, animals were central to many aspects of ancient life; they are a valuable link between domestic, sacred, and industrial space, as well as between urban and rural communities. Unlike other materials, animals do not change in style or form, but provide a consistent set of evidence in the face of changing practices. As a result, zooarchaeology can help illuminate agro-pastoral developments and cultural identities during a millennium of shifting political and economic pressures. Additionally, animal remains provide a more democratic look at lives of the Etruscans than investigation of their luxury goods. Most of the population of ancient Italy was involved in farming and agricultural production. While the aristocracy profited from the labor of these people, zooarchaeology is able to illuminate a major part of the life of an average Etruscans. Human–animal relationships reflect the various economic and social impulses driving cultural change, and investigation into these relationships at Forcello, integrated with other zooarchaeological data, can shed new light on the development of Etruscan society.

Forcello is the ideal candidate for this zooarchaeological study on account of its very large faunal assemblage and tight chronology. As a result of over thirty years of systematic study and the excellent preservation of the archaeological materials, excavations at Forcello have yielded a quantity of animal remains that dwarfs contemporary assemblages – approximately eight thousand animal remains were identified in a previous study by Scarpa (1988) and over thirteen thousand additional Etruscan specimens were recorded for this dissertation. This volume of material offers improved statistical resolution, allowing for a level of detail rarely possible in Etruscan faunal reports. Many Italian sites have produced large animal bone assemblages, but long site chronologies and problems with residuality often limit the material attributed to each phase, clouding the resolution of shorter-scale and intra-site analyses. Forcello therefore presents a unique opportunity to investigate animal management and use within the *c.* 150–160 year lifespan of an Etruscan settlement.

Operating at this higher resolution we can address, with substantial detail, questions about livestock management strategies, the importance of wild animals, the role of non-food animals, and the presence different culinary practices. Reconstruction of livestock management strategies aims to identify the focus of animal husbandry and the reasons for which animals were raised. Additionally, it investigates the scale of production – were animals used on a household level or is their evidence for greater specialization? The presence and use of fish, birds, and wild mammals provides evidence of the Etruscans' relationship with their landscape. Ratios of wild to domestic taxa can illustrate the degree to which settlements relied on their surroundings for food, and wild species offer clues about the local environment. Changes in the population structure of domestic mammals and increased signs of pathology may be linked to environmental stress and food availability. Other animals not normally consumed are no less important, and investigation of the remains of dogs and equids can help define Etruscan attitudes toward animals that have long been important companions and symbols.

In the mid first millennium BC, the Po Plain encompassed a mix of cultures living not only side by side, but also together. The significant presence of personal adornments, such as fibulae and pendants, at Forcello implies not only the exchange of goods with Celtic populations, but also an influx of Celtic individuals (de Marinis 2007f). While the abundant Etruscan inscriptions (de Marinis 2007e) and locally produced ceramics (Casini 2007) clearly define Forcello as an Etruscan settlement, the population likely contained people from surrounding Golaseccan and Venetian culture, perhaps others from more remote places in France and Germany as well. To this mix we might also add Greeks, some transient, others permanent, invested in trade relations with both the Etruscans and Celts. Diet, butchery, and food preparation methods vary between different cultures. Although culinary differences are often subtle and constantly evolving (Koestlin 1981), faunal analysis can investigate culturally linked patterns of consumption by comparing anomalous practices at Forcello with those non-Etruscan peoples in northern Italy, southern France, and central Europe.

When integrated with zooarchaeological research from central and northern Italy, the results of the faunal analysis at Forcello help illuminate changing patterns in food production and consumption across the first millennium BC. A synthesis of existing literature provides a foundation for further comparisons, which continue to focus on livestock management and use, the role of wild animals, and the significance of animals not used for food. Supplemented by new data from Forcello, this review of the zooarchaeology of central and northern Italy charts changes in the nature and focus of animal husbandry across the Bronze and Iron Ages.

1.1.2 Aims and objectives

This dissertation examines human–animal relationships at Forcello through zooarchaeological analysis, and it investigates these relationships more broadly in the Etruscan world by integrating the results from Forcello with previous zooarchaeoloigcal research. The primary aims of this thesis are:

- to establish the focus of livestock husbandry regimes, the contribution of wild resources, and the cultural significance of animals at Forcello;
- to establish the relationship between animal exploitation at Forcello and chronological and regional trends in animal management in north and central Italy in the first millennium BC;

- to consider the role culture and of the environment in determining patterns of animal exploitation at Forcello;
- to determine whether Forcello predominantly developed its own methods of animal exploitation or if it adopted practices from central Italy.

These aims are achieved through completion of five main executable objectives, which provide an outline for the structure of this dissertation. After this overview of the project, Chapter 1 continues to introduce the Etruscans and the site of Forcello. Subsequently this dissertation will:

- summarize previous zooarchaeological research on northern and central Italy (Chapter 2);
- explain the methods and materials used in this project (Chapter 3);
- present a zooarchaeological analysis of the Forcello faunal assemblage, including investigation of taphonomic factors, species frequencies, body part distribution, bone modifications, age and sex profiles, and biometry (Chapter 4);
- compare this analysis with previous research from northern and central Italy (Chapter 5);
- contextualize this study with wider issues in Etruscan archaeology (Chapter 6).

A final chapter summarizes the project and provides some ideas for future directions (Chapter 7).

1.2 ETRUSCANS IN NORTH AND CENTRAL ITALY

1.2.1 Origins and territory

Academic consensus now identifies the Etruscans as an autochthonous people with origins dating back to at least the Late Bronze Age (Perkins 2009). However, unlike their neighbors, the Etruscans wrote, and probably spoke, a language outside the Indo-European tradition – a distinction which has long contributed to the famed 'mysteriousness' of this population. Several scientific publications have recently re-kindled the popular debate surrounding Etruscan origins and even what it meant to be 'Etruscan' (Achilli et al. 2007; Pellecchia et al. 2007), but ultimately these papers point to the presence of individuals with foreign origins, rather than the mass migration of an eastern culture (Perkins 2009). Archaeological evidence clearly points to a gradual development of Etruscan civilization, progressing from the Bronze Age, through the Villanovan Iron Age (sometimes now called the proto-Etruscan period), to the seventh century BC and what is commonly recognized as the full expression of Etruscan culture (Table 1.1.1).

Most scholars agree on the main stages of Etruscan development, although the absolute chronology underlying these divisions is controversial. Recent research has proposed an earlier chronology for the Iron Age and subsequent periods, both in Italy and more widely in Europe and the Mediterranean basin (cf. Bartoloni and Delpino 2005; Brandherm and Trachsel 2008). Because of this lack of consensus and problems of comparing zooarchaeological data from different regions and cultural groups, I have used the traditional chronology throughout this discussion. However, the new earlier chronology will likely become more widely adopted, especially in light of recent radiocarbon evidence (Bietti Sestieri and De Santis 2008; Nijboer and van der Plicht 2008). The brief archaeological overview presented here discusses the development of Etruria and the Po Plain from the Bronze Age (Table 1.1.2) to the Roman period, highlighting settlement patterns, trade connections, and agricultural production. Later chapters draw on this chronology to contextualize animal management at Forcello during the Archaic period, within broader Etruscan civilization, and over the first two millennia BC.

The epicenter of Etruscan development, Etruria, lies in a region of central Italy bounded by the Arno River to the north and the Tiber to the south (Figure 1.1.1), an area that corresponds approximately with the boundaries of modern Tuscany and northern Latium. In the past, however, the Etruscans occupied a territory whose limits were mutable and not sharply defined (Camporeale 2011:46). Villanovan culture extended over the Apennines, and ceramics from northern Etruria and the Po Plain illustrate a shared material culture and common heritage between these two areas (Perkins 2012; Santocchini Gerg 2012). Etruscan cities also developed outside of Etruria in both Campania and the Val Padana. Even Etruria itself contained other cultures, and its borders encompassed the territory of several linguistically distinct peoples with similar material tradition (e.g. Faliscans, Capenates). In northern Italy the Etruscans also shared their territory with Celtic and Venetic populations. Amongst this culture background the Etruscans did not view themselves as a single state, as was the case with Rome; instead their civilization was linked by cultural, rather than political, unity. These cultural links, expressed in both material culture and language, reveal the complex and inter-ethnic nature of Early Iron Age and Archaic societies in central Italy (Fulminante 2012). As Stoddart (1990:49) points out, “Etruria presents a whole range of types of frontier within the context of one 'civilisation'.”

The landscape of Etruria varies between tufa plateaus in the south, fertile plains along the coast and river valleys, and rolling hills in northern Tuscany. Further north, the Apennine Mountains divide Etruria from *Etruria padana* – Etruscan settlement in the broad, flat Po basin (cf. Figure 1.1.1). The fertility of Tyrrhenian Etruria was renowned in the ancient world (e.g. Diodorus 5.40; Varro, *Rerum rusticarum* 1.9.6; cf. Camporeale 2011:50), and its rich produce certainly helped fuel a growing Etruscan population. Northern Italy was also known for its fertility and abundant forests (e.g. Strabo, *Geography* 5.1.12). In addition to its productive landscape, Italy was also gifted with some of the richest mineral resources in the Mediterranean (Figure 1.1.2), a fact noted by numerous ancient authors (cf. Camporeale 2011:53). While we lack systematic excavations of mines and industrials sites, the quality and quantity of Etruscan metal goods found throughout the Mediterranean and central Europe illustrate the powerful link between these natural resources and Etruscan wealth and influence. The skill and beauty of Etruscan metal working is perhaps best demonstrated by the famed large Etruscan bronzes, epitomized in the fourth century BC Chimera of Arezzo (Figure 1.1.3). The date of the Capitoline Wolf, another famous bronze traditionally considered to be Etruscan, was recently challenged and is still under debate (cf. Carruba 2006; Warden 2011). Perhaps more than anything else, it was the presence and abundance of mineral resources that drove and defined the Etruscans as a people (Camporeale 2011:54) – the exploitation of mineral-rich sites drew populations together in the early first millennium BC, and later the desire for metals made the Etruscan a powerful force in Mediterranean commerce. With these resources and trade networks, the Etruscans formed a unique culture and founded a group of cities that have endured since prehistory.

Figure 1.1.1 Map of Etruscan civilization (Haynes 2005:vi)

From Etruscan Civilization: A Cultural History by Sybille Haynes. © 2000 The J. Paul Getty Trust. Used with permission.

Figure 1.1.2 Mineral resources in Italy (Haynes 2005:19)

From Etruscan Civilization: A Cultural History by Sybille Haynes. © 2000 The J. Paul Getty Trust. Used with permission.

Figure 1.1.3 Chimera of Arezzo
c. 400 BC. Florence Archaeological Museum.
Photo by Eric Parker © 2010 used under a Creative Commons Attribution-Noncommercial license: http://creativecommons.org/licenses/by-nc/2.0/deed.en_GB.

1.2.2 Bronze Age transitions

In central Italy, settlement patterns were fairly continuous during the Middle Bronze Age, but in the subsequent Late Bronze Age significant changes began to occur, signaling a complex and important period of transition between village and state societies (Stoddart 1989; Fulminante and Stoddart 2013). The Recent Bronze Age (c. 1350–1200 BC) witnessed the emergence of local chiefdoms and early forms of socioeconomic inequality (Peroni 1996:288–291). Burials indicate that status, previously achieved through the actions of an individual, was becoming a hereditary attribute. In the subsequent Final Bronze Age (c. 1200–950 BC, dates from Nijboer and van der Plicht 2008) a significant re-configuration of the landscape took place. Whereas in previous periods sites covered the countryside with little interest in particular positions, in the Final Bronze Age settlements were located in defensible positions, regularly spaced through the landscape (di Gennaro 1988; Pacciarelli 2001; Vanzetti 2004). Even though the landscape surrounding these settlements was still inhabited (cf. Potter 1979:59; Barker and Rasmussen 1988), a process of settlement nucleation had begun. This movement was particularly pronounced in southern Etruria. Settlements formed at places that would later become important centers (e.g. Tarquinia, Veii, Cerveteri, Orvieto) in a process of nucleation, seemingly aimed at control over local resources (Stoddart 1989). Some larger settlements, like Luni sul Mignone, Sorgenti della Nova, and Monte Rovello, may have acted as local centers. Cemeteries were organized into family groups (Bietti Sestieri 2000:21– 22), and burials were simple and often accompanied by a few pots and metal items; however, differences in the quantity of grave goods indicate the further development of social hierarchies (Pacciarelli 2001). Changes were also visible within settlements. Huts were replaced by houses (e.g. Potter 1976), and agricultural production increased along with the range of cultivated crops (Jarman 1976; Pacciarelli 1982). Metal production and agricultural systems also developed during this period, and, although some foreign objects illustrate connections further afield, trade mostly focused inwards (Barker and Rasmussen 2000:58). While such changes occurred throughout central Italy, their effect on material culture and settlement structure varied geographically, and distinctive regional identities developed in the Final Bronze and Early Iron Age in an area previously united by Apennine and sub-Apennine culture (Fulminante 2012).

The Bronze Age in northern Italy witnessed related, but distinct, changes. The Middle Bronze Age in the Po Plain is characterized by the presence of *terramare* and *palafitte* culture. Both groups present little evidence of social ranking, but *terramare* settlements have a clear and complex organization structure – a feature unique in Italy at this time. Sites were subject to urban planning, and larger settlements like Poviglio and Fiavé had complex water management systems (Bogucki and Crabtree 2004). By c. 1600 BC the number of settlements in northern Italy had increased significantly, and some were protected by banks and fortifications (Nicolis 2013). Several centuries later between the fourteenth and thirteenth centuries BC, settlement hierarchies become visible (ibid.). *Terramare* culture collapsed at the turn of Recent Bronze Age around 1200 BC, but the precise reason behind its exhaustion remains unclear. It may be linked to a climatic deterioration; a regional dry event and drop in the water table coincide with the end of this cultural phase. Because *terramare* settlements relied on large amounts of water to support intensive exploitation of local landscape, this hydrological crisis would have stressed environments already subject to deforestation and intensive cereal cultivation, apparently to a point that they would no longer support the *terramare* way of life (Cremaschia et al. 2006; Mercuri et al. 2006a). Pan-Mediterranean political instability may also have contributed to cultural decline in the region (Nicolis 2013).

Although a few Middle Bronze Age sites in northern Italy persisted into the Recent and even Final Bronze Ages (albeit in a reduced form), many were abandoned, resulting in the depopulation of an area once densely inhabited (Leonardi 2008). However, not all areas of the Plain were equally affected by the collapse of *terramare* society, and during the transition to the Final Bronze Age new settlement types emerged in more resistant areas: the foothills of the Apennines, the area surrounding Fondo Paviani, and the eastern Po around Frattesina. Even in this early period, the area around Bologna seems to take on a central role (Sassatelli 2001; Manfredi and Malnati 2003). These areas were subsequently subject to population aggregation during the Final Bronze Age in conjunction with economic development and increased social differentiation and trade (Manfredi and Malnati 2003; Nicolis 2013). In the eastern Po Plain, Frattesina had a major influence in the development of proto-Villanovan culture in northern Italy (*Protovillanoviano padano*), while proto-Golasseccan culture dominated in the western Plain. Lastly, it is important not to forget that parts of Alpine Italy also developed during the Bronze Age, and Acquafredda in eastern Trentino was producing metals for trade on a proto-industrial scale by the twelfth–eleventh centuries BC (ibid.).

1.2.3 Villanovan Iron Age

The Early Iron Age in central Italy saw a reduction in the number villages and further concentration of the population in southern Etruria. As the number of sites dropped, a few large settlements over grew dramatically to over one hundred hectares in size. Major centers developed in Etruria at Cerveteri, Veii, Tarquinia, and Vulci, while population aggregation increased in Latium at Rome (Pacciarelli 2001; Vanzetti 2004). A greater range of building types and sizes within settlements is also visible, a distinction that also points to the emergence of social groups or development of a more centralized community structure (Barker and Rasmussen 2000:68). These developments occurred in tandem with changes in funerary practices. Social stratification escalated in Etruria, and by the mid eighth century BC political power and social differentiation had become fully articulated in the funerary record (Riva 2010). Early Iron Age cemeteries were organized in small family groups with one or two prominent individuals (Pacciarelli 2001; Riva 2010). Grave goods articulated differences in age, gender, and other social roles, but few differences were visible within these groups. In the second part of this period, new tomb groups with a wider range of grave goods emerged, signaling a move from horizontal to vertical social differentiation and the growth of an elite class (Bietti Sestieri 1992; Iaia 1999; Riva 2010). These social changes formed part of a long and complex process of stratification with roots in the Final Bronze Age (Iaia 1999).

A similar process of social stratification is visible in the Po Plain at Bologna (Giardino et al. 1991; Sassatelli 2010a). By the Early Iron Age, Bologna had become a population center formed from three related, but distinct, villages (Sassatelli 2010b). These settlements coalesced in the eighth century BC, forming the first major Etruscan center in the Po Plain. Older Venetic sites, like Frattesina, were abandoned as proto-urban centers formed in the eastern Plain at Este, Padova, and Oderzo – places that will later develop into Venetian city-states (Leonardi 2008). To the west, the Iron Age saw the emergence of Golaseccan culture. Tombs around Como evidence the development of a warring aristocracy, a new identity possibly related the appearance of similar burials in Etruria (Bietti Sestieri 2010:178–180).

Despite the Villanovan material culture shared across northern and central areas, each region developed its own character (Bietti Sestieri 2011). Northern Etruria already had a relationship with the area surrounding Frattesina in the Final Bronze Age, and this association with northern Italy continued into the Iron Age as Bologna developed into the primary center of the region. Southern Etruria, in contrast, assumed an autonomous role and itself became a primary center of regional activity. Differences are also present within these areas. In central Italy, funerary rituals divided inland communities from coastal ones (e.g. Iaia 1999; 2006), and differences in settlement structure are visible between cultural groups within Etruria. Etruscan areas were organized into a territorial state with a tiered settlement hierarchy (Cifani 2012). In contrast, Umbrian and Sabine settlement structure more closely resembled city-states surrounded by smaller territories of small satellite settlements.

Trade and industry increased in tandem with new forms of social complexity. By the ninth century BC Italy lay at the center of established trade routes that extended across the wider Mediterranean (Nijboer 2008). Villanovan centers “acted as collecting and distribution hubs” during this period (Nijboer 2008:17) for Latin, Venetian, and Golaseccan communities (Bietti Sestieri 2005). These networks expanded, particularly after the arrival of Greek settlers around the Bay of Naples in the eighth and seventh centuries BC (Ridgway 1992). New Greek-style banqueting vessels were adopted, and by the end of the eighth century BC large numbers of ceramics were arriving from Corinth (Haynes 2005; Osborne 2007). Luxury items manufactured from gold, silver, lead, amber, iron, and bronze became more frequent, but their distribution remained restricted – their production/dispersal was controlled by small group of aristocratic elites (Barker and Rasmussen 2000). Villanovan society probably functioned around a client system controlled by local chiefs, who in turn were clients of more powerful men in population centers. Agriculture production, which was probably similarly organized, also increased during this period. However, in contrast to the changes in the landscape of southern Etruria, settlement patterns continued relatively unchanged to the east and south of this region. In northern Etruria, a similar, but less pronounced process of nucleation is visible along the coast, probably driven by mineral exploitation in the area around Populonia and Vetulonia (Bartoloni 1991). Inland, the persistence of small farms indicates greater continuity from the previous period.

1.2.4 Orientalizing and Archaic Italy

Between the late eight and sixth centuries BC, Etruscan productivity developed significantly in nearly every area: mining and metal production, agriculture, overland transport, and long maritime distance trade. Propelled by the new accumulation of wealth, Etruscan elites developed an elaborate aristocratic culture. New monumental tombs echoed the princely residences of the living. The exotic goods, precious jewelry and fine banqueting vessels deposited in these tombs not only attest to the great wealth of the families buried within them, but also to the rise of a new artisan class. The specialized craft production of metals, pottery, bone and antler (albeit still on a small household scale) developed in regional centers in the seventh century BC; these activities became more expansive in the Archaic period (Nijboer 1997; 1998). The orientalizing influence of Greek and eastern Mediterranean visual culture led to the appearance of new artistic subjects, particularly human and animal forms. Cities developed a new urban vocabulary concerned with the articulation of public and private space (Izzet 2007a), and orthogonal planning was implemented for the first time, both in settlements and cemeteries. The Etruscans of the seventh and sixth century BC are the Etruscans we recognize from museums – innovators and consumers of fantastic objects.

The Etruscan city that emerged during this period was driven by trade and the growth of the middle classes (Damgaard Andersen 1997). Economic centralization occurred around resources, natural harbors, sanctuaries and ‘homesteads’ of the elite (Nijboer 2004). In the seventh and sixth century BC, surveys from southern Etruria, Tuscania, and the Albegna Valley show an increase in the number of rural and subordinate settlements surrounding a larger dominant site (Potter 1979; Barker and Rasmussen 1988; Perkins 1999). Cities became the center of a system of villages, in turn surrounded by single farmsteads. This population shift also led to the rise of independent intermediate sites such as Poggio Civitate (Murlo), Acquarossa, and Bisenzio. New routes were constructed to link both major centers and minor sites (Ward-Perkins 1961; Potter 1979; Cifani 2002a; Cifani 2002b).

The Etruscans exported *bucchero*, bronze goods, and amphorae (containing wine, olive oil, and other foods) across the Mediterranean. Etruscan goods have been found in Spain, Corsica, Sardinia, Greece, Turkey, Cyprus, Syria, the Black Sea, and the north coast of Africa. In the west, France was the largest consumer of Etruscan exports (Dietler 2010). The earliest Etruscan ceramics arrived in southern France during the mid/late seventh century BC, but it was not until a century later that a significant exportation of wine to this region occurred. Dietler (2010:96) describes the relationship between the Etruscans and southern France as “floater” trade; despite the large quantity of Etruscan goods and perhaps even the presence of Etruscan individuals, the Etruscans did not establish any permanent colonies in this region. Wine and drinking equipment also were traded with central Europe via trade routes that extended over the Alps and along the French coast (Collis 1984; Dietler 1989). The Etruscans imported Greek ceramics from Corinth, Laconia, and the Aegean islands, but their greatest appetite was for pottery from Athens, which made pottery for export to Etruscan markets (Barker and Rasmussen 2000:132; Osborne 2001; 2007).

Changes in social and settlement structure had serious repercussions on the organization, use, and management of the countryside (Barker 1988). Over the seventh and sixth centuries BC, southern urban centers systematically extended their control of the surrounding landscape (Riva 2010). Evidence for land clearance and soil erosion illustrates that expanding areas of land were brought into cultivation. The greater abundance of off-site material alludes to an increase in farming and herding (Barker and Rasmussen 1988), and extensive networks of *cuniculi* (drainage channels) transformed wet land and flood plains into areas suitable for farming (Bergamini 1991). Plant remains also indicate an expansion and intensification of agricultural production. Archaeobotanical evidence suggests both the introduction of crop rotation and an increase in the variety of crops cultivated (Barker 1988). Tree cultivation and viniculture were adopted in widespread polyculture; the increase in grape pips and olive stones alludes to the development of these Mediterranean staples (Constantini and Giorgi 1987; Barker 1988; Perkins 2007).

The wide scale trade of Etruscan products, together with an intensification of agriculture, illustrates an increasingly specialized economic system that was increasingly controlled by major centers (Camporeale 2011:51). At the end of the sixth century, the landscape of Etruria was again changed as its cities extended their influence into area previously controlled by smaller, independent settlements (Barker and Rasmussen 2000:100). Many of these intermediate and small sites were destroyed or abandoned in this political restructuring as “landscapes of power” developed in the rural territory surrounding southern population centers (Barker and Rasmussen 2000:174). Environmental pollution from the expansion of metal production may have also driven immigration into cities, which were normally some distance from mines and metal processing sites (Harrison et al. 2010). This process of settlement nucleation was not as dramatic in northern Etruria. Instead of a centralization of power in a few large centers, northern spheres of influence were more fluid and less formalized (Riva and Stoddart 1996).

Changes in north of the Apennines progressed along somewhat different lines. During the seventh century BC, villages in the Po Plain, northern Adriatic coast, and foothills of the Alps developed into proto-urban settlements (Lomas 2012). At the same point, a process of settlement nucleation and social differentiation, analogous to that in central Italy, occurred at Bologna (Camporeale 2011:65). In the sixth century BC regional centers emerged, each poised to mediate trade with different populations (Sassatelli 2011): Spina on the Adriatic faced outwards to the sea; Marzabotto in the Apennines controlled exchange with Etruria; and Mantova and Forcello were oriented toward the northern Plain and central Europe. These sites exchanged oil, wine, and ceramics from Greece, bronzes from Etruria, and wares of their own production along the waters of the Po River and into Central Europe (ibid.). Bologna assumed a central role as the "fulcrum" of Etruscan trade between the Adriatic, central Europe, and Etruria (Sassatelli 2010b:208).

The origin of these Etruscan cities is still debated. One explanation, based on historical sources, identifies the establishment of northern Etruscan cities as an act of colonial expansion undertaken by southern centers. Some ancient authors name Tarconte, the founder of Tarquinia, as their progenitor (cf. Sassatelli 2001). Alternatively, Ocnus, a much later king of Perugia, is identified with Bologna and Mantova (Vergil, *Aeneid* 10.198). These characters are mythical, but these stories may indicate the involvement of particular southern cities in the development of the Plain (Haynes 2005:188). Sassatelli (2001) suggests that, despite the long period between their dates, these foundation stories might not be contradictory. Instead, two acts of expansion are possible: the first in the Early Iron Age in search of new areas for agriculture, the second for commercial purposes during the Archaic period. However, the archaeology of the Plain presents a more nuanced story, and Sassatelli (2008) convincingly argues against viewing the Etruscan presence in the Po Valley as a form of colonial explanation.

Drawing from historical, epigraphic, and material evidence, he links the rise of northern cities to a dramatic economic and political re-organization of Etruscan culture already present in the north. This continuation, but also transformation, of Etruscan habitation is particularly evident at Marzabotto, where a monumental and orthogonally-planned city (dated to the fifth century BC) replaced a more modest settlement founded in the sixth century (Sassatelli 2008; Sassatelli and Govi 2010). Epigraphic evidence from the site also indicates that a major part of the population derived from local groups, not central colonists (Sassatelli 2008). After conflicts over the control of southern ports, Etruscan influence in the Tyrrhenian Sea waned, increasing the importance of Adriatic trade links (Haynes 2005:188). The majority of land considered in central Italian surveys was in use by the fifth century BC, and competition for land and resources probably helped drive Etruscan interest in the Po Plain. The emergence of Marzabotto, Spina, and Mantova/Forcello was accompanied by a re-foundation of Bologna and new focus on economic production and inter-regional exchange. Large areas of land around these centers were reclaimed and drawn into cultivation in a conscious and systematic effort for territorial expansion (Malnati 1989). While these developments would have attracted and been influenced by groups from Etruria, there is no evidence, other than the mention of semi-mythical figures, they these changes were driven by central cities.

The Etruscans were not the only people interested in the region. The frequent appearance of Celtic objects, particularly personal ornaments such as fibulae and buckles, began in the sixth century BC and increased through time (Frey 1995). These items were not typically traded and probably evidence the increasing presence of Celtic individuals northern Italy. As Etruscan influence in the central and eastern Po strengthened, it declined in Romagna. Despite clear links to Bologna in the Villanovan period, settlements in this area developed along Umbrian, rather than Etruscan, lines. In the Veneto, Padova, Este, Treviso, and Altino grew into larger and more complex settlements with organized cemeteries and stratification in material culture indicative of the emergence of an elite (Lomas 2012). Streets and public buildings developed at Este and Padova between the sixth to fourth century BC. However, these processes are not visible in the Alps, where settlements remain small and simple until the Roman occupation of the region (ibid.). Similar commercial pressure probably also drove Etruscan cultural expansion southward. Numerous inscriptions and other Etruscan goods from Campania, especially the area around the Bay of Naples, attest to the expansion of Etruscan influence south of the Tiber and their encounters with Latins and Greeks (Haynes 2005:197).

1.2.5 The Classical period

Etruscan influence waned in the Classical period under increasing pressure from Celtic expansion in the north and Roman aggression from the south. Celtic finds in northern Italy appear during the sixth century BC (Frey 1987; 1995). Small personal adornments fashioned from metal, like open work belt hooks, torques, bracelets, and fibulae, attest to the presence of La Tène culture on both sides of Alps. As previously stated, the presence of these personal ornaments probably attests to movement of individuals and small groups between central Europe and northern Italy (Frey 1995). Orientalizing iconography also appears in central Europe at this time, illustrating an exchange of ideas as well as objects (Kruta 1987). Bronzes from Etruria continued to travel into the Po Valley and over the Alps at least until the beginning of the fifth century BC, but declined soon after. Trade dropped during the fourth century BC, indicating a break down in Etruscan commercial networks (ibid.). Greek imports to northern Italy decreased, and Etruscan exports became rare in central Europe. The Etruscan wine trade with southern France also evaporated, probably under competition from local Massalian products (Dietler 2010). With the decline of Etruscan urban centers in the Po Plain, the presence of La Tène culture expanded, so that by the mid fourth century BC most of area had developed a Celtic character (Williams 2001). Celtic burials increased in area around Bologna and Marazbotto, and Etruscan *Felsina* was eventually transformed into a major settlement of the Celtic *Boii*.

Despite the negative connotation surrounding the 'decline' of Etruscan culture, this was dynamic period of great social and political complexity (Williams 2001). Etruscan and Celts lived alongside each other in settlements like Monte Bibele and Bologna (Vitali 1987; Bourdin

2012:627–666). The contents of Celtic and Etruscan tombs suggest a process of cohabitation and mutual acculturation, rather than one-sided socio-political dominance (Vitali 1987(. While the illustration of battles between Etruscans and Celts on grave markers from Bologna indicate that skirmishes between these populations probably occurred (Frey 1995), the two groups may not have been competing for territory in a traditional sense. Malnati (1988) suggests that these cultures might have employed different forms of settlement organization, with Etruscans concentrated in cities and hamlets and Celts living in dispersed and more transient villages. In either case, the archaeological record is especially complex and difficult for this period, owing to the gradual and discontinuous nature of Celtic movement into the region (Bourdin 2012:642) – a situation which bears little resemblance to a violent invasion. Tomb structure and grave goods, typically used to assign culture identity, are difficult to attribute to either group because of the similarities between many object forms, and even when they are distinguishable their relationship to the ethnicity of the deceased is not always apparent (Bergonzi 1989).

Etruscan influence in central Italy suffered a similar decline. Tradition holds that in 507 BC the Tarquin kings were expelled from Rome, leading the establishment of the Roman Republic. A few decades later, in 474 BC, the Etruscans suffered a serious naval loss off Cumae. As a result, Syracuse gained control of Tyrrhenian Sea. Etruscan cities, especially the coastal centers of Cerveteri, Tarquinia and Vulci experienced a significant drop in trade, a decline particularly visible in Attic imports. Inland cities were more resilient to these changes, perhaps due to their reliance on agriculture rather than costal trade. Tensions escalated toward the end of the fourth century BC. While inter-city conflict had existed through the Etruscan period, many major Etruscan centers only erected walls in the fifth and fourth centuries BC (Barker and Rasmussen 2000:273–274). After the siege and destruction of Veii in 396 BC, Rome gained control of the city-state's large sphere of influence, initiating Roman expansion into Etruria. Despite alliances with Gauls and other Italic peoples, the Etruscans could not halt the tide of Roman expansion. Provoked in part by Rome's new control of Veii's territory, Tarquinia initiated a period of repeated conflict between Etruria and the Latial power in the mid-fourth century BC (Torelli 1986). Etruscan–Roman wars continued intermittently until Rome's dominance in the third century BC. With this new control over the territories of Cerveteri, Tarquinia, and Vulci, Rome established colonies and garrisons and built roads throughout southern Etruria (Torelli 1986). Over the same period, Rome continued its advances northward. Some small rural centers in northern Etruria constructed walls and probably acted as defensive outposts in response to Roman campaigns (Cresci and Viviani 1995), but a pattern of continuity on other rural sites in the region indicates that other places assimilated more easily with Roman control (Camin and McCall 2002).

1.2.6 Hellenistic and Roman Italy

Although the Etruscans threatened action against Rome in the Social Wars (a revolt over land and citizenship rights in 90–88 BC), they did not take up arms and were granted Roman citizenship by the *Lex Iulia* in 90 BC (Torelli 1986; Hall 1996:367). Cities in the northernmost of reaches Etruria were somewhat less influenced by Rome until the first century BC, at which point they were drawn into the Rome's civil war. Most Etruscan cities backed Marius in the conflict against Sulla, with the northern centers of Chiusi, Volterra, Arezzo, and Populonia leading the resistance. After Sulla's victory, Roman colonies were established at these cities and much their land redistributed to soldiers (ibid.). Local populations were moved from fortified positions into river valleys, and many likely fled or were taken prisoner (e.g. Livy, *Ab urbe condita* 10.4.37). Soon after this loss of political autonomy, Etruscan artistic and material culture also lost its distinctiveness and became absorbed into Roman cultural vocabulary.

The Po Plain was also drawn into Roman control during this period. Over the fourth and third centuries BC, the distribution of Celtic goods increased in northern Italy, and Celtic swords were adopted by Umbrians and Ligurians (Frey 1995). The continuing arrival of this population had varying, but significant effects on northern Etruscan cities: Spina and Marzabotto were abandoned during the third century BC, while Bologna and Mantova were inhabited by Celts until the Romans gained control of the area. Celtic peoples from the Plain began a series of raids over the Apennines that led to the sack of Rome in 390 BC (Hornblower et al. 2012:604). Skirmishes continued throughout the fourth and third centuries until Rome's victory at Telamon. Rome advanced into the Plain, capturing Mediolanum (Milan) in 222 and founding colonies at Piacenza and Cremona. The Second Punic War briefly interrupted their efforts, which they resumed in the first decade of the second century BC. The Roman defeat of the *Boii* in 191 led to the re-foundation of Roman colonies in the north and the establishment of Bononia (Bologna), Parma, and Mutina (Gabba 1989). Roman conquest of 'Cisapline Gaul' brought about a significant re-ordering of the landscape through centuriation and the construction of roads (Williams 2001). The Po Plain was rapidly romanized, and little remained of the Celtic language or culture by the end of the first century BC (Hornblower et al. 2012:604).

1.3 THE ETRUSCAN SETTLEMENT AT FORCELLO

Although the site now houses an archaeological park actively engaged in a variety of community outreach activities (www.parcoarcheologicoforcello.it), the Etruscan settlement at Forcello suffers from limited advertising and remains relatively unknown, even to local residents. The original Etruscan name of the site is also unknown. Archaeological research began on site in the early 1980s with a program of coring and geophysics, and excavations have progressed with limited interruption over recent decades. Despite this rather significant history of research, only a handful of individuals excavate on site each season and work moves slowly. Perhaps because of this constrained pace, publication of the site is limited. Nevertheless, a broad range of environmental and material specialists have contributed to the project, and their on-going research promises new perspectives on the settlement and its surrounding landscape. Two multi-authored volumes edited by the excavators – de Marinis and Rapi's (2007) *L'abitato Etrusco di Forcello di Bagnolo S. Vito (Mantova)* and de Marinis's (1988b) *Gli Etruschi al Nord del Po* – are the most recent and complete references introducing the site and its materials, and the information below is drawn primarily from these volumes. Information from other publications is referenced in the text.

1.3.1 Geographic and geomorphologic setting

Forcello is located in the town of Bagnolo San Vito, approximately seven kilometers southeast of the city of Mantova (English: Mantua) in the region of Lombardia (Lombardy). Both Forcello and modern Mantova lie on the banks of the Mincio River (Figure 1.3.1), a tributary of the larger Po River. The Mincio originates in the Alpine Lake Garda and connects with the Po approximately twelve kilometers southeast of Forcello. The province of Mantova is situated within the Po Plain (*Pianura Padana*), Italy's largest alluvial basin (Figure 1.3.2). The Plain stretches from the Alps to the Apennines, and west to the adjacent Venetian Plain and Adriatic Sea. The Po River is Italy's longest at 652 km, and its basin dominates the landscape of northern Italy, encompassing an area of *c.* 46,000 km^2. Overall, the modern landscape is strikingly flat and covered in wide agricultural fields crossed by irrigation ditches. Small groups of trees cluster along the banks of the Mincio and provide shade in the area's villages.

The archaeological site of Forcello occupies an elongated mound of modest height (sixteen meters above sea level) roughly one kilometer in length and geomorphologically situated in the palaeochannel of the Mincio (Figure 1.3.3). This palaeochannel cuts into the Po Low Plain Unit (*livello fondamentale della pianura*), a layer of fluvial and fluvial-glacial sediment deposited during the Pleistocene. The site was constructed on a layer of Holocene alluvium that fills the base of the Mincio's palaeochannel. Investigation of the area's geology in conjunction with recent palynological research has shown that, until the Late Middle Ages, the area surrounding Bagnolo San Vito contained a large lake (Figure 1.3.4). This body of water extended for at least five kilometers and stretched from Mantova past the settlement at Forcello and through a wide area of poorly drained lowlands before meeting the Po (Ravazzi et al. 2011).

Figure 1.3.1 Aerial view of Forcello and its surroundings (de Marinis 2007b:fig. 1)
The site lies just left of the wooded area at the center. The modern city of Mantova and its lakes are visible in the background.

Figure 1.3.2 Topographic map of modern Northern Italy showing the Po catchment area (in yellow)
© 2008 WikipediaCommons user NordNordWest used under a Creative Commons Attribution-Share Alike 3.0 Unported license: http://creativecommons.org/licenses/by-sa/3.0/deed.en

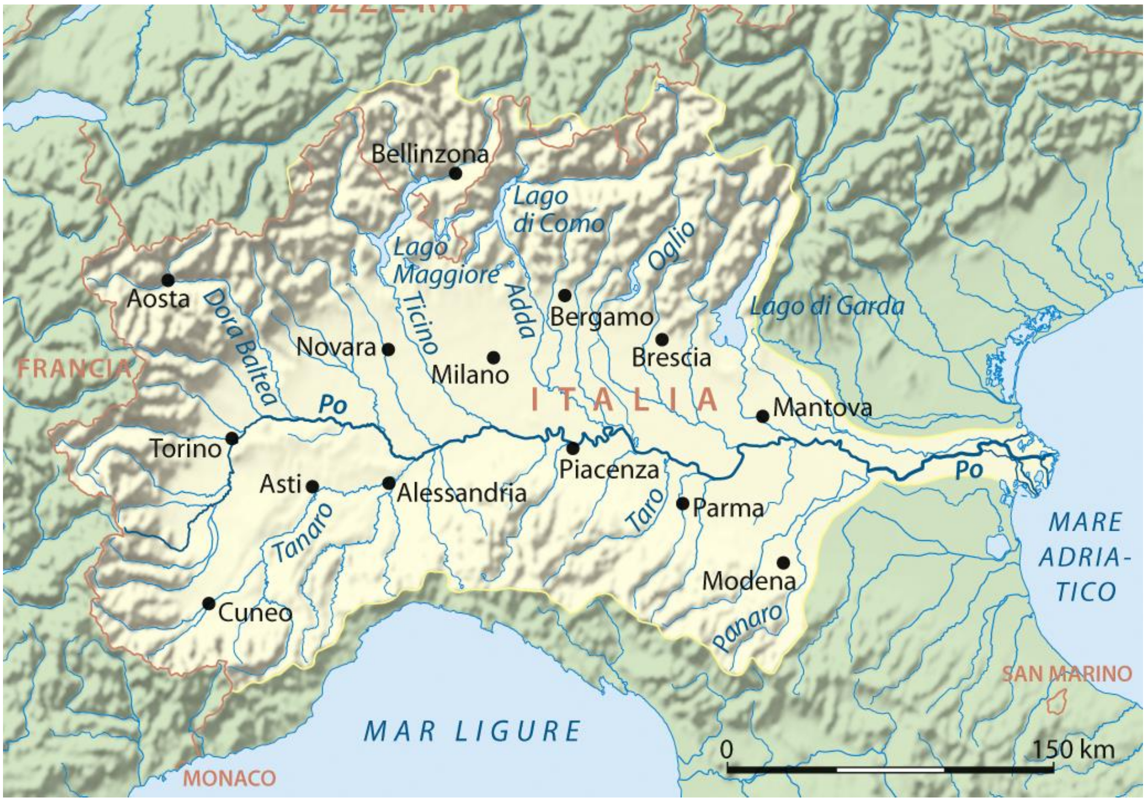


Figure 1.3.3 Geomorphologic maps of the area surrounding Forcello (Ravazzi et al. 2011:fig. 2)
a. modern setting. b. 5th century BC.
1. Rivers and lakes (dashed lines depict presumed fluvial tracks); 2. High water fluvial bed, mostly between main levees; 3. Poorly drained lowlands; 4. Alluvial ridge; 5. Abandoned fluvial course; 6. Main fluvial scarp; 7. Crevasse splay area; 8. Main Plain Level (surface marking the last aggradation phases, before beginning of deglaciation).

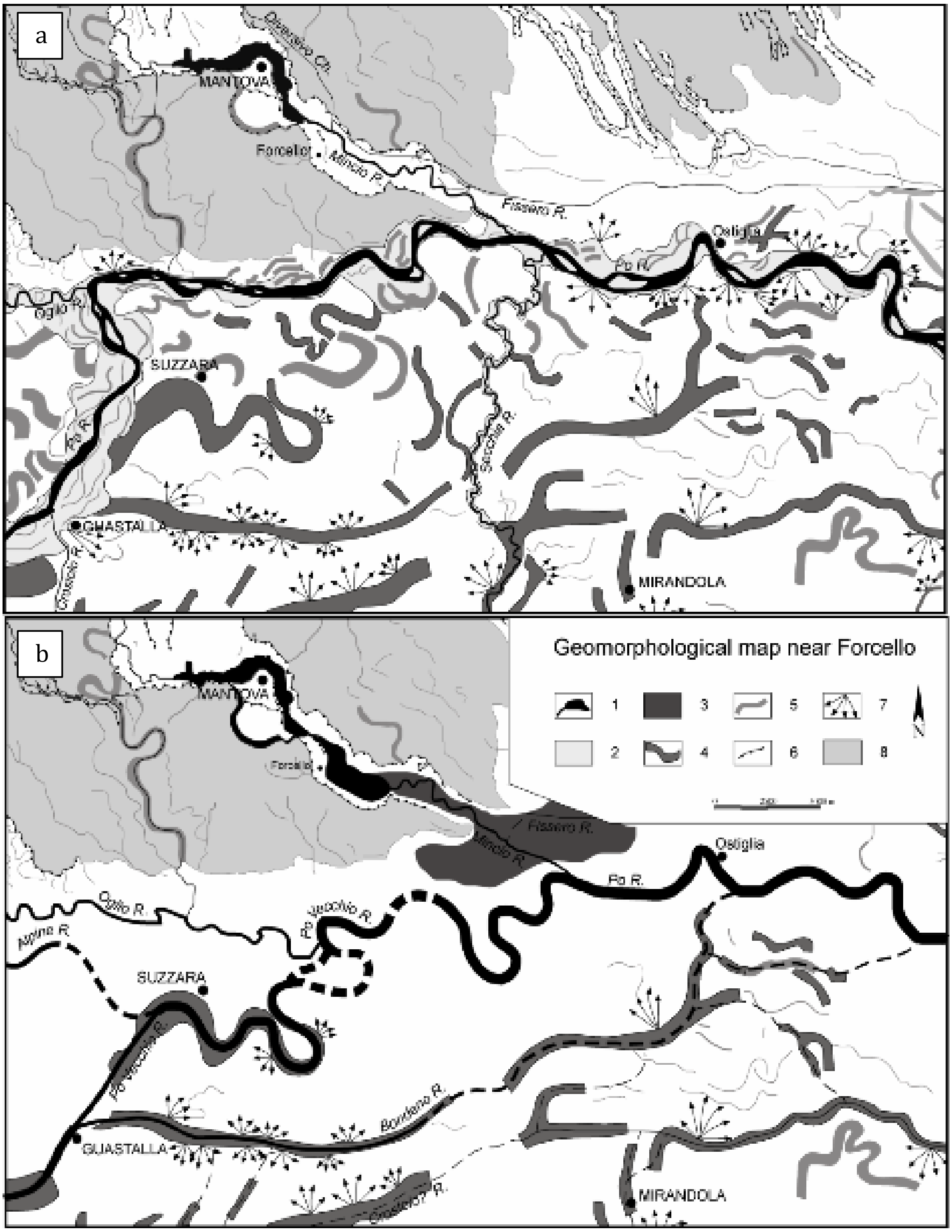
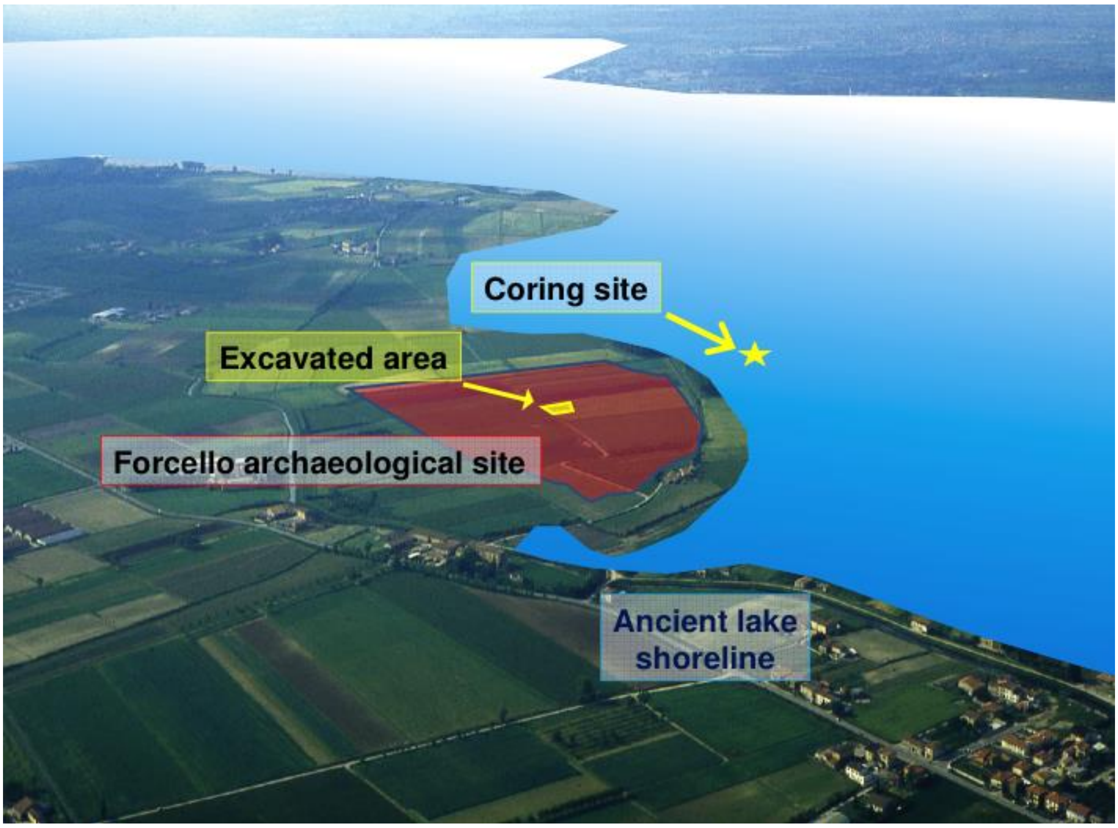


Figure 1.3.4 Hypothesized position of the Bagnolo lake in the Etruscan period (Ravazzi 2010)



1.3.2 Environmental context

Pollen cores from the aforementioned Bagnolo lake (Ravazzi 2010; Deaddis et al. 2011; Ravazzi et al. 2011) combined with botanical evidence from Forcello's habitation layers (Castelletti and Rottoli 1988) allow a basic reconstruction of the local environment. Throughout the Bronze Age and Etruscan period, an indigenous oak–hornbeam forest covered the majority of the Po Plain, including the area surrounding Forcello (Castelletti and Rottoli 1988; Cremaschia et al. 2006; Ravazzi 2010). Oak (*Quercus* sp.) dominated drier areas, but other trees, such as hornbeam (*Carpinus betulus*), ash (*Fraxinus* sp.), elm (*Ulmus* sp.), beech (*Fagus* sp.), and fir (*Abies* sp.), were also common. Black alder (*Alnus glutinosa*), willow (*Salix* sp.) and lacustrine reeds and sedges occupied the waters and banks of the Mincio. Downriver from Forcello, poorly drained lowlands were occupied by a large marsh (see Figure 1.3.3).

Around Forcello, significant human-made clearings interrupted the mature woodland. The presence of cereal pollen indicates cultivation occurred in these spaces, and the appearance of pollen from Plantaginaceae and *Rumex acetosa* also attests to anthropogenic activity and continued disturbance, likely related to cultivation or grazing. Walnut (*Juglans regia*) and grapes (*Vitis* sp.) appeared in the area around Forcello in the Late Bronze/Early Iron Age and were probably introduced by early Etruscans (Ravazzi 2010; Deaddis et al. 2011). Overall, however, the Etruscans at Forcello appear to have caused only minor deforestation, since high percentages of arboreal pollen indicate that the area remained predominantly forested throughout occupation of the site. However, the long-term continuity insinuated by pollen cores and vegetation history partly obscures smaller scale fluctuations that would have proved significant in the lives of the site's inhabitants. Forcello was prone to flooding, and multiple deposits of alluvial sand within the settlement prove that the site's protective earthworks and drainage systems were not always effective against the waters of the Mincio (de Marinis 1991; Casini and de Marinis 2007).

While an effort to envision the vegetation surrounding Forcello is a relatively direct task, an understanding of the changing relationship between the inhabitants of the site and their environment is a more complex exercise. Scholars currently disagree whether human or natural factors played the greater role in environmental change in prehistoric Italy (Roberts et al. 2004), but recent work indicates that humans may have had a significant hand in the "mediterraneanization" of the landscape (Roberts et al. 2011:11; cf. Giraudi et al. 2011 for a dissenting opinion), especially in the Po Plain (Oldfield et al. 2003; Mercuri et al. 2006b). As a fluvial basin, patterns of erosion, drainage and sedimentation in the Po Valley are complex, and they depend on both local conditions and those of the mountains where the Po's tributaries originate. Human activity in the Po basin may also be compounded by the morphology of the plain: swift changes in altitude can magnify the effects of temperature and rainfall even during small changes in climatic conditions (Marchetti 2002). Sediment cores from the Adriatic provide a large-scale view and indicate that the Etruscan period was generally a time of slow forest recovery with interspersed cultivation; however the antecedent Late Bronze Age was marked by dramatic vegetation clearance (Oldfield et al. 2003), and the significant deforestation of this period was likely a major contributor to the abandonment of the *terramare* culture (Cremaschia et al. 2006). Although such crises are unknown in Etruscan times, the dramatic end emphasizes two aspects of life in the Po Valley that are equally valid in the Etruscan period: the importance of human–environment interaction and the power of ancient people to significantly influence the landscape.

1.3.3 Settlement and chronology

Archaeological work at Forcello began in the early 1980s and since 1988 has been under the direction of Professor de Marinis of the Università degli Studi di Milano, who summarizes the excavations' history in the most recent compilation of research at Forcello (de Marinis 2007b). Prior to the first excavations, a program of coring and geophysics was employed to investigate the nature and extent of the site. A habitation area of approximately twelve hectares was discovered, a portion of which has been excavated. Research has revealed the site was founded *c.* 540 BC, a date which corresponds with the re-assertion and extension of Etruscan influence in northern Italy during the sixth century BC. The foundation of Forcello and rise of Etruria padana is likely to have occurred in response to the re-ordering and increased exploitation of the central Italian landscape and the new commercial opportunities presented by connections to the

Adriatic and central Europe (cf. section 1.2.4). Forcello was inhabited until the beginning of the fourth century BC, when it was likely abandoned due to pressure from neighboring Celtic peoples. Although other settlements and cultures are known to have occupied the region, there is no evidence of occupation at Forcello other than the Etruscan settlement. Thus the site has a tight chronology of approximately 150–160 years (Casini and de Marinis 2007). Excavation has focused primarily on a small area in regions R–S 17–19 (Figure 1.3.5, cf. Figure 1.3.4), which encompasses several phases of superimposed houses and workshops (e.g. Figure 1.3.6, Table 1.3.1). Except for some test trenches and a brief excavation in region V–W, all of the excavation at Forcello has focused on this limited area. At the moment, the earliest and latest phases occupation are less understood than the middle habitation layers; agriculture has destroyed the site's terminal strata, and the earliest phase has been less extensively excavated than subsequent activity.

Figure 1.3.5 Extent of the Etruscan site of Forcello (in grey) with excavated area and site features
Adapted from de Marinis (2007b:fig. 2)

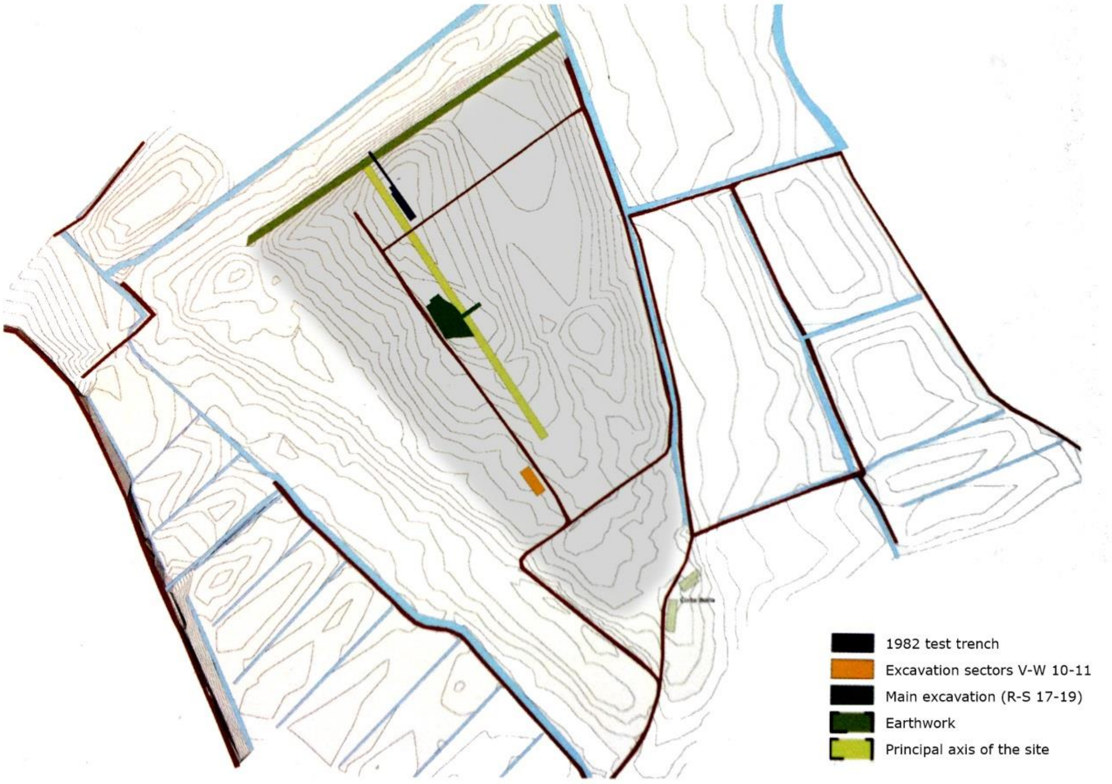
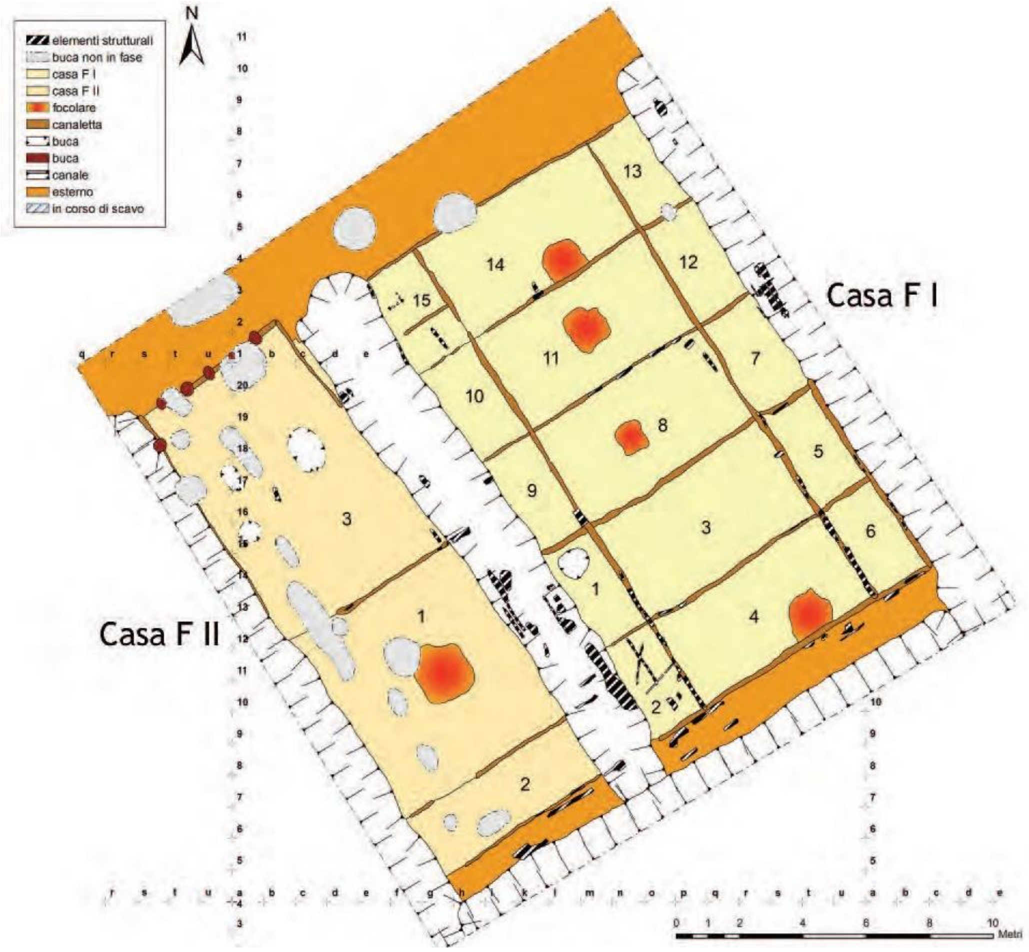


Figure 1.3.6 Plan of houses F I and F II at Forcello (Lamanna and Quirino 2013:fig. 2)
Illustration by T. Quirino.



The houses of the later phases G, F and D were constructed in the *Blockbau* or 'log-cabin' method, with horizontal beams stacked on top of one another and cut at the corner to facilitate attachment to the adjacent perpendicular log. Houses of both early (phases A, B, C) and late (phases D, F, G) habitation phases were constructed according to an orthogonal grid oriented along the main northwest–southeast axis of the site. This urban plan of perpendicular structures dates from the settlement's foundation, and is a defining feature of the site. The Etruscans adapted orthogonal city planning from the Greeks; the fifth century site of Marzabotto near Bologna is its most celebrated example (Figure 1.3.7). The presence of a fully developed orthogonal plan at the foundation of Forcello, several decades before its appearance at Marzabotto, suggests that this mode of urban organization was already appreciated and well-developed in northern Italy the sixth century BC.

Figure 1.3.7 General plan of the Etruscan city of Marzabotto (Sassatelli and Govi 2010:fig. 1)
Early 5th century BC.

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1.3.4 Foreign influence and trade

The wealth and variety of imported objects and materials at Forcello, in conjunction with its distinctly urban plan, present a thriving and well-connected city. Forcello lay along important trade routes that connected the Adriatic, Etruria, and central Europe (Marinis 1987). These networks, which ran along the Po River and up its tributaries into the Lake District, are visible archaeologically on both a regional (Figure 1.3.8) and pan-regional scale (Figure 1.3.9), and ceramics construction techniques and iconographic traditions illustrate close links between the Po Plain and northern Etruria (Perkins 2012; Santocchini Gerg 2012). Fragments of *balsamari*, small glass ointment containers, and beads demonstrate connections to the wider Mediterranean basin. Greek ceramics are common and suggest shifting trade patterns through the site's occupation. Attic ceramics – mainly black glaze, but also black and red figure vessels – are found from Forcello's earliest phases. Greek amphorae are also common and allude to Forcello's role linking Adriatic and inland trade (de Marinis 2007c). These transport vessels have forms indicating diverse origins: the north Aegean (Taso, Mende, or similar cities), south Aegean (Chios, Samos, Miletus, and possibly Kos), and Corinth, among other locations. In early site phases (I–F, c. 530–490 BC) the absence of amphoric forms from Samos, Miletus, Chios, Mendes and Corinth (type A) suggests a more limited trading range than present in later periods. All these types appear in the first half of the fifth century BC. In the final stages of the site, Corinth type amphorae are more numerous than vessels from the eastern and northern Aegean. Trade, therefore, appears to have occurred with the northern Aegean and Corinth throughout Forcello’s life, while relations with the eastern Aegean are focused on the first half of the fifth century BC. Interestingly, while wine amphorae are present in all phases, oil amphorae are only present from phase D (c. 490 BC).

Figure 1.3.8 Etruscan finds from the 5th and 4th centuries BC
in the territory between the Oglio and Mincio Rivers (Casini et al. 1988:fig. 51)

Figure 1.3.9 Principal commercial routes from the Mediterranean to central Europe during the early 5th century BC (Pauli 1988:fig. 200)

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In addition to close relations with Greek traders, the Etruscans at Forcello also communicated with other Iron Age peoples of northern Italy and central Europe, and evidence of Alpine and trans-Alpine trade is present in multiple phases at Forcello (de Marinis 2007f). Ceramics, fibulae, and pendants attest to links with the adjacent Golasecca culture, a Celtic civilization which inhabited parts of northern Italy from the ninth to sixth centuries BC. Fibulae provide further evidence of regional and long-distance exchange. In addition to those of the northern Etruscan Certosa type, fibulae of Este, Hallstatt, Retic-Euganean, and Vix types have also been identified (de Marinis 2007a). A fibula of Castellin di Fisterre type represents the southernmost example of this Alpine group. These personal ornaments are typically associated with the movement of the individuals who wore them, and they identify people from the Val d'Adige, Lago di Como, southwestern Germany, and Burgundy in France. These people may have been merchants, artisans or slaves (de Marinis 1988a), but whatever their occupation, they were not all transient travelers. The presence of a Celtic goods in upriver at the Etruscan cemetery of Collefiorito (Rivalta Mantovana) illustrates that non-Etruscans people settled permanently in the area (de Marinis 1988d).

Glass beads also link Forcello with Alpine, central European and Venetian peoples as well as other northern Etruscan sites like Bologna and Marzabotto, and Venetian ceramics provide further evidence of neighboring non-Etruscan peoples within the settlement (de Marinis 2007f).

Fairly quotidian aspects of Etruscan culture, like games (Lejars 2011), were also adopted in Europe along with more prestigious goods like wine, oil, Greek ceramics, and central Etruscan metalwork. The origins of this material cover a wide geographic area and demonstrate the variety of Celtic groups with which the Etruscans were in contact. Celtic material at Forcello is rare in the site's earliest phases, which, in conjunction with the Greek ceramics, suggests that trade expanded with the development of the site. However, since earlier site phases are less extensively excavated than later levels, the limited presence of Celtic material may be related to the extent of excavation rather than real differences in trade. Though the precise scope and development of trade relationships remains obscure, overall the material culture at Forcello demonstrates a wealth of international and Italic connections throughout the site's occupation.

1.3.5 Local production

Another characteristic of Forcello which supports its identification as an urban settlement is the level of expertise demonstrated by its locally manufactured metals, ceramics, and textiles. Metal tools and personal items (Casini et al. 2007a; de Marinis 2007a) and ceramic cooking and dining vessels (Casini 2007) were produced in local workshops. No workshop spaces have yet been found for the production of the local courseware, fineware, and *bucchero* found on site, but these facilities may be located in unexcavated areas. In contrast, the common presence of waste fragments from metal production and the remains of forges and furnaces attests to the importance of this activity throughout the life of the site (de Marinis 2007a), and open-air areas for metal production characterize phases H and E (Casini et al. 2007a). The phase H workshop produced a large quantity of slag as well as numerous partly-finished metal objects, above all fibulae. From the Phase E workshop numerous bone tools were recovered, along with waste fragments from iron and bronze working, and sheets, rods and ingots of bronze. Additionally, the phase E workshop may also have manufactured glass objects (Rapi 2007). Both bronze and iron appear to have been worked in the same spaces, as was common practice at the majority of Etruscan metal-working sites (Nijboer 1998). Objects and fragments of lead are also present. Textile production was another important area of craft activity at Forcello evidenced by the significant number of loom weights recovered from the Phase C and F houses (de Marinis 1988c; Vay 1988; Casini et al. 2007b). The range of loom weight sizes and forms suggests that the inhabitants of Forcello were producing a variety of different textiles types, and the location of these objects in orderly lines along the walls of the houses probably indicates the presence of large looms and areas dedicated to textile production (Vay 1988). In contrast, no evidence for spinning was recovered from the Phase C house, perhaps indicating that this activity took place in a separate workshop. Etruscan metalworking and craft production, although more specialized than in previous periods, generally occurred at a modest scale, and workshops were probably associated with particular households (Nijboer 1998). At Forcello, both the workshops are located within the settlement and may have been affiliated with one of more of the surrounding houses.

1.3.6 Agriculture

Despite the presence of workshops, most Etruscans would have been employed in agriculture. Castelletti and Rottoli's (1988) examination of stored plant remains from a phase C house established some of the plant species that were cultivated at Forcello. Legumes are more prevalent than grain, with broad beans (*Vicia faba*) as the most abundant species overall. Lentils (*Lens esculenta*) and peas (*Pisum* sp.) were also recovered, and several types of wheat (*Triticum monococcum*, *Triticum dicoccum*, and a third unidentified naked type) and barley (*Hordeum* sp.) are also present. Other botanical remains from the house included wild and/or cultivated grapes (*Vitis vinifera* or *Vitis silvestris*) and hazelnut (*Corylus avellana*). The cultivation of grapes and cereals at Forcello is further supported by the pollen record (Ravazzi 2010; Deaddis et al. 2011). Based on present evidence it appears that cultivation was done at a small-scale or household level. The pollen record does not support dramatic clearance indicative of large agricultural system, and the modest quantity of legumes and grains stored within the phase C house do not indicate a large-scale distribution network. Likewise the presence of hand-held millstones in phase F house (Casini et al. 2007b) also alludes to a domestic focus.

CHAPTER 2

ZOOARCHAEOLOGY: PAST RESEARCH AND PRESENT CONSIDERATIONS

2.1 INTRODUCTION

2.1.1 Etruscan animals beyond Etruria

In recent decades, zooarchaeology in Italy has expanded significantly and become better integrated with broader proto-historic and Classical research agendas. The study of animal bones has long been an important tool in prehistoric studies, but only relatively recently have faunal remains gained notoriety in Late Iron Age and Roman research in Italy. Within this timeframe, the Etruscan and Roman heartlands of Lazio and southern Tuscany have received the most attention (e.g. de Grossi Mazzorin 1989; 1995a; 2001a; 2004; 2006a; de Grossi Mazzorin and Minniti 2009b). Recent work has expanded this focus, integrating central-eastern Italy with the more established areas (Minniti 2012), and investigating Apennine and southern regions (Love 2008). Looking slightly later, MacKinnon (2001; 2004a; 2004b; 2010) charts variation in animal use across the Italian peninsula throughout the Roman period. In contrast, northern Italy has received less attention, and the most ambitious synthetic work on the region was published twenty years ago (Riedel 1994). Slightly more recent publications focusing on Friuli (Petrucci 1996) and Trentino-Alto Adige (Riedel and Tecchiati 1999b; 2002) have helped clarify animal management in peripheral areas of northern Italy, but understanding of zooarchaeology in the Po Plain is comparatively coarse. Farello (1995b; 2006) has sought to address the character and development of Etruscan animal husbandry in this lowland region; however these relatively brief works draw heavily from unpublished data and a limited number of sites. As a result, the relationship between animal management on northern and central Etruscan sites is understood only in broad terms.

Despite the pan-regional presence of the Etruscans, zooarchaeology, especially in northern Italy, is segregated along the political boundaries that divide regional *soprintendenz*e and academic spheres of influence (MacKinnon's work on Roman Italy and that of de Grossi Mazzorin et al. (2004) on the Recent Bronze are notable exceptions). A multi-regional and long-term view is necessary not only to contextualize the relationship of this dissertation to the current state of the field, but also to interpret animal exploitation at Forcello within its broader context. Like material culture and language, human–animal relationships at this city were linked to Etruscans on the other side of the Apennines. Equally, the Po Plain presented environmental advantages and limitations different from those of central Italy. Through comparing and contrasting these adjacent regions, we can begin to untangle the aims of Etruscan animal husbandry, the role of the environment in determining livestock selection, models of provisioning urban centers, and dietary preferences that separate Etruscan culture from other groups. This section bridges historic divisions to discuss the role of animals in northern and central Italy from the late Bronze Age to the end of the first millennium BC. Because much of the Italian literature is difficult to obtain (some even unavailable in the UK), I hope to provide the reader with a relatively broad and comprehensive view of the evolution of and current issues within the discipline. After an introduction to the development of the field, discussion focuses on key aspects of Italian zooarchaeology where major trends have already been identified: species frequencies, mortality patterns, biometry, and the presence and distribution of rare taxa. I have tried to balance unnecessary repetition of the synthetic works listed above with my desire to provide an adequate introduction to the topic. Northern Italy is discussed in greater depth because central areas have already been discussed at length in recent publications.

2.1.2 The origins and development of zooarchaeology in Italy

Zooarchaeology in Italy has been well-connected internationally since its inception, and thus the growth of the field generally follows the development of the broader discipline (excellent summaries of which are provided in Davis (1987), Reitz and Wing (1999), and Lyman (1994b, 2008)). Although the systematic recording and analysis of animal remains did not become common until the 1970s and 1980s, an interest in animal remains in Italy can be traced back to the mid-nineteenth century (cf. de Grossi Mazzorin 1997c; de Grossi Mazzorin 2006a). Much of Europe had embraced a keen interest in archaeology and natural history, and Darwin's *On the Origin of Species*, published in 1859 and translated into Italian in 1878 by Canestrini, provoked even greater interest and debate. Faunal collections, both archaeological and zoological, were established or expanded during this period, both in major cities like Rome, Milan, and Venice, as well as smaller centers such as Modena and Ferrara.

Of the numerous publications of the period, Rütimeyer's (1861) study of Neolithic *palafitte* (stilt houses/pile dwelling) in Switzerland particularly influenced naturalists and archeologists, both in Italy and elsewhere. The study distinguished the bones of domestic animals from their wild progenitors, provided information on the number of specimens, attempted to investigate animal age, and discussed butchery modifications. This work inspired Italian researchers, especially those investigating other *palafitte* cultures in northern Italy, to collect and study animal remains, and some of the earliest faunal reports in Italy were written during this period (e.g. Strobel 1864; Canestrini 1866; Marinoni 1868). Faunal remains had a particular impact on those studying the Bronze Age *terramare* culture. Coppi, who excavated the site of Gorzano, addressed the site's fauna in several publications (1871; 1873; 1874). He also wanted to publish a volume expressly dedicated to the settlement's botanical and animals remains (Caleffi 2007). Although this work was never realized, in preparation for the text he began arranging loose and fragmentary bones into a full skeleton – perhaps an early precursor toward establishing the minimum number of individuals (ibid.). Other studies of northern Italian *palafitte* and *terramare* fauna followed in the late nineteenth century. Strobel, who was author to some of the earliest reports on the archaeological faunas, was also one of the most prolific writers on the subject (de Grossi Mazzorin 1997c). Although frequently brief and, like much archaeology of the time, not particularly methodologically sound, these early reports served to educate and inspire researchers and enthusiasts about the potential of animal remains. Many of these historic assemblages remain on display in the region, and they represent important primary archaeological sources that continue to aid in the study of these cultures when subject to the application of modern zooarchaeological methods (e.g. de Grossi Mazzorin 1994b; 1996a).

During the same period, interest in the zooarchaeology of other regions and periods was comparatively limited. Only a handful of papers from the time deal with the Roman period (e.g. Fiorelli 1873; Tiberi 1879; Luzj 1893), in contrast to the growing body of influential prehistoric literature (e.g. Regalìa 1904; 1905; 1907). As a dicipline, zooarchaeology developed in multiple directions over the first half of that twentieth century and began to systematically address questions of domestication and past environments, inspired by works like those of Duerst (1908) and Bate (1937). With a few exceptions (e.g. Zancani Montuoro and Zanotti-Bianco 1937), faunal studies in Italy focused on the Palaeolithic. As in the past, reports remained brief and chiefly dealt with lists of fauna, but this was to change in the later twentieth century. A. Riedel, considered by many to be the father of Italian zooarchaeology, began publishing on the faunas of northern Italy just after World War II. In a prolific career that spanned more than fifty years, Riedel investigated faunal assemblages in northern Italy dating from the Pleistocene to the Medieval period. His writings include numerous site reports (many used as comparisons for this project), discussions of specific taxa, and synthetic texts exploring domestication, animal size change, and chronological trends in the region (e.g. Riedel 1979a; 1986b; 1988; 1989a; 1990b; 1991a; 1994; 1999; 2002). During the same period the development of 'environmental' archaeology and paleoecology inspired works by British authors, typically more active in central Italy, to address northern topics (e.g. Barker 1987; Clark 1986). Riedel remained an active part of northern Italian zooarchaeology, co-authoring studies with colleagues (e.g. Riedel and Tecchiati 1988; 1999; 2001; 2002; 2003; 2005) even in recent years. Today, authorship of faunal studies in northern Italy tends to be divided along the regional lines. Many assemblages from the Veneto, Trentino-Alto Adige, and Friuli have been studied by Tecchiati, while Farello has published the majority of Etruscan assemblages from Emilia-Romagna.

Analyses of specifically Etruscan animal remains in Etruria padana are a relatively recent addition to the corpus of faunal research in northern Italy. Etruscan zooarchaeology reports first appeared in the late 1970s with Riedel's (1978) preliminary analysis of the fauna from Spina. Faunal data from Etruscan sites north of the Apennines expanded in the 1980s and 1990s as zooarchaeology became better integrated with other archaeological research programs (e.g. Bertani 1995). Because many Etruscan sites in northern Italy lie within Emilia-Romagna, Farello is responsible for the analysis and publication of most of the Etruscan animal bone assemblages in northern Italy, as well for syntheses of this research (Farello 1995b; 2006).

The development of zooarchaeological research in central Italy followed a somewhat different course. As in northern Italy, many early works deal with prehistoric faunas (e.g. Gejvall 1967; Lepiksaar 1975; Barker 1976), but without a figure working as early as Riedel, comprehensive studies on central Italian material were rare before the late 1970s. The first Etruscan faunal publications appear during this decade (e.g. Cardini 1970; Azzaroli 1972; Azzaroli 1979), followed by an expanding body of work in the 1980s (e.g. Sorrentino 1981a; Sorrentino 1981b; Gejvall 1982; Sorrentino 1986; Corridi 1989; Clark 1989). In 1987, the publication of *L'alimentazione nel mondo antico: gli etruschi* (Barbieri 1987) signaled the rising importance of animal bones and other environmental remains within Etruscan archaeology, and the *Associazione Italiana di ArcheoZoologia* (AIAZ) formed shortly after to promote zooarchaeology in Italy. Numerous bone reports followed in subsequent years. An early attempt to draw together these individual reports is represented by Caloi et al. (1988)'s work, but for the next twenty-five years, another major figure of Italian zooarchaeology, J. de Grossi Mazzorin, has been responsible for conducting and synthesizing zooarchaeological research in the region (e.g. de Grossi Mazzorin 1989; 1995a; 2001a; 2004; 2006a) often with C. Minniti (de Grossi Mazzorin and Minniti 2008; de Grossi Mazzorin and Minniti 2009a; de Grossi Mazzorin and Minniti 2009b; de Grossi Mazzorin and Minniti 2010). Minniti's recent volume, *Ambiente, sussistenza e l'articolazione sociale nell'Italia centrale tra Bronzo medio e Primo Ferro* (2012), is the most comprehensive work on zooarchaeology in central Italy to date.

2.1.3 Sites considered in this study

Drawing from this diverse authorship and research tradition, the archaeological sites that form the comparative base of this project (Figure 2.1.1–2) were compiled from the literature outlined above and updated with more recent reports (Tables 2.1.1–3). These tables also provide the reference for each site; references for reports not included in this comparative list are placed in the text. This selection of assemblages is not intended to be an exhaustive catalog of faunal studies, nor is it able comprehensively address all aspects of zooarchaeology in Italy. Rather, it aims to provide a basis for comparing and contextualizing animal husbandry at Forcello. For this reason, animal remains from funerary, cultic, or other ritual contexts are excluded even if they fall within the study area (e.g. Bertani 1995; Riedel and Tecchiati 2001; Riedel and Tecchiati 2005; Tecchiati 2006; Facciolo and Tagliacozzo 2006; Maini and Curci 2010; Petrucci and Vitri 1995). The character of faunal remains from ritual contexts frequently varies from patterns set by habitation-related assemblages, and the inclusion of bones from animal sacrifices, tombs/graves, and other offerings would complicate investigation of animal husbandry regimes. Likewise peripheral areas like Liguria and Campania are also excluded from discussion despite an Etruscan presence in these regions in order to allow greater focus on the depth, rather than breadth, in this discussion.

Figure 2.1.1 Map of Italy showing the location of comparative Bronze Age sites
Compiled by the author. Terrain map from the Ancient World Mapping Center. ©2011. Used under a Creative Commons Attribution-NonCommercial 3.0 Unported license: http://creativecommons.org/licenses/by-nc/3.0/

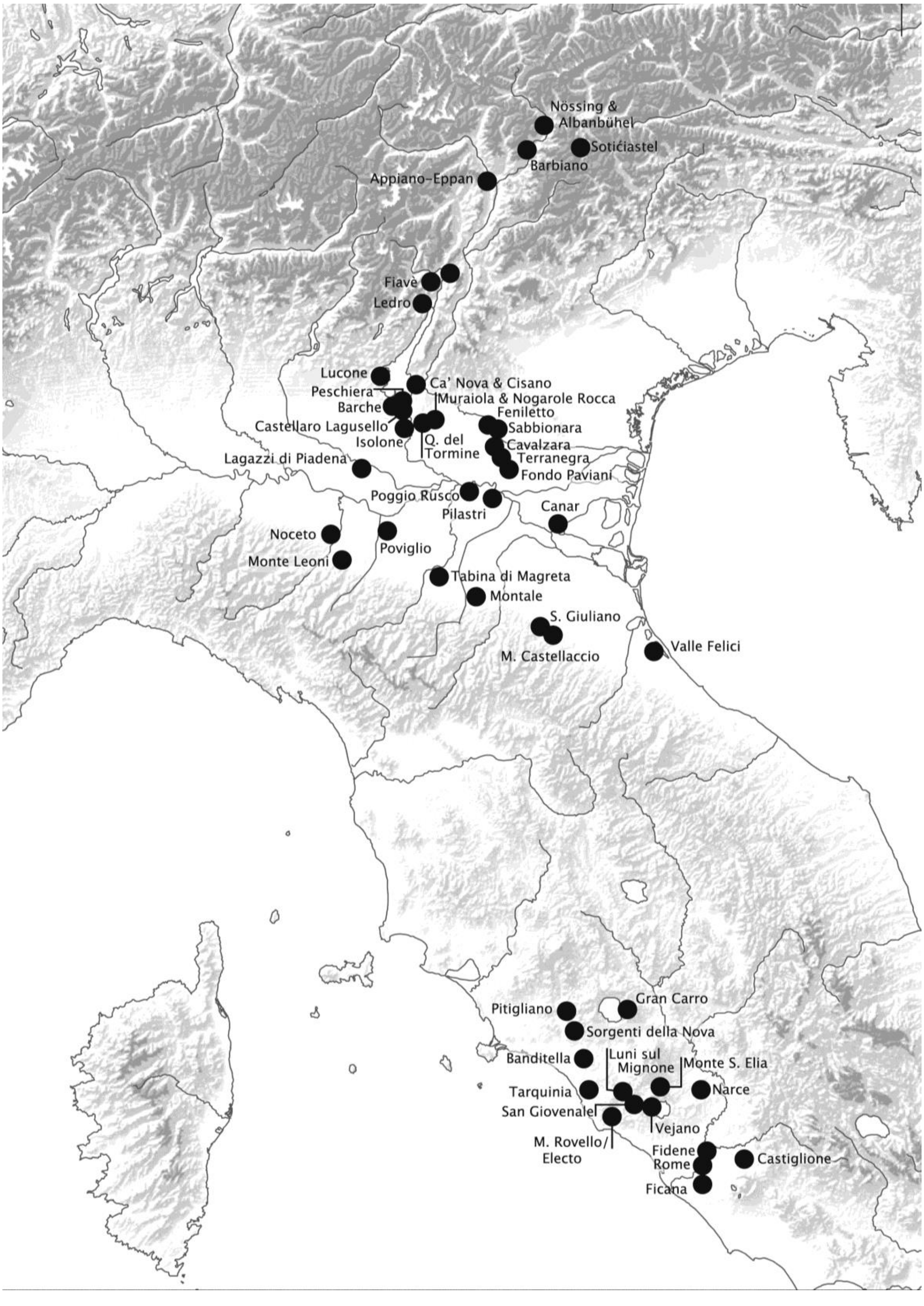
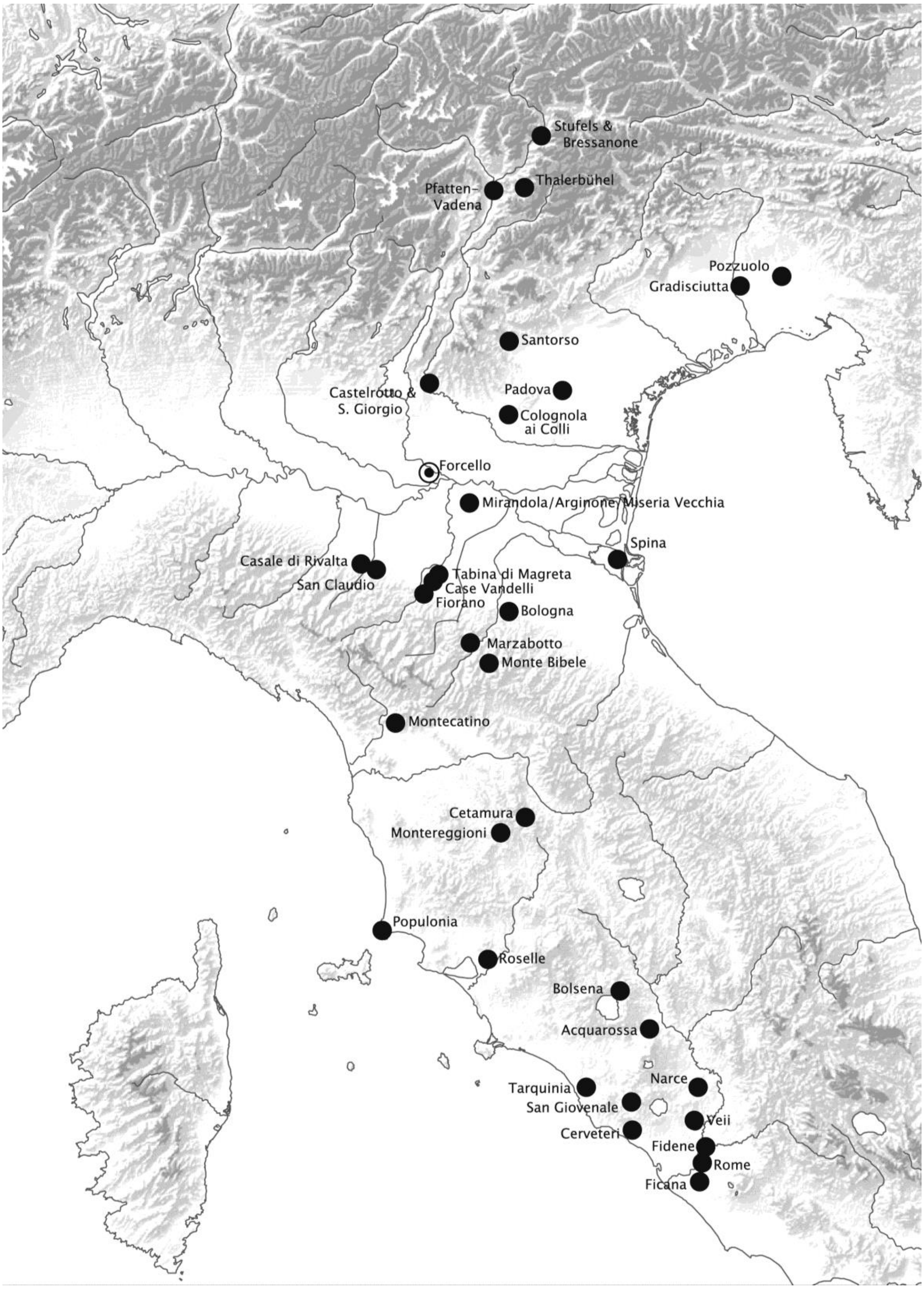


Figure 2.1.2 Map of Italy showing the location of Forcello and comparative Iron Age/Etruscan sites
Compiled by the author. Terrain map from the Ancient World Mapping Center. ©2011. Used under a Creative Commons Attribution-NonCommercial 3.0 Unported license: http://creativecommons.org/licenses/by-nc/3.0/



2.1.4 Challenges and limitations

Integrating this diverse body of literature has several challenges that should be articulated before making zooarchaeological comparisons. The first challenge is posed by the distribution and nature of animal bone data. Regional and chronological gaps are present in the site list. Northern Italian sites are not equally distributed across the region, and central Italian data comes primarily from the region surrounding Rome; conversely, northern Tuscany is underrepresented. Additionally, few sites from the Final Bronze Age are available for northern Italy, and there are large gaps for this period in Emilia-Romagna and the southern Plain. Another issue is that of sample size. The overall size of the faunal assemblages varies significantly, and caution is needed when interpreting chronological and regional trends. Despite these limitations, sites with smaller NISP values are still useful, particularly for addressing more general questions on economy and diet. These assemblages are most suitable for comparisons of species frequencies (Gamble 1978; Davis 1987), although samples under one hundred are probably best considered primarily on an ordinal scale. Sample size also complicates investigation of animal characteristics. Small faunal assemblages have even smaller samples of aged, measured, or sexed remains (often under twenty remains per species) that are not statistically viable. On the whole, northern Italy has produced much larger animal bone assemblages than central regions. Forcello, Spina, Canar, and Albanbühel have produced animal bone assemblages with more than ten thousand identified remains. Central Italian assemblages are much smaller, partly as a result of longer and more complex occupational histories, the poorer survival of faunal remains, and regional archaeological traditions that do not favor large-scale projects.

Other challenges present themselves during inter-site comparisons. Firstly, the different taphonomic histories of these sites are important to bear in mind. Differing treatment of the faunal material pre- and post-burial by past populations will affect the final assemblage. Likewise, the choice of excavation area and the quality of recovery will also influence what is recovered. Very little comparative data on taphonomic factors, like the impact of butchery, burning, gnawing, and recovery method, is available for these sites. Unless otherwise stated, faunal material was assumed to be hand collected. Another challenge facing inter-site zooarchaeological comparison is variation in recording methodology (Albarella 1995b). The means of expressing biometric and age data varies significantly between sites. Sometimes exhaustive lists or tables are included; other publications only summarize the situation in the text. These differences in the presentation precluded direct, quantitative comparisons in many instances. Sheep/goat age determined using Payne’s (1973) system allowed a direct comparison of mortality profiles at a few sites, but many northern reports express tooth wear through a generic series of pluses (e.g. +, ++, +++). Without listed boundaries for the division of animals in various age groups (juvenile, adult, etc.), only a cursory comparison of animal age is possible.

Likewise, subjective descriptions of animal size encountered in the text are of limited comparative value. Measurements are now more frequently included in animal bone reports than in the past, but few large-scale synthetic works integrate this data. In most instances, size analysis relies on a small number of sites that have assemblages large enough to support such comparisons. As a result, our understanding of animal size is based on measurements from a few, often geographically distant settlements. Additionally, previous work has relied heavily on comparison of average withers heights. Because withers height is calculated using individual greatest length measurements, this method only takes into account one aspect of animal size – bone length. Because complete bones are rare in archaeological assemblages, concentration on bone length disregards the greater abundance of width and depth measurement. Bone length is also sensitive to environmental pressure, and it may reflect location conditions rather than real differences in animal breeds or types (Klein 1964; Brisbin and Lenarz 1984; Klein et al. 1987). Teeth, especially tooth widths, are less susceptible to environmental influence and would be a more useful mode of comparing populations (Payne and Bull 1988). An evaluation of three-dimensional bone biometry and animal shape, as well as size, would also help clarify the distribution and development of animal types (cf. Albarella 2002). While current research has identified several major trends, further research could do much to develop and clarify them.

2.2 WILD ANIMALS AND THE IMPORTANCE OF HUNTING AND FISHING

By the Early Bronze Age animal husbandry had prevailed over hunting as the main means of subsistence on Italian sites. In faunal assemblages, the remains of wild animals are infrequent compared to the large quantity of material from domestic livestock, and wild fauna rarely account for more than a small percentage of the total assemblage. In northern Italy, hunting focused primarily on red deer, which had been the most important wild species in the region for a millennium (Riedel 1991). Although rarely abundant, the remains of wild boar are also frequently found on northern sites. Both species were hunted for their meat and raw materials and also possibly killed to protect crops. Deer antler fragments are especially common, although this material can also be collected when antlers are annually shed. Antler was used for a variety of tools and ornaments – a practice attested to by numerous worked fragments and finished objects. Other wild species, such as hare, roe deer, fox, beaver, wild cat, otter, badger and smaller mustelids, are present but comparatively rare. Large carnivores like wolves and bears are also infrequent. The ibex and chamois have also been recorded, not only in the far north (e.g. Bressanone-Elvas, Fiavè, Nössing), but also in the Plain at Lagazzi di Piadena.

Hunting remains of secondary importance during the Iron Age and Etruscan period. Red deer and wild boar continue as the major prey species, although smaller wild animals were also hunted. By this point, bears had become limited to the northern part of the plain at Santorso and Castelrotto, while wolves, although infrequent, are more widely distributed (e.g. Casale di

Rivalta, Colognola ai Colli, Monte Bibele). Ibex has been identified at Thalerbühel, and several chamois bones were recovered from the Po Valley at Padova. Even today chamois horn is desirable material for knife handles and other objects; the horncore recovered from Padova probably indicates a similar usage in the past. Common wild birds (*Corvus corax, Columba* sp., *Perdix perdix*) and ducks (*Anas* sp.) are present in several assemblages. Game birds were probably caught in nets or shot with a sling, as seen in the fifth century BC Tomb of Hunting and Fishing at Tarquinia (Figure 2.2.1). Songbirds may also have been eaten. Small mammals not normally consumed, like moles, could have become naturally incorporated into the site matrix.

Hunting strategies followed similar patterns in central Italy. Deer and wild boar were the most popular quarry, although birds and smaller mammals were also hunted (de Grossi Mazzorin 2001a). As in northern Italy, hunting was a marginal part of Bronze Age subsistence in central areas, and wild animals rarely account for more than a tiny fraction of assemblages (Minniti 2012). Vejano and Pitigliano are the main exception to this trend, and both sites contain a more marked number of wild taxa. In the Early Iron Age, the contribution of wild animals decreases further, although they still make a contribution to subsistence at Gran Carro. After the eighth century BC, a division between site types emerges: hunting made some contribution to subsistence on a few small sites, like San Giovenale and Ficana, while wild species are especially rare in larger centers such as Roselle, Tarquinia, Cerveteri, and Populonia.

Within the study area, two sites break from this trend. With over 10% of their assemblages attributed to wild species (particularly red deer and wild boar), Monte Bibele and Spina are outliers when the importance of hunting is considered. At Monte Bibele, a small Apennine hill-top settlement, the increased presence of wild species may be linked with the relative isolation of the site and a greater reliance on or exploitation of its wild environs (Cattabriga and Curci 2007). Roe deer, typically a rare species, are more frequent than wild boar, which may suggest that the site targeted easier prey in subsistence hunting. Spina, in contrast, was a large urban center. Also interesting is the distribution of wild taxa at this city – wild boar is as common as red deer (typically the latter is much better represented). Here hunting might be linked with a larger population of elite individuals. Etruscan hunting was predominantly an aristocratic pastime charged martial symbolism. It provided an important outlet for Etruscan elites to display their wealth and power, and it has a rich tradition in Etruscan art, which reaffirms its association with aristocratic life (Camporeale 1984; Cattabriga and Curci 2007). The focus on large game, and especially wild boar, which would require the coordination of several men, may suggest a different motivation behind hunting at Spina – one linked to prestigious display rather than subsistence.

Although their economic contribution decreases after the Bronze Age, wild species continue to appear in funerary offerings and cultic contexts (e.g. Sorrentino 1981a; Caloi and Palombo 1988–1989; Bedini 1997; Chierici 1999; Perego 2010). Their inclusion in these special deposits indicates that, although they were no longer a part of quotidian consumption, wild animals were not necessarily far from people's minds. Equally, although hunting no longer provided an important dietary contribution, it provided an important opportunity for Etruscan and Celtic elites to display their wealth and practice/demonstrate martial skills (Cattabriga and Curci 2007). The choice of prey also reflects its role as an elite institution. Small mammals and birds could be hunted by individuals with minimal resources. In contrast, to kill a mature red deer or wild boar would have required larger groups and an access to quality weapons (de Grossi Mazzorin 1989; de Grossi Mazzorin 1995a). Scenes of hunting involving deer, hare, and birds that recall both the cultural importance and pleasure of these activities are reoccurring themes in Tarquinia's fifth century BC aristocratic tombs (Steingräber 2006).

Figure 2.2.1 Tomb of Hunting and Fishing (Pallottino 1985:51)
Tarquinia, 5th century BC.

This image has been removed by the author for copyright reasons.

Fish remains are rare in both regions of Italy for the Bronze and Iron Ages. Interestingly, the dearth of fish remains from central Italian contexts may not be entirely related to recovery bias. Despite programs of sieving at Celano, Rome (Campidoglio), and Sorgenti della Nova, no fish remains were recovered (Minniti 2012). The same proved to be true despite systematic sieving at San Omobono (I. Cangemi pers. comm.). Currently it is unclear whether this result is entirely taphonomic or linked to an emphasis on land-based foods.

The most significant fish bone assemblages from the Po Plain come from Canar (Bronze Age) and Frattesina (Iron Age) (de Grossi Mazzorin and Frezza 1998; 2000; de Grossi Mazzorin 2002). Fishing at these sites was based on pike (*Esox lucius*), tench (*Tinca tinca*), and rudd (*Scardinius erythrophthalmus*). Eel (*Anguilla anguilla*), chub (*Leuciscus cephalus*), barbel (*Barbus barbus*), sturgeon (*Huso huso* and *Acipenseridae* sp.) and cyprinids (*Cyprinidae* sp.)

were also identified. Between the Early and Final Bronze Age, pike increased in importance at the cost of tench, although the overall variety of fish then remains stable between periods. Additionally, both tench and pike are clearly larger in size at Frattesina. This difference in fish size cannot simply be explained by a change in net types, because numerous small species are also present at the site.

Knowledge of fishing outside these two examples is comparatively limited. If present, fish are typically represented in archaeological assemblages solely by a handful of remains. A program of systematic sieving at the late Bronze Age site of Monte Ignacio led to the recovery of eels and cyprinids, typical inhabitants of freshwater lakes and streams. Several bones from a sea sturgeon (*Acipenser sturio*) illustrate Ficana's links with the coast. A very small number of pike and cyprinid remains have also been identified at Pilastri di Bondeno, Lagazzi di Piadena, Bologna (Castenaso), Padova, Arginone and Marzabotto. More frequently fish bones are left unidentified, for example at Tabina di Magreta, Santorso, Colognola ai Colli, and Fondo Tomollero near Vicenza (Jarman 1976). Overall, fish recovered from pre- and proto-historic contexts in northern Italy are common freshwater species similar to those that inhabit the region's rivers today. Small numbers of unidentified fish are also found in central Italian assemblages at Castiglione, Cerveteri, and Populonia. Squalidae remains, probably from a dogfish, have been found in a tomb at Populonia (de Grossi Mazzorin and Minniti 2009a), and tuna (*Thunnus thynnus*) has also been recovered from Roman contexts at the site. The fish, found in an amphora, were probably conserved in brine or under salt (de Grossi Mazzorin 2006b). Cuttlefish remains have also been recorded at Populonia, an unsurprising find considering the center's short distance from the sea. Like fish, both fresh and salt water mollusks were also exploited, and are frequently recovered from archaeological sites in all periods. The presence of marine mollusks evidence the links between the sea and inland *terramare* settlements during the Bronze Age and with a range of sites, including Rome (Palatino) and Forcello (discussed further in section 3.2.2), in later periods.

The Etruscans certainly made use of the aquatic resources available to them, but the real contribution of freshwater and marine resources to the Etruscan diet is difficult to interpret and probably varied throughout Italy. Most likely, populations with access to these resources made use of them. They also may have exchanged a limited quantity of preserved foods, for instance salted or fermented fish or fish-based products. While marine shells are not uncommon on inland settlements, salt-water fish remains are more rare, and although their absence may be partly taphonomic, it seems likely that major consumption of marine foods was limited to coastal sites. The limited isotopic data available point to regional variation in the Etruscan diet. Marine foods made a greater contribution to the diet of several individuals from Populonia in the second century AD (Scirè Calabrisotto et al. 2009) than at other sites (e.g. Forniciari and Mallegni 1987; Scarabino et al. 2006).

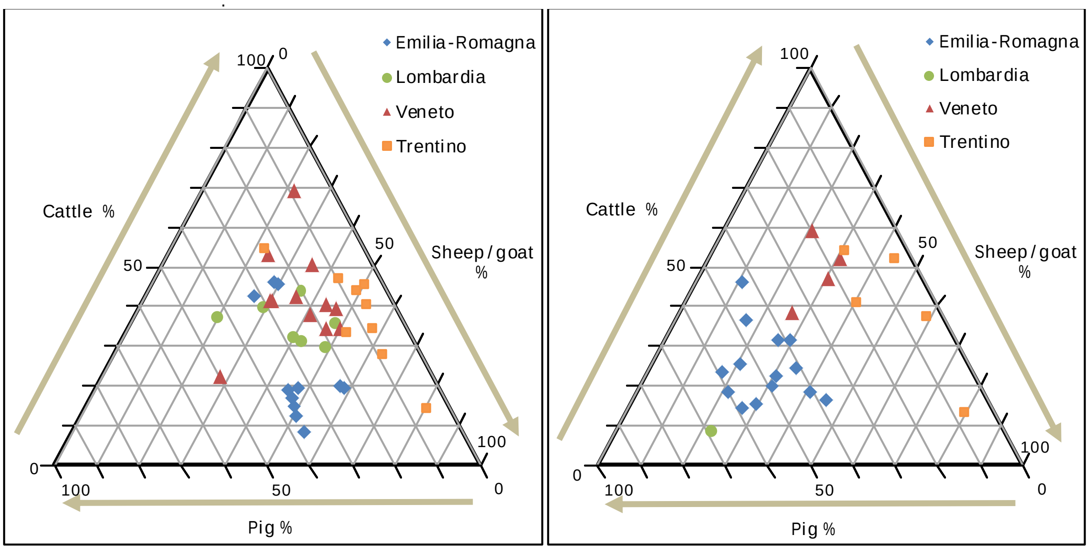
2.3 A PENCHANT FOR PORK: CHANGES IN LIVESTOCK FREQUENCIES

2.3.1 Northern species frequencies

Animal management in northern Italy during the Bronze Age has been the subject of a number of synthetic works that investigate faunal data on a long-term, intra-regional scale (e.g. Clark 1986; Barker 1987; Riedel 1986b; 1988; 1989a; 1990b; 1991; 1994; de Grossi Mazzorin et al. 2004). Focused, summary publications are also available for Trentino-Alto Adige (Riedel and Tecchiati 1999b; Riedel and Tecchiati 2002), Friuli (Petrucci 1996), and Emilia-Romagna (de Grossi Mazzorin and Riedel 1997).

For most of the Bronze Age, animal husbandry in northern Italy was governed primarily by the regional differences in geography and the local environment (Figure 2.3.1)(Clark 1986; Riedel 1988; 1994; de Grossi Mazzorin and Riedel 1997; de Grossi Mazzorin et al. 2004). Caprines and cattle dominate in northern Alpine areas (Trentino-Alto Adige). The region's rough terrain probably also emphasized a pastoral way of life, especially for groups with limited access to fertile valleys. Pigs are much less abundant. Within this region, the choice to focus on sheep/goat or cattle husbandry appears to have been governed by both environmental constraints and cultural preferences (Riedel and Tecchiati 1999b; Riedel and Tecchiati 2002). At some sites, like Appiano and Ledro, the prevalence of cattle may be linked the wide availability of land for farming and pasture. However, this trend is not universal. No clear zooarchaeological patterns that separate cultural groups have yet been identified. In mountainous areas, Late Bronze Age patterns of animal management continue mostly unaltered throughout the first millennium BC, only to change radically with the arrival of the Romans (Riedel and Tecchiati 2002).

Figure 2.3.1 Northern species frequencies for the Bronze Age and Iron Age/Etruscan period
Trentino = Trentino-Alto Adige. Figure by the author.



a. Bronze Age

b. Iron Age/Etruscan period
All sites in Emilia-Romagna and Lombardia are Etruscan.
All sites in the Veneto and Trentino are from other cultures.

Within the Po Plain, a closer association between culture, geography, and animal management is visible. The *terramare* culture in Emilia-Romagna was clearly focused on a pastoral economy, and sheep/goats are the predominant species on most sites belonging to this culture. These settlements would have had access to higher areas of the Plain and tracks of mature forest amendable to sheep/goat pastoralism and pig keeping. Nogarole, Quarto del Tormine, and Castellaro del Vhò, sites north of the Po but still within *terramare* influence, had similar economies to those south of the river. In the northern Plain, settlements under the influence of the Polada *palafitte* culture are dominated by cattle or sheep/goat husbandry, although all three livestock taxa are fairly balanced. On the southern edge of the Plain, cattle predominate on *romagnoli* settlements near Imola (e.g. Monte Castellaccio and San Giuliano).

In summary, during the Bronze Age cattle and caprines were the dominant species in the northernmost areas, while pigs were less common. Within the Po Plain, *terramare* culture had a clear focus on sheep/goat pastoralism. Outside of their influence, other sites adapted either cattle or sheep/goat husbandry to suit their needs. Pigs are more prevalent in the Po Valley than on northern settlements, but they are rarely the dominant species. Pigs are especially numerous in the central and eastern Plain. Both cultural preferences and the environmental limitations contributed to forming these patterns of livestock management. The clear predominance of one species (more than 60%) is rare. In the Veneto and Trentino-Alto Adige these basic animal husbandry strategies persisted through time, but larger changes are visible in Emilia-Romagna, where Etruscan influence introduced new patterns of animal management (Figure 2.3.1b).

Iron Age faunas in the northern plain and foothills of the Alps are also generally similar to late Bronze Age sites. Cattle are normally the predominant species, followed by sheep/goats, and lastly pigs. The sample size is small – just three sites – but, pig frequencies are slightly higher than in the previous Bronze Age, resulting in a more balanced proportion of pigs and sheep/goat than in the past. Patterns of animal management changed more significantly in the central and southern plain with the arrival of the Etruscan period. After a gap of several centuries spanning the Final Bronze Age, assemblages are again available starting at Bologna in the eight–sixth centuries BC. At this proto-urban center, pigs surpass sheep/goat as the most common domestic taxa. This increase in the importance of pigs is visible at all settlements under Etruscan influence and represents an important break from animal management in the past (Figure 2.3.2). Large urban centers (Bologna, Marzabotto, Spina, Forcello) have the greatest proportion of pigs (Farello 1995b), while species frequencies from agricultural sites and smaller villages are more varied, and the emphasis on pigs is less pronounced (Figure 2.3.3). Finer trends are harder to distinguish. The adjacent sites of Arginone and Miseria Vecchia have an elevated presence of sheep/goat. During the Bronze Age this area was used by the *terramare* for sheep/goat pastoralism; perhaps it remained suited to this type of husbandry in the Etruscan period. Likewise, the continuation of comparatively high pig frequencies in the area around Mantova and in the eastern plain from the Bronze Age into later Etruscan (Forcello, Spina) and Roman (Torcello, Riedel 1979b) periods points to the persistence of a pig-friendly environment in these areas. The far western sites of Casale di Rivalta and San Claudio are very similar in their balance between the three species. In contrast, the relationship between livestock frequencies is more variable in the Val di Secchia (Case Vandelli, Fiorano). This variation may result from local conditions and subsistence, or simply from the limited area chosen for excavation and small sample size of the assemblages.

Figure 2.3.2 Pig frequencies from sites in Emilia-Romagna, Lombardia, and the southern Veneto
Figure by the author. MBA = Middle Bronze Age. RBA = Recent Bronze Age. FBA = Final Bronze Age. Numbers indicate century BC.

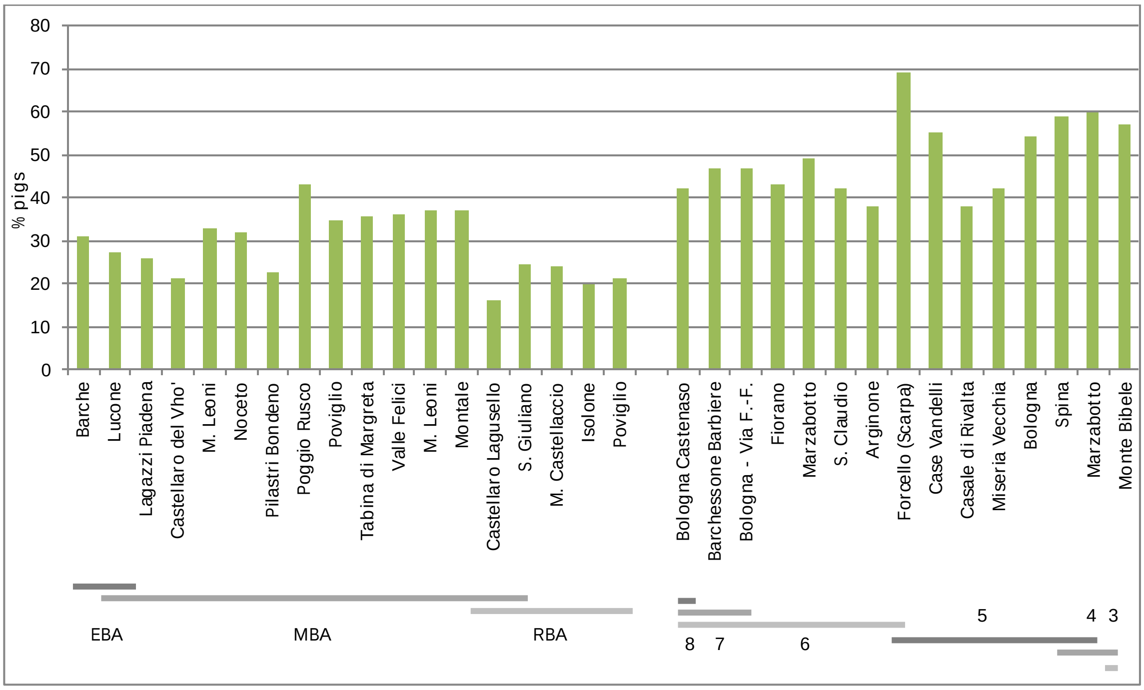
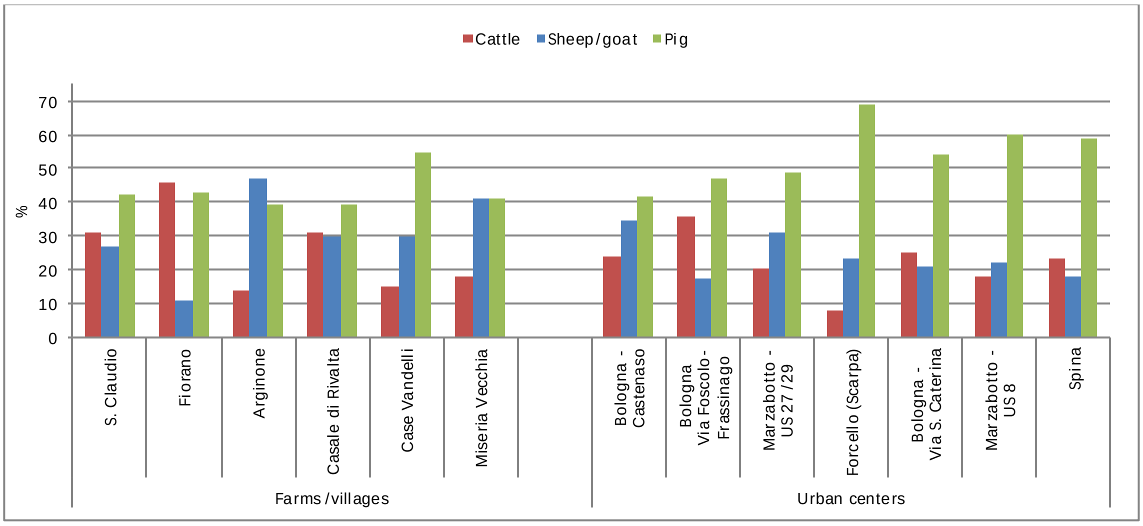


Figure 2.3.3 Species frequencies from northern Etruscan sites from the 8th–4th centuries BC
Settlements organized chronologically within groups. Figure by the author.



Iron Age assemblages from Trentino-Alto Adige are similar to those of the Bronze Age. Cattle and sheep/goat continue to remain more important than pig, although pig frequencies at some sites in the region (e.g. Stufels and Pfatten-Vadena) increase slightly between the Middle

Bronze and Iron Age, expanding from single-digit to double-digit proportions. A drop in pig frequencies at Bressanone-Elvas (Boschin 2006) illustrates that this was not a universal trend. In Friuli, in the far east of the Plain, livestock ratios are more mixed, although sheep/goat and cattle typically outnumber pigs (Petrucci 1996). However, pigs are of greater importance here than in mountainous areas, and they frequently reach over 20% of assemblages.

2.3.2 Central species frequencies

During the Bronze Age in central Italy, cattle and caprines were the most common type of livestock (Figure 2.3.4). Pigs were less frequent, but not as rare as on Alpine sites. Previous research has identified an increase in sheep/goat at the expense of cattle between the Middle and Recent Bronze Age (de Grossi Mazzorin et al. 2004; Minniti 2012), a trend that is visible within sites whose chronologies span this period: Pitigliano, Luni sul Mignone, Monte Rovello (de Grossi Mazzorin 1995b; 2001a). These authors have tied the rise in sheep/goat frequencies to the increasing differentiation of social cases and wealth accumulation that occurred during this period; flocks of sheep and their ability to produce meat, milk, and especially wool were an important asset. This situation remained fairly constant throughout the subsequent Final Bronze Age, until rising pig percentages (Figure 2.3.5) at some large settlements indicate a new focus on pork consumption (de Grossi Mazzorin 2001a; 2004; de Grossi Mazzorin and Minniti 2009b; Minniti 2012). This emphasis on pigs slowly increased during the Early Iron Age and into the Etruscan period, becoming especially visible around the eighth century BC in Rome and Tarquinia. This rise in the importance of pig rearing in central Italy has been linked to rising urban populations and the intensification of cereal production (ibid). Pigs would have been an ideal food source to supply to rising urban populations, because they have large litters, grow quickly, and do not require pasture for grazing. This model is best illustrated by the expansion of Rome, where pig frequencies over 50% appear in the ninth–eighth centuries BC and continue to rise in subsequent periods. Pig production escalated into the Roman Imperial period, when pig frequencies over 60–70% became common on sites throughout Italy (MacKinnon 2001; MacKinnon 2004a). Pork was central to the Italian diet in the Roman period, and increased pork consumption can be associated with the ‘romanization’ of parts of Italy (Love 2008) and the provinces (King 1999).

Figure 2.3.4 Central species frequencies for the Bronze Age and Iron Age/Etruscan period
Figure by author.

a. Bronze Age

b. Iron Age/Etruscan period

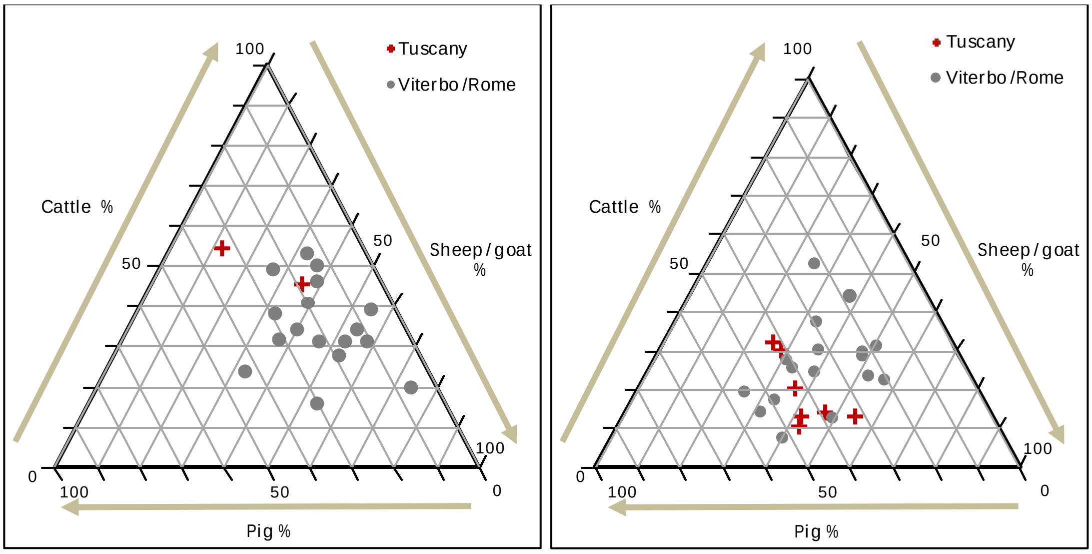
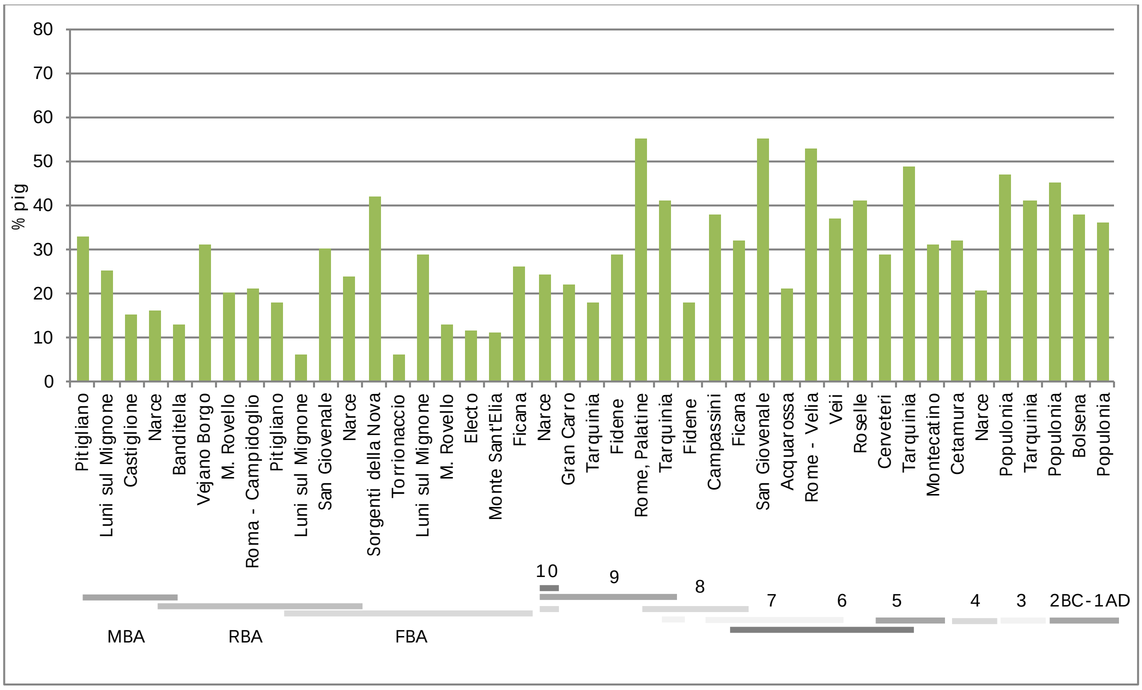


Figure 2.3.5 Pig frequencies from central sites for the Bronze Age and Iron Age/Etruscan period
Figure by the author. MBA = Middle Bronze Age. RBA = Recent Bronze Age. FBA = Final Bronze Age. Numbers indicate century BC.



2.3.3 *Etruscan livestock north and south*

As stated above, the major trend in livestock frequencies during the Etruscan period is an increase in pig consumption throughout the study region. This increase has been linked to a new strategy of urban provisioning in central (de Grossi Mazzorin and Minniti 2009b; Minniti 2012; de Grossi Mazzorin 2001a; de Grossi Mazzorin 2004) and subsequently in northern (Farello 2006) Italy. This model of pork production and consumption explains high pig frequencies during the ninth to seventh centuries BC at early urban centers like Rome, Bologna, and Tarquinia. The emphasis on pig husbandry continues through subsequent centuries in northern Italy, where larger settlements have high pig frequencies. However, the same situation does not develop south of the Po Valley. Pigs are the dominant species at only three locations in central Italy before the third century BC: Rome, Tarquinia and Roselle. Conversely, large pig populations are visible at Marzabotto, Forcello, and Spina in the fifth century BC, and pigs are also the dominant livestock type at smaller contemporaneous settlements in the Plain. Compared to Etruria padana, the shift toward pig production between the eight and fifth centuries is more variable and less marked in central Italy. At two major centers, Cerveteri and Acquarossa, pigs are the least abundant of the three main domesticates. De Grossi Mazzorin (2006a) attributes relatively low frequencies of pigs at Cerveteri to an inflation of cattle numbers due to bone working and at Acquarossa to collection bias on early excavations. Because caprines outnumber pigs in these assemblages, collection bias or the inflation of cattle frequencies is not enough to explain the departure from a pig-dominated pattern. While rising urban populations are decidedly one impetus behind the increase in swine production, differences in pig rearing on northern and central settlements demonstrate that pork consumption is not linearly linked to the degree of urbanism on a site. Areas on the eastern and southern periphery of Etruria and Lazio developed more slowly than central ones (Love 2008), but northern Etruscan sites display an earlier and more emphatic shift toward pig consumption than central settlements outside of Rome. Additionally, this increase in pigs is visible not only on urban sites, but also at more marginal settlements like Monte Bibele at the end of the first millennium BC. In this hill-top center, pigs may have proved a useful food source because of the abundance of local woodland pasture and a process of population consolidation in the face of waves of Celtic immigration (Farello 2006); however others have suggested that the development of a cultural penchant for pork led to its more universal adoption across site types (Curci and Cattabriga 2005; Curci 2010).

2.4 SECONDARY PRODUCTS AND SPECIALIZATION

2.4.1 Cattle – age and sex profiles

During the Bronze Age in both northern and central Italy, cattle were killed primarily in adulthood, although both juvenile and sub-adult animals were also culled. The presence of individuals of other ages in conjunction with an emphasis on the slaughter of adult animals indicates a mixed system of use, in which cattle provide meat, probably milk, and labor, without a strong emphasis on any one product. Most adult cattle are from the earlier part of this life stage, although the repeated presence of small numbers of senile cattle indicate that some animals were kept for lengthier periods. Individuals of advanced age attest to cattle's role in traction and possibly milk production. The occasional presence of a lesser peak in the culling of juvenile/sub-adult cattle suggests that prime meat was also of interest to some Bronze Age populations in both northern and central Italy. Age stages for central Italian cattle are presented in Figure 2.4.1; northern cattle mortality patterns could not be similarly quantified.

Because age data for cattle on northern sites is less standardized and frequently described only in broad terms, establishing precise trends for northern Italy is difficult. High proportions of animals under one year of age are rare, although young calves are present in small numbers in most Bronze Age faunal assemblages. Young animals would have been culled annually to save fodder over the winter and control herd size. Equally, culling a calf may have allowed humans to exploit the mother's milk. Uniquely for the Bronze Age, high percentages of fetal and neonatal animals have been recorded at sites in Trentino-Alto Adige. The large proportion of calves at Albanbühel and Sotćiastel demonstrate a greater emphasis on milk production than in other regions. With the exception of a few sites in the northernmost part of the region, Bronze Age cattle were typically raised within a mixed system of exploitation that did not specialize in any one product. Iron Age cattle across northern Italy were culled in a pattern similar to that of the previous era: the majority of animals lived into adulthood, although animals from other age classes (very young, juvenile, sub-adult, and elderly) remain present in smaller quantities. This distribution of cattle across the age spectrum indicates the continuation of a mixed use of these animals for meat, labor and milk. Bologna (Castenaso) is somewhat of an exception to this pattern as no very young cattle are present in the assemblage. However, without information on sample size, the importance of their absence is unclear.

Figure 2.4.1 Cattle age stages from central sites between the Bronze and Iron Ages (Minniti 2012:fig. 19)

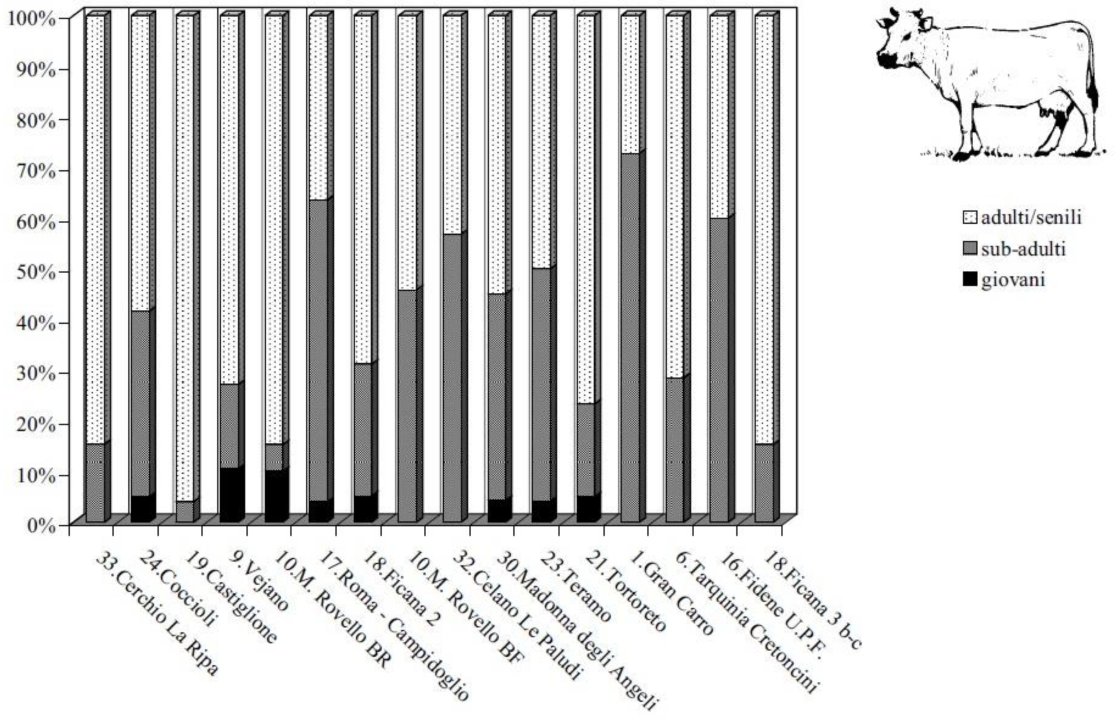


Figure 2.4.2 Cattle metacarpal shape from Barche and Canar
Figure by the author. See section 3.5.5 for abbreviations.

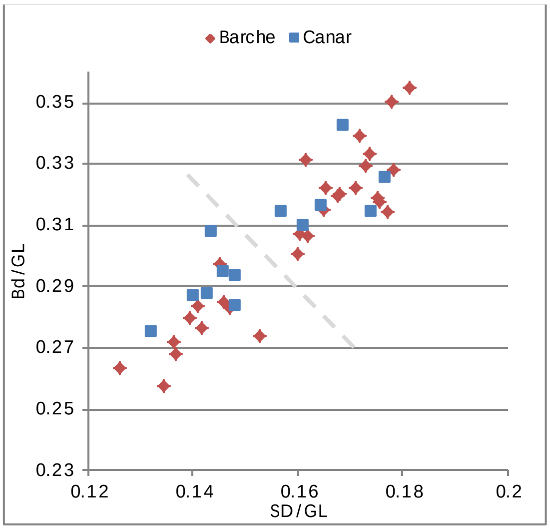
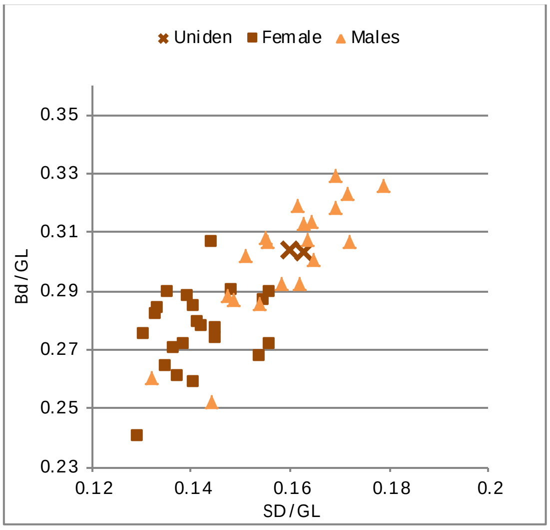


Figure 2.4.3 Cattle metacarpal shape from Isolone
Sex identified by Riedel (1976b).
Figure by the author. See section 3.5.5 for abbreviations.



In the Recent Bronze Age of Central Italy, Rome (Campidoglio) provides the earliest evidence of a cattle population raised primarily for meat. Over half of the herd was killed before adulthood. In the subsequent Final Bronze Age and early Iron Age the data is quite coarse, but it appears that in central Italy differences in cattle management became more polarized. More than half of the cattle at Gran Carro and Fidene were culled before adulthood, while at other settlements the proportion adult and elderly animals increased in tandem with the presence of stress-related pathologies. The overall trend in central Italy indicates an increase in the slaughter of sub-adult animals, which points to the rising importance of cattle in meat production. By the early Iron Age, cattle were very probably moving toward centers of consumption on a local, if not regional, scale (cf. Barker 1989).

Cattle sex ratios in northern Italy are fairly evenly split between males and females throughout the Bronze and Iron Ages. Etruscan sites show similar trends, although low sample size limits investigation of cattle sex. Assemblages with a predominance of either sex, like Cavalzara (females) or Terranegra (castrates), have small samples (less than twenty). The cattle measurements from Canar and Barche illustrate both the even split between males and females and the high level of sexual dimorphism visible in northern cattle during the Early Bronze Age (Figure 2.4.2). Males, which are more robust, plot to the right of the diagram, while females plot to the left. Interestingly, while faunal reports indicate that cattle sex ratios remained fairly equal across this period, we see less sexual dimorphism in the Recent Bronze Age at Isolone (Figure 2.4.3); perhaps castration was more widely practiced. Further aspects of cattle shape and size change are discussed below in section 2.5.1.

Overall cattle sex ratios in northern Italy appear to remain fairly evenly split between males and females throughout pre- and proto-history; however, these conclusions should probably be revisited in the future in order to address issues of small assemblage size and intra-population variation. For instance, at Pfatten-Vadena, female cattle outnumber males both in pelvises and horncores. Combined with the elevated frequency of cattle at the site, milk may have been an important part of the local economy. However, few very young cattle were found in the assemblage. These young individuals are normally expected in milk-producing economics (Payne 1973), although calves are not necessarily killed if the community is not interested in surplus production (Halstead 1998). In central Italy, analysis of cattle sex indicates that populations were dominated by females and castrates, a typically pattern of herd management (Minniti 2012). However, looking at the data from the later Bronze and Iron Ages in central Italy (Figure 2.4.4), differences between cattle sexes are not well defined, and there is a good level of variability in cattle metapodial size.

Figure 2.4.4 Cattle metapodial measurements from central sites (Minniti 2012:fig. 20)
c=castrate; f=female; m=male.

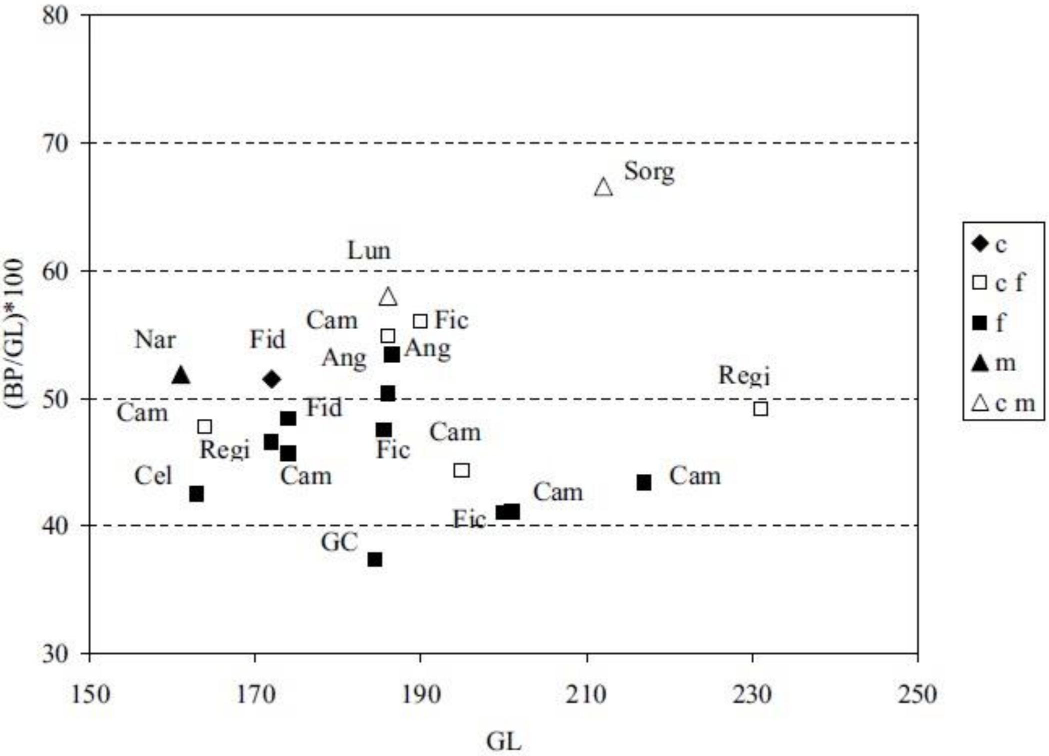
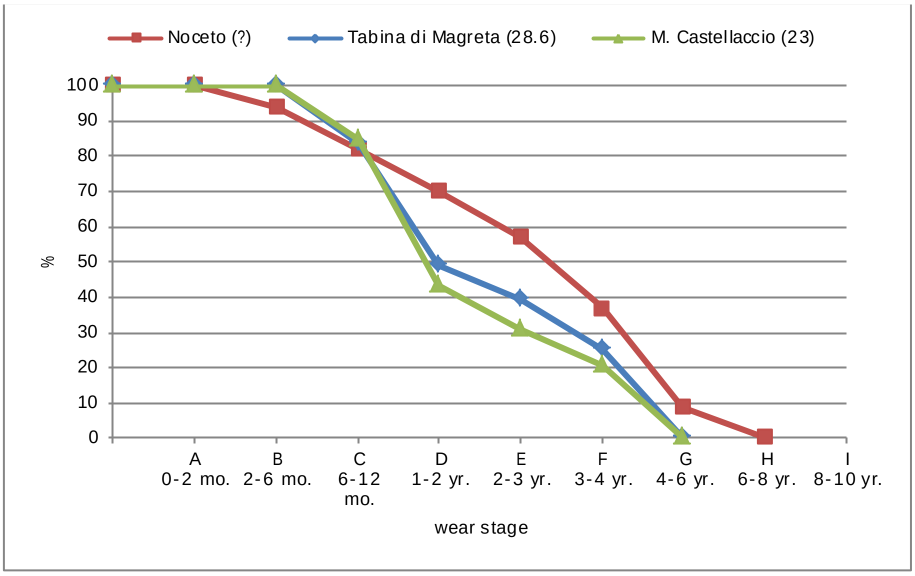


Figure 2.4.5 Sheep/goat kill-off curve for northern Middle Bronze Age sites
Wear stages follow Payne (1973). (n)=sample size. Noceto sample size not published. Figure by the author.



2.4.2 Sheep/goat – age and sex profiles

While goats are found in nearly all Bronze Ages assemblages, bones from sheep are far more prevalent – typically at least twice the number of goat remains. In both northern and central Italy, caprine age at death during the Bronze Age suggests a mixed use of sheep and goats primarily for meat, and secondarily for wool and milk. Most caprines are killed as sub-adults or young adults (between one and four years of age), but the presence of animals under one and over six years of age indicates that secondary products were also commonly exploited. The focus on these products varies somewhat between sites. A high proportion of female animals at Poviglio (Riedel 2004) may suggest a particular emphasis on milk production, while the absence of very young lambs at the *romagnolo* site of Monte Castellaccio and the *terramare* settlements of Tabina di Magreta and Noceto implies the opposite (Figure 2.4.5). However, these small samples should be treated with caution, because the absence of very young or old animals may relate to the limited size of the assemblages.

In central Italy, a shift toward the culling of older caprines is visible in the Final Bronze Age (Figure 2.4.6), signaling an increased emphasis on wool production (de Grossi Mazzorin 2001a; de Grossi Mazzorin 2006a; Minniti 2012). By the Iron Age, a pattern of sheep/goat management aimed at milk and wool production emerges at Rome (Velia) (Figure 2.4.7). Slaughter focuses on very young and mature adults, rather than sub-adult animals and young adults. However, despite a regional increase in reliance on pig meat, this pattern did not become a clear model for other settlements. During the same period at Gran Carro and Tarquinia (Cretoncini), young animals are well represented, but less emphasis is placed on wool production. The opposite appears to be the case in the seventh century BC at Monteriggioni (Figure 2.4.6), where few very young animals were killed in a more wool-focused system of husbandry. While sample sizes are low for these examples, a return to a meat-focused mortality curve is clearly visible in the larger sample from Populonia in the third century BC (Figure 2.4.8).

Figure 2.4.6 Kill off pattern for sheep/goat for central sites (De Grossi Mazzorin 2001a:fig. 1)
Sample size: Vejano = 15. Ficana 3b-c (II) = 40. Ficana zone 5 = 22. Monteriggioni = 21.6.

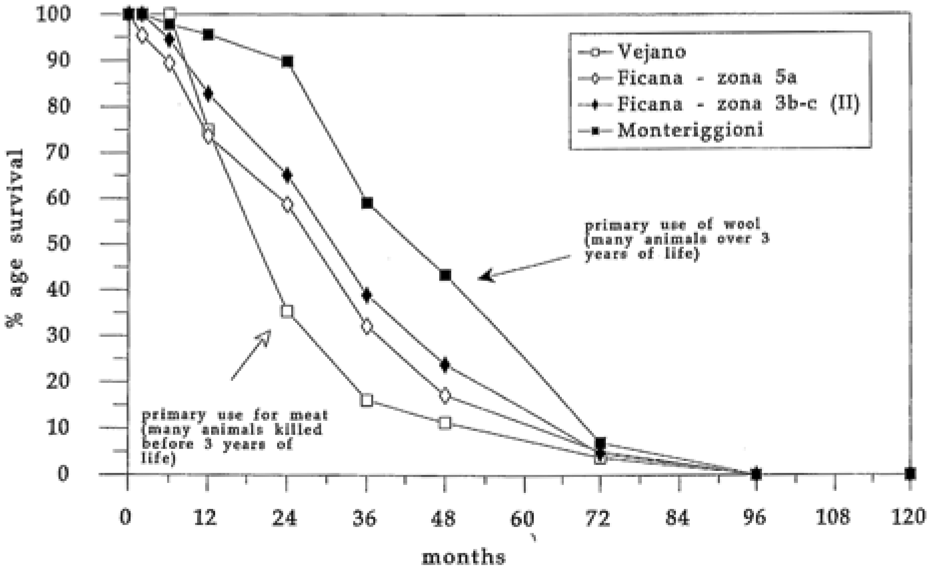


Figure 2.4.7 Kill off pattern for sheep/goat from Rome - Velia (Minniti 2012:fig. 26)
Wear stages follow Payne (1973). Sample size ≤ 16.

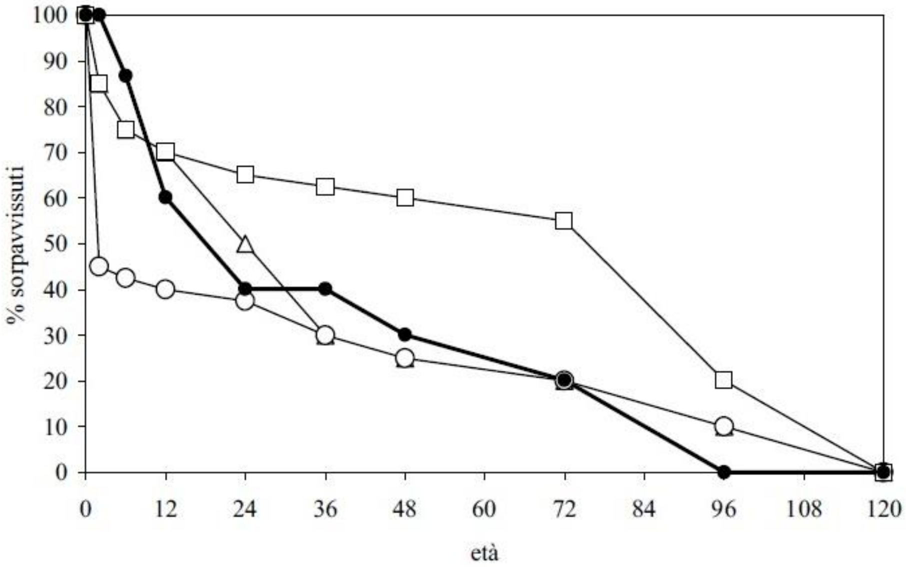
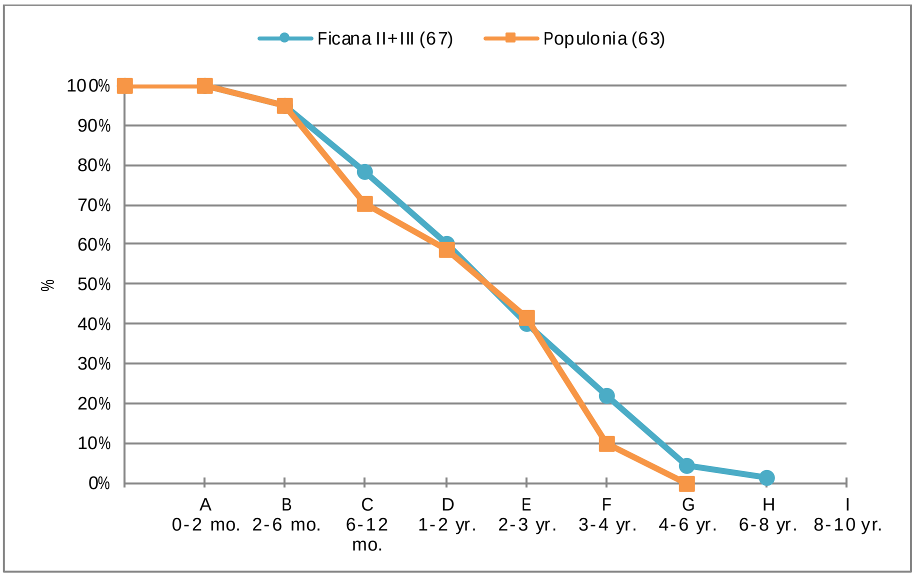


Figure 2.4.8 Kill off pattern for sheep/goat from central Etruscan sites
Wear stages follow Payne (1973). (n) = sample size. Figure by the author.



In northern regions caprine culling patterns in the Iron Age are not dissimilar to the previous periods and remain focused on a mixed use of caprines; however, some new trends emerge. At Pfatten-Vadena a change from the culling of mature sheep/goats to young animals is visible after the seventh century BC. Problematically, samples are small and differential recovery may influence these results. At the Venetian sites of Santorso, Colognola ai Colli, Castelrotto, and Padova, sheep/goat mortality patterns indicate an interest in meat and wool with a limited focus on the culling of very young animals. For two of these sites, Payne's mortality curves are also available (Figure 2.4.9). Sheep/goat culling on Etruscan sites of the same period is similar to that of Padova, which demonstrates a greater interest in very young caprines (Figure 2.4.10). These small samples must be treated tentatively, but a greater interest in milk production may have been present on these northern Etruscan settlements. Interestingly, there are very few individuals under one year in the larger Santorso assemblage; caprine milk production does not appear to have been a priority at this site. Rather, wool and mature meat are the focus. Like in Etruria, wool increased in importance with the development of Etruscan culture north of the Apennines (Farello 1995b). The presence of older animals at Castenaso and Marzabotto indicates an increased emphasis on wool production. The situation is different at Casale di Rivalta; no caprines older than four years were identified, but the mortality curve only includes 18 specimens. Elderly sheep/goat are also absent from several other Etruscan assemblages (e.g. Fiorano, Arginone, Miseria Vecchia, San Claudio). However, the samples from these sites are particularly small – sometimes only a few specimens.

Figure 2.4.9 Sheep/goat kill-off curve from Santorso and Padova
Wear stages follow Payne (1973). (n)=sample size. Figure by the author.

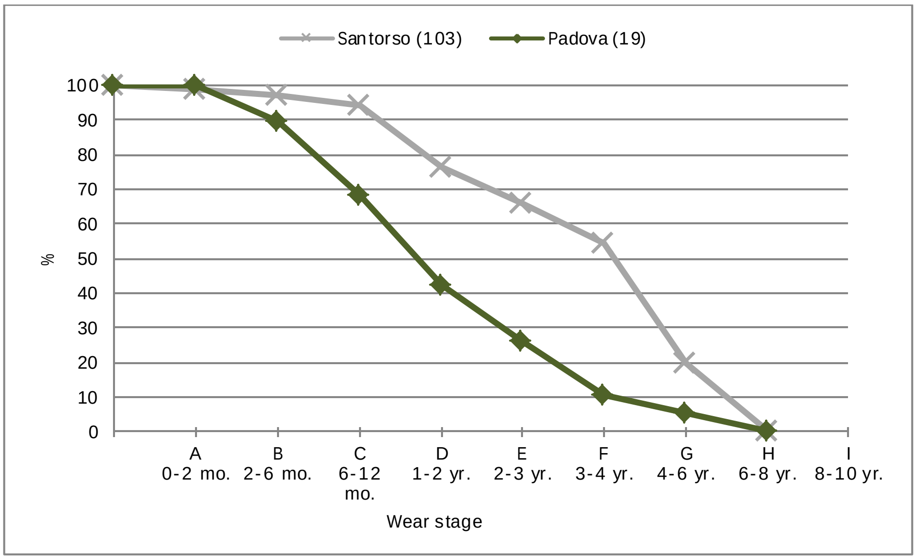
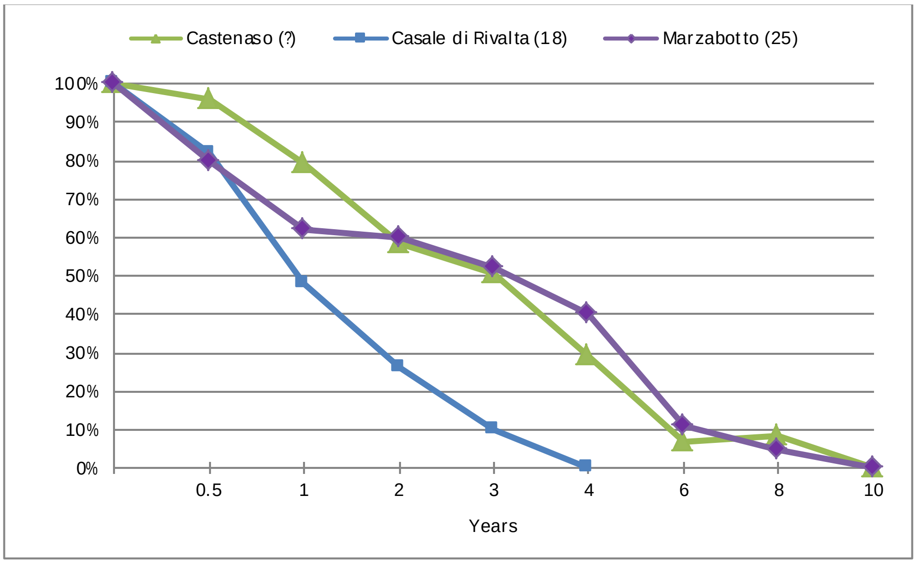


Figure 2.4.10 Sheep/goat kill-off curves for northern Etruscan sites
Wear stages follow Payne (1973). (n)=sample size. Castenaso sample size not published. Figure by the author.
Note the change on the horizontal access. Farello presents kill-off curves in the manner.
Without the raw data to re-draw the graph I have chosen not to change it.



An interest in milk production is visible in the far east of the Plain during the same period. Mortality data from Pozzuolo in Friuli indicates that over half of the population was slaughtered “when their dentation was still incomplete” (sample size unknown, Riedel 1984a:231). The culling of lambs continues at the Etruscan–Celtic site of Monte Bibele, where over a fifth of the animals were slaughtered in their first year (n=48). Interestingly, no elderly individuals were identified at this site. Perhaps this settlement/sanctuary was less concerned with wool production or involved in some sort of transhumance, but without the raw data we cannot reach firm conclusions. Likewise animal movement probably explains the meat-focused mortality curve at Populonia in the third century BC. As an urban center, animals raised elsewhere would have been brought to the city for consumption, generating a kill-off pattern which emphasizes meat.

Overall, Etruscan caprine mortality patterns indicate an increasing focus on secondary products. Culling strategies that include significant proportions of very young and old individuals, which were rare in the Bronze Age, become more common during the first millennium BC. In central Italy this specialization is first clearly visible at Rome. In the Veneto and southern Plain similar trends are present on Etruscan settlements. Celtic sites of the same period are more variable, and data remain coarse. The presence of goats, which were kept primarily for meat and milk, can also complicate the interpretation of mortality patterns; however, sheep are more common on all the sites where mortality curves are considered, and no relationship between the ratio of sheep/goat and mortality patterns is currently apparent. Further analysis is needed before we can certainly prescribe a geographic origin to the development of milk and wool exploitation in central Italy; however the broader trend increasing specialization in caprine management is clear. The return to a meat-focused model at Populonia indicates that livestock management was more hierarchically divided between centers and peripheral farms and villages by this period – a fact already illustrated by the predominance of pigs in the assemblage.

Little information is available on sheep/goat sex for this period in either region, but the existing data for both sheep and goats point to a roughly even split between the sexes, with little evidence for specialized culling. The identification of sheep/goat sex on northern Italian sites has frequently relied on horncore shape, which may not be a reliable method; it is certainly complicated by the presence of hornless sheep. Nevertheless, some trends are visible. Isolone has fairly equal numbers of the two sexes; Barche likewise has similar numbers of specimens identified as female and castrates. Canar has a predominance of females over castrates. The predominance of females over males is typically linked to their role in reproduction and providing milk. Pfatten-Vadena is the primary exception to this trend and female sheep/goats outnumber males when the pelvis is considered; the sexes are equally represented by horncores. Although very young sheep/goats are reported in the Pfatten-Vadena assemblage, their modest numbers suggest a mixed, if somewhat milk-oriented, economy, rather than highly specialized system of management. In central Italy similar trends are visible, although these are not universal, as the greater presence of males Early Iron Age site of Tortoreto demonstrates.

2.4.3 Pigs – age and sex profiles

As throughout much of history, pigs in north and central Italy were exploited primarily for their meat. Pigs were typically slaughtered as sub-adults or young adults; however both younger and older individuals were also culled. The presence of elderly animals at sites like Canar and Barche demonstrates that some pigs, possibly the best breeding sows or boars, were kept for a longer period. Younger animals are also common, and the presence of neonatal/very young piglets in both northern (e.g. Fiorano, Miseria Vecchia, Colognola ai Colli, Castelrotto, and Marzabotto - casa 1, Monte Bibele) and central (Ficana - zone 2 and Rome - Velia) settlements attests to the practice of local pig breeding throughout the first two millennia BC. Some inter-site variation in pig management is also visible. Normally pig slaughter patterns peak at the cusp of adulthood, but nearly half of the pig population (n=71) at Santorso was killed in its first year. Castelrotto also has a high proportion of very young pigs. A similar situation seems to have existed at San Claudio, although the lack of raw data makes it difficult to interpret this trend. One of the caves at Sorgenti della Nova contained a large quantity of neonatal pig remains, but these bones have been interpreted as the result of cultic activity, rather than domestic food debris (de Grossi Mazzorin 1998).

Data on pig sex is more numerous than for other species, because the animal's canine is highly dimorphic between the two sexes. On nearly all sites, male canines were more common than those of females. Spina is the sole exception, but the study presented only preliminary qualitative results, which may not prove to be an accurate representation of the assemblage. Because the male canine is much larger and more robust than the female equivalent, the predominance of males may relate to recovery bias inflating the collection of male specimens. This seems to be the case at Castelrotto and Colognola ai Colli, where males outnumber females in loose canines, but the reverse proves true when mandibles are considered. Considering the bias toward recovery of the male canine both sexes seem to have been present in roughly equal numbers.

2.5 INCREMENTAL IMPROVEMENTS: ANIMAL SIZE CHANGE

2.5.1 Cattle – biometry

Cattle size during the Bronze Age was hardly uniform, and it varied both between and within regions (Riedel 1986b; 1994; de Grossi Mazzorin and Riedel 1997; Riedel and Tecchiati 2002; de Grossi Mazzorin et al. 2004). The major trend visible in northern Italy during the Bronze Age is a general decrease in cattle size over the course of this period. At the very end of the Bronze Age/Early Iron Age, cattle size begins to increase in the Po Plain (Figures 2.5.1–2). Further significant increases in cattle height are visible in the Roman period. This trend is also visible in maximum withers heights (Table 2.5.1). Withers heights help reveal several other trends as well. Firstly, the dramatic increase in cattle size seen in Figures 2.5.1–2 is partially related to the geographic distribution of the sites. Alpine cattle are shorter than those in the Plain; when they are excluded the increase in cattle height between the Iron Age and Roman period is still significant but less dramatic. Additionally, the tables demonstrate that the range of cattle height measurements also increased in the Roman period.

Cattle in the northernmost mountainous regions follow a similar pattern, although they do not develop synchronously with those in the Po Plain and increase in size only after Roman influence (Riedel and Tecchiati 2002; Riedel and Tecchiati 1999b). Alpine cattle, and those in central Europe, remain small during the Iron Age, only to increase in size after the Roman conquest (Bökönyi 1974; Riedel 2002). The first evidence for larger cattle in the Po Valley is found at Pozzuolo del Friuli in the tenth and ninth centuries BC (Riedel 1984a). However, this location is not necessarily the origin of the change, because these centuries are underrepresented throughout the rest of the Po Valley. By the mid first millennium BC, larger cattle had become common throughout the Plain on both Etruscan (Farello 1995b) and non-Etruscan settlements (e.g. Colognola ai Colli and Castelrotto), and larger cattle are also present in the fifth century BC in the far eastern Plain near Udine at Gradiscutta (Riedel et al. 2006). Cattle size across northern regions continues to develop, sometimes at a rapid rate, in the Roman period.

Figure 2.5.1 Average cattle astragalus average length (GLl) for northern sites between the Neolithic and Roman period (Riedel 1997:fig. 2)
Neolithic: 1.Columbare. Bronze Age; 2. Lasino, 3. Monte Covolo, 4. Sonnenburg, 5. Albanbühel, 6. Barche, 7. Canar, 8. Ledro, 9. Poviglio, 10. Muraiola, 11. Isolone, 12. Peschiera, 13. Sabbionara. Iron Age: 14. Pfatten -Vadena, 15. Stufels H. Dominik, 16. Pozzuolo, 17. Castelrotto. Etruscan: 18. Spina. Roman 19. Aquileia.

m

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Figure 2.5.2 Average cattle 1st phalanx length (Glpe) for northern sites between the Neolithic and Roman period (Riedel 1994:fig. 6b)
NR = number of remains. Neolithic = NL, Bronze Age = BA, Iron Age = IA, Roman period = RA.
Data from (in order): Colombare, Barche, Lasino, Canar, Ledro, Albanbühel, Sonnenburg, Poviglio, Isolone, Settiponti, Appiano -Eppan, Pfatten -Vadena, Stufels H. Dominik, Pozzuolo, Colognola ai Colli, Castelrotto, Spina, Stufels/Innichen, Altino, Aquilieia.

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Riedel (Riedel 1986b; 1994; Riedel and Tecchiati 2002) also identified a change in horncore form through time, an attribute that sometimes evolves independently from cattle size. Early Bronze cattle have smooth, large, long, and thin-walled horncores (e.g. Barche, Ledro) that give way to small, short forms with thick walls in the late Bronze Age (Isolone) and Iron Age in the far north (Pfatten-Vadena, Stufels H. Dominik). A third horncore type appears in the Plain during the Iron Age: a medium-sized, strong, thick and deeply furrowed variety is visible at Pozzuolo, Colognola ai Colli, Terranegra, Castelrotto, but not in Alpine regions. Riedel identifies a fourth group of Etruscan and Roman horncores (larger, slender, elongated) at Spina and Aquileia. At the latter of these sites, Riedel (1979a) hypothesizes the presence of three types of cattle based on horncore forms: an improved Roman type, a large semi-local type perhaps also visible at Etruscan Spina, and an older local landrace. Considering the time scale in question – over two millennia – changes in horn form are not surprising. However, the timing, extent, and cause of these changes remain obscure. Riedel discusses how age, sex, and pathology, in addition to breed/type differences, can also influence horncore shape, and while recent or modern breeds provide some analogs for identifying horncore sex and type, caution must be taken when applying these conclusions to ancient populations (Riedel 1993). Different types of horncores are visible in the Aquileia assemblage, but much variability exists with the region, and further work is needed before confidently assigning cattle breeds to cultural groups. Cattle may have been introduced by the Etruscans or other peoples migrating through and settling in northern Italy, but currently the evidence is too sparse to separate the movement of animals from local development.

Changes in cattle size also occurred in central Italy. Bronze Age and Early Iron Age cattle in this region were small but variable in size and form (Figure 2.5.3–4), although their stature is not dissimilar to that of northern populations (Table 2.5.2). Cattle size remains relatively stable until the Archaic period, when larger cattle being to emerge (Figure 2.5.5). These animals are thought to be the product local animal improvements which began in the Early Iron Age and escalated in the fifth–third centuries BC (de Grossi Mazzorin 1995a). By the end of this period, cattle of exceptional size are present at Populonia. Cattle continued to develop into the Roman Imperial period, although they still varied both in size and form across the peninsula (MacKinnon 2010). Rugged, upland areas adopted Roman/central Italian improvements at a slower and more uneven pace than central regions (Love 2008). Ancient authors do not specifically distinguish between cattle breeds in central and northern Italy, but they do differentiate between those in central Italy and Alpine areas. The cattle of Etruria and Latium are noted as being thick and powerful, while Alpine cattle were especially suited to milking (Columella, *De Re Rusitca* 6.24.5; Pliny, *Natural History* 8.70.179; MacKinnon 2010) – traits still present in characteristic heritage breeds of these areas.

Figure 2.5.3 Cattle distal tibia size from central sites between the Bronze and Iron Age (Minniti 2012:fig. 30a)
See section 3.5.5 for abbreviations.

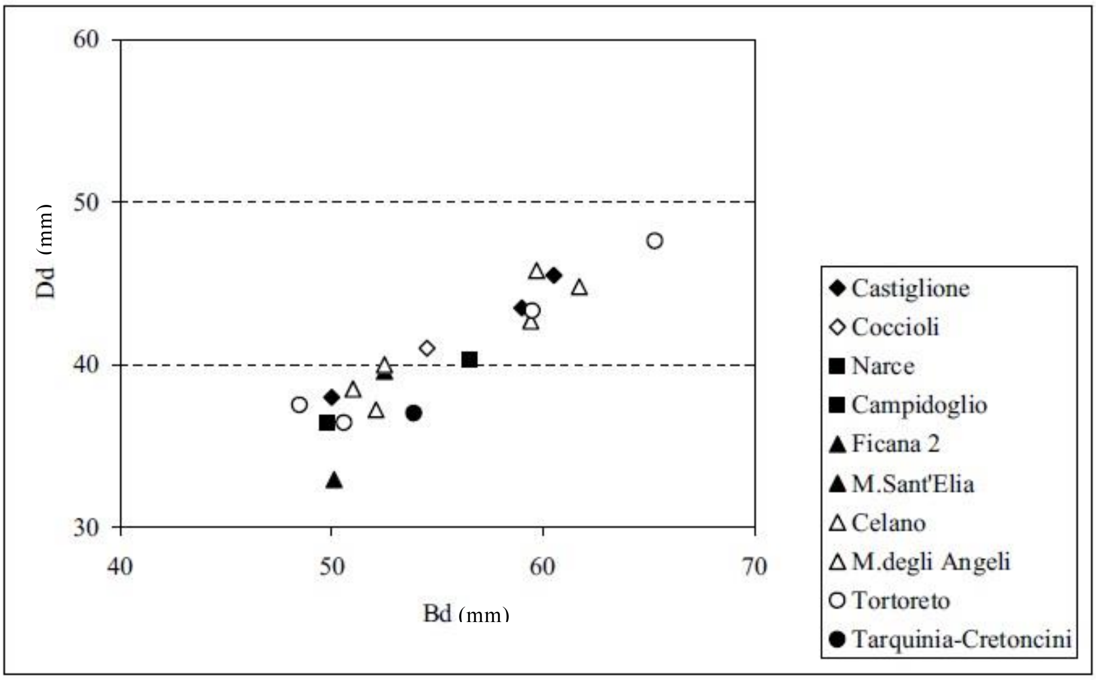


Figure 2.5.4 Cattle astragalus shape from central sites between the Bronze and Iron Age (Minniti 2012:fig. 30b)
See section 3.5.5 for abbreviations.

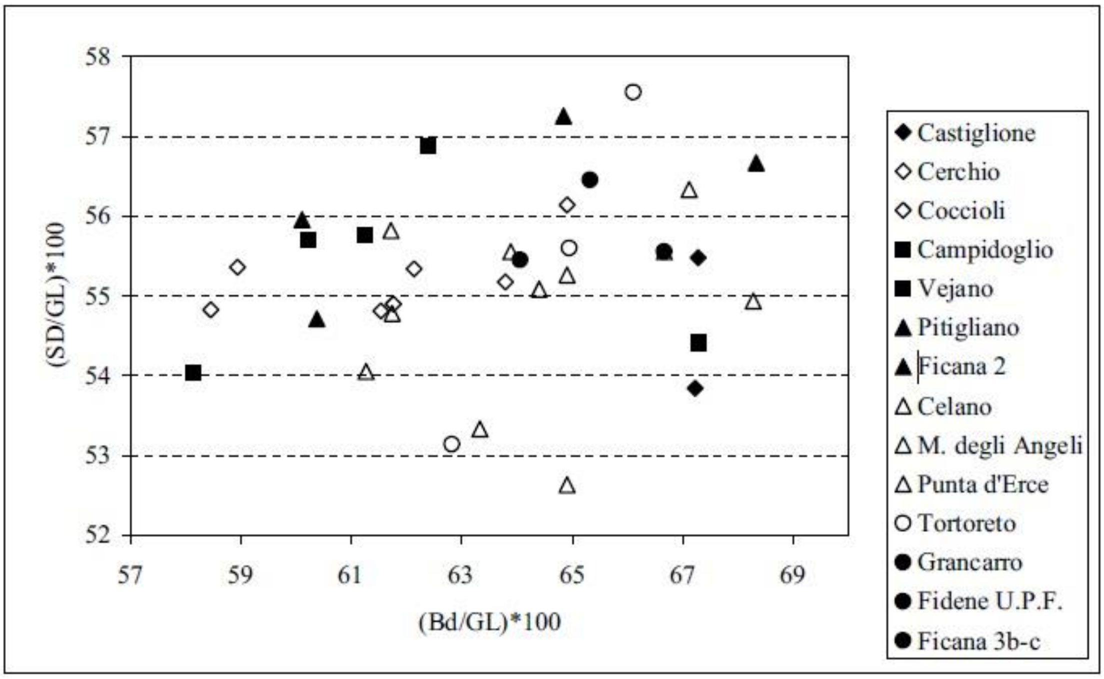
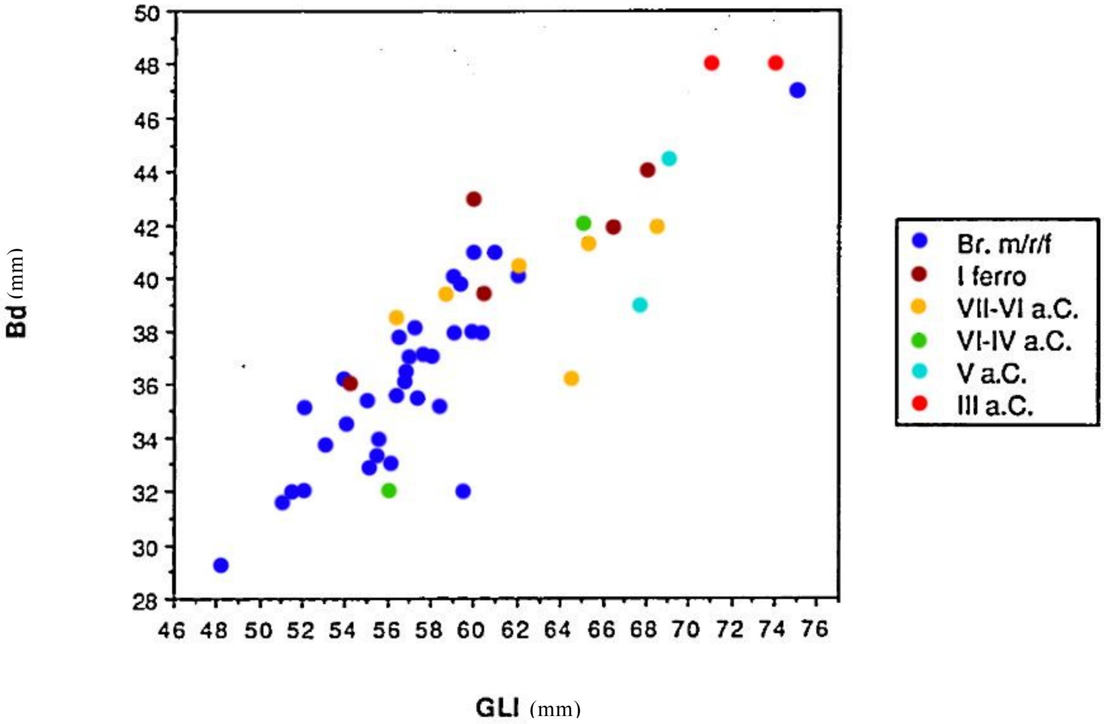


Figure 2.5.5 Cattle astragalus size for central sites between the Bronze Age and 3rd century BC
Adapted from de Grossi Mazzorin (1995a:fig. 4a). See section 3.5.5 for abbreviations.



2.5.2 *Sheep/goat – biometry*

Like cattle, sheep and goats also varied in size across different parts of the Italian peninsula (Riedel 1986; 1994; de Grossi Mazzorin et al. 2004). Most of our knowledge relates to the more common of these species: sheep. During the Bronze Age, sheep in the Po Plain were especially small, with an average withers height under 60 cm (de Grossi Mazzorin and Riedel 1997; de Grossi Mazzorin et al. 2004). Their height remained fairly stable across the Bronze Age until larger animals appeared in the Final Bronze Age/Early Iron Age in Trentino-Alto Adige at Sabbionara and Pfatten-Vadena (Riedel and Tecchiati 1999b; 2002). By the Iron Age larger sheep were also present in the Plain at Fondo Paviani (Riedel 1994; de Grossi Mazzorin 1996c). These trends are visible in the proximal metacarpal (Figure 2.5.6). However, because it lacks an epiphysis to constrain the articulation, the proximal metacarpal is an age-dependent measurement. Withers heights (Table 2.5.3) provide confirmation of the size increase seen in carpine metacarpals. Hornless sheep, probably ewes, were also common throughout prehistory in the Po Valley (Riedel 1994). Unlike in cattle, the only change in sheep horncore form is the appearance of a more robust type during the Roman period (Riedel 1986). However the current dearth of osteological evidence for the Etruscan period does not necessarily indicate that animals were not moved into and around the region at this time. Sanford (2012) has recently illustrated that the Greeks were moving sheep into southern Italy after the eight century BC; the same may have been true for the north as well.

Sheep in central Italy follow similar trends to those discussed above. Bronze Age animals were small in stature, although they vary throughout the region (Figure 2.5.7, Table 2.5.4). Their size remained relatively constant until a new pattern emerged in the Final Bronze Age. At this point, a greater range of size variability is visible within sheep/goat populations. This increase in variability may relate to the introduction of new types (Minniti 2012). Mean animal size remained fairly stable until the Archaic period, when it began a slow increase (de Grossi Mazzorin 1995a). Like in cattle, sheep size increased noticeable by the third century BC when especially large animals are visible at Populonia (Figure 2.5.8).

Figure 2.5.6 Average sheep metacarpal proximal breadth (Bp) for northern sites between the Neolithic and Roman period (Riedel 1994:fig. 6c)
NR = number of remains. Neolithic = NL, Bronze Age = BA, Iron Age = IA, Roman period = RA.
Data from (in order): Barche, Canar, Ledro, Albanbühel, Poviglio, Isolone, Sabbionara, Pfatten -Vadena, San Briccio, Pozzuolo, Colognola ai Colli, Castelrotto, Spina, Stufels/Innichen, Altino, Aquileia.

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Figure 2.5.7 Sheep/goat withers height for central sites between the Bronze and Iron Age (Minniti 2012:fig. 33)

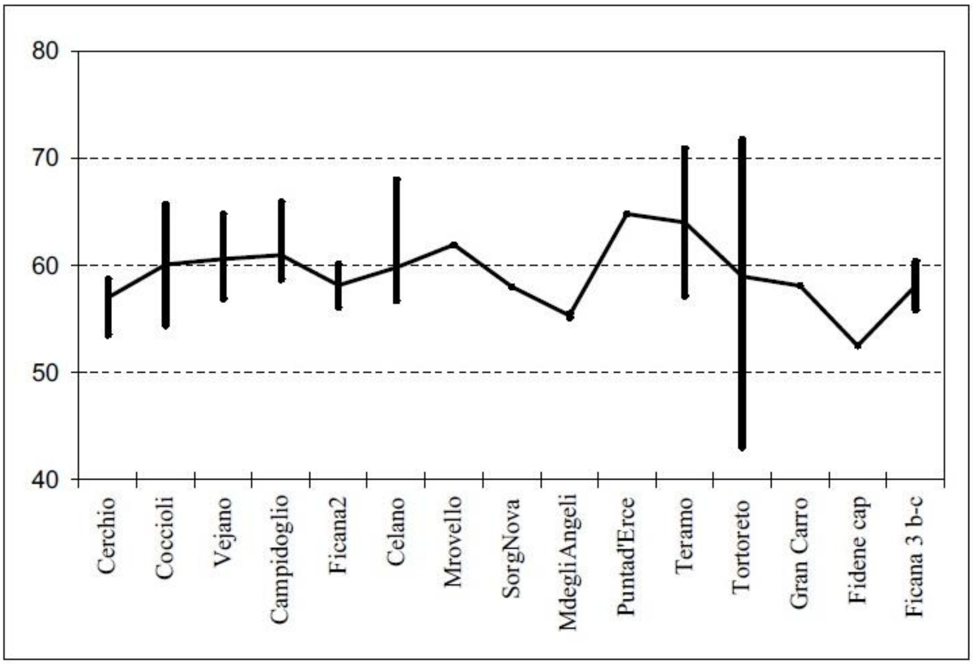
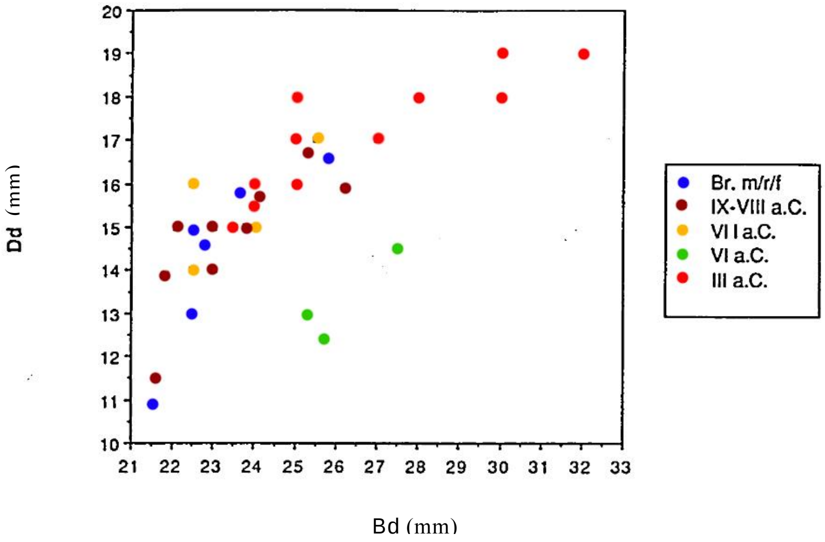


Figure 2.5.8 Sheep/goat distal metacarpal size from central sites between the Bronze and Iron Age
Adapted from Grossi Mazzorin (1995a:fig. 5). See section 3.5.5 for abbreviations.



Sheep in both north and central Italy continued to develop during the Roman period, although this change is less pronounced than in cattle (Riedel 1994; de Grossi Mazzorin et al. 2004; MacKinnon 2004a). Some differences in sheep size are noted by Roman authors. Sheep in lowland regions are described as taller than those in rougher mountainous areas (Columella, *De Re Rustica* 7.2.3), an expected distinction considering the more taxing nature of upland environments. Classical authors dedicate more words to the wool produced by different sheep breeds (cf. MacKinnon 2004a:115). The production of quality wool for use in textiles would have been an important aspect of both the Roman and pre-Roman economy (Jones 1960; Gleba 2008b), and by the Imperial period sheep employed in wool production were probably well developed, considering sheep mortality profiles already show an interest in the product in the eighth century BC.

Less information is available for goat size change. These animals tend to be slightly taller than sheep, but generally follow the same developmental trends.

2.5.3 Pigs – biometry

Unlike other domestic livestock, no clear size trends are visible in pigs in either northern (Riedel 1986; 1994; Riedel and Tecchiati 1999b; 2002) or central regions (Minniti 2012). Compared to other forms of livestock, the distribution and development of pig size is more varied and irregular (Figure 2.5.9), and their stature remains fairly constant into the Roman period (MacKinnon 2004a). Comparing pig height between north and central Italy (Tables 2.5.5–6), pigs in the latter region appear to be slightly shorter (de Grossi Mazzorin et al. 2004), although there is a high degree of variability between sites. Approaching the issue on a longer time scale, beginning in the early Neolithic Albarella et al. (2006) identify a progressive decrease in the size of domestic pigs in Italy accompanied by a similar increase in the size of wild boar. This gap between domestic and wild populations is clearly visible at northern Bronze

Age sites like Canar (Figure 2.5.10) and Barche. This trend may also be visible in maximum withers heights of domestic pigs, which in northern Italy are slightly lower in later periods.

Figure 2.5.9 Average pig distal humerus width (Bd) in northern Italy between the Neolithic and Roman period (Riedel 1994:fig. 6d)
NR = number of remains. Neolithic = NL, Bronze Age = BA, Iron Age = IA, Roman period = RA.
Data from (in order): Colombare, Barche, Canar, Ledro, Albanbühel, Poviglio, Isolone, Ptatten-Vadena, Pozzuolo, Castelrotto, Spina, Aquileia, Verona.

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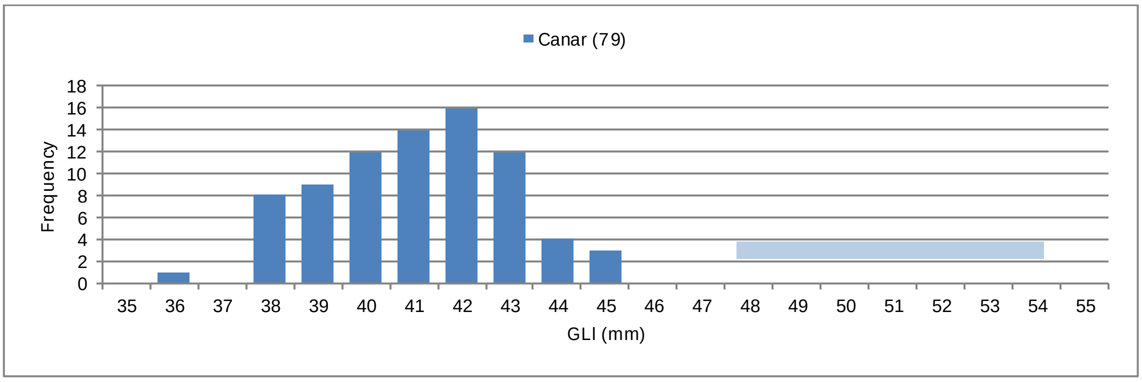
Figure 2.5.10 Pig astragalus length (GLl) from Canar
Blue bar indicates Canar wild boar size range (individual measurements not published). Figure by the author.



2.6 BEYOND THE TABLE: OTHER DOMESTIC ANIMALS

2.6.1 Equids

Horses disappeared from the Italian peninsula at the end of the Pleistocene and once again appeared on Bell Beaker sites in the Chalcolithic period (de Grossi Mazzorin 1996d). Horses are very rare during the early Bronze Age, although their remains have been recovered from the Barche and Sonnenburg in northern Italy and the Bracciano Lake (Vicarello) in central regions. In the Middle Bronze Age horses were more widely adopted throughout the peninsula (cf. de Grossi Mazzorin 1994a; Minniti 2012:109). The distribution of horses throughout northern Italy and the recovery from *terramare* sites of horse bits fashioned from deer antler and of early cart wheels suggests a re-introduction of horses from central Europe through the Po Valley and subsequently down the Italian peninsula (de Grossi Mazzorin 1996d; de Grossi Mazzorin et al. 2004). By the Iron Age horses had become more widely distributed and more numerous, but they remained a status symbol accessible only to the elite. Horse bones are commonly recovered, albeit in small numbers, from Etruscan sites, and they feature prominently in Etruscan art. Bronze horse bits and trappings are also frequent Etruscan grave goods that attest to both the wealth and military prowess of the deceased. Profound expressions of equestrian wealth are found in funerary chariots, such as those at Adria, Populonia, Castro, and Spoleto. Indeed, the sixth century BC Monteleone chariot from Spoleto is not only a testament to Etruscan skill in bronze-working, but also one of the best preserved chariots of the ancient world (Figure 2.6.1). Like other species, horse size also increases during the Iron Age, and especially in the Roman and Late Antique periods (de Grossi Mazzorin 1995a). Horses remained a prestigious animal in Roman Italy, where they were used for racing, military purposes, pulling carriages and chariots, and breeding; however they were not used as draught or pack animals (White 1970:297–299).

Figure 2.6.1 Monteleone chariot
c. 530 BC, Metropolitan Museum of Art, New York.

Donkeys appear to have been introduced to Italy in the Recent Bronze Age (cf. de Grossi Mazzorin et al. 2004; Minniti 2012:109). In contrast to horses, they first appear in southern Italy before becoming more widely diffused. Early identifications of this species are noted at Luni sul Mignone and Sorgenti dell Nova in central Italy. Donkeys also became more common in later periods, and their remains have been recovered from the Etruscan sites of Arginone, Spina, and

Marzabotto (casa 1; uncertain identification, cf. Curci 2010:400) in northern Italy and Republican levels at San Giovenale. They are rarer in the archeological record than horses, a reflection of both their lower numbers and the difficulty of distinguishing their remains from those of the more common species. This problem is further complicated by the possible occurrence of horse/donkey hybrids – hinnies and mules – the latter of which was widely used in Roman times (White 1970:294–296).

The scarcity of equid remains throughout pre-Roman Italy and the very limited occurrence of butchery modifications on these bones suggest that these animals were never widely used as a food source. This pattern continues into the Roman period. Writing in the first century AD, Tacitus describes how starving soldiers consumed horses, even though they were considered "unclean and disgusting" (*Histories* 4.60). Horses also had an important function in ritual activity, especially in northern Italy. Horse burials appear at Palaeo-Venetian sites, such as Este, Padova, Altino, and Oppeano, and also in Etruscan contexts, both in northern Italy, at Adria (Tomba dell Biga), Casalecchio di Reno, Villanovan Bologna, and in Etruria at Castro (Farnese) and Populonia (Fossa della Biga) (cf. Azzaroli 1972; de Grossi Mazzorin 1996d; Donati and Rafanelli 2004). With the exception of an annual Roman sacrifice to the god Mars (Bennett Pascal 1981), horses were not used commonly as sacrifices in either Etruscan or Roman religion.

2.6.2 Dogs

Throughout the last two millennia BC, dogs were important guards, hunters, and companions, and small numbers of dog remains are frequently recovered from sites throughout Italian prehistory. They are typically described in the literature as "spitz type" dogs (Figure 2.6.2). Like other domestic mammals, the size and morphology of dog populations in northern Italy evolved over the Bronze and Iron Ages. Some variation in size began to appear in dog populations during the Bronze Age (Riedel 1994; Riedel and Tecchiati 2002). In the subsequent periods dog size became increasing variable, with the appearance of large and small breeds during Roman times (de Grossi Mazzorin and Tagliacozzo 1997). Like horses, dog were not normally consumed. However, butchery marks on bones indicative of dismemberment or filleting (rather than skinning) indicate that dogs were sometimes eaten. Dog bones with cut or chop marks have been recorded at Luni sul Mignone (mandibles), Trasacco (femur), Tortoreto (atlas), Rome (Domus Reggia, atlas), and Montecatino (mandible, vertebra) in central Italy. In northern Italy butchered dog bones have been found at Albanbühel (scapula, metacarpal), Santorso (distal tibia, proximal femur), Fiorano (tibia, mandible), and Casale di Rivalta (atlas, ulna) (for site references cf. Tables 2.1.1–3 and Minniti (2012:45,61,92)). Overall, evidence of dog butchery is rare, and dog carcasses may also have been disarticulated for non-culinary reasons. For instance, the recovery of a dog femur shaped into a handle from Santorso illustrates that dogs also provided raw materials for tool production. Because of the plurality of roles fulfilled by dogs throughout pre-Roman Italy, their presence in funerary contexts, foundation deposits, and sacrifices is not surprising. Textual sources attest to their use in Umbrian and Roman religion (Smith 1996; de Grossi Mazzorin and Minniti 2006; 2008; Wilkens 2006), and special dog burials in tombs and deposits in sanctuaries are also known in Etruscan culture (e.g. Caloi and Palombo 1980; de Grossi Mazzorin 2001b).

Figure 2.6.2 Modern Italian spitz-type dog (Volpino Italiano)
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2.6.3 Chickens and geese

Domestic chickens arrived in Italy during the early Iron Age but were not widely adopted until the Etruscan period (de Grossi Mazzorin 2005). While chicken bones have been recovered from two Bronze Age *terramare* sites, Monte Castellaccio and Montale (cf. de Grossi Mazzorin 1996c), these remains are currently considered to be intrusive and later in date. The earliest securely dated presence of chicken in Italy is recorded at the necropolis of Castel Gandolfo (Bartoloni et al. 1987) in the ninth century BC. Domestic fowl appear in similar contexts in the Po Plain shortly afterward, during the eighth century BC (Bertani 1995). Eggshells have been recovered from Villanovan tombs at Villanova (Caselle) and Bologna (Castenaso) (ibid.), but these early identifications need to be revisited. Chicken remains became more frequent in habitation contexts in northern Italy starting in the sixth century BC, and bones have been recovered from both large centers like Marzabotto and the smaller settlements of Casale di Rivalta and Case Vandelli. One chicken bone – the diaphysis of a radius – was also documented at San Claudio. Considering the difficulty of this identification and the specimen's location just under the plow zone, this identification should probably be considered tentative. The diffusion of the chicken into central Europe occurs along a similar time frame (Benecke 1993), so the appearance of domestic fowl at Santorso and the necropolis of Santa Maria di Zevio (Riedel

1992) is unsurprising. Chicken remains and eggshells also became more common in central Italy during the same period, although they are restricted to funerary (e.g. the necropoli of Osteria, Cerveteri, Tarquinia, and Fidene), cultic (Pyrgi, Cardini 1970), and elite contexts (Tarquinia - phase 2). After the fourth century BC, domestic fowl became more widely distributed in central Italy, and their remains also appear outside the religious/elite sphere, for instance at Blera (Scali 1987), Musarna (Tagliacozzo 1990), and Populonia (de Grossi Mazzorin 1985b). Chicken became more abundant in the Roman period in both habitation and ritual contexts. In Roman religion they are closely associated with Mithras, and large numbers of chicken bones are frequently found on cultic sites dedicate to him (de Grossi Mazzorin and Minniti 2001b; Lentacker et al. 2004).

The bones of geese are present in northern Italy at Miseria Vecchia and Bologna (Castenaso). Wild geese have been identified at Bologna (Via Foscolo-Frassinago) and Ficana (zone 3 b-c). The remains of a large anseriform (possibly a goose) were found at Fiorano. At least a few of these geese were probably also domestic birds. Geese were domesticated in Ancient Egypt by the late fourteenth century BC, and by the eighth century BC had made their way to Greece (Albarella 2005). By the Roman period several varieties had emerged. Pliny the Elder (*Natural History* 10.26–27) speaks of geese acting as guards, the tastiness of their liver, and the uses of their feathers. Other authors dedicate a few words to managing these birds (Varro, *Rerum rusticarum* 3.10; Columella, *de Re Rustica* 8.13–14). Considering the well-developed relationship between Romans and geese by the first century BC, Etruscan and Celtic peoples must have also been involved with raising these birds. However, in contrast the adoption of domestic chicken, much less in known about the diffusion of geese in Italy during the Etruscan period.

2.6.4 Cats

Wild cats appear at a small number of northern Italian sites in the Bronze Age and Etruscan period (e.g. Canar, Terranegra, Luni sul Mignone, Arginone, Pyrgi (Caloi and Palombo 1988–1989)). However, the oldest documented evidence for domestic cats in Italy may come from the eighth century BC at Fidene, where the complete skeleton of an adult animal, possibly trapped inside a building during its destruction, was identified (de Grossi Mazzorin 1997a). This identification is not universally accepted, however (cf. Masseti 2000:139). Domestic cat remains have also been identified in slightly later assemblages from Cures Sabini (Ruffo 1988) and Ficana (de Grossi Mazzorin 1989). Cats may have been introduced to southern Italy via Greek contact, and their rarity would have made them an exotic species, probably restricted to the elite classes. While fantastic felines like lions and leopards abound in Etruscan art, domestic cats are less frequently depicted (Ashmead 1994). When they do appear, their setting often reinforces their high status – cats are pictured under banqueting tables and couches in Etruscan tomb art.

CHAPTER 3

THE FORCELLO FAUNAL ASSEMBLAGE: MATERIALS AND METHODS

3.1 INTRODUCTION

3.1.1 Introduction

This chapter provides information on the Forcello faunal assemblage and describes the methods used in this dissertation and the reasoning behind their selection. Underlying the broad aims of this research is a need to reconstruct the structure of livestock populations and their management strategies. From these models we can then draw inferences about local land use, the focus of production, and the cultural attitudes that shaped husbandry regimes. The methods of data collection and analysis used in this dissertation were chosen because of their ability to comment directly on animal exploitation at Forcello. Species frequency, skeletal element distribution, sex ratios, age at slaughter, and animal size and shape are central lines of evidence in this investigation. In conjunction with these academic concerns, practical constraints also influenced the choice of method. Particular attention was paid to both the timescale and accuracy of data collection.

At its core, this project deals primarily with animal exploitation at the site of Forcello and its relation to that of other Etruscan sites. Research was therefore focused on the study site and is organized into three broad phases: data collection, analysis, and interpretation. The first stage, data collection, involves identification and documentation of the faunal remains not included in the Scarpa (1988) report. In order to cover the entire assemblage within the time frame of this project while providing an accurate record of the faunal evidence, a selective, diagnostic zone-based recording protocol was employed. The second major project phase was the analysis of the collected data, which is presented in Chapter 4. Standard zooarchaeological analyses commonly encountered in faunal reports are included in this investigation. Other methods of analysis, less commonly adopted on Italian sites, are also used to address specific research questions. New results are then compared with those from the previous report. Chapter 5 presents a regional and chronological comparison used to place Forcello in the wider context of Bronze and Iron Age Italy. The remainder of this chapter details these three project phases and provides specific information on methods and materials employed in each.

3.1.2 Overview of the assemblage

The faunal assemblage at Forcello is divided into two parts: material examined by Scarpa in the 1988 report and more recent material identified and analyzed as part of this dissertation. Together these two studies encompass nearly all of the faunal remains excavated at Forcello from the initial excavations through the 2010 season; only fish (currently under study by H. Russ) and mollusks (presented in a preliminary report by Franchini (1988)) are excluded. The duration of the settlement at Forcello, and therefore the entirety of the faunal assemblage, spans the sixth to fourth centuries BC. As no known habitation occurred before or after the Etruscan period, there are not problems with residual material, except perhaps the possible intrusion of later material into strata disturbed by plowing. The vast majority of the assemblage was hand collected, a recovery method which biases against small elements and young animals (Payne 1972; Payne 1975). Due to the substantial size of the assemblage, data was primarily collected in Italy at Bagnolo San Vito (Mantova) where the faunal remains are currently stored.

3.1.3 Terminology

In consideration of the confusion surrounding zooarchaeological vocabulary (Casteel and Grayson 1977; Lyman 1994a; Lyman 2008), this dissertation strives to be clear in its usage of various terms and abbreviations. The majority of the nomenclature used in this paper follows Lyman (2008). ‘Specimen’ refers to any bone, tooth or fragment thereof, any individual skeletal remain, anatomically complete or not. ‘Remains’ and ‘material’ are used interchangeably to describe groups of specimens. A ‘skeletal element’ is a complete, discrete anatomical unit, for example a complete radius or lower third molar. Elements include ‘skeletal parts,’ which refer to specific sections/portions of bones and teeth, *e.g.* the proximal epiphysis of a radius, the occlusal surface of a lower third molar. Methods of quantification, their various titles, and their relevant references are explained in section 3.5 below. While care has been taken to avoid the creation of superfluous new acronyms, analytic methods are precisely titled to avoid confusion with similar, but not identical, techniques. Scientific names for animals identified at Forcello are listed in Table 3.5.1. Lastly, ‘n’ is frequently used an abbreviation for ‘number’ in tables and figures.

3.2 PREVIOUS RESEARCH

3.2.1 Scarpa’s (1988) report

A preliminarily report on the faunal material from Forcello was published by Scarpa (1988) in the *Gli Etruschi al Nord del Po* summary volume. Although this report only included material from the project’s initial years of excavation, the 8,864 specimens in the report remain an exceptionally large assemblage for an Etruscan site. The specimens identified by Scarpa were less than 18% of the 50,503 remains studied; the other material consisted of ribs, vertebrae, and unidentified fragments. The majority of the identified assemblage derived from the three common domestic mammals: cattle, sheep/goat and pig, though a portion was also attributed to birds, fish, and other mammals. For birds, a humerus from a mute swan (*Cygnus olor*) was identified. Other identified mammals included deer (*Cervus* sp.), dog/wolf (*Canis* sp.), equids (*Equus* sp.), fox (*Vulpes* sp.), hare (*Lepus* sp.), and a single specimen from a beaver (*Castor fiber*). Particular species within these genera were not identified. Material from animals other than the main domesticates accounts for 904 specimens, *c.* 10% of the identified assemblage. These taxa are not discussed further in the original report.

Scarpa divided the assemblage into two undefined chronological phases (ancient and recent) and compared five context types: (1) houses, (2) middens, (3) ditches, (4) areas between houses and ditches, and (5) material from the southeastern trench (area V–W 10–11). Quantification focuses on NISP (the *number of identified specimens*), which was compared across the two periods (Table 3.2.1, Figure 3.2.1) and between areas (Table 3.2.2, Figure 3.2.2). Scarpa concludes that there are not substantial differences in the relative frequency or distribution of taxa between phases and points out the continuity this interpretation implies. The only context that deviates from the normal pattern (recent canals) has a much smaller sample size than the other groups.

Figure 3.2.1 Relative species frequencies by phase from the Scarpa report
Data from Scarpa (1988). Figure by the author.

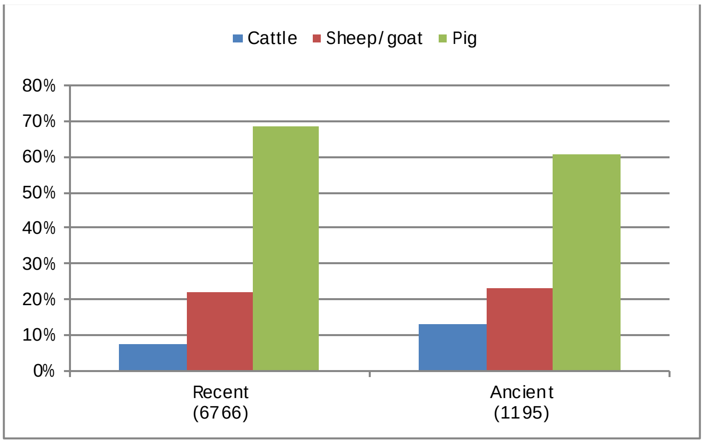
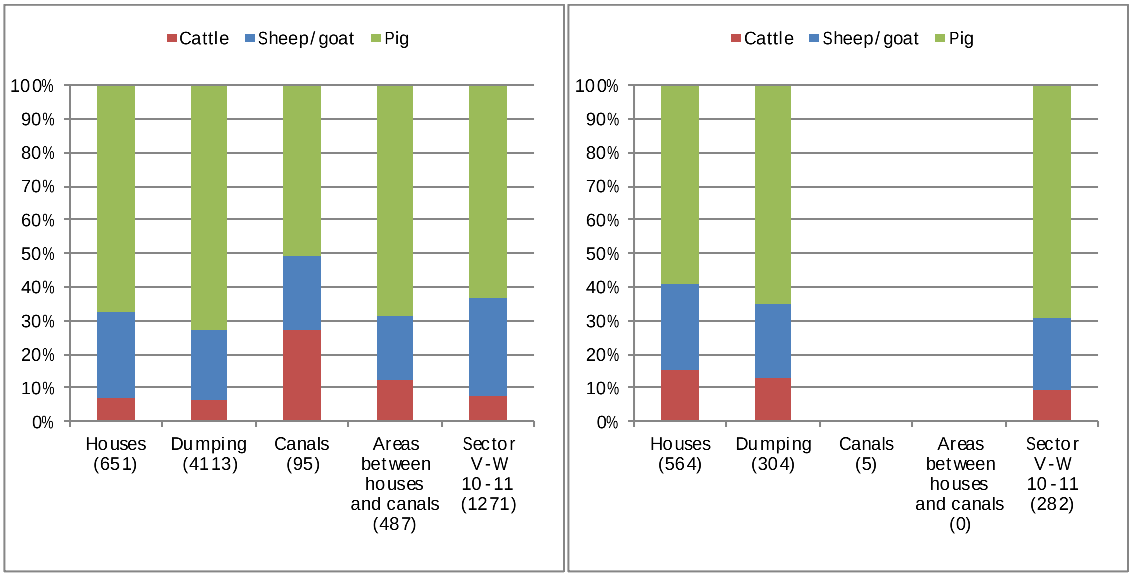


Figure 3.2.2 Relative species frequency by context from the Scarpa report
Data from Scarpa (1988). Figure by the author.


a. Recent

b. Ancient
Canals excluded because of sample size.
No data for areas between houses and canals.

Overall, the most striking result from the original report is the high percentage of pigs. Pigs are the predominant domesticate at many Etruscan sites, but at over 60% of the identified assemblage, pigs are present at Forcello in frequencies more comparable to Imperial Rome (cf. de Grossi Mazzorin and Minniti 2009). Also interesting is that over three-quarters of pigs in the assemblage were identified as having reached maturity, in contrast with other contemporaneous sites that have higher percentages of sub-adult animals. Male and female pigs occur in roughly equal proportions, and the pigs from Forcello are of a height similar to those of other pre-Roman sites in the region. In light of the unusually high percentage pigs at Forcello and the elevated quantity of adult animals, Scarpa suggests that the site may have had a unique and specialized husbandry system, one centered on the rearing of mature pigs. The existence of such a system at Forcello would be surprising, as it is more economical to slaughter pigs as sub-adults, when they reach their full size. The report also found that when divided into central (cranium, teeth, vertebrae), anterior (scapula, humerus, radius, ulna), posterior (femur, tibia, pelvis, patella, calcaneum, astragalus), and distal (metapodials, carpals, phalanges) parts, the posterior limb was underrepresented compared to other skeletal areas. Scarpa took this as further evidence for a specialized husbandry system and concluded that the posterior limb must have been transported/exported out of the site.

However, another explanation may relate to the recovery method used in excavation. Since the assemblage was nearly entirely hand-collected, the age trend in pigs may be at least partially related to the bias inevitably caused by hand collection, which has been shown to miss smaller remains from younger animals (Payne 1975; Payne 1972). While the hindlimb may indeed be underrepresented, Scarpa’s conclusion as to why it is missing needs to be revisited. Taphonomic factors must also be considered before reaching conclusions on the location of underrepresented elements, and further analyses are needed in order to control for specimen interdependence, in situ degradation, and density-mediated survival before making a final interpretation. The hindlimb is less common than the forelimb in many Italian assemblages, a situation normally attributed to taphonomic bias (cf. Minniti 2012).

Sheep/goats are the second most common taxon at Forcello after pigs. Again, aging results showed that fewer than 14% of animals where juvinille, which Scarpa conlcudes reflects a speclized system of husbandry focused on hides, milk, and wool. Again, this result is probably related to the collection method, which discrimates against young and small animals. Cattle are the least frequent of the main domesticates, and, like pigs, they stand at a height similar to other animals in the region.

3.2.2 Mollusks

A report on the malacofauna from Forcello appeared in the same publication as Scarpa's animal bone study (Franchini 1988). The study identified marine, freshwater, and terrestrial mollusks (Table 3.2.3) from archaeological contexts as well as some recovered from the surface of the site. Marine shells from Forcello's Etruscan layers provide a clear indication of transport links with the coast. All of the species, except the ring crowie (*Cypraea annulus*), are typical of the lagune zone of the Adriatic Sea. The ring cowrie is native to the Indian Ocean, and its habitat extends into the Pacific Sea. However, both examples of this species were recovered from the surface, and they may not be related to Etruscan activity in the area. Other freshwater mollusks would have been eaten or could have provided material for decoration. *Glycymeris* species, including some edible clams, survive well outside of their natural environment, making them ideal for transport inland. Small clams could be used as beads, and the inside of the fan mussel (*Pinna nobilis*) is lined with striking mother of pearl. *Murex* species were known for their ability to produce a valuable purple dye. Local freshwater mollusks were likely also eaten, and the large number of freshwater mussels (*Unio elongatulus*) probably relates to this practice. Some terrestrial snails, like *Cepaea nemoralis* and *C. hortensis*, may have been eaten as well, as they are in Italy today. The terrestrial snails identified include both species that prefer dark, humid areas (*Carychium minimum*) and others adapted to drier agricultural and natural fields (*Monacha cartusiana, Helicella itala*); the round-mouthed snail (*Pomatias elegans*) also enjoys open spaces. These few indicators reinforce the environmental picture of the settlement presented above, indicating the presence both of damp microclimates within the site and larger open areas, probably for cultivation.

3.3 THE NEW ASSEMBLAGE

3.3.1 Excavation and recovery

Animal remains recorded for this dissertation derive from the 1982–2011 excavation seasons, although little material came from years prior to 1990. The faunal assemblage was hand collected, save for a few boxes which were marked as sieved. Sieving was a rare occurrence and only used for small number of contexts. Mollusks had been separated from the animal bone and were not studied for this project.

3.3.2 Context information and phasing

The excavation team from the Università degli Studi di Milano provided phasing and context information for the recorded assemblage. A table with the original context information (BSV Contexts) is available in Appendix C (Access database on the attached CD). During excavation contexts were assigned either a US (positive feature, e.g. fill) or ES (negative feature, e.g. cut) number. During recording ES numbers were denoted by a slash preceding the number (e.g. ES 100 = /100; US 100 = 100). Contexts were assigned to a phase (Table 3.3.1) and one of sixteen context types (Table 3.3.2, a–q). The excavators also provided a written description of each context. If a context lacked a specific letter assignment but was accompanied by a written description of its form/function, the written description was used to categorize it (Table 3.3.2, r–z). Contexts not assigned to a specific habitation phase were classified into broader chronological groups. For contexts without specific phase information, the written description was used to assign a *terminus post quem* or *ante quem*, delineated by a greater than or less than sign (cf. Table 3.3.1). Broad phase ranges applied mainly to material recovered from various fills and middens, when the deposition of the fill could be dated, but not the material within the fill itself. Etruscan contexts that could not be securely dated were classified as other 'unphased' archaeological contexts (U).

This division of the faunal material into three tiers of phasing is useful at Forcello because of the relatively short occupation of site. As discussed in section 1.3.3, the chronology of the settlement is divided into nine habitation phases (A–I) spanning approximately two centuries. Because individual phases are relatively short, zooarchaeological analysis is possible at several levels of resolution: between individual habitation phases (phases A–I); across broadly divided Late (phases A, B, C, D) and Early (phases E, F, G, H, I) periods; and for the site as a whole (phases A–I, loosely dated deposits and fills, and unphased material). As the length of the chronological period considered increases, so does the sample size and the range of analyses that can be employed.

For many of the analyses in this dissertation, faunal material is grouped into two broad periods: Early and Late. The Early period includes phases A–D; the Late period includes phases

E–I (Table 3.3.3). Each period contains both contexts assigned to a specific phase (e.g. Phase H) and those which have broader chronological limits (e.g. H–I and H≥). The Early and Late periods encompass a similar number of habitation phases, but they do not describe equal lengths of time. The Late period encompasses approximately 110 years of habitation from c. 490–380 BC, while the Early period covers a period of approximately forty years from c. 530–490 BC. The periods were divided in this manner in order to include the 1300+ specimens grouped into a ‘C–D’ phase. Although dividing the chronology slightly earlier between phases C and D would have created Early and Late groups more equal in timescale and size, such a division would have excluded a large portion of useful data; splitting the Late and Early periods between phases D and E only excludes only five specimens from the ‘D–E’ phase. In order to ensure that splitting the time periods between phases D and E was not biasing results, each analysis was recreated comparing an A-B-C phase group to a D-E-F-G-H-I phase group. Howeve, this second set of analyses did not generate significantly different results from the original analysis. Because of the similarity of results between the two period groupings, only the main set of results (Late phase A-B-C-D, Early phase E-F-G-H-I) is presented here.

Other material assigned to non-archaeological phases (cf. Table 3.3.1) is excluded from the majority of analyses. Problematic phases include material disturbed by plowing (P) and modern (M) remains. Unfortunately, the excavators were unable to provide accurate context information for all the contexts included in this report, and for some contexts (X) that had no phasing information it was unclear if the remains were modern, archaeological, or mixed. However, many of these contexts are probably Etruscan, and they could be integrated into the analysis at some future date if new context information is generated for them.

3.3.3 Spatial distribution

Despite the large volume of faunal material recovered from Forcello, the assemblage derives only from a small portion of the full Etruscan settlement. Excavation has focused on a limited area of superimposed houses and workshops within the settlement (cf. section 1.3.3). The animal remains likewise derive primarily from this area. The vast majority (over 99%) of the material came from sectors Q–S 17–19, an area that covers approximately 3% (3600 m^2) of the full twelve hectares of Etruscan habitation. This limited spatial distribution will influence the nature of the assemblage. Because the material was recovered from within a relatively small area of habitation, much of the faunal material is likely related to activity in and around the houses and workshops in this area. In particular, we can expect to find the remains of food and some craft working. The butchery and disposal of large animals, like cattle and horse, may have been more convenient on the periphery of the settlement or at least outside the immediate vicinity of homes and workspaces.

3.3.4 Fish remains

Fish remains encountered during the project are currently under study by H. Russ (Oxford Brookes University). The previous faunal report by Scarpa made no mention of fish bones, but pike vertebrae and mandibles are mentioned in a separate discussion of production and exchange at the settlement (de Marinis 1988e:197). Prior research has also uncovered metal fishing hooks. To date, about a third of the fish from Forcello have been identified (n=267). This material derives from Phases C and D in the Late period. Over half of the remains were identified as pike (*Esox lucius*). Cyprinids are the next largest taxa, a group which probably includes tench, rudd, and European chub (*Tinca tina, Scardinius* sp., *Squalius* sp.). A very small percentage of salmonids and European eel are also present. Because these remains were hand collected, nearly all derive from large fish; all the pike are over 60 cm, and some are very large – over a meter in length. Cyprinids also reached large sizes (40–50 cm). This work is on-going, and when complete the results will incorporated with those from the larger faunal assemblage.

3.4 A DIAGNOSTIC ZONE APPROACH

3.4.1 Introduction

The faunal remains from Forcello (other than those of fish) were recorded according to a selective diagnostic zone-based protocol. 'Diagnostic zones' are morphologically distinct parts of bones, which are defined prior to recording and provide a formula by which the analyst can describe each specimen in a straightforward and accurate manner. The diagnostic-zone method of recording was originally proposed by Watson (1979) to control specimen interdependence, to allow for greater flexibility in choosing what to record, and to improve the comparability of recorded material. The use of diagnostic zones is now common practice in many zooarchaeological reports, though the number of zones per bone and the level of detail they describe can vary (e.g. Dobney and Rielly 1988; Davis 1992).

The diagnostic zone recording system employed in this project records a restricted set of skeletal parts, focusing on teeth and bone articulations/epiphyses. Within the context of this research, this recording system presented several advantages. Firstly, it allowed the entirety of the unanalyzed faunal material to be studied for this project. The use of more zones would have been especially time consuming and would have precluded inclusion of the entirety of the unidentified Forcello assemblage. Secondly, restricting recording to bone epiphyses/ articulations increased the confidence of identifications. Limited skeletal reference material was available on site, and a recording system which focuses on distinct, recognizable skeletal parts provided a practical methodological approach. Lastly, the selected zones focus on the skeletal elements most useful to this project's aims and the study of husbandry practices. Thus, a selective zone system proved the best fit for the project, as it allowed collection of high quality data directly related in project aims while controlling the total amount of time required to identify the assemblage.

3.4.2 Differing methodologies: diagnostic zones and the Scarpa report

The recording methods employed in the earlier Scarpa report differ from that of this project. Unlike the methods employed in this study, which define limits in recording, Scarpa's work presumably identified and recorded the maximum number of specimens possible. The most basic difference between the two studies is, therefore, that the earlier report includes elements and skeletal parts not considered in this dissertation. The methodological differences underlying these two studies is an important characteristic to consider when comparing their results, because these differences in method prevent some direct numeric comparisons between the datasets. Initially, in the hope of creating a single homogenous assemblage, a re-examination of the Scarpa material was considered. However, the substantial quantity of material at Forcello and the difficulty in accessing the older material meant that only recent material could be included in the scope of this project.

While the different methodologies used in the two zooarchaeological studies will add a level of complexity when integrating and interpreting their results, this discrepancy is not a major cause for concern. Because they draw from the same raw data, the recording methods used in this dissertation will generate information on animal age, sex, and size comparable to, and likely more detailed than, that presented by Scarpa. However the two studies are more likely to differ when taxon percentages and element distribution are compared. In consideration of the likelihood some of moderate fluctuations, these analyses will need to be juxtaposed on a broader level, but they are still unlikely to vary to a substantial degree owing simply to the recording method employed. At Forcello, material excluded from the new recording protocol (e.g. limb shaft fragments, second and fifth metapodials and phalanges, etc.) is likely to provide information redundant with the recorded zones (i.e. epiphyses and third and fourth metapodials) rather than shed new light on human action in the past.

Several previous studies have re-evaluated assemblages using different recording protocols (e.g. Bar-Oz and Dayan 2002; Marom and Bar-Oz 2008; Trentacoste 2009), and in each of these examples, basic zooarchaeological results generated by a restricted recording protocol were comparable to those from more intensive methods. In the case of the open-air Epipalaeolithic site of Ein Gev I in Israel, researchers did not find significant differences in either taxonomic composition or skeletal element abundance despite the presence of significant density-mediated bias resulting from both human bone processing and post-depositional attrition (Marom and Bar-Oz 2008). Likewise at Nahal Hadera V, another Epipalaeolithic site in Israel, Bar-Oz and Dayan (2002) observed that more laborious methods do not overthrow the results from a restricted recording protocol; rather they "fine-tune" our understanding of the assemblage and provide a higher-resolution look at the depositional history of the site. The re-investigation of a British commercially excavated site using restricted recording methods also did not contradict previous results (Trentacoste 2009). In contrast to these reassuring reports, Maream and Kim's (1998) work at Kobeh Cave challenges the use of limited recording methods. These researchers spent three years painstakingly refitting indeterminate shaft fragments into identifiable specimens. These re-formed remains completely transformed the skeletal element profile of the site and revealed a subsistence strategy based on hunting rather than scavenging. This revelation sent a wave of "shaft-anxiety" through the discipline (Stiner 2002). However, the primary problem in this situation was not the absence of these shaft fragments from the identified assemblage; rather it was a failure to recognize that absence as an artefact of method. Basic understanding of the factors that may have influenced assemblage formation is important (Albarella 1995b). Restricted or epiphyses-based methods of zooarchaeological recording are clearly not appropriate for every assemblage, but at Forcello, where we have no evidence of taphonomic processes that would selectively delete epiphyses from the archaeological record, limited recording methods are well-suited to addressing the aims of this dissertation.

3.5 IDENTIFICATION AND RECORDING METHODS

3.5.1 Recorded elements

The diagnostic-zone recording system employed at Forcello is based on an unpublished protocol (Albarella 2009) adapted from an earlier systems by Albarella and Davis (1994) and Davis (1992). The database structure and field codes for this system are detailed in Appendix B. Specimens were originally recorded in Microsoft Excel spreadsheets before being transferred to an Access database (Appendix C). Sieved material was recorded in separate tables. The goal of the system is to record a maximum level of information useful to the reconstruction of livestock populations and a minimum amount of low-grade or repetitive data. Therefore this system includes multiple characteristics useful in establishing population age curves, sex ratios and animal size, but excludes parts of the skeleton likely to supply be redundant information (e.g. second and fifth metapodials).

The foundation of the recording protocol is set of skeletal elements that are always recorded. At least half of the specified zone must be present in order for the specimen to be included. **Recorded Elements** for mammals and birds are:

Recorded Elements: Mammals

Upper teeth – occlusal surface*
Lower teeth – occlusal surface*
Cranium – zygomaticus
Atlas

Calcaneum – sustentaculum
Scafocuboid / scafoid / cuboid
Metatarsal – distal epiphysis
    (only III, IV or III+IV)
Indeterminate Metapodial –

Axis
Scapula – glenoid cavity
Scapula – neck
Humerus – distal epiphysis
Humerus – head of proximal epiphysis
Radius – distal epiphysis
Radius – proximal epiphysis
Ulna – proximal articulation
Carpal 3 or Carpal 2+3
Metacarpal – distal epiphysis
  (only III, IV or III+IV)
Pelvis – acetabulum, ischial part
Femur – distal epiphysis
Femur – head of proximal epiphysis
Tibia – distal epiphysis
Tibia – proximal epiphysis
Astragalus – lateral half

  distal epiphysis (only III, IV or III+IV)
Phalanges 1, 2 and 3 – proximal articulation
  (only for digits III, IV or III+IV)
Horncore – complete transverse section
Antler – complete transverse section

Recorded Elements: Birds

Coracoid – proximal articulation
Scapula – proximal articulation
Humerus – distal epiphysis
Ulna – proximal articulation
Carpometacarpus –
  proximal articulation
Femur – distal epiphysis
Tibiotarsus – distal epiphysis
Tarsometatarsus – distal epiphysis

** Pig canines are an exception and are recorded when a complete transverse section is present.*

Side (left/right) is specified for all of the elements above except loose teeth and phalanges. In addition to this list of elements, the remains of rare taxa, very young animals, and animals of unusual size were also recorded. Optionally, other specimens of interest, such bones displaying pathologies or evidence of butchery, working, and burning were also recorded. Specimens not in the list of Recorded Elements are documented under a different code (OTH for 'other') to simplify separation during analysis. The presence of large (cattle/horse size), medium (pig/sheep size), and small (hare/cat size) ribs and vertebrae was noted for each context. Specimens of particular interest were photographed. Thus, while a limited set of skeletal elements is explicitly designated as 'always recorded,' the recording system allows a large degree of flexibility. All remains were examined for unusual features and any additional specimens of interest were added to the database together with the Recorded Elements.

3.5.2 Species distinction

Identifications made in the field were assisted on site by modern reference material from sheep, pig, cow, horse, red deer, and rabbit. Difficult species were determined through consultation of reference collections at the University of Sheffield (Sheffield, United Kingdom) and the University of Siena (Siena, Italy). Manuals by Schmid (1972), Barone (1976), Sisson (1930), Prummel (1987a; 1987b; 1987c) and Cohen and Serjeanston (1996) were also always on hand. Sheep/goat separation was attempted on the dP_3 and dP_4 when at least two identification criteria were present, and on mandibles with multiple molars. Distinction criteria followed Payne (1985b), Halstead et al. (2002), and Zeder and Pilaar (2010). Separation of sheep and goat was also attempted on horncores, the distal humerus, proximal and distal radius, distal metapodials, distal tibia, astragalus, calcaneum, and first and second phalanges following the criteria presented in Halstead et al. (2002), Boessneck (1969), Kratochvil (1969), Payne (1969; 1985a), and Zeder and Lapham (2010). Equid species were differentiated using check teeth following Davis (1980), and Lister (1996) was consulted on the determination of deer taxa. The pelvis was used to distinguish frog from toad. Bird and small mammals remains were identified using the University of Sheffield reference collection and manuals by Cohen and Serjeanston (1986) and Chaline (1974).

3.5.3 Aging and sexing

Animal sex and age at death are central to reconstructing husbandry regimes, and comparison of these profiles to model kill-off patterns for wool, milk and meat-focused economies can suggest objectives in animal management (Payne 1973). As an animal approaches maturity, the epiphyses and diaphyses of its bones fuse at various times, a process which culminates in the fully sized adult skeleton. Teeth are worn down naturally throughout the animal's life, and, like in humans, permanent teeth replace the deciduous teeth of young animals. Environment, diet, castration, and pathology complicate these processes (Reitz and Wing 1999:69; Davis 2000), and such factors must be considered during interpretation. Further information on age can be derived from skeletal measurements, discussed below in section 3.5.5.

Both dental and post-cranial data were used to establish mortality patterns and sex profiles for domestic species. Wear stages were recorded for the premolars and molars of cattle, sheep/goat, and pig. Wear stages follow Grant (1982) for cattle and pig, and Payne (1973; 1987) for sheep/goat. Pig tooth wear was also identified according to Wright and Albarella (2009) for the initial stages of recording, but the use of this method was discontinued after it proved to be redundant in comparison with Grant's better established system. Fusion state was recorded for both proximal and distal epiphyses/diaphyses. For bones with only one fusion area (scapula, calcaneum, pelvis, etc.) fusion was recorded in the database as 'proximal' out of convenience. Bones are described as 'fusing' if any part of the fusion line is still visible. Perinatal and neonatal human bones were aged based on their dimensions using Schaefer et al. (2009).

Sex was determined at the time of recording for *Sus* canines and canine alveoli based on their size and morphology (cf. Mayer and Lehr Brisbin 1988). The distinction between male and female is easily apparent in animals with sufficiently developed or erupted canines, but more problematic in younger animals where the tooth is not yet or only partially erupted. Sex distinction was also attempted on the pelvis of sheep/goat, cattle and pig using its general morphology (Boessneck 1969) and Greenfield (2006)'s H1 and H2 measurements of the height of the medial wall of the acetabulum at the ilio-pubic intersection.

3.5.4 Pathology, butchery, burning, and gnawing

Identifying pathological bones is a fairly straightforward task; however, untangling the connection between an abnormal skeletal feature and its cause is not as simple. This situation is particularly relevant to elderly cattle. There is often a desire to link 'stress-related' pathologies of the lower limbs to the use of cattle in traction. Problematically, cattle with pathologies are also typically old animals. Separating age-related stress from traction-related stress is extremely difficult and requires analysis of the full set of cattle remains (De Cupere et al. 2000; Johannsen 2005; Thomas 2008). The prevalence and types of pathologies encountered in an assemblage can provide some information on the treatment and management of animals, but it is not the only or most reliable measure of population health. Many diseases do not alter the skeleton, and diseased/abnormal animals might have been disposed of differently than domestic debris, perhaps deposited outside settlement or burnt. For this project, identification of pathologies focused primarily on the presence of exostosis (new growth on the bone's surface), lipping (and extension of articular surface), and eburnation (polished area created by two bones rubbing together). Where possible, Baker and Brothwell (1980) was consulted to identify possible causes (e.g. osteoarthritis, infection) of skeletal abnormalities.

Modifications to bone surface and structure are important indicators of the many anthropogenic and natural factors involved in the treatment, deposition, and decay of an animal. These attributes provide clues about the management and butchery of livestock as well as the post-deposition decay of their carcasses. Each specimen from Forcello was examined under a bright lamp for evidence of pathology, butchery, gnawing and burning, the presence of which was recorded. Bone surface preservation was noted on a five-level ordinal scale. A description of any pathological features was included with the identification, and the presence of linear enamel hypoplasia (LEH) noted as one (P) or multiple (PP) lines. LEH is a pathological condition related to nutrient deficiency and infection that is frequently encountered on human teeth, and its presence on animal teeth may provide similar information (Dobney and Ervynck 1998; Dobney and Ervynck 2000). The presence of coral-like roots was also recorded. This type of abnormal root growth is thought to result from low-grade infection or inflammation (Baker and Brothwell 1980:151). Coral-like roots are most common in bovids, although they have also been recorded in pigs and cervids (Murphy 2005; Chilardi and Viglio 2010, Bertini Vacca 2012: 143–147). The precise cause of coral-like roots is not well understood, but it may be related to the penetration of the alveolus by external material, such as calculus (Chilardi and Viglio 2010). Bertini Vacca (2012:147) links the condition with diet, particularly the consumption of hard and spiny plants, and old age.

Butchery marks were identified as cut (knife), chop (cleaver) or saw marks. When cut marks were found in positions analogous to those in Binford (1981:96–142), they were recorded as the result of skinning, filleting, or dismemberment; Binford's location code for each mark was not included. If possible, a conjecture (delineated by '?') was attempted on cut marks that did not match marks noted by Binford. Gnawing was recorded as the result of activity by carnivores, rodents, or digestion. Burning was recorded as burnt (black), calcined (white), or singed (bone only partially colored). All burned bones with dimensions over *c.* 36 mm^2 were recorded, although few of these qualified as quantifiable specimens.

This set of characteristics related to pathology and taphonomy represents an introductory line of inquiry into the processes that influenced the formation of the Forcello assemblage. Numerous other ways to record and analyze pathology, butchery, bone breakage, and trampling are also available (Lyman 1994b). However, comprehensive identification of these additional attributes would have added excessive time to the recording process. The information collected for this project does not define the overall potential of the Forcello assemblage for further research; rather the data collected aims to provide answers to the questions most relevant to this research – namely, basic evidence related to animal skeletal health and information on the major factors that might influence interpretation of zooarchaeological results.

3.5.5 Biometric data

The analysis of biometric data has proved to be an important tool in determining differences within and between populations (Boessneck and von den Driesch 1978; Albarella 2002). At Forcello, measurements are central to the investigation husbandry regimes because they provide data related to animal sex, age, size, and shape. The measurements taken on teeth from Forcello are explained in Table 3.5.2; post-cranial measurements are described in Table 3.5.3 (cf. Appendix B for which measurements are taken on each species). Measurements were taken with Mitutoyo 150mm or LTL 300mm digital calipers on remains sufficiently preserved to yield accurate, reproducible results. The calipers have a 0.01mm resolution, and measurements are rounded to the nearest tenth. The only exception to this practice is for greatest length (GL) measurements taken with the large LTL calipers, which are rounded to whole millimeters. The measurements used in this project were chosen based on their availability in archaeological assemblages, level of consistency, and ability to define age, sex or size groups:

Teeth

Tooth widths are particularly useful for assessing general animal size, because they demonstrate little sexual dimorphism and individual variation (Payne and Bull 1988). Tooth length may decrease in older animals as inter-dental enamel is worn away. Thus no measurements were taken on teeth where the enamel had been lost due to advanced wear.

Forelimb

In pigs, the forelimb tends to be more sexually dimorphic than the hindlimb (Payne and Bull 1988). Differences in the forelimb of bovids are even more sexually pronounced (Polák and Frynta 2010; Davis et al. 2011). For the humerus, the height of the trochlea constriction (HTC sensu Payne and Bull 1988) has proved a minimally age-dependent measurement in both pig (Albarella and Payne 2005) and sheep (Davis 1996), and it is therefore useful for separating animals of different sexes and general sizes. At least in sheep, however, an indeterminate amount of growth post fusion may occur. Despite this limitation, HTC is a particularly useful measurement because it survives well archaeologically, even in gnawed or otherwise damaged specimens. Another forelimb measurement, the smallest length of the column of the scapula (SLC) is also sexually dimorphic, but more strongly correlated with animal age because of its considerable growth both before and after fusion (Rowley-Conwy 2001).

Hindlimb

As with tooth widths, measurements from the hindlimb (Payne and Bull 1988) and the length of the acetabulum (LAR or LA) tend to show less individual and sex-related variation than the forelimb, and are therefore better suited to detecting differences in population size (Albarella and Payne 2005). The astragalus is another element that survives well in archaeological contexts, and the width and length of this bone are also amongst the least sex-dependent measurements (Higham 1969 cited in Albarella 1997a). The distal tibia also survives well. The calcaneum, another dense bone, is also frequently measureable, but its greatest depth (GD) (Albarella and Payne 2005) is highly age-variable. This measurement is also very difficult to take consistently. Lastly, pelvis H1 and H2, both measurements of the height the ilio-pubic wall of the acetabulum, can be used to separate animals of different sexes, although some degree of overlap is likely to occur (Greenfield 2006). These pelvic measurements were primarily taken to provide a comparison to sexing information from *Sus* canines.

Other measurements taken in data collection include greatest lengths (GLs), which provide useful data for recreating animal height. Two measurements from the atlas, the greatest breath of the cranial articular surface (BFcr) and the height (H), were the only measurements taken from the axial skeleton. Atlas BFcr is another measurement with low individual variability (Albarella and Payne 2005) useful for separating animals of different size and sex (Grigson 1982).

3.6 QUANTIFICATION AND ANALYSIS

3.6.1 Working with the recorded assemblage

The recording methodology detailed above creates an assemblage that can be divided between elements that are always recorded and other (OTH) specimens. Analyses include only data from the list of Recorded Elements. Other specimens are used non-quantitatively, for instance, to inform interpretations or document rare specimens. This strategy maintains control over the data included in each analysis. Limiting the material in this way streamlines and simplifies the quantification process. The restriction of analysis to the pre-determined list of Recorded Elements also improves comparability, because it ensures that the variables being compared across periods or contexts are equal in all of the samples involved. For this reason, horncores are excluded from many analyses that compare cattle, sheep/goat, and pigs, because pigs do not have horns. The neck of the scapula (zone OTHSC) is also excluded from many analyses. It was added to the recording protocol because the articular end of the scapula was missing from many specimens. However, because it focuses on the area next to the articulation and not the articulation itself, its inclusion would artificially bolster the representation of the scapula compared to other elements with fewer zones. Scapula values used in analyses equal the sum of the SC1 and SC2 zones (cf. Appendix B). In sum, unless other stated, analyses exclude horncores (element code 'HC'), the neck of the scapula (OTHSC), and other specimens (OTH). Material that could not be confidently assigned to the Etruscan period was also excluded from analysis. This encompasses specimens from modern (phase code 'M'), plowzone (P), and unassigned contexts (X). Exceptions are expressly noted figure and table captions.

3.6.2 Taphonomic factors

Numerous taphonomic processes affect the formation of a faunal assemblage, and each of these factors has implications for the recovery and study of animal remains. Carcasses undergo a series of modifications from the point of death and deposition until recovery, and these processes can dramatically affect an animal bone assemblage. The slaughter, butchery, cooking, use, and disposal of an animal are all human modifications that alter the faunal record. Dogs and other scavengers can transport and destroy bones, and local environmental conditions will affect bone preservation after burial. Equally, methods of excavation, recovery, and identification also influence the final recorded assemblage. If taphonomic factors are very different between chronological periods, areas, or context types, they can complicate comparisons. Differences in the taphonomic histories of different archaeological sites will hinder analysis on a larger scale. Because of their effect on zooarchaeological analysis, the implications of some basic taphonomic factors must be considered before progressing to consideration of animal management on site. This dissertation investigated surface preservation, butchery, gnawing, and burning across chronological periods and context types. Recovery bias was analyzed using the method recommended by Payne (1972; 1975) which compares the presence of adjacent small and large adjacent bones. Left/right side distribution was tested in Microsoft Excel using Pearson's chi-squared test (function CHISQ.TEST).

3.6.3 Taxonomic abundance and species frequency

To quantify the abundance of each taxon, faunal reports traditionally use the *number of identified specimens* (NISP), a sum of the total number of fragments identified for each taxon. Alternatively, in this project, only a portion of the recorded database ('Recorded Elements' listed above) is included in specimen counts. Specifically, counted elements are those listed above in section 3.5.1, *excluding* horncores, antlers, and OTH specimens. Metapodials 1, 2 and 5 are non-Recorded Elements and are excluded. Because not all 'identified' specimens are included in taxon counts, totals are referred to as the *number of counted specimens* (NCSP), rather than NISP, as the new term better illustrates the underlying methodology. The *minimum number of animal units* (MAU) is used in place of the *minimum number of individuals* (MNI, see below).

3.6.4 Body part/skeletal element distribution

Skeletal element distribution is used to detect differential transportation and destruction of different body parts. Also referred to as 'body part distribution,' analysis of skeletal element distribution adjusts element counts so that they may be directly compared to other parts of the body. For example, cows have many more teeth (32) than metapodials (4). In order to detect if there is an over/under representation of either of these elements, these numbers must first be adjusted according to their frequency in a complete skeleton. Skeletal element distribution is quantified through the *minimum number of animal units* (MAU) (sensu Binford 1984). MAU is a better tool than the widely employed *minimum numbers of individuals* (MNI) for describing relative frequencies of skeletal parts, because MNI quantifies the presence of individual animals rather than the presence of body parts (Lyman 1994b). MAU is a calculation based on the *minimum number of skeletal elements* (MNE) for each taxon. As in taxon counts above, calculation of MNE and MAU includes only Recorded Elements. Because each zone encompasses a different skeletal element, the MNE for each element is equal to the NCSP of that zone. MAU is calculated, following Binford (1984), by dividing the MNE by the element's frequency in a complete skeleton; specific equations for each element are presented in Table 3.6.1. The overall MAU for a taxon is equal to the greatest MAU for an individual element.

3.6.5 Aging, sexing, and biometry

Aged specimens are quantified to construct mortality profiles, a central analytic tool in establishing the focus of husbandry regimes. To create mortality profiles, bones and teeth are assigned to general age groups. Mandibles with two or more identifiable teeth were assigned a mandible wear stage based on the wear of individual teeth within the jaws. Mandible wear stages follow O'Connor (1988) for cattle, O'Connor (2003) for pigs, and Payne (1973) for sheep and goats. Grant (1982) and Payne (1973) were used to estimate the age of incomplete mandibles for sheep/goat and cattle. For pigs, estimation tables like those in Payne (1973) were developed using mandibles from Forcello (Tables 3.6.2–5). These tables only include mandibles from Etruscan contexts with definitive wear stages. Using complete mandibles from an assemblage to estimate the age of fragmentary specimens is ideal; however, sample size and time constraints frequently preclude this practice. Instead comparative samples from elsewhere are normally used: Payne (1973) is based on Hellenistic–Medieval sheep and goats from Turkey; Grant (1982) uses animals from Iron Age–Medieval assemblages. These new estimation tables for pigs are not only useful at Forcello; they also provide researchers with a new, and potentially more accurate, way of estimating animal age in other Iron Age assemblages.

Age categories for post-cranial bones were established using Silver (1969). Early fusing bones are those that fuse within one year (for cattle this include the proximal radius and distal humerus). Middle fusing bones fuse between one and three years. Late fusing bones are those that fuse after three years.

Biometric data is investigated through a series of scatter plots and histograms. Scatter plots chart size differences when one variable is assigned to each axis, or plots can be used to investigate shape change if ratios (e.g. width/length) are assigned to the axes (Albarella 1997b; Albarella 2002). Log ratio histograms are also an important tool in examining size changes through time (Albarella 2002). Log ratios are a useful scaling technique which compares measurements from Forcello to a baseline of measurements derived from a separate population. The standard for cattle is from Viner (2010); the standard for sheep/goat from Davis (1996); and the standard for pigs from Albarella and Payne (2005). Log ratio diagrams then show if measurements from Forcello are relatively larger (the log is positive) or smaller (the log is negative) than the chosen standard. This technique is useful for identifying patterns between different sites. Log ratios are not subjected to statistical tests, because of the many potential pitfalls that such analysis entails (Atchley et al. 1976; Atchley and Anderson 1978; Packard and Boardman 1988).

CHAPTER 4

RESULTS OF ZOOARCHAEOLOGICAL ANALYSIS AT FORCELLO

4.1 INTRODUCTION

This chapter presents an analysis of faunal material recovered from Forcello that was not previously studied as part of the 1988 Scarpa report. Although the assemblage is formed primarily from food refuse, the faunal remains provide more than just an estimate of meat consumption. Zooarchaeological analysis seeks to supply information not only on diet, but also on livestock management strategies and the role of secondary products, as well as the use of animals outside the culinary sphere. Both chronological changes and variation between different contexts and areas of the site are explored, and the results of these investigations provide a detailed view of the scope and evolution of animal exploitation on site. Analysis begins with consideration of the taphonomic factors that influenced the formation of the assemblage. These sections are followed by an investigation the species present at Forcello and their relative importance. Next, zooarchaeological analyses of the three main domestic taxa – cattle, sheep/goat, and pig – are presented. These taxa are first analyzed according to the distribution of anatomical elements. The effects of butchery, gnawing, and burning are also discussed within the context of carcass processing and deposition. Data related to age and sex ratios provides further information on breeding practices, and analysis of animal biometry and pathology evidences husbandry conditions, animal size, and livestock improvement. Results related to dogs, equids, and wild animals follow those of the main domesticates. Where applicable, analyses are integrated with the earlier faunal report for Forcello (Scarpa 1988). Together, these two studies present a high-resolution view of human–animal relationships on site.

4.2 PRESERVATION AND TAPHONOMIC FACTORS

4.2.1 Recovery bias

Almost all of the faunal material at Forcello was hand collected, a recovery strategy that is known to bias against small taxa and elements (Payne 1972; Payne 1975). A comparison of the ratio of unfused metapodial epiphyses and diaphyses (Figure 4.2.1) indicates that such bias was a factor at Forcello. The smaller unfused epiphysis are consistently underrepresented in comparison to the unfused diaphyses, particularly so in sheep/goat and pig, the smaller taxa.

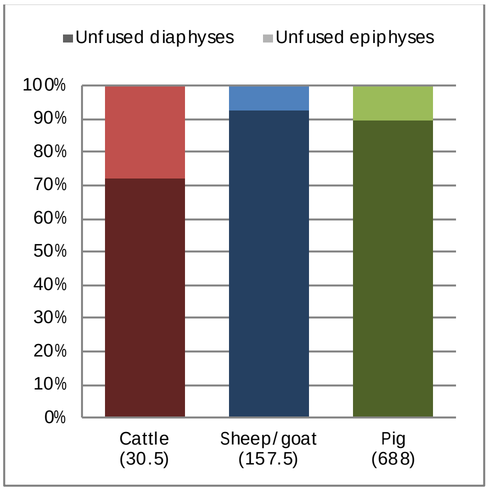
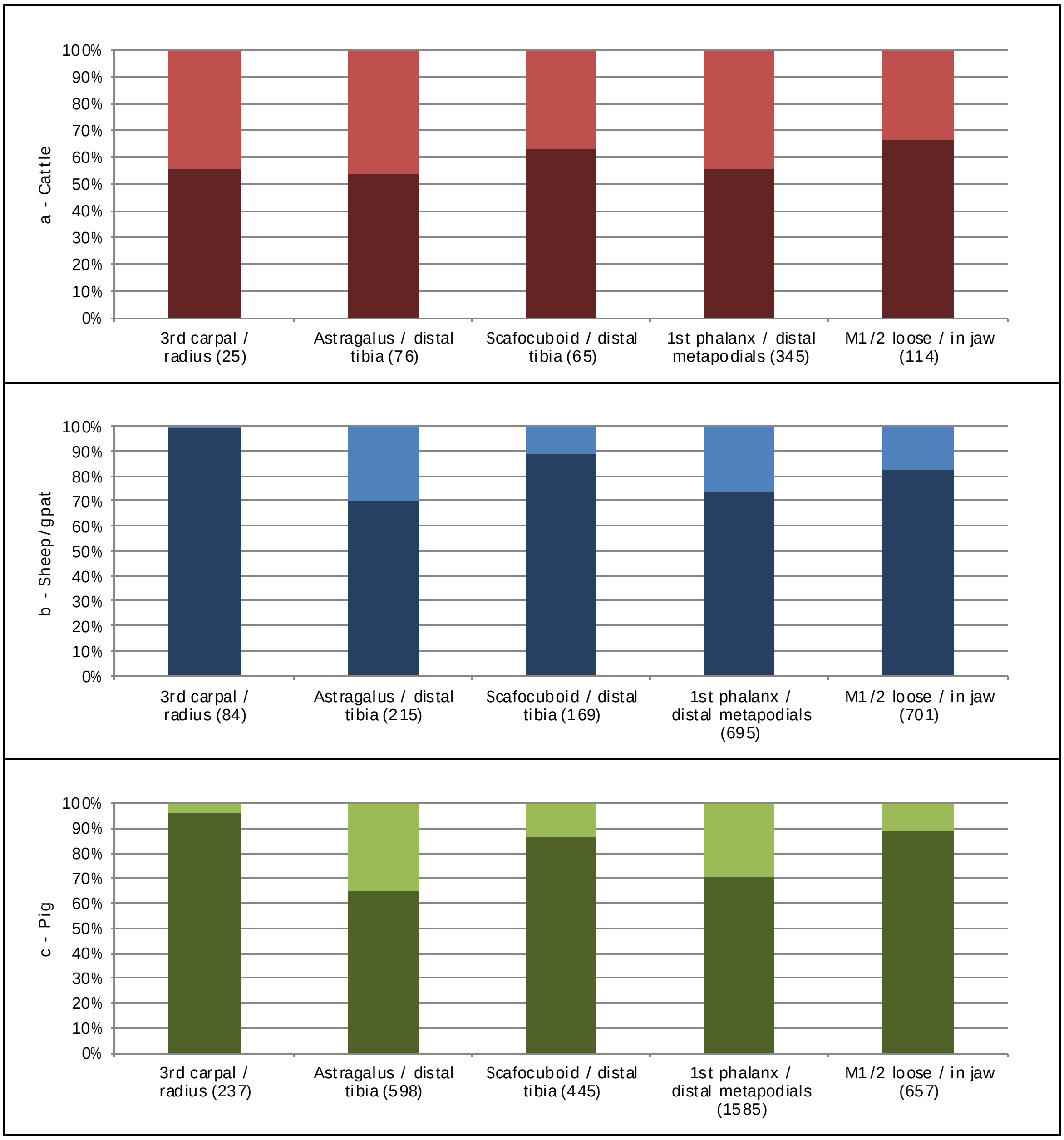


Figure 4.2.1 Unfused metapodial diaphysis and epiphyses
All faunal material (including phases X, P, and M).
((MC1+MT1+MP1)+(MC2+MT2+MP2)/2) = (n).

A review of the frequencies of adjacent large and small bones (Figure 4.2.2) confirms a recovery bias against small specimens. In cattle, adjacent small bones and large bones are present in near equal quantities, but in sheep/goat and pig, small bones are less frequent than neighboring large bones. Although different transport or degradation can sometimes remove elements from an assemblage, in this case differential recovery is the most logical option. Carcass dismemberment is not likely to have separated adjacent elements, and most small bones are very dense and difficult to destroy. The comparison of first and second mandibular molars in jaws and as loose teeth represents a different type of analysis, also dependent on fragmentation. The fact that the values for loose molars are very similar to those of unfused epiphysis suggests that recovery bias is likely to be the governing factors in the relationship between teeth in and out of mandibles. Recovery strategy, therefore, is an important factor in the formation of the Forcello assemblage that biases against both small animals and small elements. As a result, sheep/goat and other smaller animals will be underrepresented. Pig metapodials and mandibular molars were used to test differences in recovery bias between the Late and Early periods (Table 4.2.1). Hand collection was fairly consistent for both periods, but the latter contains a slightly higher percentage of unfused epiphyses and loose molars. The better representation of these small elements may indicate that recovery was of a higher standard in the Early period. However, this slight difference is unlikely to significantly influence analysis.

Lastly, in a small number of instances, sieved faunal remains appeared to have been re-integrated with the hand collected assemblage without any indication of their origin. The elevated presence of tiny bone fragments (less than one cm in size), bird bones, and rodent remains in some contexts provided evidence of this practice. Mixing sieved and unsieved faunal material can complicate analysis, because sieving will improve the recovery of smaller specimens and taxa, distorting chronological and spatial comparisons between sieved and unsieved materials. However at Forcello, because sieving was a rare occurrence, it is not a major problem. Sieving improved the recovery of birds, rodents, and probably fish from a few contexts; however it had little effect on the overall representation of domestic livestock, because only a small portion of a small number of contexts were sieved. The three contexts most affected by sieving (292, 476, 876) all contain unphased archaeological material, and therefore will not affect comparisons between the Late and Early periods. Additionally, taxa frequencies from material clearly labeled as sieved reflect those from hand collected faunal remains (cf. section 4.3.3). Thus while sieving appears to have been a significant factor in the recovery of small taxa, it had little influence on the representation of domestic livestock because of its very limited application.

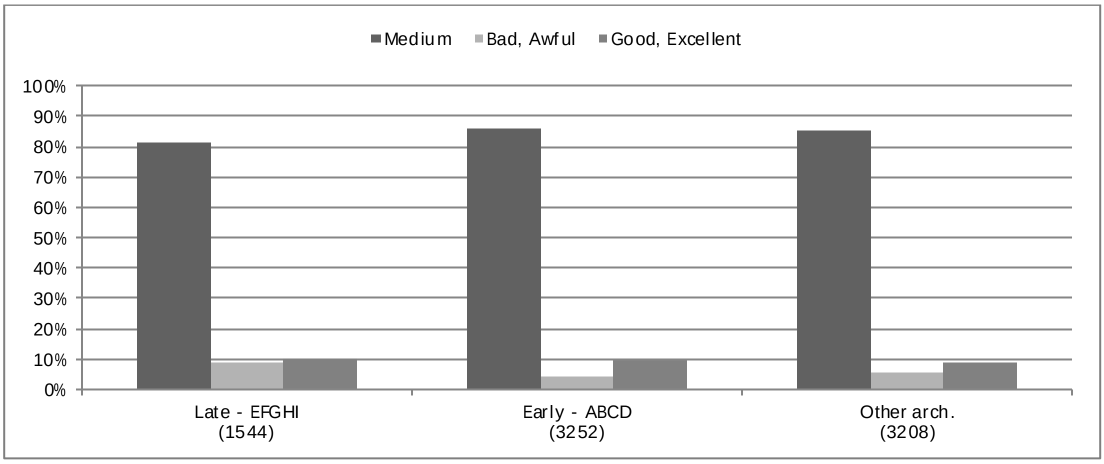
Figure 4.2.2 Relative frequencies of adjacent small and large bones
(n) =number of specimens. All phases including M, P and X. M1/2 = 1st and 2nd lower molars.
Metapodials = the number of metapodial condyles = 2(MP1 + MT1 + MC1) + (MP2 + MT2 + MC2).



4.2.2 Surface preservation

The surface preservation of bones can supply valuable information on their post-depositional histories. Local environmental and burial conditions can cause bone to deteriorate, complicating the identification of modifications on the bone's surface or even destroying remains entirely. The average level of surface preservation at Forcello was very good and allowed for a relatively easy identification of original marks on the bone surface. Despite the limitations of hand collection, a good number of fish and bird bones were also recovered. Sieved samples included fish, birds, and microfauna, indicating that even very small and delicate remains survived intact. While the overall quality of the bone surface was high, occasionally bones and teeth were found coated with concretions. These cement-like deposits proved very difficult to remove, and although they did not interfere with the taxonomic or anatomical identification of the specimen, at times they obscured the bone's surface and the collection of measurements. Nevertheless, the presence of such a good level of preservation through various periods (Figure 4.2.3) suggests that weather and post-depositional degradation did not severely affect the assemblage.

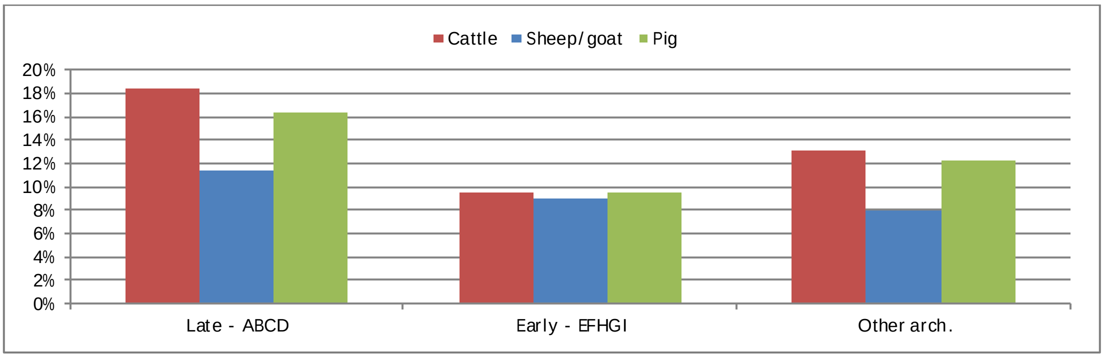
Figure 4.2.3 Bone surface preservation by period
(n) =number of specimens.



4.2.3 Butchery

The skinning, dismemberment, and processing of a carcass will influence bone fragmentation and, therefore, identification as well. At Forcello, butchered bones were present in moderate frequencies throughout the assemblage (Figure 4.2.4, Table 4.2.2). The Late period contains a higher proportion of bones with butchery marks, especially for cattle and pig. Within periods, the prevalence of bones with butchery modifications is relatively constant, indicating that main domestic taxa species were processed in a relatively similar manner or at least to a similar degree. The distribution of butchered bones between context types (Table 4.2.3) is also fairly constant and ranges from approximately 10–15% of bones. Pits and postholes from the final levels of habitation (context b, 22%) are the largest derivation from the trend, but the limited amount of material associated with this context type (n=50) prevents further interpretation.

Figure 4.2.4 Relative frequencies of bones with butchery marks by period
Number of specimens (Late/Early/Other arch.) = cattle (223/173/220), sheep/goat (445/290/593), pig (2163/900/2106).

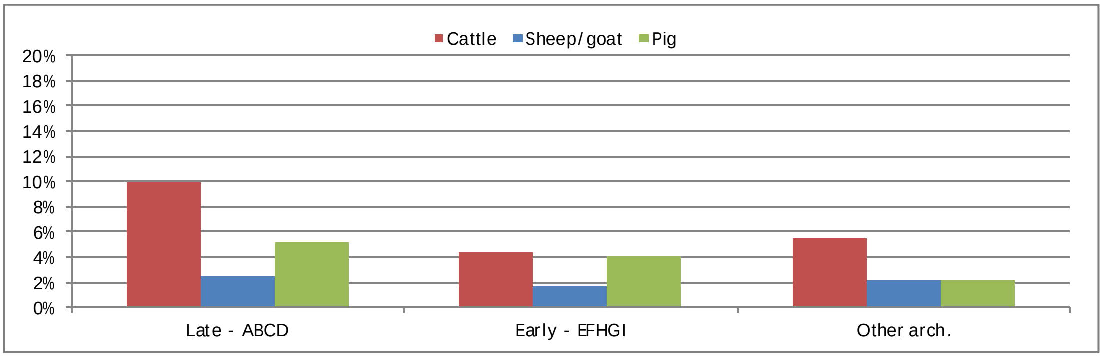


The majority of the recorded marks were small cut marks from knives (Table 4.2.4). The predominance of low-impact cut marks suggests that the bones were not regularly broken for marrow extraction, and carcass processing focused more on dismemberment, filleting, and skinning. Heavier chop marks from cleavers were also recorded, and these tools would have aided in the initial butchery and dismemberment of larger animals. Knives were also used in a chopping motion. Saw marks provide evidence of horn and antler working – in all but one instance saw marks appeared on horncores or antler fragments. Horn and antler would have been important pliable materials used extensively in the manufacture of tools and ornaments. Worked bones are discussed further in section 4.11 below. Overall, the rough consistency of butchered bones between species and periods suggests that the intensity of carcass usage was relatively constant across the domestic taxa and fairly stable throughout the life of the settlement. Tool technology also appears to remain constant through time, although we would not expect it to change much in the 150–160 years that Forcello was inhabited. As a larger animal, cattle would require more processing than the other taxa, and, as a result, cattle remains are slightly more affected by butchery than sheep/goat or pig.

4.2.4 Gnawing

Scavengers can affect a faunal assemblage by damaging or destroying bones and by transporting animal remains. Gnawing marks provide evidence for the presence scavenging carnivores and can supply information on the treatment and disposal of rubbish. Gnawing marks were present throughout the Forcello assemblage. Nearly all of these marks were attributed to carnivores, most likely dogs. The remaining few (15 specimens, Table 4.2.5) were gnawed by rodents. The Late period has slightly higher frequencies of gnawed remains, but in general gnawed bones are a minority within the total assemblage (Table 4.2.2, Figure 4.2.5). Cattle remains are most frequently gnawed, followed by pig. This pattern reflects the robustness of the bones of each taxa and the nature of the recording protocol. Gnawing will more easily destroy the epiphyses and recordable diagnostic zone on sheep/goat than on cattle or pig bones. As a result, a lower percentage of sheep/goat bones will be recorded as gnawed. Overall, the frequency of gnawing marks within each taxon remains consistently low between periods. The prevalence of gnawed bones between context types was also relatively constant, normally between 3–5% of the total zone count (Table 4.2.3). Context types that vary from this trend include store pits (context m, 0%) and pits and postholes whose cut is directly under the plowzone (context b, 10%). The lack of gnawed bones in store pits reflects their function; material for human consumption is unlikely to be exposed to scavengers. The increased prevalence in type 'b' pits and postholes is difficult to interpret because of the small sample size. Enough evidence of gnawing is present at Forcello to conclude that dogs, and probably foxes, had some access to rubbish and food refuse. The activity of these scavengers will further bias against the survival and recovery of sheep/goat bones, which are smaller and less robust than those of cattle or pig.

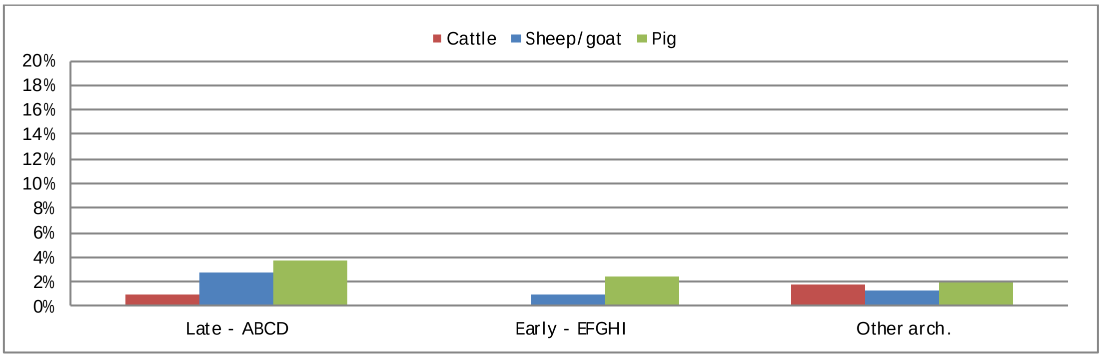
Figure 4.2.5 Relative frequencies of bones with gnawing marks by period
Number of specimens (Late/Early/Other arch.) = cattle (223/173/220), sheep/goat (445/290/593), pig (2163/900/2106).



4.2.5 Burning

The treatment of bones during cooking and disposal can also affect their survival. Evidence of burning was rare on bones from the main domesticated taxa for all periods considered (Figure 4.2.6, Table 4.2.2). Additionally, the distribution of burned faunal material varies little across context types (Table 4.2.3). Hearth and forges, as a result of their function, contain a higher proportion on burned material. Store pits also have a higher proportion of burnt bones than other context types, possibly resulting from the destruction of the structure that contained them. The predominance of calcined bones in store pits supports post-depositional burning; the bones were burnt to a degree well beyond that required for cooking, so it seems unlikely that the material was burned before deposition. For all archaeological context types, calcined bones, rather than burnt or singed, where the most prevalent. Overall, destruction by fire does not appear to be a major factor in the formation of the Forcello faunal assemblage.

Figure 4.2.6 Relative frequencies of burnt bones period
Number of specimens (Late/Early/Other arch.) = cattle (223/173/220), sheep/goat (445/290/593), pig (2163/900/2106).



4.2.6 Summary and comparison to previous work at Forcello

Of the taphonomic processes considered above, recovery bias will have the greatest effect on subsequent interpretation of the assemblage. Ratios of adjacent small and large bones clearly indicate a preference for the recovery of larger species and anatomical elements. Because of their size, sheep and goats are negatively affected and will be underrepresented. The distribution of butchery, burning, and gnawing is comparable across taxa, periods, and context types, although the Late period contains slightly higher instances of butchery and gnawing. These differences are important to consider when making chronological comparisons, especially in the case of cattle, which contains the largest variation between periods. Besides this example, the taphonomic differences should not significantly complicate comparisons across taxa, periods, or context types.

Another important aspect to consider is the sheer size of the Forcello assemblage. Both this project and the previous work done by Scarpa recorded a much greater quantity of animal remains than normally seen on Etruscan excavations. The great quantity of faunal material at Forcello is partly linked to the brief chronology of the site – there are not complications from residual material. The excavation of areas of rubbish disposal may also play a role, but the main factor linked to the recovery of so many animal remains is the good level of preservation seen onsite. In her 1988 report, Scarpa does not provide any comments related to taphonomic factors. However, the report does note the presence of a large quantity of bone fragments. Considering the short period of excavation and vast quantity of material presented in the previous report, we can assume a similar level of preservation and recovery was present in the previous study.

4.3 SPECIES REPRESENTATION AND RELATIVE FREQUENCY

4.3.1 Species representation and frequencies through time

As on all Etruscan sites of this period, the animal bone assemblage from Forcello is dominated by the remains of the main domestic taxa – cattle, sheep/goat, and pig (Tables 4.3.1–3). Both sheep and goat remains were identified. Dogs and equids, including both horse and donkey, are also present. Red deer is the most common wild species, although roe deer, fox, badger, wild boar, hare, birds, and fish also feature in the assemblage (cf. Table 3.5.1 for scientific names). Wild animals were rare compared to domestic species (Table 4.3.3). Thus, while hunting was practiced, it made a relatively minor contribution to the diet and subsistence of the settlement. In contrast, the breeding and keeping of domestic livestock was central to life at Forcello. Pig is by far the most prevalent species according to the number of counted specimens (NCSP) (Figure 4.3.1). Sheep/goat is the next most frequent taxon, followed by cattle. The clear predominance of pig is visible throughout the Early and Late periods and in other archaeological contexts. There is a slight increase in pig and decrease in sheep/goat frequencies in the Late period, while the relative importance of cattle remains low and stable. When individual phases are considered (Figure 4.3.2), the relative proportions of the three taxa vary to a greater degree; however, there are not major changes between phases, and the variation is in part linked to large differences in sample size. Furthermore, no major differences in species frequencies are visible between phase types. Phases characterized by open air workspaces (phases E and H) have similar species frequencies as phases associated with houses.

The species frequencies presented by analysis of the *minimum number of animal units* (MAU) are more complex. When the site is considered as a whole (Figure 4.3.3), pig is clearly predominant in both NCSP and MAU analyses. For the Late and other/unphased archaeological periods, species frequencies mirror those presented by NCSP (Figure 4.3.4). However, the Early period is markedly different. When MAU is considered, sheep/goat is the most frequent taxon, followed by pig. Cattle frequencies are low and similar to those presented by the NCSP. The elevated presence of sheep/goat in the Early period is partially a result of the relationship between teeth and post-cranial bones. For all periods, sheep/goat and pig teeth represent a similar number of individuals (Figure 4.3.5a). Conversely, pig postcranial bones account for many more animals than sheep/goat bones (Figure 4.3.5b). The influence of body part distribution on species representation is explored further in sections for individual taxa.

Figure 4.3.1 Relative frequencies from NCSP by period
(n) = NCSP.

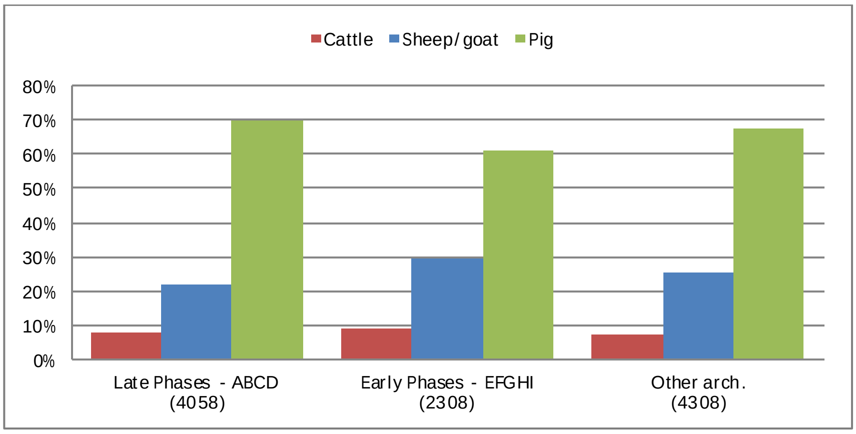


Figure 4.3.2 Relative frequencies from NCSP by phase
(n) = NCSP.

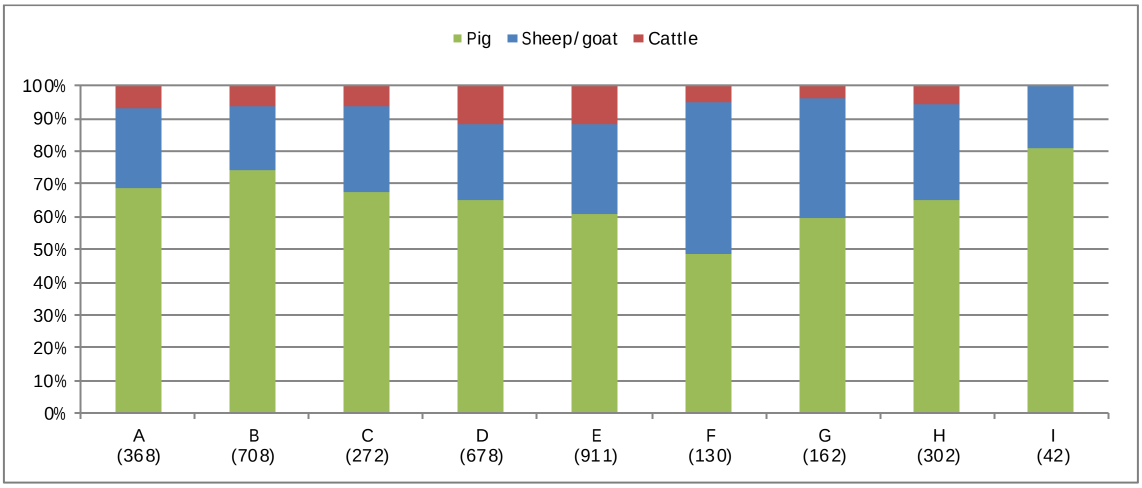


Figure 4.3.3 Relative frequencies from NCSP and MAU for all archaeological periods
(n) = sample size. MAU = max MAU.

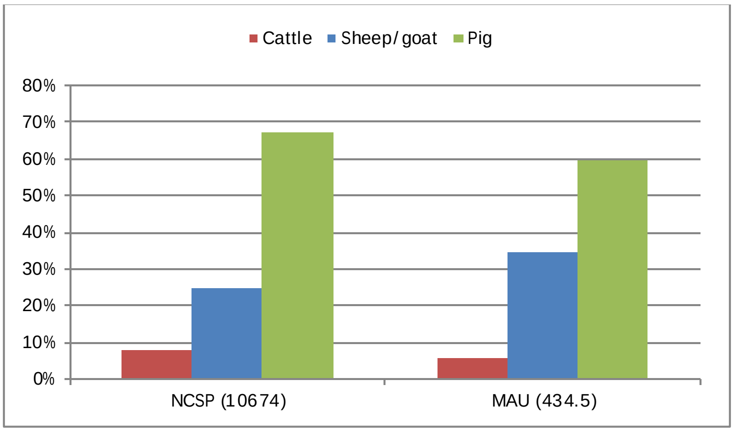


Figure 4.3.4 Relative frequencies from MAU by period
(n) = MAU total.

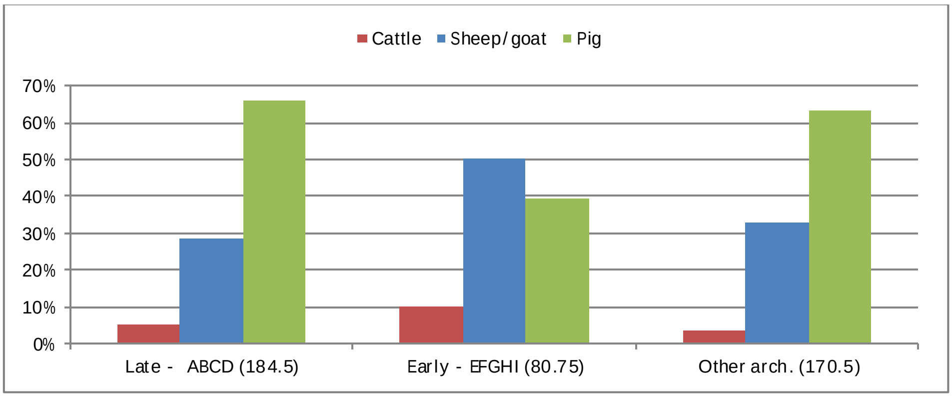


Figure 4.3.5 Relative frequencies for teeth and bones from MAU by period
(n) = MAU total.

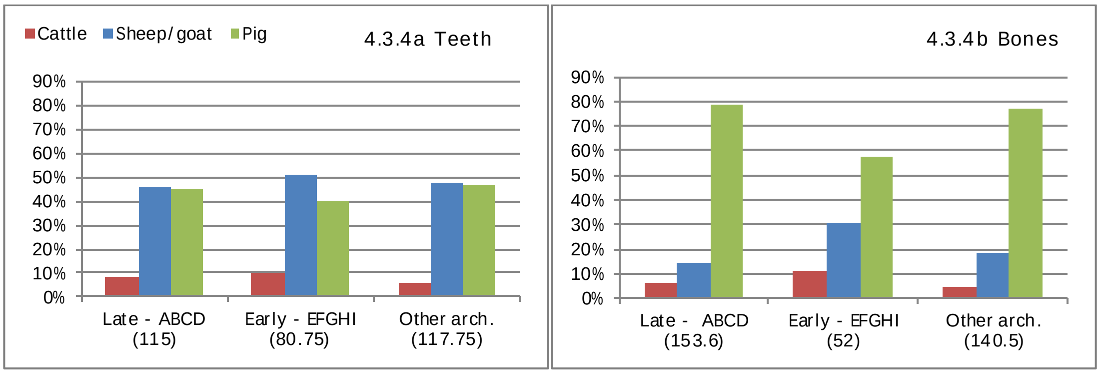
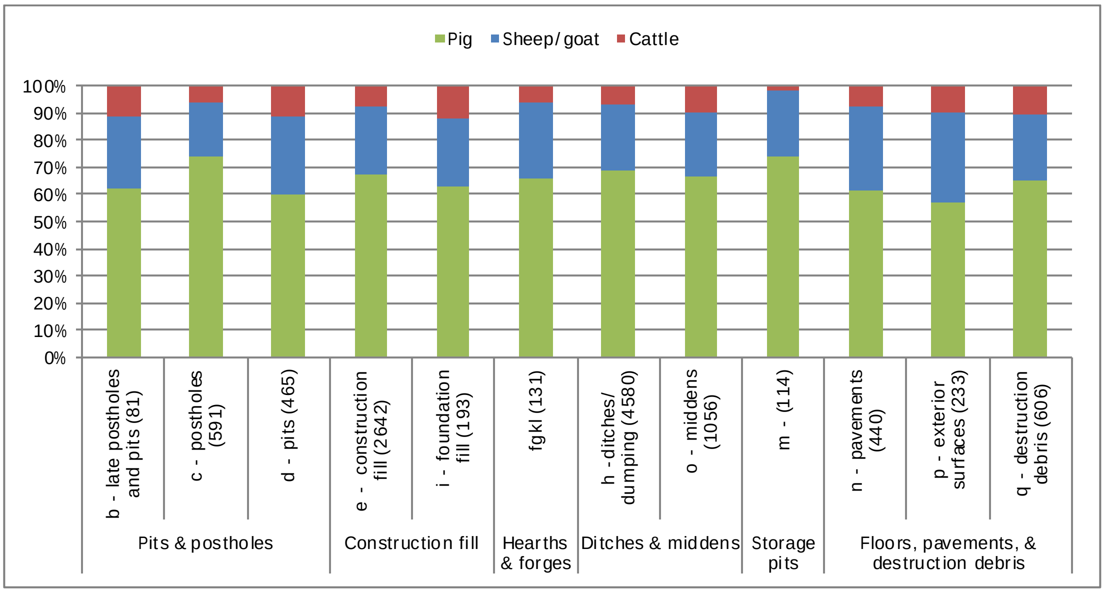


Figure 4.3.6 Relative frequencies of cattle, sheep/goat and pig by context type
(n) = number of specimens.



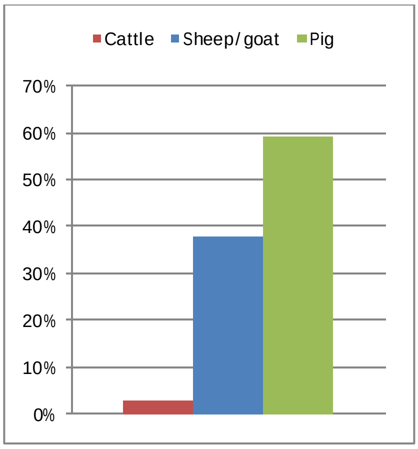


Figure 4.3.7 Relative frequencies from sieved NCSP
NCSP = 66. Only includes specimens labeled as sieved.

4.3.2 Species frequency by context type

The distribution of different taxa across context types was quantified using the NCSP. Overall, species frequencies between different context types is strikingly constant (Figure 4.3.6), despite large differences in the amount of material associated with each group. All of the context types considered contain high proportions (c. 60% or more) of pigs. Sheep/goat and cattle are less frequent. Wild taxa were rare (3–5%) in all context types. MAU was not used to calculate species frequencies for context types because of low sample size.

4.3.3 Species representation and frequencies from sieved material

Compared to the hand collected assemblage, only a tiny portion of faunal material was sieved. Species frequencies from faunal material clearly marked as sieved (Figure 4.3.7, Table 4.3.5) were similar to primary NCSP and MAU frequencies, although some differences are visible. As a result of the improved level of recovery, small rodents and amphibians account for a larger proportion of the sample. Among domestic livestock, the relative proportion of cattle is very low; large specimens were probably removed before samples were sieved, and therefore were bagged separately. Sheep/goat remains are more frequent than in taxa frequencies from the main NCSP and MAU, illustrating the better recovery of small specimens. As in the other analyses, pigs remain the most frequent taxa. Species frequencies from the three contexts most affected by sieving (Table 4.3.6) also reinforce the main species frequencies. Pigs are the dominant taxa, followed by sheep/goat, and lastly cattle. Context 476 has a higher percentage sheep/goat and a lower percentage of pig than usual, but this may result the unique nature of the context (destruction layer in primary context from the phase F house) as well the influence of sieving. Overall, species frequencies from sieved material support those presented above. Domestic livestock from sieved contexts are not discussed further because of their tiny contribution to the overall assemblage.

4.3.4 Summary and comparison to previous work at Forcello

The above analyses draw together an interesting picture of the relative proportions of species present at Forcello. An increase in pigs through time is visible in each investigation, although the amplitude of this increase varies. NCSP and MAU agree that pigs were clearly the predominant species in the Late period and for unphased archaeological material, but in the Early period the two quantification systems are less consistent.

The results of previous zooarchaeological work at Forcello are in close agreement with species frequencies provided by the NCSP. Scarpa reports taxa frequencies derived from NISP (cf. Figure 3.2.1). Species frequencies are compared between ‘recent’ and ‘ancient’ periods, and the results identified a high frequency of pig remains and an increase in pig proportions through time. The relative abundance of sheep/goat and cattle remains is also very similar between the two studies, although the older report does not demonstrate as great a drop in sheep/goat frequencies in later phases. Scarpa's comparison of different context types (cf. Figure 3.2.2) also supports the NCSP analyses presented above. Again, pig is the most frequent species in all context types, followed by sheep/goat and finally cattle. Fauna recovered from canals varies somewhat from the main pattern, but there are a number of discrepancies in the original tables (*e.g.* data totals are not actually the sum of related sub-groups) that prevent further interpretation of this trend.

Species frequencies derived from the MAU are more puzzling. When the site is considered as a whole, pig is clearly predominant in both NCSP and MAU analyses. Results for NCSP and MAU are also similar in the Late and unphased archaeological periods; however these quantification methods present disparate results for the Early period: NCSP indicates that pig was clearly the dominant species, while MAU shows sheep/goat as predominant. The previous report is unable to resolve this issue. Scarpa does not present MAU or MNI values. Additionally, because the original study deals with material from the earliest excavations, the previous report is unlikely to include fauna from the site's deepest strata. Hand recovery should bias against sheep/goat because of their small size, but this should occur consistently across periods. Species distribution across context types is constant, so it also seems unlikely that aggregation inflated the importance of sheep/goat. Body part distribution is a factor that typically influences MAU, and the inconsistency species frequencies will be discussed further after analysis of anatomical element representation for each taxon.

In conclusion, analyses of overall species frequencies provided by the NCSP, the MAU and the earlier work by Scarpa demonstrate a clear overall predominance of pigs at Forcello. Sheep/goat is the next most common species, while cattle frequencies remain low. The relative importance of pig increases through time, mirrored by a relative decrease in the contribution of sheep/goat. The proportion of cattle remains low throughout. Frequencies from MAU suggest differences in the management and use of pigs versus sheep/goat and imply a greater reliance on sheep/goat in the Early period. Species representation remains constant between context types.

4.4 PIGS

4.4.1 Skeletal element abundance and body part distribution

All parts of the pig (*Sus scrofa*) skeleton are present in the Forcello assemblage. When all archaeological periods are considered together (Table 4.4.1, Figure 4.4.1), the scapula is the most abundant element. On account of the scapula and ulna, the forelimb is better represented compared to the hindlimb. Post-cranial bones are more common than teeth. Despite large differences in the total MAU, the distribution of most elements is similar through time (Figure

4.4.2, Tables 4.4.2–4). However, the relative abundance of the scapula is somewhat greater in the Late period. In turn, most other elements are comparatively less frequent than in the early phases of the site. Pig teeth and the atlas break from the overall trend and are much better represented in the Early period than the Late period.

Two of the major factors which appear to have influenced body part distribution are hand collection and bone density. As discussed above, recovery through hand collection will bias against smaller elements. As a result, small bones, like the third carpal, cuboid, and phalanges, are infrequent. Hand collection will also influence the abundance of teeth, since individual teeth are less likely to be recovered than those in jaws. A clear link between element survival and density is shown in Figure 4.4.3. The diagnostic zones for each bone were matched as closely as possible to one of Pugsley's (2002) density sample sites from pig bones (Table 4.4.5) and plotted against their %MAU. For most of the elements considered, there is a strong correlation between density and survivorship (r = 0.922, main bones in blue), but phalanges and the scapula are clear outliers. Phalanges will be underrepresented because their small size. Indeed, second and third phalanges are further from the trend line than the larger first phalanx. In contrast, the scapula is far more abundant than anticipated for both density values that fall within the scapula diagnostic zone (i.e. SP1, SP2). Pugsley's density measures for each element, including the scapula, do not fit perfectly with the zones used for this project, so some degree of variation is expected. The unique shape of this bone may also enhance its survival or recovery.

Figure 4.4.1 Pig body part distribution for all archaeological phases
Max MAU = 260. (scapula). Unfused epiphyses excluded. cf. Table 3.6.1 for MAU calculations.

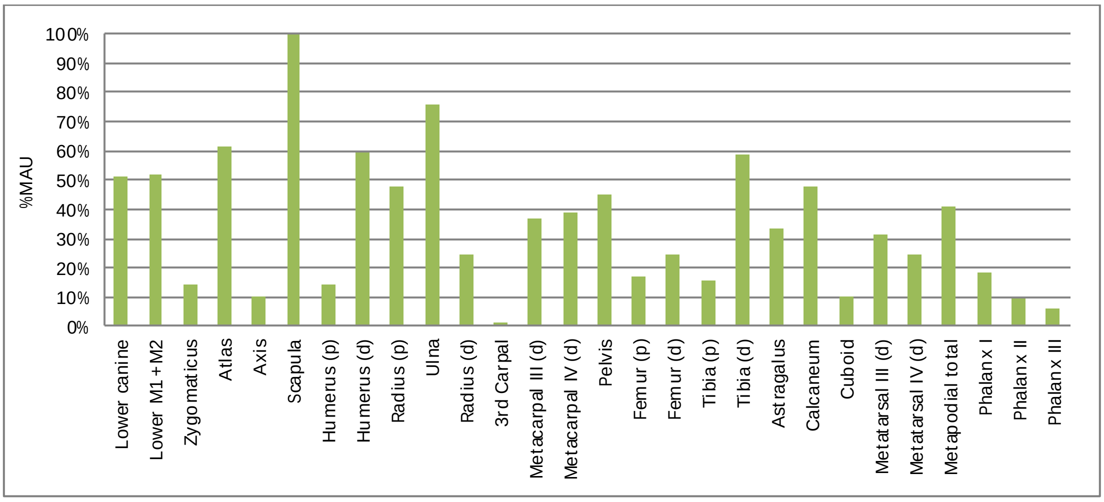


Figure 4.4.2 Pig body part distribution by period

Late max MAU = 121.5 (scapula). Early max MAU = 32 (canine). Unfused epiphyses excluded. cf. Table 3.6.1 for MAU calculations.

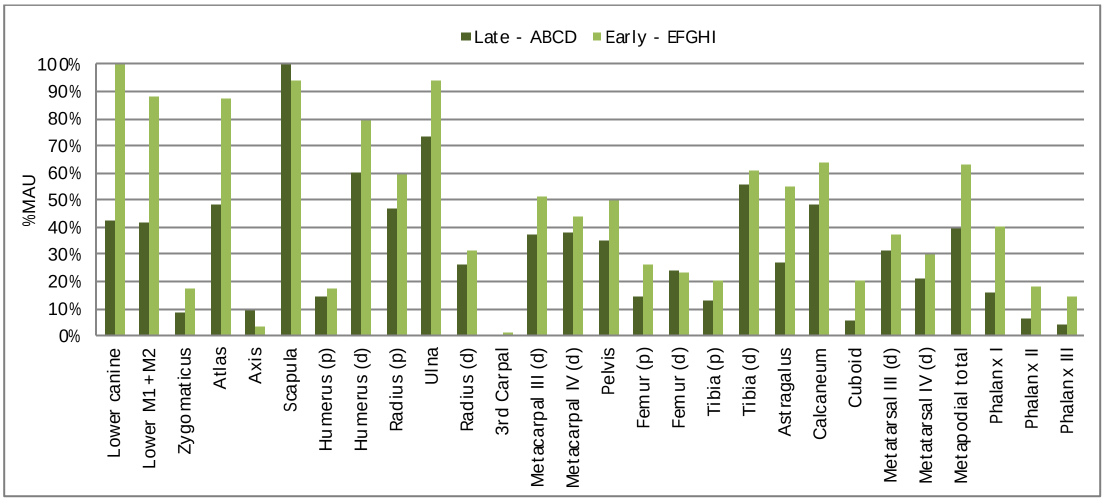


Figure 4.4.3 Pig %MAU vs. density for different elements

Sus scrofa combined mineral bone density from Pugsley (2002).

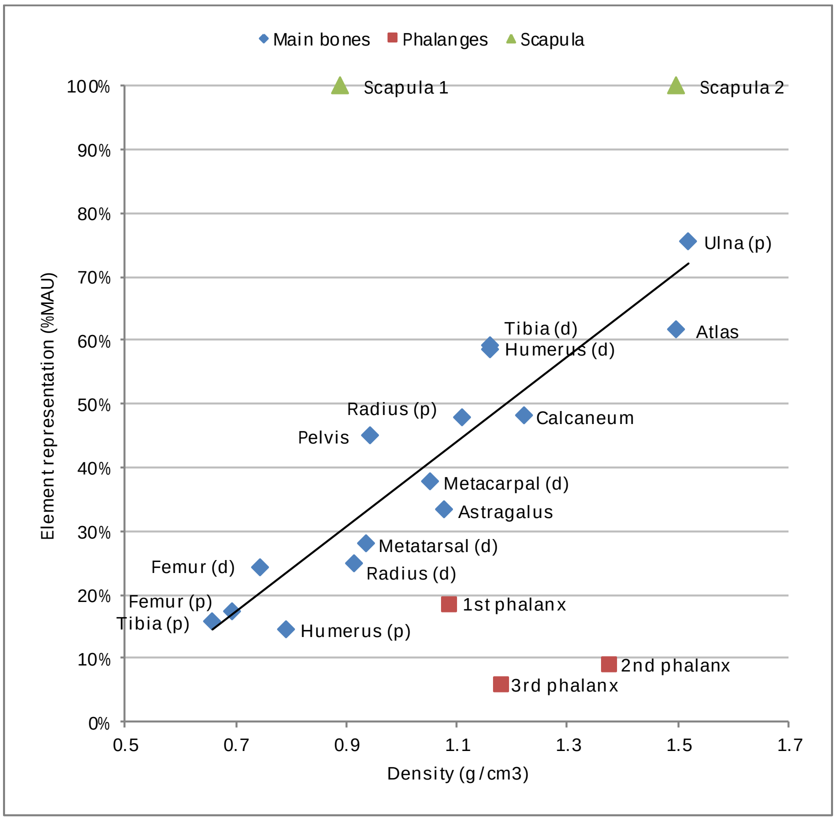
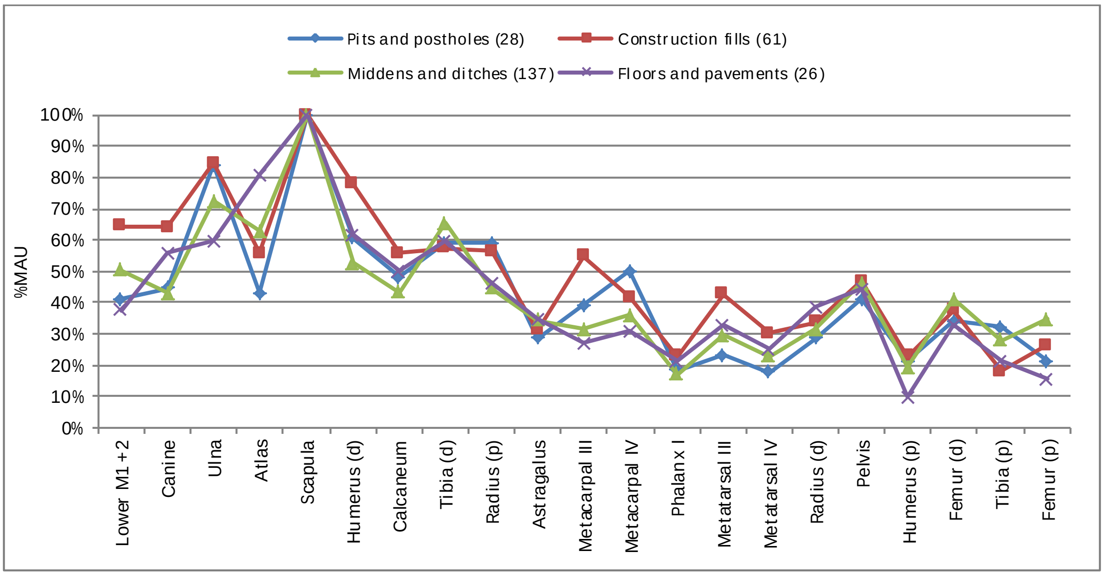


Figure 4.4.4 Pig body part distribution by context type
(n) = max MAU (scapula). Elements ordered according to density. Unfused epiphyses excluded. cf. Table 3.6.1 for MAU calculations.



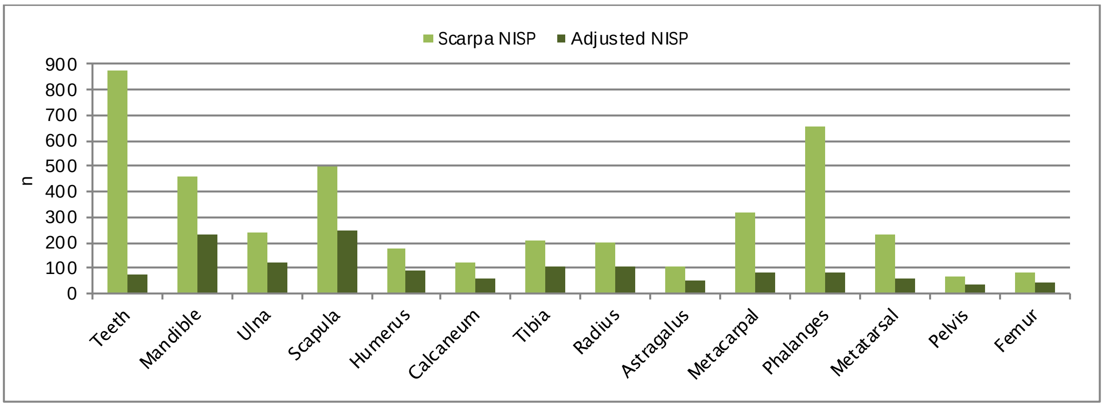
The relative abundances of different skeletal parts were very similar across different context types despite large differences in sample size (Figure 4.4.4). The scapula was the most common element in all context classes, and element survivorship decreases with bone density. The consistency of pig body part representation across context types indicates that pig remains were not selectively deposited into pits, middens, or other features. If the shoulder was treated differently than other body parts, differences might be visible in the disposal of the scapula between contexts. However this is not the case and the pattern is very similar across context types.

Analysis of side (left/right) bias in body part distribution revealed a significant result ($p<0.01$) for only one element – the astragalus (Table 4.4.6). Left astragali outnumber right-sided specimens. The astragalus is not a meat-bearing element, so it is unlikely to have been specially used for economic reasons; rather cultural factors probably underlie the differential treatment of pig knucklebones. Astragali have been used as a tool for divination and as gaming pieces throughout antiquity, including in pre-Roman Italy. Large collections of knucklebones have been found in graves (de Grossi Mazzorin and Minniti 2012; 2013). De Grossi Mazzorin and Minniti (ibid.) do not note any significant side biases in their discussion of astragali in ancient Italian games and rituals, although the placement of dozens or hundreds of astragali in some graves (e.g. along the left side of the body in tomb 101 at Varranone) suggests that knucklebones played some role in the organization of space around the deceased. Many of the astragali in cemetary assemblages have been pierced or smoothed (ibid.), unlike at Forcello where no unusual modifications were recorded. Without any evidence for ritual activity at the site, it seems likely that pig astragali were used as gaming pieces or other small toys. Left astragali may have been more desirable for this purpose and therefore preferentially kept by some inhabitants of Forcello.

Overall, hand collection and bone density are major influences on the distribution of pig body parts in the Forcello assemblage, while there is less evidence of differential destruction or transport by the inhabitants of the site. Small elements, most likely missed by hand collection are rare. Bone density is closely linked to bone survival and recovery. Pig body part distribution is very similar across context types. The relative abundances of different elements are very similar between periods, except for a greater abundance of teeth and atlas vertebrae in the Early period. This probably relates to taphonomic factors. In many cultures the head of an animal is commonly removed between the skull and the atlas (Binford 1981:91), so it seems unlikely that that atlas and cranium were transported together as a unit. Additionally, the zygomaticus and axis do not follow the same pattern and are rare in both periods; the opposite would be expected if either the head or the neck of the animal were transported together. Likewise, the prevalence of the scapula could relate to special use of the pork shoulder, but the homogenous distribution of body parts across context types does not support the special treatment of this part of the animal. The pig forelimb is somewhat better represented than the hindlimb, but the anterior limb contains a great number of dense and early-fusing elements than the back leg. In fact, the forequarter of the pig is better represented than the thigh on almost all central Italian sites studied by Minniti (2012). Taphonomic factors probably account for the majority of variation in pig body part distribution, but these factors are difficult to determine with certainty.

Scarpa found a similar situation in her early work. She too noted that the anterior limb was more prevalent than the posterior limb. Contradictions in the data tables presented in the earlier report preclude a detailed reconstruction of pig element distribution, but a basic summary of the data illustrates similarities between this project and the earlier report. Figure 4.4.5 presents NISP totals for various pig body parts and an adjusted NISP calculated by dividing an element's NISP by its frequency in the skeleton. This adjustment was done to provide a rough estimate of MAU and to improve comparability between the original results and those presented here. Again, the scapula is particularly abundant. The earlier report does not provide additional information on teeth or the atlas, because teeth were considered as a group and the atlas was not included. The report also does not offer information on the distribution of sided remains. Nevertheless, Scarpa's report concurs with the major trends in pig body part distribution. Future excavations may resolve some of the puzzling trends visible in the current data, but at this point it appears that all parts of the pig appear were deposited on site. Context type had little influence on the deposition of pig remains, and, with the exception of teeth and the atlas, body part distribution changed minimally through time.

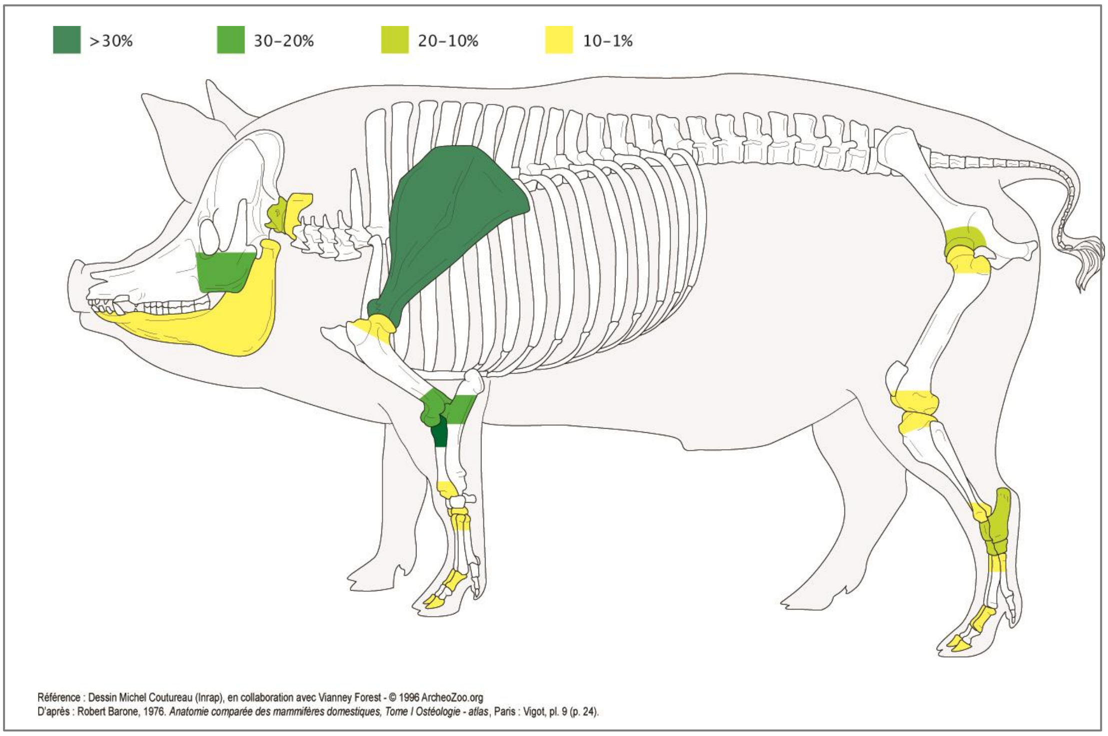
Figure 4.4.5 Total number of pig elements from Scarpa (1988) and adjusted NISP
Adjusted NISP= n/2, except for teeth (n/12), metapodials (n/4), and phalanges (n/8)



4.4.2 Butchery

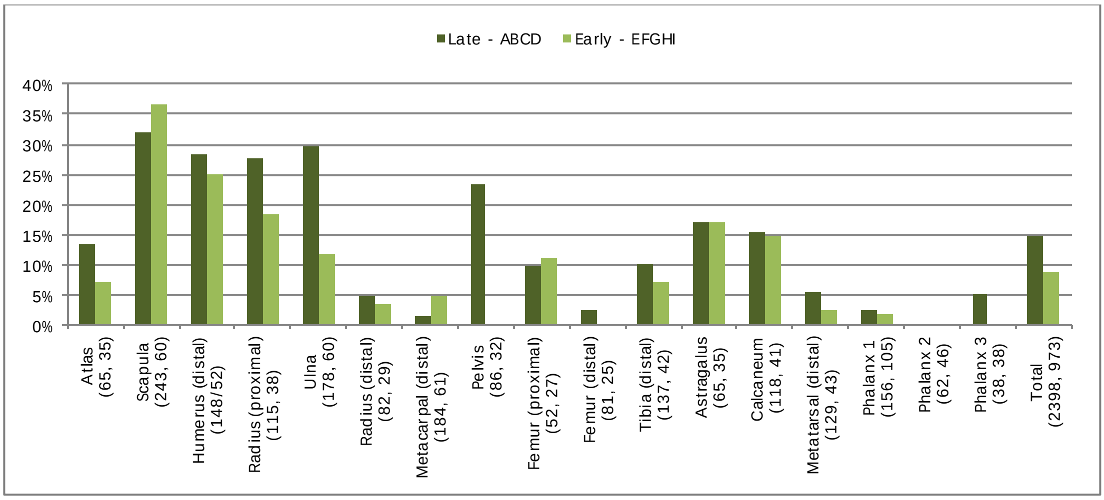
The majority of butchery marks on pig bones are cut marks left by knives or other light tools (Table 4.4.7). Chop marks left by heaver cleavers are also present, as are lighter clefts left by the forceful use of a knife. Butchery marks are most heavily concentrated on the upper forelimbs (Figure 4.4.6), a common location for such marks due to the irregular shapes of these bones (Binford 1981). Marks are also present on long bone articulations, as well as on the pelvis, tarsals, and atlas. Nearly all butchery marks were associated with dismemberment of the carcass. Breaking down a pig carcass in Etruscan times followed a pattern not unlike that of today. The head was removed from the body, as were the fore and hind quarter. These limbs were divided into smaller sections at the articulations of long bones. The identification of several sets of joining third and fourth metapodials indicates that the trotter was sometimes deposited intact. Similarly, several articulating radii and ulnae demonstrate that the upper arm was occasionally left intact or disposed of simultaneously. The scapula and ulna also bear longer longitudinal cuts indicative of filleting. Cut marks on the phalanges, lower metapodials, and mandible may result from skinning; most Iron Age pigs probably had a considerable amount bristly hair that would need to be removed (either through skinning, scalding, or singeing). Marks on the jaw and zygomaticus may result from removal of meat from the head. The pattern of pig butchery present in the Forcello assemblage encompasses what Binford (1981) refers to as primary and secondary butchery. Primary butchery, done at the kill site, frequently includes the removal of the head and limbs. Secondary butchery for meat distribution, consumption, or storage is often done closer to the place of consumption. Pig bones from Forcello bear traces of both of these stages, and the slaughter and butchery of pigs probably took place within or very near the settlement.

Figure 4.4.6 Pig bones with butchery marks
Bones with butchery marks are shaded according to the frequency of butchery marks.



Référence : Dessin Michel Coutureau (Inrap), en collaboration avec Vianney Forest - © 1996 ArcheoZoo.org
D'après : Robert Barone, 1976. *Anatomie comparée des mammifères domestiques, Tome I Ostéologie - atlas*, Paris : Vigot, pl. 9 (p. 24).

Figure 4.4.7 Percentages of pig bones with butchery marks by period
Number of specimens = (Late, Early). For elements with > 25 specimens.



The frequency of butchery marks on pig bones is fairly consistent through time (Figure 4.4.7) and between context types (Table 4.4.8). The primary change is an increase in the percentage of marks on the radius, ulna, and pelvis. Although butchery marks are present on the cranium, mandible, and atlas, they are not helpful in explaining the lower frequency of teeth and atlases in the Late period. Overall, butchery patterns on pig bones support conclusions from analysis of body part distribution: use of the pig carcass was fairly consistent through time, and different body parts were disposed of similarly.

4.4.3 Gnawing

Gnawing marks are most frequent on dense elements like the scapula, calcaneum, and distal humerus (Table 4.4.9). Conversely, the rarity of gnawing marks on the femur and proximal tibia likely relates to their density and the late point at which these bones fuse; they would have been more easily fragmented by carnivores. The prevalence of gnawing on different bones is similar throughout the three periods considered. The distribution of gnawed bones between context types is also very similar (Table 4.4.10). As expected, intact storage pits did not contain any gnawed remains. The consistency of gnawed bones through time and between context types confirms the patters established by body part distribution and butchery analysis above. Bones faced similar levels of carnivore exposure before burial through the history of the site and regardless of context type.

4.4.4 Burning

Evidence of burning is rare throughout all periods (Table 4.4.11), and the distribution of burned faunal material varies little across context types (Table 4.4.12). Store pits and hearths and forges contain a higher proportion of burned remains. For all archaeological context types, calcined pig bones, rather than burnt or singed, were the most prevalent.

4.4.5 Age

Age data for pig bones was provided by mandible wear stages and bone fusion. Pig jaws indicate a peak in the culling of sub-adult animals, but about half of the pig population lived into early adulthood (Figure 4.4.8). The presence of a relatively high percentage of animals at adult stage 2 is somewhat unusual, as pigs throughout history have typically been slaughtered when they reach maximum body size as sub-adults. Once Late and Early periods are divided, a shift toward the culling of younger pigs is visible in the later phases (Figure 4.4.9). A smaller proportion of pigs reached adult stages 2 and 3, and a higher percentage of pigs were slaughtered when they were immature or sub-adult. Analysis of pig fusion confirms the age trends presented by pig mandibles. Across all archaeological periods, most early fusing elements fused; while a lower proportion of late fusing bones reached maturity (Figure 4.4.10). A shift toward a younger age at death in the Late period is also visible in fusion data (Figure 4.4.11). In addition to age information provided by mandible wear stages and bone fusion, over a hundred neonatal/fetal pig bones were recovered from Forcello. These very young remains attest to the on-site breeding and probable consumption of very young pigs.

Figure 4.4.8 Pig mandible wear stages for all archaeological periods
Sample size = 295. Wear stages were assigned based on the Forcello estimation tables. Age classes follow O'Connor (2003).

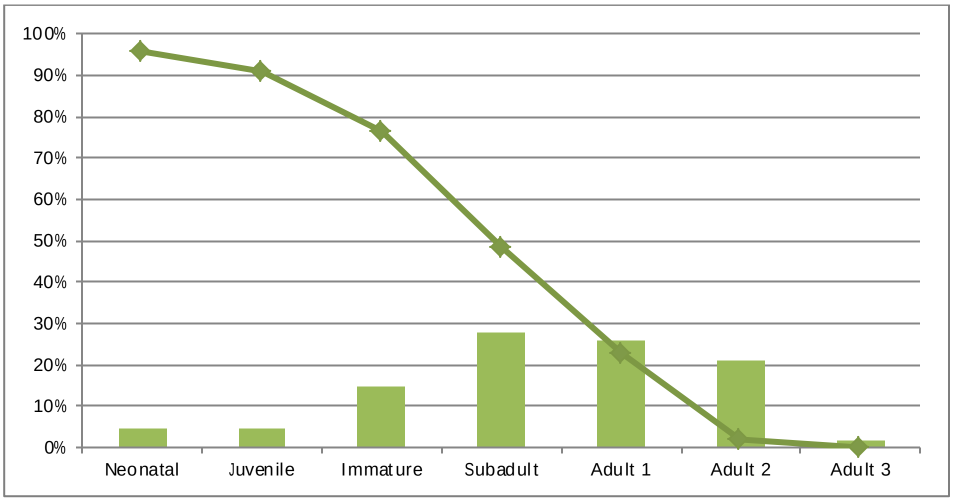


Figure 4.4.9 Pig mandible wear stages for the Late and Early periods
Sample size: Late = 110. Early = 69.
Wear stages were assigned based on the Forcello estimation tables. Age classes follow O'Connor (2003).

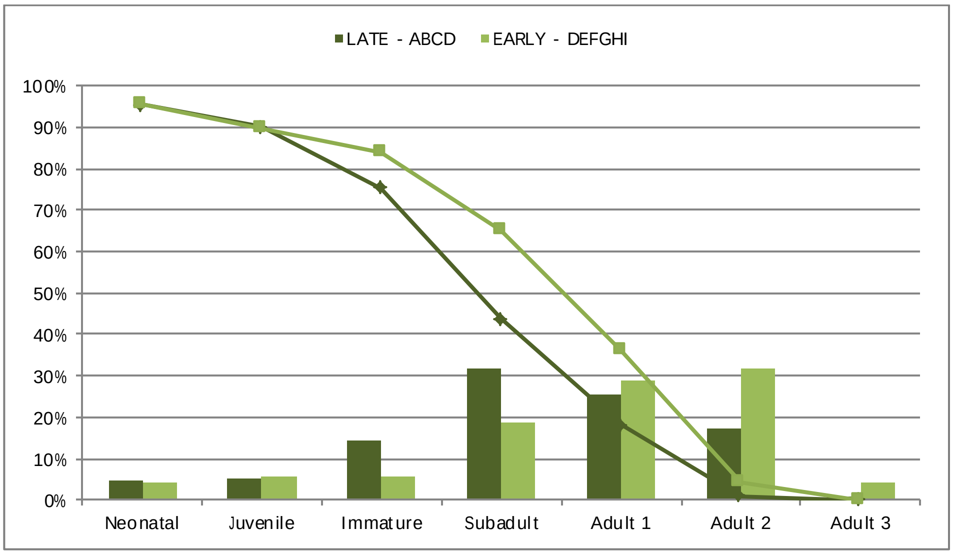


Figure 4.4.10 Pig fusing/fused vs. unfused bones for all archaeological periods
(n) = number of specimens. Unfused epiphyses excluded. Fusion sequence based on Silver (1969).

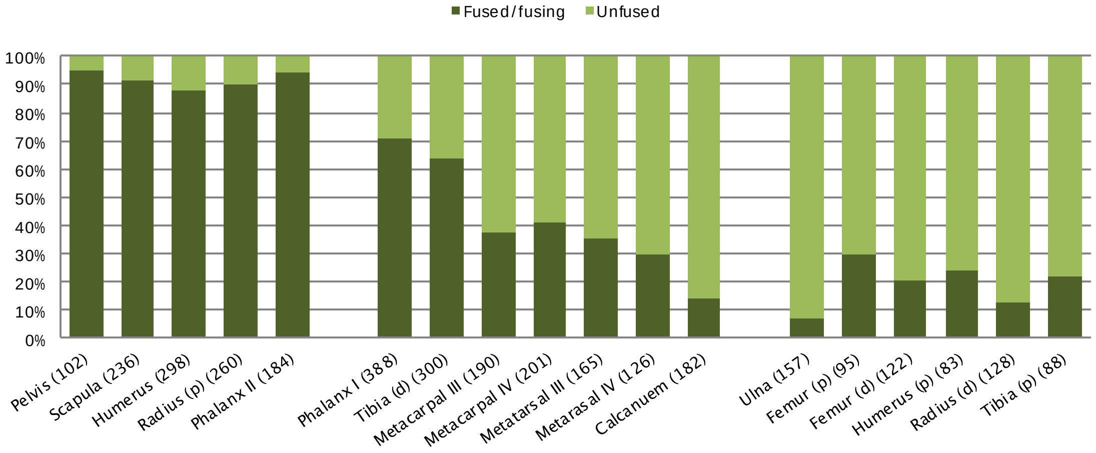
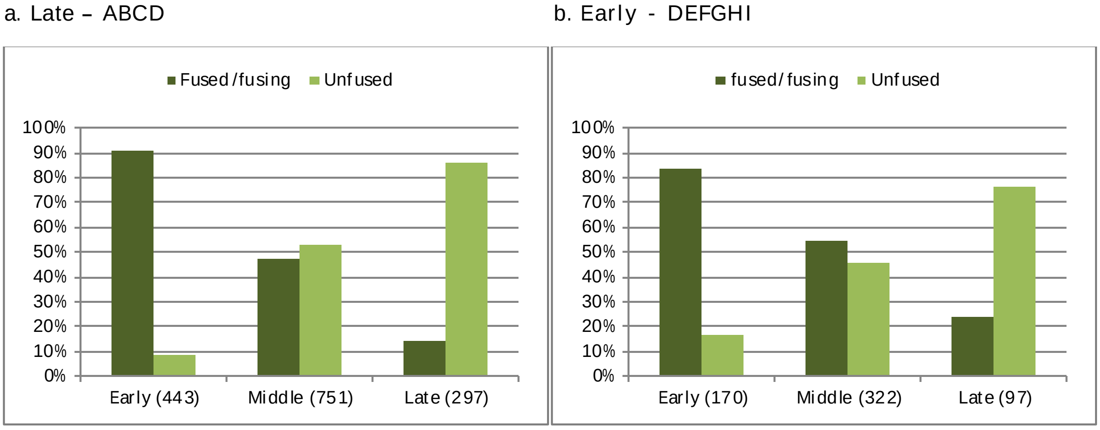


Figure 4.4.11 Fusing/fused vs. unfused pig epiphyses for Late and Early period
(n) = number of specimens. Unfused epiphyses excluded. Unfused epiphyses excluded. Fusion sequence based on Silver (1969).


a. Late – ABCD

b. Early - DEFGHI

Scarpa identified a higher proportion of adult animals. She reports that approximately 80% of the pig population at Forcello reached adulthood, based on a study of teeth and metapodials. This is a much higher percentage than the c. 50% adult population found in the analyses above. This proportion of adults is also in disagreement with the chronological shift toward a younger age at slaughter. Scarpa does not include information on aging methods or fusion data, so it is not possible to re-evaluate these conclusions. The metapodials analyzed in this project do not agree with a high proportion of adult animals; rather, they indicate a lower percentage of mature individuals – about 30–40% of the assemblage. The disparity between the kill-off patterns presented in analysis at Forcello is important, because Scarpa uses the marked prevalence of adult pigs as evidence of a complex and well-structured and system of animal husbandry that includes the exportation of the pork hindlimb. The results presented here contradict the earlier findings. Although a higher percentage of pigs reach maturity at Forcello than at other sites, the proportion of the population that lives into early adulthood is closer to half.

4.4.6 Sex

Information on pig sex ratios comes from canine teeth. Measurements for the height of the medial wall of the acetabulum (H1, H2) were also taken following Greenfield (2006), in the hope of providing comparative post-cranial data on pig sex. Unfortunately, these measurements do not expand upon sex information provided by pig teeth. Greenfield, working with only six pig H1 measurements, noted that this measurement may have the potential to distinguish between the sexes, if measurements from archaeological specimens are compared to those of known sex. However, three quarters of the seventy-two H1 measurements from Forcello are larger than Greenfield's largest male specimen; his samples and the Forcello assemblage are not comparable in size. Likewise, no groups are visible within the population (Figure 4.4.12.).

Canines indicate that males and females were present in roughly equal numbers, although there are slightly more males in the later period (Figure 4.4.13). The predominance of male canines relates to their larger size and ease of recovery during excavation. When alveoli are considered the sex ratio reverses to favor female animals (57% female, 43% male, n=44). While for cattle and sheep/goat females are typically the preferred sex for reproductive reasons, both ethnographic work (Albarella et al. 2011) and zooarchaeological data from the Roman period (MacKinnon 2004a) indicate that castrated males, which have canines similar to complete boars, are sometimes the preferred sex, especially in extensively managed herds. Most male pigs at Forcello were probably castrated. Boars are more likely to fight and can be dangerous to other, especially male, pigs (Albarella et al. 2011; Halstead and Isaakidou 2011). Scarpa also found near-equal numbers of male and females canines (56 male, 59 female).

Figure 4.4.12 Pig pelvis measurements

a. H1 measurements b. H2 measurements

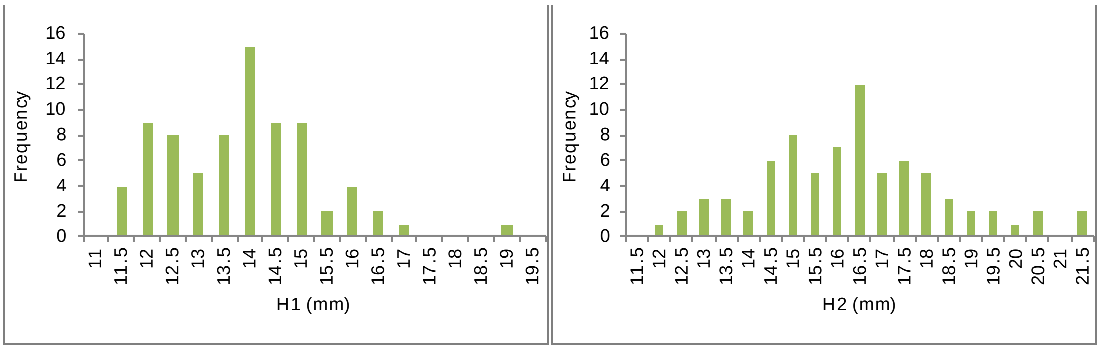
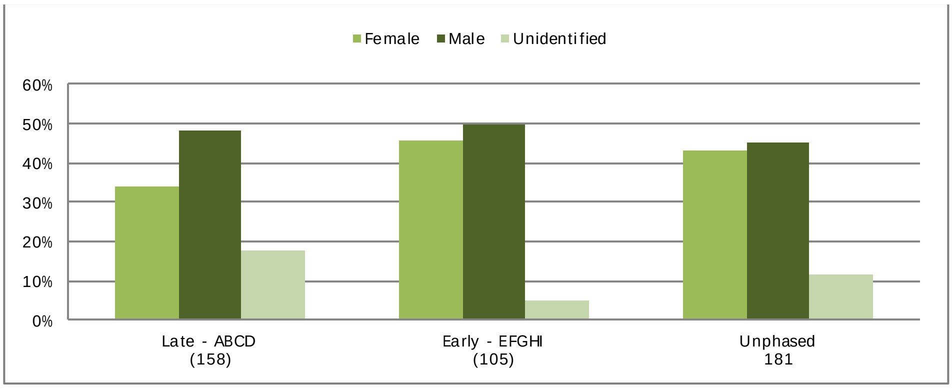


Figure 4.4.13 Pig canine sex by period.
(n) = number of specimens. Includes both canines and alveoli.



4.4.7 Biometry

Measurements from pig bones and teeth allowed for an investigation of pig size through time. Measurements from Forcello are consistent throughout both periods, and do not provide evidence of a change in animal size through time. Width measurements from the lower third molar (Figures 4.4.14) demonstrate a normal population curve with a few large outliers. Mandibular third molar measurements from the Late and Early periods (Figure 4.4.15) are similar. A clear separation of the lower first and second molar also indicates a relatively homogenous population (Figure 4.4.16), although large outliers are visible here as well. The size range presented by the deciduous mandibular premolar (Figure 4.4.17) is more limited. Post-cranial measurements echo the trends seen in teeth. The humerus (Figures 4.4.18–20), tibia (Figures 4.4.21–22), and astragalus (Figures 4.4.23–24) all point to a single pig population punctuated by a few large outliers. Very large specimens are visible in both the Late and Early periods. Measurements from the earlier report for the humerus (Figure 4.4.25), tibia (Figure 4.4.26), astragalus (Figure 4.4.27), were comparable to those take for this project. The small differences between the two sets of data are expected, because measurements in the early report were rounded to the nearest whole number rather than including a decimal place. Small differences may also result from minor variations in the way the measurements were taken. Large outliers are also visible in Scarpa's humerus measurements.

Especially large pig specimens are indicative of wild boar. Other, unmeasurable bones of similar size were also noted while recording. Figure 4.4.28 provides a real example of the size difference between domestic pigs and wild boar a Forcello. Like other wild species, wild boars are rare compared to the prevalence of domestic animals, but they appear in both the Late and Early periods. However, it is not impossible that wild boar of smaller size may be concealed within the main measurement group. Interestingly, outliers are less obvious in pig lower fourth deciduous premolars; perhaps hunting focused on mature individuals.

Figure 4.4.14 Pig M_3 width (WA) from all archaeological phases

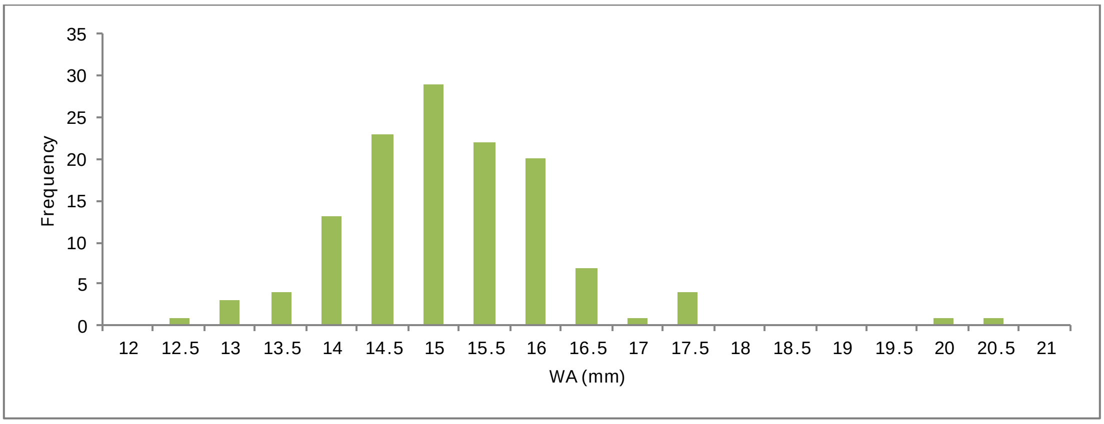


Figure 4.4.15 Pig M_3 width (WA) from the Late and Early periods

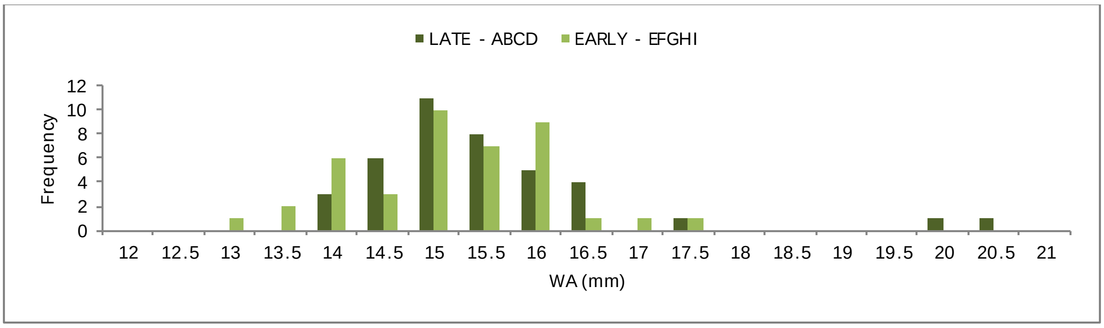


Figure 4.4.16 Pig lower molar widths

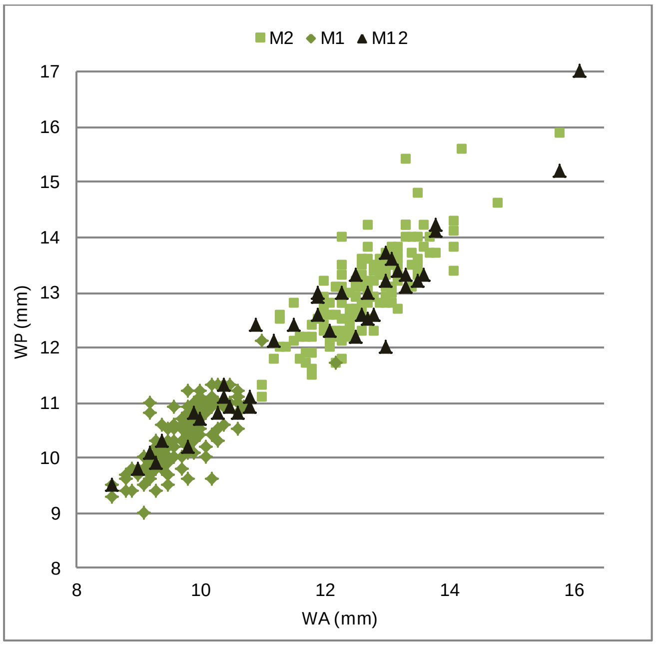


Figure 4.4.17
Pig dP$_4$ length (L) vs. width (WP)

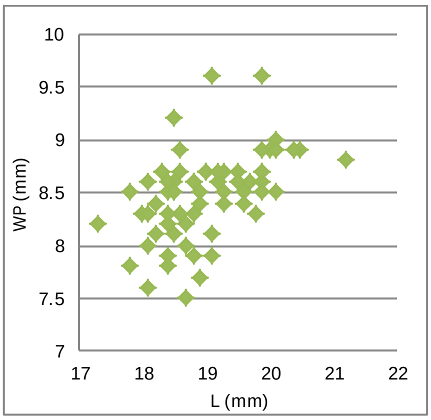


Figure 4.4.18 Pig humerus height of the trochlea condyle (HTC)

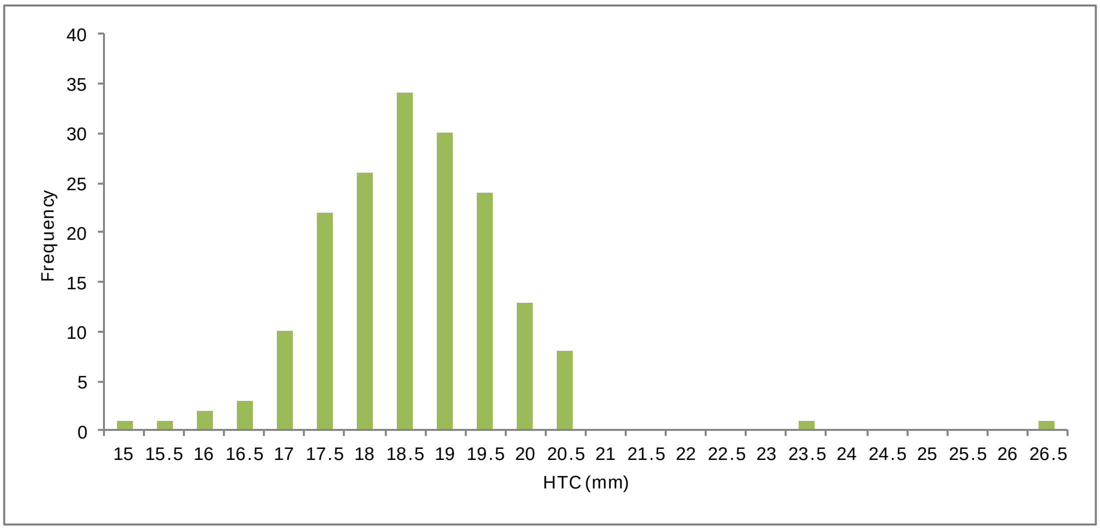


Figure 4.4.19 Pig humerus: BT vs. HTC

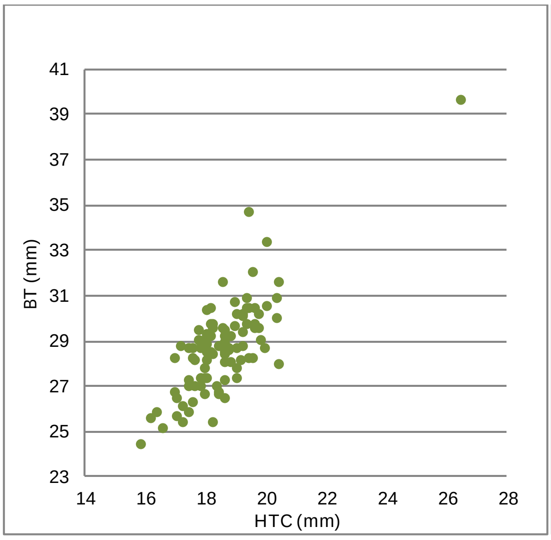


Figure 4.4.20 Pig humerus: BT vs. HTC

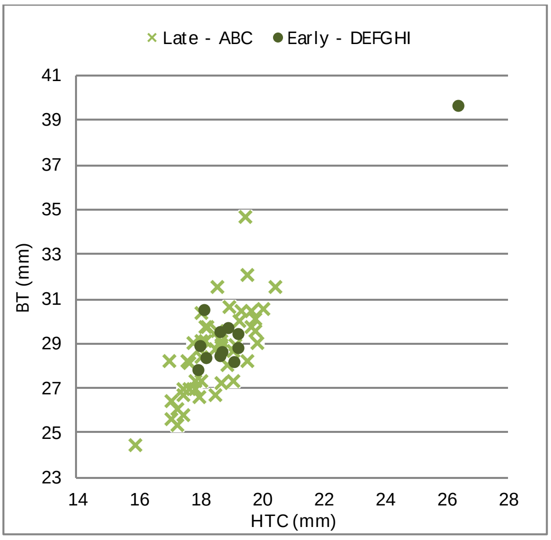


Figure 4.4.21 Pig tibia: Dd vs. Bd

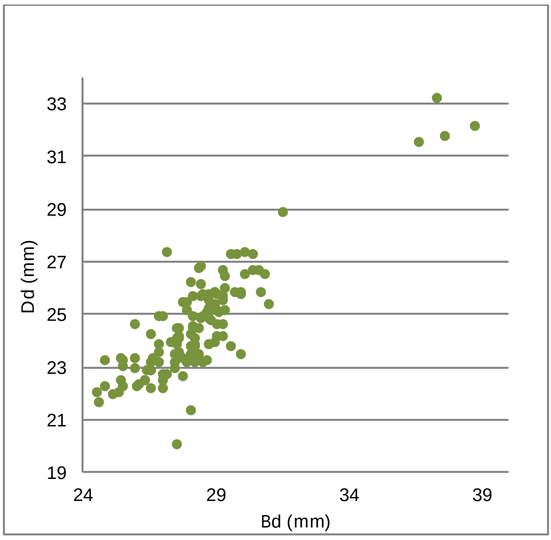


Figure 4.4.22 Pig tibia: Dd vs. Bd

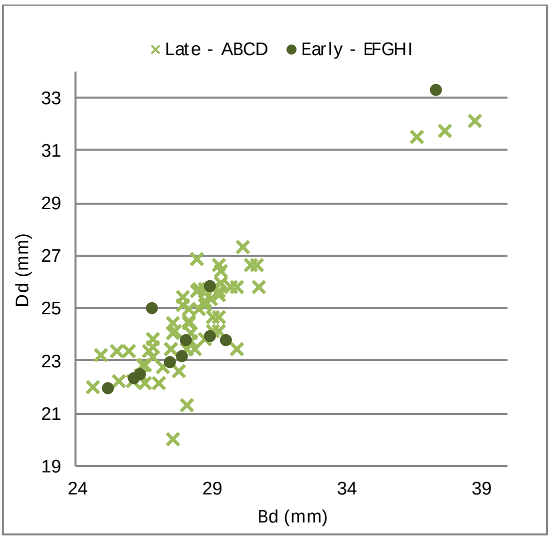


Figure 4.4.23 Pig astragalus: GLm vs. GLl

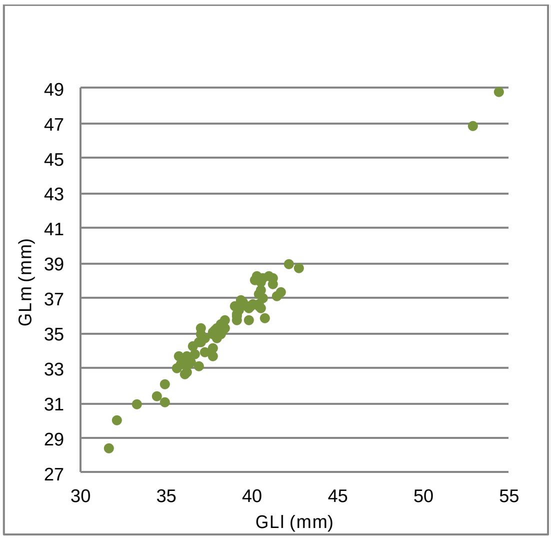


Figure 4.4.24 Pig astragalus: GLm vs. GLl

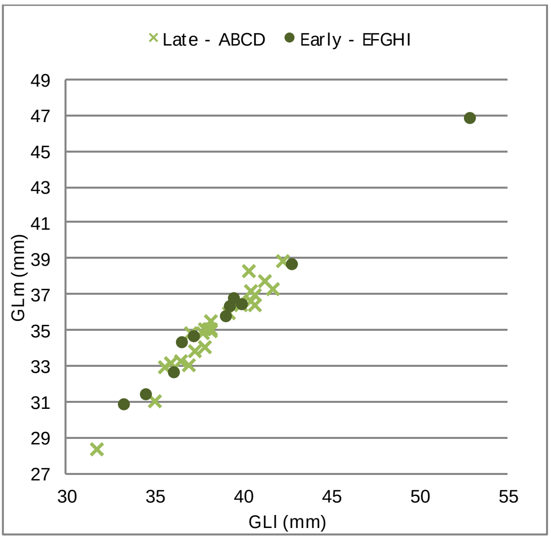


Figure 4.4.25 Pig humerus BT for this project compared to the earlier Scarpa report

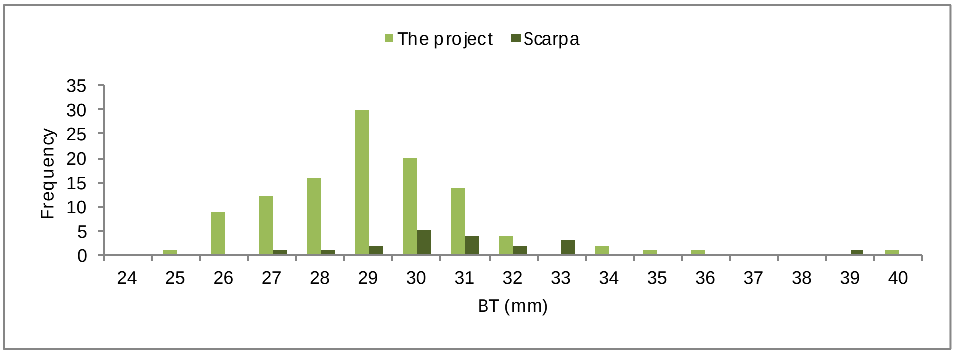


Figure 4.4.26 Pig tibia Bd for this project compared to the earlier Scarpa report

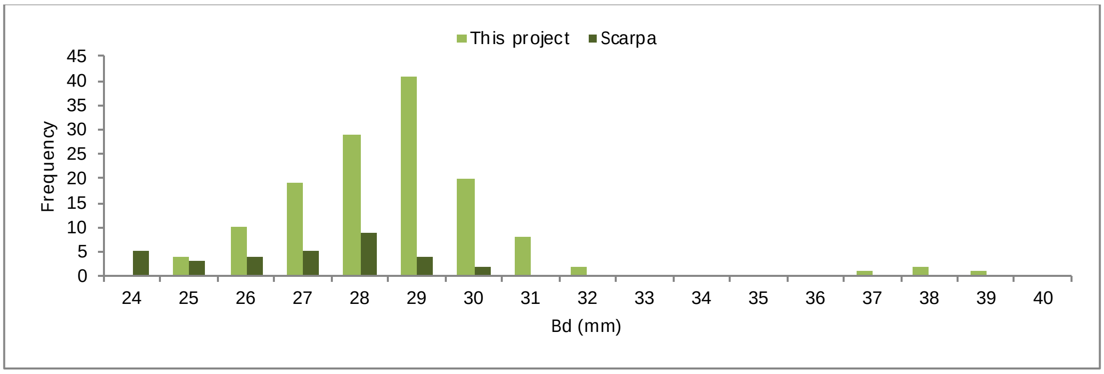


Figure 4.4.27 Pig astragali from this project compared to the earlier Scarpa report

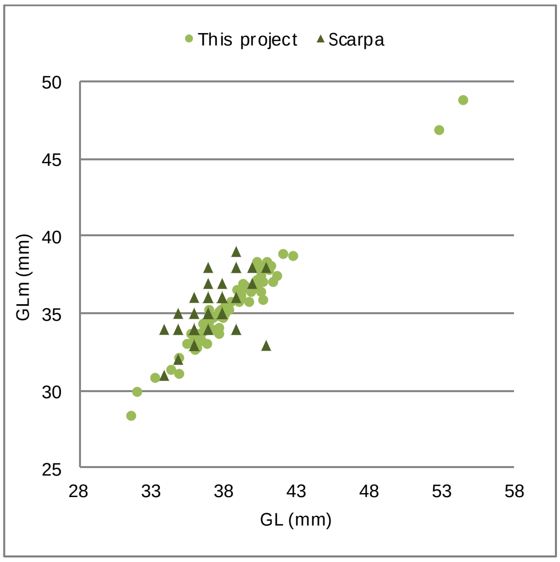


Figure 4.4.28 Pig calcanea from Forcello

From the same context. Specimen #11443, 11444. Photo by the author.

Figure 4.4.29 Pig calcaneum
with exostosis around the fusion zone
Specimen #4233. Photo by the author.

Figure 4.4.30 Pig scapula with
exostosis and evidence of breakage
The proximal gnawed. Specimen #11117. Photo by the author.

Figure 4.4.31 Pig scapula
with lipping on the articulation
Specimen #3289. Photo by the author.

Figure 4.4.32 Pig proximal
radius with exostosis
Specimen #2721. Photo by the author.

4.4.8 Pathology

Only a few pathological pig specimens were found in the Forcello assemblage. Most of the observed pathologies consisted of osseous growth related to infection or trauma (Figures 4.4.29–32). Several dental pathologies were also noted. These included a damaged lower third molar and associated mandibular lesion, and an abnormal swelling on the buccal side of one mandible. Several examples of crowded/rotated teeth were also recorded. Coral-like roots were present on a loose upper first or second molar from an undated deposit. Considering the plethora of pig remains, pathologies were very rare. The previous Forcello report does not include information on skeletal abnormalities.

4.4.9 Summary and interpretation

The wealth of data from pig remains permits a detailed zooarchaeological analysis of the management and exploitation of this species at Forcello. Results are roughly similar across chronological periods and context types. The homogeneity of body part distribution and levels of butchery, burning, and gnawing indicates a high degree of consistency in the use and disposal of the pig carcass. All parts of the body are present on site, although the forequarter is better represented than the hind limb. The scapula is the most frequent skeletal element from pigs, but its predominance appears to be related primarily to taphonomic processes rather than unique treatment. There is no evidence of any sort for the special use or disposal of this bone – its only exceptional characteristic is its abundance. Skeletal element distribution and the incidence of butchery, burning, and gnawing are fairly homogenous between contexts, and they do not indicate the import or export of any part of the pig. In contrast, density was the main factor that influenced pig body part distribution. Without any evidence of the use this bone as a special tool or of the highly specialized exchange of scapula meat, it seems likely that the placement of Pugsley's (2002) density sample zone either does not reflect the maximum density of the epiphyses or that element's distinct shape adds to is chances of survival or recovery. Pigs are primarily slaughtered as late sub-adults/early adults. Pig sex ratios and size is also fairly stable through time, as is the presence of measurements indicative of wild boar. Butchery appears to have taken place on-site and probably occurred on a household-level, similar to the situation with crop processing (cf. section 1.6.3). Nevertheless, some developments are visible. Teeth and the atlas vertebra, which are common in the Early period, are less frequent in later phases. Pigs are also slaughtered slightly younger in the Late period, and the percentage of male animals increases slightly. Results generated for this project generally support those of the previous report, with the exception of age data and the conclusions drawn from it. Pig age analyzed here is more balanced between juveniles and adults than previous research. This distinction is important because Scarpa uses a high proportion of adult pigs as evidence of a fairly complex system of pig management that includes exportation of the posterior limb.

The analyses presented here do not support this assertion. Rather, the distribution of body parts recovered from Forcello seems primarily governed by taphonomic factors. Indeed, many Italian sites of this period also present a greater proportion of animal forelimbs (Minniti 2012). Thus, even if we entertain the idea of pork hindlimb exportation, we lack a destination for this product. The consistency of pig remains across context types also suggests a less organized system; no clear rules or patterns govern the treatment or deposition of pig remains.

A complex system of pork management could be expected to produce a more articulated or hierarchical pattern of remains. While zooarchaeological data from the Roman period provides evidence of the transport and exchange of cuts of meat (MacKinnon 2004a), similar osteological data are not available this period. Whether exported or not, pigs would have been raised primarily for meat. The Romans did not value pig secondary products (MacKinnon 2004a:150): they found pig manure less productive than other domesticate animals, and pig skin was not a popular material for leather goods. While the pig carcass was probably used more intensively in the Etruscan period, meat was likely one of, if not the main, aim of pig breeding at Forcello.

The local area would have been well suited to pig keeping. Large swathes of mature oak-hornbeam woodland covered the Po Valley, and these forests would have provided ample land for pigs. Pig herds could be raised extensively in the local area, taking advantage of wild foods (Albarella et al. 2011). Neonatal pig bones provide evidence of on-site breeding, but ethnographic work has shown that even extensively managed, free-range pigs are frequently bred under closer supervision (Albarella et al. 2011; Halstead and Isaakidou 2011). As in the Roman period, pigs may also have been kept on two scales of management – one extensively in the environs of the site, the intensively raised in or near the settlement (MacKinnon 2001). This double system of pig husbandry has a long history in some parts of Italy, where it is still practiced today (Albarella et al. 2007; Albarella et al. 2011). Like in these ethnographic examples, most of the pigs at Forcello were probably killed in the autumn, after they had grown fat. The season's cool temperatures would also allow the meat time to cure. Considering the predominance of pigs on site, this season might have brought about a great flurry of activity around the annual pig cull.

4.5 SHEEP/GOAT

4.5.1 Identification

Sheep (*Ovis aries*) and goat (*Capra hircus*) remains are notoriously difficult to identify to species. For this reason, the majority of remains from these species were assigned to the general sheep/goat taxon (Figure 4.5.1). Despite their similar skeletal morphology, it is important to remember that sheep and goat represent different genera with different environmental tolerances, dietary needs, secondary products, and temperaments. At Forcello, sheep is consistently more common than goat across major periods and within individual phases (Figure 4.5.2); the relative proportions of sheep and goats remain relatively stable through time. Scarpa does not provide information on sheep/goat distinction in the earlier report.

Figure 4.5.1 Frequencies of sheep and goats by period
(n) = number of specimens.

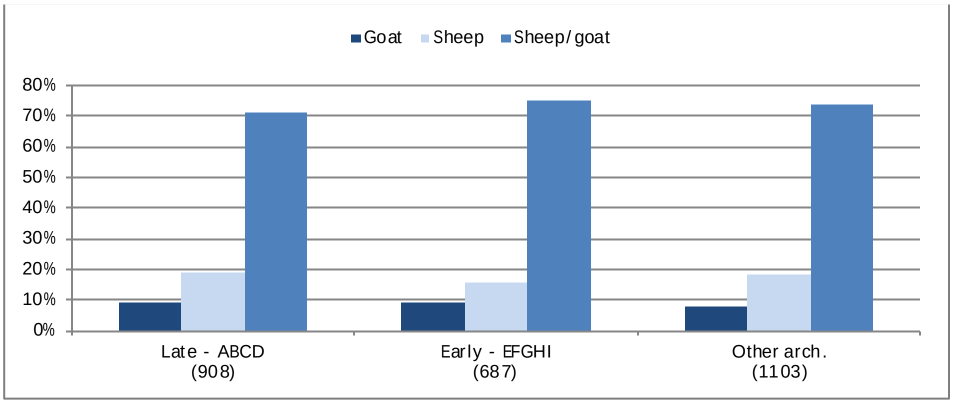
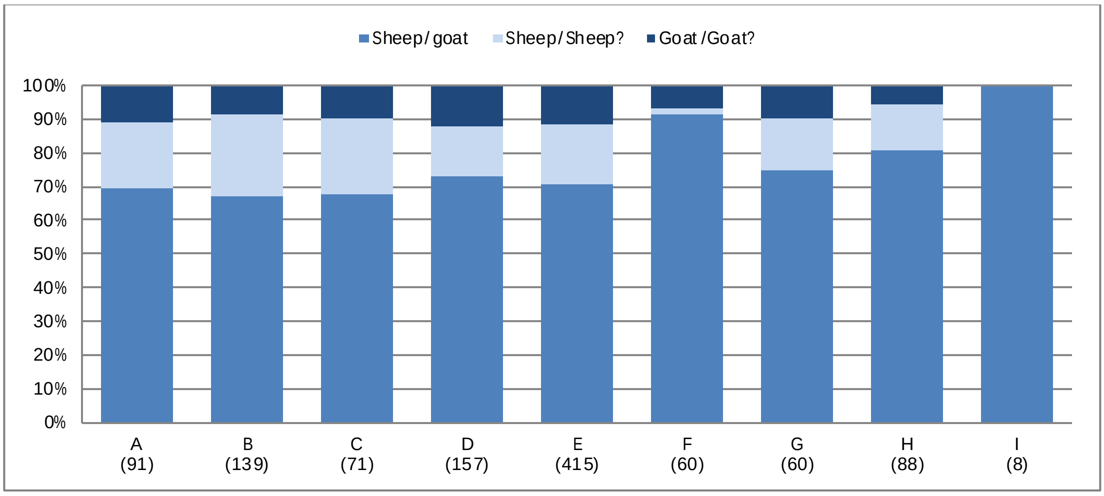


Figure 4.5.2 Frequencies of sheep and goats by phase
(n) = number of specimens.



4.5.2 Skeletal element abundance and body part distribution

Overall, sheep/goats are much better represented by teeth than bones (Table, 4.5.1, Figure 4.5.3). The lower fourth deciduous premolar is nearly as common as the lower first/second molar, but post-cranial elements are all less than half as frequent. Some maxillary teeth are more common than post-cranial elements, but still only about half of the total MAU (upper M1+2 MAU = 83.5, 56%, cf. Table 4.5.1). Maxillae are more prone to fragmentation than mandibles, resulting in a larger proportion of loose maxillary teeth. As in pigs, loose teeth and small bones, like phalanges, carpals, and tarsals, are especially rare and were probably lost during excavation. Late-fusing bones, like the proximal humerus and tibia, are also infrequent. Unlike pig, the scapula is no more common than any of the other bones. Body part distribution in the Late period is very similar to that of the Early period (Figure 4.5.4, Tables 4.5.2–4). The largest changes are an increase in percentages of the lower fourth deciduous premolar, distal humerus, and metapodials in later phases. Comparison of left and right elements did not reveal any significant ($p<0.01$) evidence of side bias (Table 4.5.5). Scarpa’s report provides some data on sheep/goat body part distribution, but, as with pigs, skeletal element abundances can only be estimated (Figure 4.5.5). No information on side bias was included in the earlier report. This data also suggests that sheep/goat were better represented by mandibles than by postcranial elements, but it cannot confirm the trend because of the significant differences between the recording systems.

Figure 4.5.3 Sheep/goat body part distribution – all archaeological phases
Max MAU = 150 (lower M1+2). Unfused epiphyses excluded. cf. Table 3.6.1 for MAU calculations.

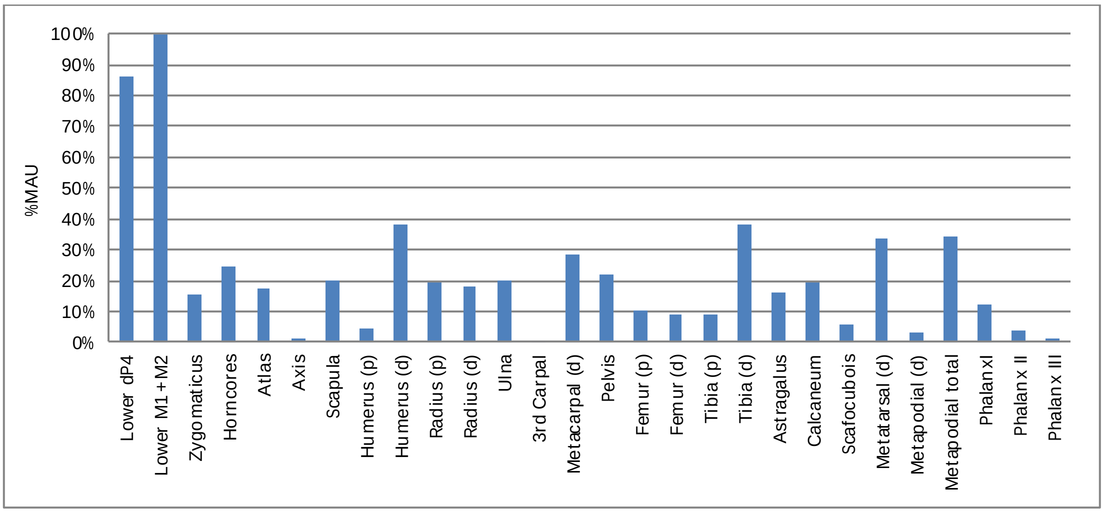


Figure 4.5.4 Sheep/goat body part distribution by period
( ) = max MAU (lower M1+2). Unfused epiphyses excluded. cf. Table 3.6.1 for MAU calculations.

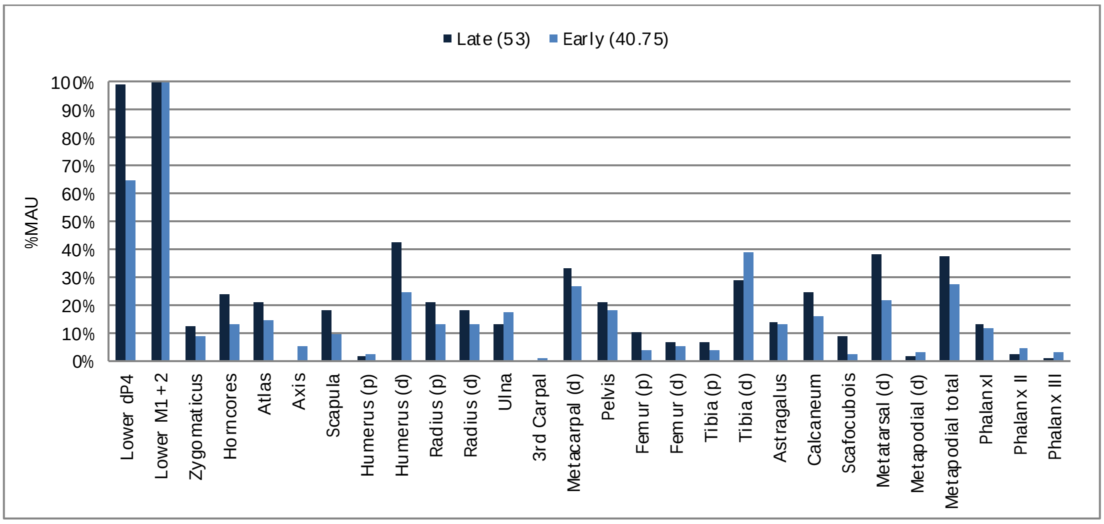


Figure 4.5.5 Total number of sheep/goat elements from Scarpa and adjusted NISP
Adjusted NISP = n/2, except for teeth (n/12), metapodials (n/2), and phalanges (n/8)

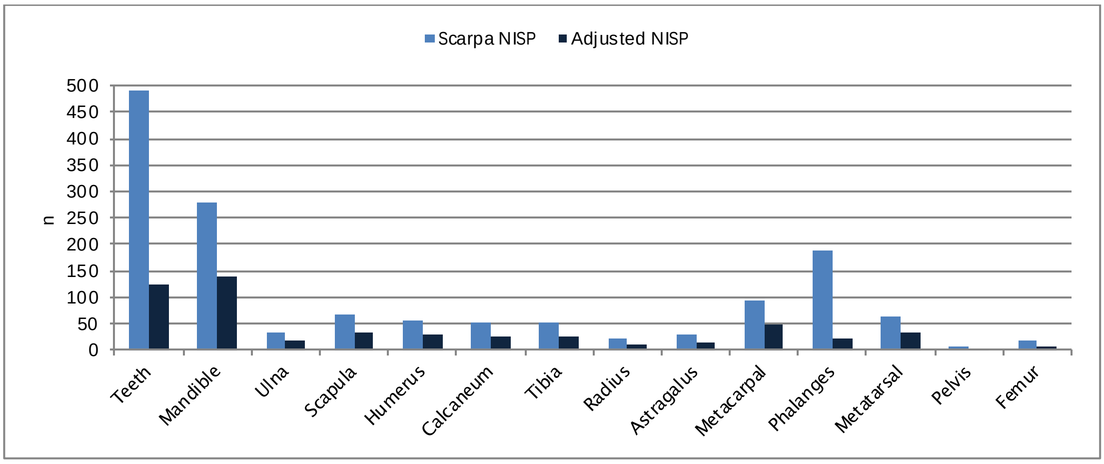
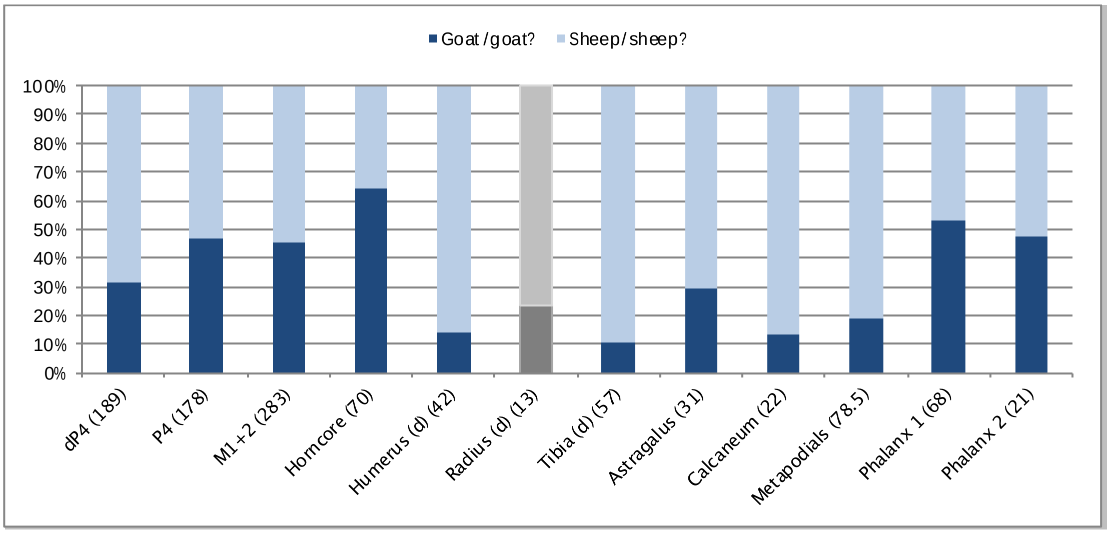


Figure 4.5.6 Sheep and goat NCSP for various elements
Sample size ≤ 20 in gray.



Body part distribution was also compared between elements identified to species, and there is significant variation in the presence of sheep and goat elements (Figure 4.5.6). In general, goat remains are infrequent among post-cranial bones (c. 10–30%). In contrast, goats represent a larger proportion of permanent teeth and phalanges (c. 50%). The most notable result of this comparison of sheep/goat elements is the predominance of goat horncores. Many of the sheep – either females or separate type – at Forcello may have been hornless. As a result, goat horncores would be more numerous than those of sheep. No hornless crania were identified at Forcello, but Riedel has recorded hornless ewes at several northern Bronze Age sites (e.g. Riedel 1976a; 1976c; 1998). The elevated presence of goat horncores and phalanges may also be due to their relation to horn and hide working. Goats had large, scimitar-like horns (Figure. 4.5.7) that would have provided a valuable raw material for tools and craft production. Hides may have been transported with the head/horns and feet attached, which would inflate the number of goat teeth, horncore, and phalanges relative to meat-bearing limbs bones. Methodological bias in sheep/goat distinction may be another factor that has contributed to the elevated number of goat horncores and phalanges. A similar pattern with elevated numbers of goat horncores and phalanges is visible in Medieval Britain, a situation currently under investigation by L. Salvagno (cf. Salvagno 2014).

Figure 4.5.7 Goat horncore from Forcello
Specimen #3194. Photo by the author.

Figure 4.5.8 Sawn goat horncores from Forcello
Specimen #9478, 9488. Photo by the author.
Sawn at the base and in the right example also at the top.

4.5.3 Butchery, burning, and gnawing

Butchery modifications on sheep/goat bones are similar to those seen on pig remains. Butchery marks are predominantly cut marks left by knives; although heavier chop marks are also present (Table 4.5.6). As in pigs, marks focus on joint articulations and are more frequent on the scapula and distal humerus. Cuts on the phalanges are probably related to skinning. Horncores display a particularly high frequency of butchery marks. Both cut and chop marks are present on horncores, although, unlike for other remains, chop marks are more prevalent. Saw marks were also recorded on sheep and goat horncores (Figure 4.5.8). The high proportion of affected horncores and the presence of saw and frequent chop marks allude to horn-working.

The distribution of butchery marks across context types is fairly constant (Table 4.5.7). Gnawing marks are present in very low frequencies on many elements, although marks are more prevalent on the distal tibia and calcaneum (Table 4.5.8). As with pigs, the distribution levels of gnawing are similar between context types (Table 4.5.9). Evidence of burning is rare across different anatomical elements and between context types (Tables 4.5.10–11). Low sample size prevents a detailed analysis, but there is no indication of a change in the prevalence of butchery, burning, or gnawing between the Late and Early periods. This consistency indicates a similar and non-selective treatment and deposition of sheep/goat carcasses.

4.5.4 Age and sex

Sheep/goat kill-off patterns were constructed from mandible wear stages. When all the archaeological phases are considered, sheep/goat slaughter is evenly distributed across the wear stages (Figure 4.5.9). However, mandible wear stages do not represent equal time intervals. Nearly a third of the sheep/goat mandibles were attributed to animals in approximately their first year (Payne wear stages A, B, and C). Although not included in quantification of mortality profiles, loose lower fourth deciduous premolars and neonatal/fetal bones attest to the presence of very young animals (stage A). Few animals lived beyond their fourth year (stage F). Between the Early and Late periods, there is a small shift to younger mandible wear stages, and an increase in the culling of juvenile animals (Figure 4.5.10). This trend is also visible in the increase of mandibular fourth deciduous premolars in body part distribution. Age data from bone fusion confirms these trends (Figure 4.5.11). When all archaeological material is considered together, bone fusion indicates that about one third of the population was killed in the early fusion phase. Culling continues across the middle fusion phase, and most animals did not live through the late fusion phase. During the Late period, fusion data also indicate an increase in the slaughter of younger animals (Figure 4.5.12). However, the changes presented by fusion data do not exactly correspond with those presented by tooth wear. Jaws indicate an increase in the slaughter of animals less than one year of age (wear stages B and C), while bone fusion registers an increase in animals in the middle fusion stage, between one and three years. Perhaps bone fusion data is too coarse to highlight this trend; tooth wear is probably more reliable. Based on tooth wear and bone fusion, Scarpa reports a lower percentage (13.6%) of young sheep/goats. As with pigs, this conclusion is antithetical to the results presented here. Without further data, Scarpa's age analysis cannot be investigated further.

Figure 4.5.9 Sheep/goat mandible wear stages for all archaeological phases
n = 340. Wear stages follow Payne (1973).

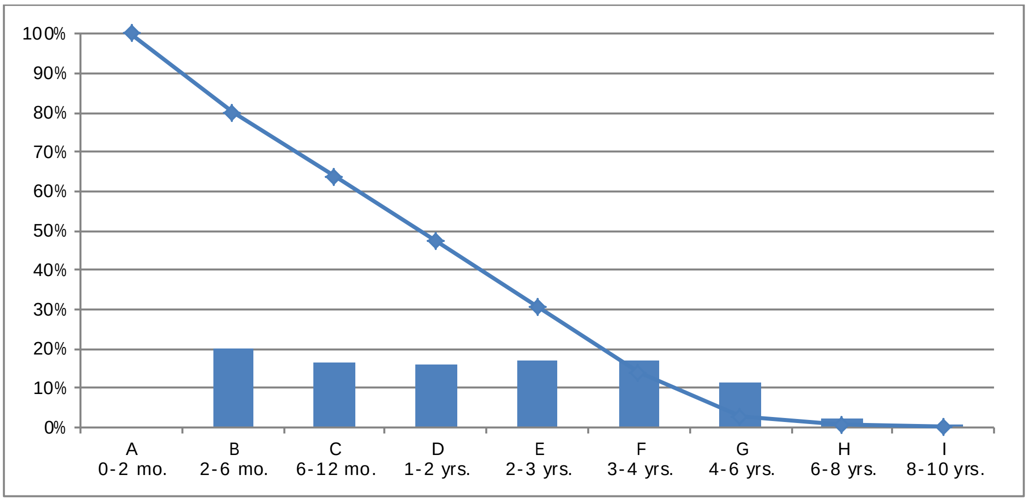


Figure 4.5.10 Sheep/goat mandible wear stages for the Late and Early periods
(n) = number of specimens. Wear stages follow Payne (1973).

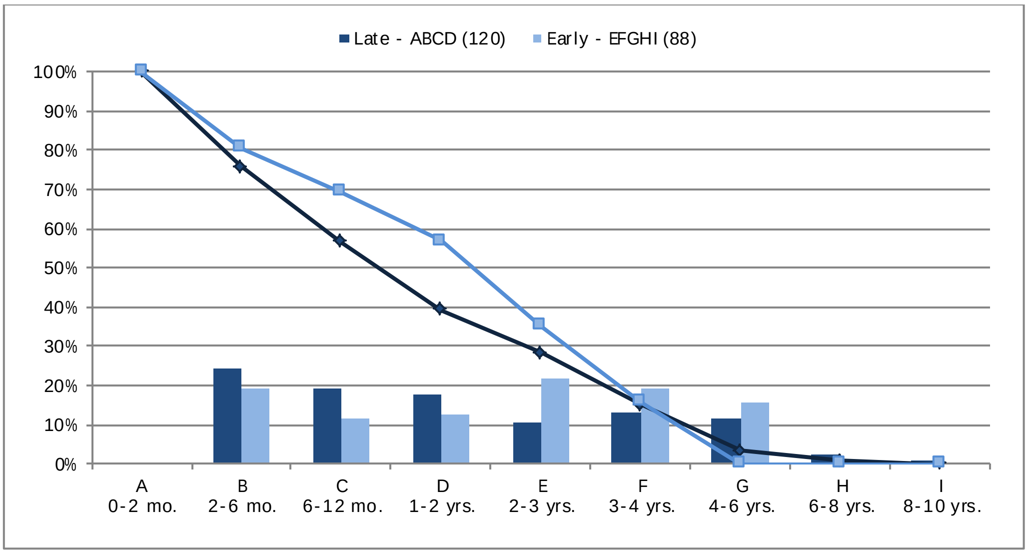


Figure 4.5.11 Sheep/goat fusing/fused vs. unfused bones
(n) = number of specimens. Unfused epiphyses excluded. Fusion sequence based on Silver (1969). Sample size ≤ 25 in gray.

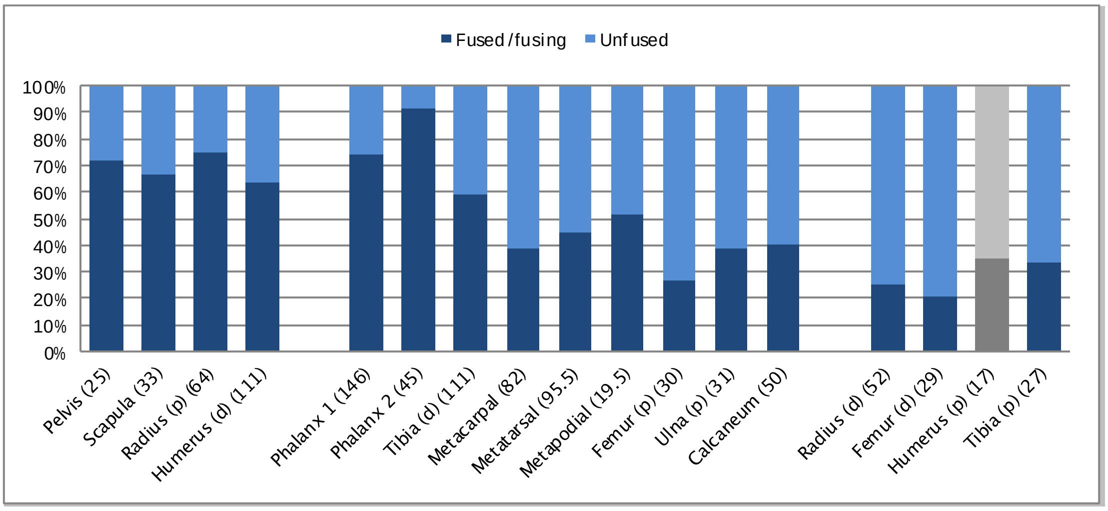
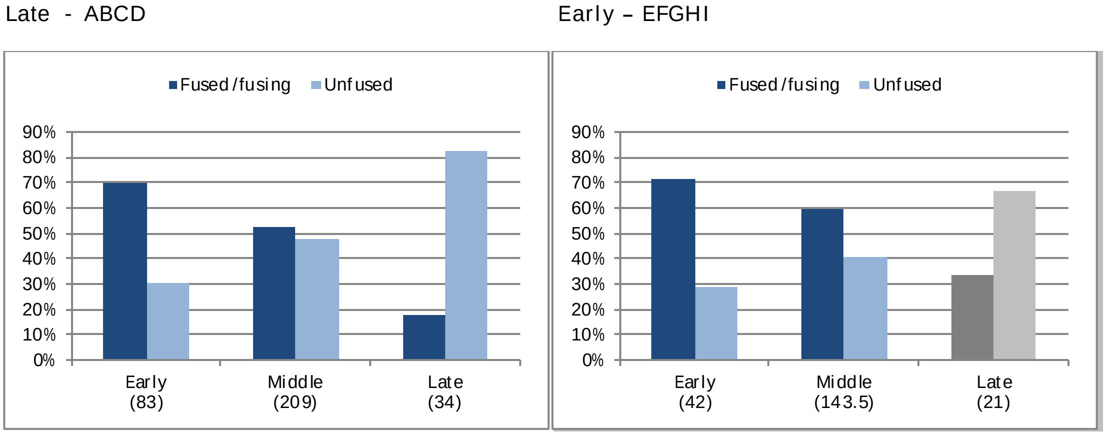


Figure 4.5.12 Sheep/goat fusing/fused vs. unfused bones by period
(n) = number of specimens. Unfused epiphyses excluded. Fusion sequence based on Silver (1969). Samples size ≤ 25 in gray.


Late - ABCD

Early – EFGHI

When considered separately, sheep and goat mandible wear stages demonstrate different kill-off patterns for each species (Figure 4.5.13). Over 50% of sheep are culled in their first year (stages B, and C). Although there is a peak in goat mortality at stage B, fewer goats are killed very young; most are culled between two and four years of age (stages E and F). Despite a peak in early culling, a portion of the sheep population lived longer than goats – some even into stage H (six to eight years). The relative proportions of sheep and goat teeth (counting both loose teeth and those in jaws) confirm this trend (Figure 4.5.14). Sheep deciduous teeth are more prevalent than those of goat; in contrast permanent sheep and goat teeth occur in similar frequencies. Sheep and goat kill off patterns demonstrate a mixed system of management that provides milk, tender meat, and wool, but the emphasis on these products varies between the two species. The slaughter of a significant proportion of sheep in stage B and C is indicative of milk exploitation and also of an interest in tender meat. Although Payne's (1973) primary milk model stresses lamb mortality in the first two months of life (stage A), it is also possible to exploit milk while keeping the lamb (Halstead 1998). This method of milk production is common in traditional Mediterranean pastoralism when producing a surplus for trade is not a primary concern (Halstead 1998; Helmer et al. 2007; Vigne and Helmer 2007). Sheep that survived this cull in their first year were likely to live into maturity, and animals culled in stages F, G, and H indicate an emphasis on wool. Goat management is less focused on tender meat and instead emphasizes milk and mature meat (milk type B, cf. Helmer et al. 2007; Vigne and Helmer 2007). After a peak in kid mortality (stage B), older, presumably female, animals were killed in stages E and F as their productive capabilities decreased. By this point the animals had also reached their full size and would have provided meat as well. Raising sheep and goats this manner would have ensured a supply of milk and wool in addition to both tender and mature meat.

Sex data for sheep/goat is only available from the pelvis. Sheep/goat pelvises from Forcello were frequently fragmented and only eight could be attributed to either sex (Table 4.5.12). Female pelvises (n=6) are more common than those of from males (n=2). Males may have been preferentially culled at a younger age, making it more difficult to recover and identify their pelvises. Herds with a preponderance of male animals are rare, and normally only employed when raising wethers for specialized wool production. In contrast, female animals would have provided both breeding stock and milk as well as wool and meat.

Figure 4.5.13 Sheep vs. goat mandible wear stages
(n) = number of specimens. Wear stages follow Payne (1973).

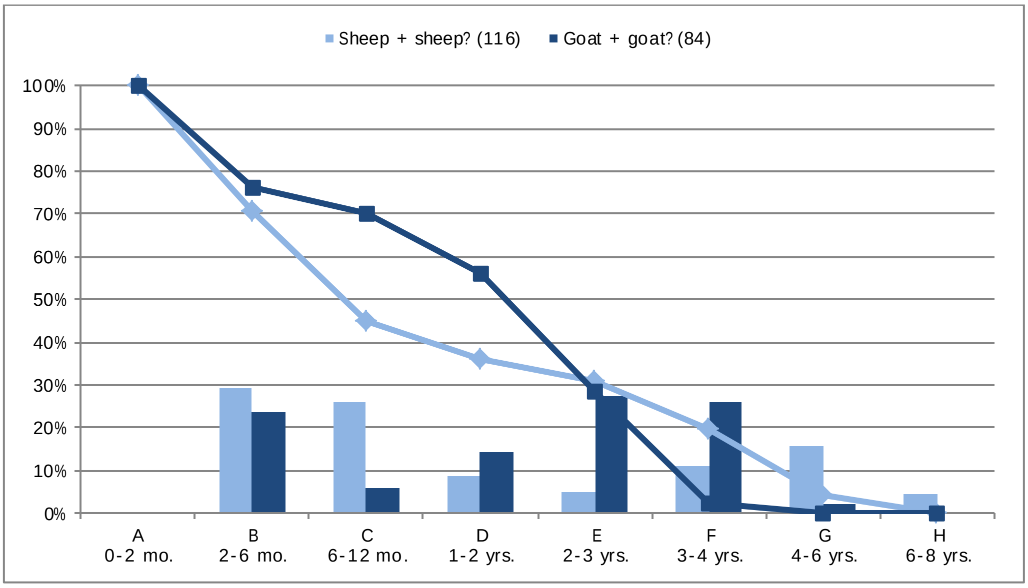
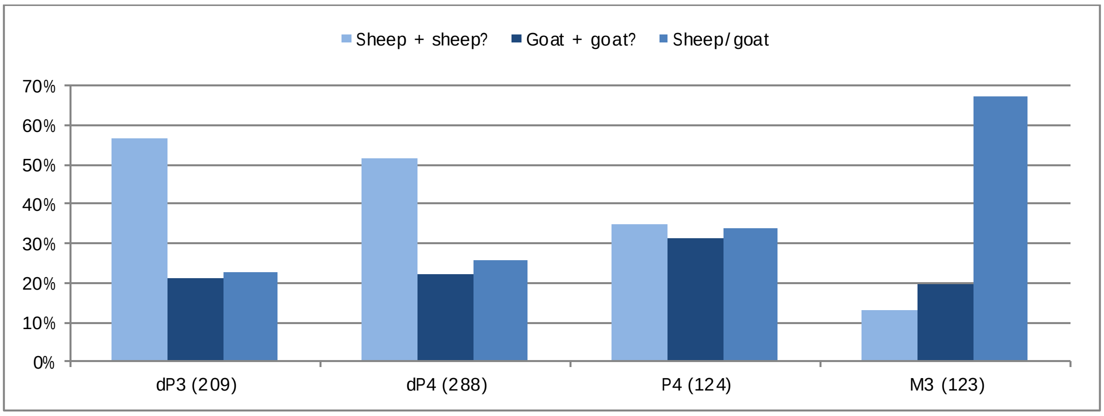


Figure 4.5.14 Relative proportions of mandibular sheep, goat and sheep/goat teeth
(n) = number of specimens. Includes both loose teeth and those in jaws.



4.5.5 Biometry

Measurements taken on sheep/goat bones are less numerous than those from pig and permit fewer analyses. Despite these limitations, important trends are still visible. Sheep/goat measurements fall within a smaller size range than those for pig. No clear outliers are visible in measurements from the lower third molar (Figure 4.5.15), humerus (Figure 4.5.16–17), or astragalus (Figure 4.5.18–19). However, large measurements are occasionally present (e.g. for the distal tibia, Figure 4.5.20). Scatter plots of post-cranial biometric data also demonstrate differences in sheep and goat bone size/shape. Morphological distinctions between the humerus (Figure 4.5.17) and metacarpal (Figure 4.5.21), are more apparent and confirm species identifications made at the time of recording. Like pigs, no changes in sheep/goat size are visible between the Early and Late periods (e.g. Figure 4.5.22). Scarpa provided little biometric information on sheep/goat in the earlier report, but the measurements available are within the same range as those presented here (e.g. for the astragalus, Figure 4.5.23).

Figure 4.5.15 Sheep/goat M$_3$ width (WA) for all archaeological periods

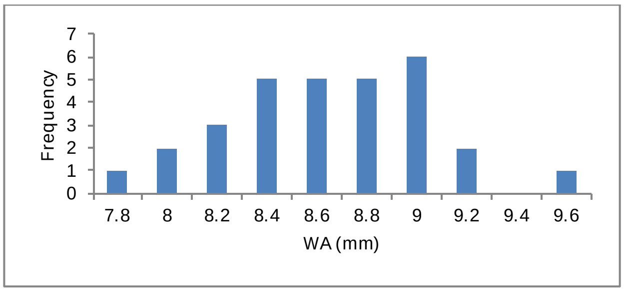


Figure 4.5.16
Sheep/goat humerus: HTC

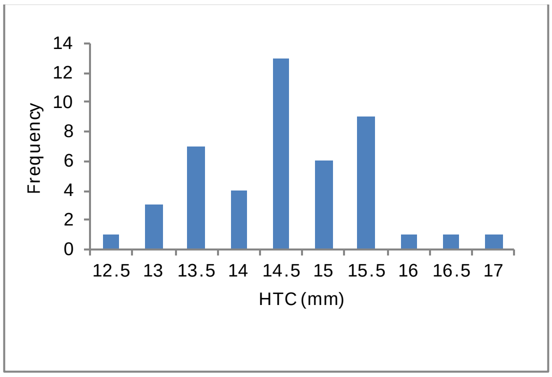


Figure 4.5.17
Sheep and goat humerus: HTC vs. BT

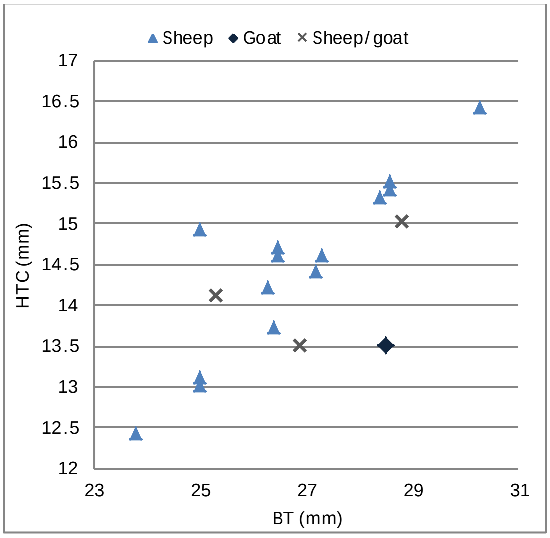


Figure 4.5.18
Sheep/goat astragalus: Bd

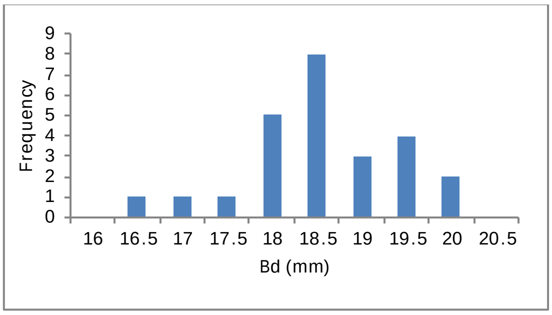


Figure 4.5.19
Sheep and goat astragalus: Bd vs. GLl

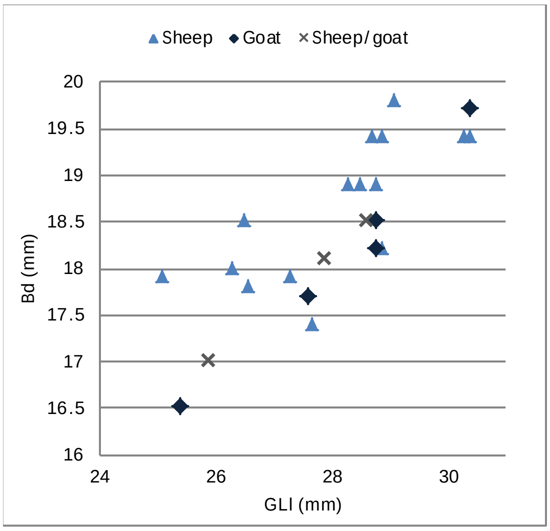


Figure 4.5.20 Sheep and goat tibia:
Dd vs. Bd

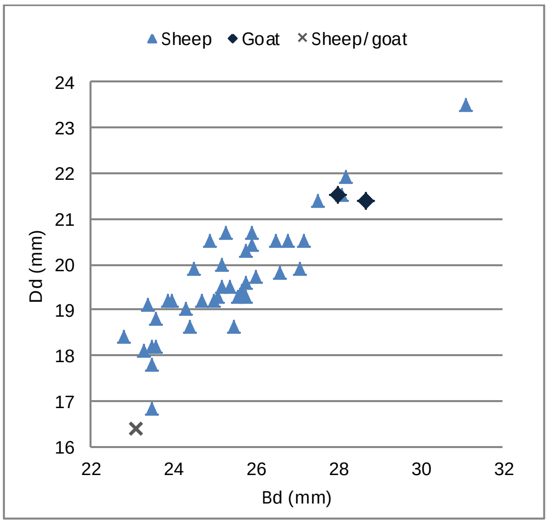


Figure 4.5.21 Sheep/goat metacarpal condyle ratios

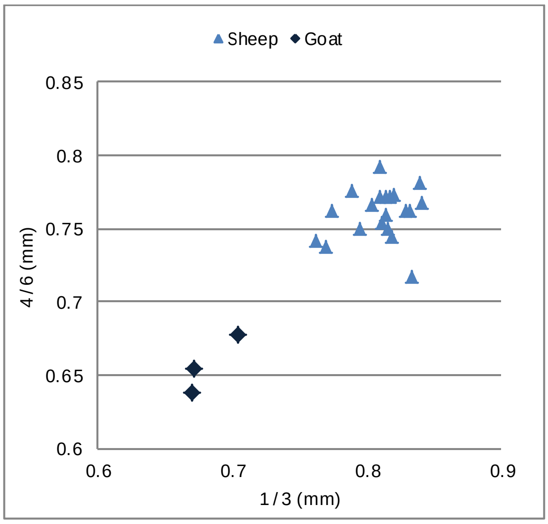


Figure 4.5.22 Sheep/goat tibia
Dd vs. Bd for the Early and Late periods

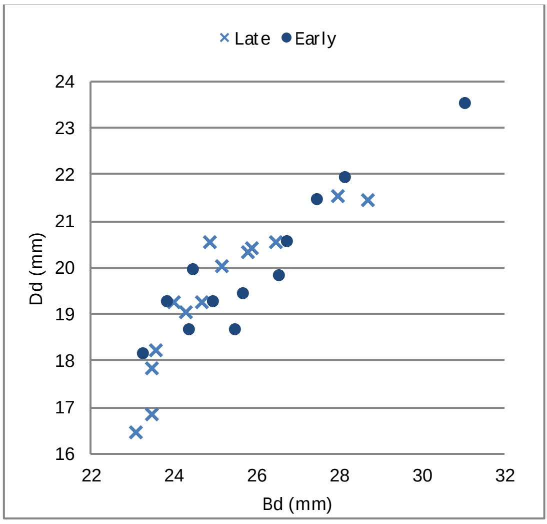


Figure 4.5.23 Sheep/goat astragalus
from this project and the earlier report

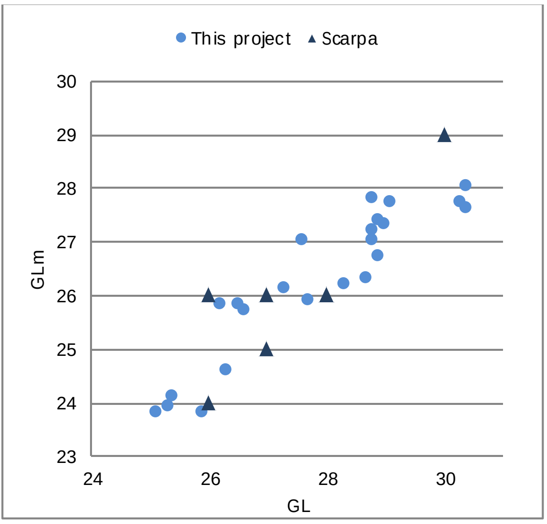


Figure 4.5.24 Sheep horncore with 'thumbprint'
Specimen #3461. Photo by the author.

Figure 4.5.25 Sheep mandible with abscess
Specimen #1699. Photo by the author.

4.5.6. Pathology

Several sheep specimens with pathologies were identified. The first is a horncore with a 'thumbprint' depression near the base (Figure 4.5.24). This condition is common in both modern and archaeological specimens. Such depressions have been linked to calcium reabsorption due to environmental stress, malnutrition, intensive milking, repeated pregnancies, or a combination of these factors (Albarella 1995a). The second pathological specimen is a sheep jaw with evidence of an abscess below the premolars (Figure 4.5.25). Mandibular abscesses are also not uncommon in past animal populations. Only one instance of enamel hypoplasia was found on a sheep/goat molar. Additional instances of enamel hypoplasia may also be present, but concealed, on teeth still in the mandible. Eight sheep/goat molars with coral-like roots were also identified (four from unphased deposits; four from Etruscan contexts). This pathology occurred mainly on mandibular molars; only one case was noted on a maxillary tooth. Coral-like roots were recorded on sheep/goat and goat teeth, but not on sheep teeth. The greater incidence of this pathology on goat teeth supports Bertini Vacca's (2012:147) hypothesis that the condition is related to the consumption of hard/spiny plants, which goats, as browsers, would be more likely to eat. Several other minor congenital abnormalities were also noted on sheep/goat teeth. The rarity of horncore depressions and other pathologies related to disease or hardship may indicate that the local sheep/goat population was well kept.

4.5.7 Summary and interpretations

Both sheep and goats were raised by the Etruscans at Forcello, although sheep were more numerous than goats. Sheep/goat skeletal element abundance and body part distribution are markedly different from that of pig. Compared to teeth, all other elements are clearly underrepresented. A similar trend was noted in the previous report. One explanation may be that the head was separated from the body during carcass processing, but the relative rarity of the other recorded portions of the skull – the zygomaticus and horncores – does not support this hypothesis. Modifications on horncores demonstrate that horn working occurred, but horncores are no more frequent than post-cranial bones. Limited sample sizes do not allow an analysis of sheep/goat body part distribution across context types; however the distribution of butchery, burning, and gnawing does not provide evidence for the differential treatment or deposition of sheep/goat remains. Instead, taphonomic factors probably influenced the survival and recovery. Nearly half of the sheep/goat population was culled prior to maturity, and about a third of the population was killed in their first year. These remains are especially small and fragile, and many were probably destroyed by carnivores and other taphonomic processes. Hand collection also significantly influenced the assemblage, limiting the recovery of small specimens. These factors, rather than past use or disposal practices seem to have biased against the recovery and and therefore identification of sheep/goat remains.

This scenario also helps explain the discrepancy between MAU species frequencies derived from teeth and those from bones. Taphonomic factors suppressed the recovery of sheep/goat bones compared to teeth/mandibles, which survive well archaeologically and are easily recognizable during excavation. Because less of the sheep/goat skeleton was collected, sheep/goat MAU based on teeth is much greater than MAU based on bone counts. In the Early period, sheep/goat teeth are more numerous than pig scapulae; the opposite is true in the Late period. MAU frequencies suggest that the number of sheep/goat and pig at Forcello in the past may not have been as markedly different as suggested by NCSP, at least in the Early period. However, the close relationship between NCSP and MAU values when the site is considered as a whole (cf. Figure 4.3.3) reinforce the primary importance of pig on site.

Sheep/goat size is consistent between periods and does not indicate the swift improvement or introduction of animals. Measurements are concurrent with those presented in the earlier report. Age data from sheep and goats demonstrates a mixed management strategy where sheep are raised for milk, tender meat, and wool, and goats are bred primarily for milk and mature meat. Sheep and goat husbandry thus worked in tandem to produce a supply of both meat and secondary products. Sex data, while limited, is concurrent with this management system and indicates a predominance of female animals. The shift toward the culling of younger sheep/goats in the Late period may indicate a greater focus on milk and tender meat. Fetal and neonatal remains also illustrate that caprines were bred near or in the settlement at Forcello. Textual sources indicate two systems of sheep farming in use in Roman period: local herding and transhumance (MacKinnon 2004a:112). Some pasture around Forcello was likely well-suited to sheep/goat rearing. Virgil describes Mantova as having lush lowlands excellent for sheep pasture and cattle raising (Virgil, *Georgics* 2.195–202), although he may be biased towards his home region. Goats could be kept in tickets or rough wooded areas (Varro, *Rerum rusticarum* 2.3.7; MacKinnon 2004a:119). Sheep/goats at Forcello were probably kept under a greater level of control than pigs. The mature forest that covered the Plain was an environment well-suited to pig rearing, but one less ideal for caprine husbandry. Lowland areas, especially those near watercourses, were likely to be damp – conditions very damaging for sheep. Additionally, the notable increase in sheep/goat size between the Final Bronze Age and Roman period also suggests more generally that a greater level of control was extended over caprine reproduction than that of pigs. Although there is no strong indication of caprine transhumance at Forcello, it cannot be entirely ruled out because of the difficulty of detecting seasonal animal movement archaeologically (Barker et al. 1991; MacKinnon 2004b). Both local and regional transhumance is known to have occurred in the Roman period (ibid.), and the Etruscans likely also participated in this practice.

Horn-working is another interesting aspect of sheep/goat exploitation. Goat horncores are large, and they would have provided an important source of raw material. Butchery marks, including saw marks, on and around the base of horncores attest to the use of horn on site. Sheep horncores are less frequent than those of goat despite the predominance of sheep in the assemblage, and some sheep may have been hornless. Hornless sheep were present in the Po Plain during the Bronze Age (Riedel 1976a, 1976c, 1998), and they were also known by Roman authors (MacKinnon 2004b). Sheep/goat culling strategy at Forcello could also suppress the number of sheep horncores identified – if females were hornless and the majority of males were culled when very young (as suggested by age and sex analysis), their horncores, like their pelvises would be difficult to identity to species level and therefore underrepresented. Goat hides may also have been of value. If left attached to the cranium and feet, goat hide exploitation would help explain the distribution of sheep and goat remains at Forcello. The presence of skinning marks on sheep/goat bones may be linked to this practice. However, other scholars have noted a similar pattern in goat phalanges and horncores (cf. Salvagno 2014), and the elevated presence of these elements may be related to identification bias. At Forcello, some differences are visible in the exploitation of sheep/goat carcasses, but without evidence for a large-scale hide and horn working industry, it is likely that methodological bias plays some role in the distribution of sheep and goat remains

4.6 CATTLE

4.6.1 Identification

The distinction between cattle (*Bos taurus*) and red deer (*Cervus elaphus*) proved challenging at times. Over a eighty bones (Figure 4.6.1) and eight teeth (Table 4.6.1) were identified as cattle/red deer. The separation of cattle and red deer is not usually problematic, but the material from Forcello presented specific challenges. Red deer bones from Forcello were as large and robust as cattle remains. Because of the great similarly in the size of bones from the two species, identifications had to be based solely on distinctive morphological characteristics. Butchery, gnawing, and breakage also complicated identifications by removing distinctive features from some bones. Juvenile and unfused bones were also challenging. Elements with few characteristics useful for separating cattle and red deer, like the head of the femur and loose incisors, were commonly assigned to the cattle/red deer group. Breakage frequently complicated identifications of the scapula and pelvis. Both these bones are highly variable within a species, and when broken or damaged in a way that removed useful species markers, they could not be confidently identified. A similar issue was encountered when identifying loose metapodial condyles, and, to a lesser extent, other bones. Many of the bones identified as cattle/red deer probably derive from domestic cattle. As a result, cattle will be slightly underrepresented in when the relative proportion of different species are compared. Additionally, some cattle elements, like the proximal femur, scapula and pelvis, will be underrepresented in analysis of body part distribution. These biases are important to keep in mind in subsequent analyses.

4.6.2 Skeletal element abundance and body part distribution

Cattle teeth, particularly permanent teeth, are more common than bones (Table 4.6.2). At first, some post-cranial elements appear to be missing (Figure 4.6.2), but these parts of the skeleton are included in the general cattle/red deer category. When material identified as cattle/red deer is added to cattle body part distribution, the entire skeleton is present (Figure 4.6.3, Table 4.6.3). More detailed discussion of cattle body part distribution must be considered as tentative on account of the low maximum MAU (24.5). The atlas and axis are also rare, as are the humerus and radius. When unfused epiphyses are excluded, the femur and proximal tibia are underrepresented. However, when unfused epiphyses are included, this is no longer the case. In general, though, the hindlimb is better represented than the forelimb. As with the other domestic taxa, these trends are probably linked to bone density; long bones are more likely to be highly fractured and therefore excluded from the recording protocol. Scarpa's results for cattle body part distribution are not dissimilar to those above (Figure 4.6.4). The humerus, radius and femur and underrepresented compared to other elements, especially teeth/mandibles and phalanges. Low sample size also precludes a detailed chronological comparison of body part distribution (Tables 4.6.4–6), but all parts of the skeleton are present and no obvious changes are visible between periods.

Figure 4.6.1 Bones identified to the general taxa cattle/red deer
Sample size=89.

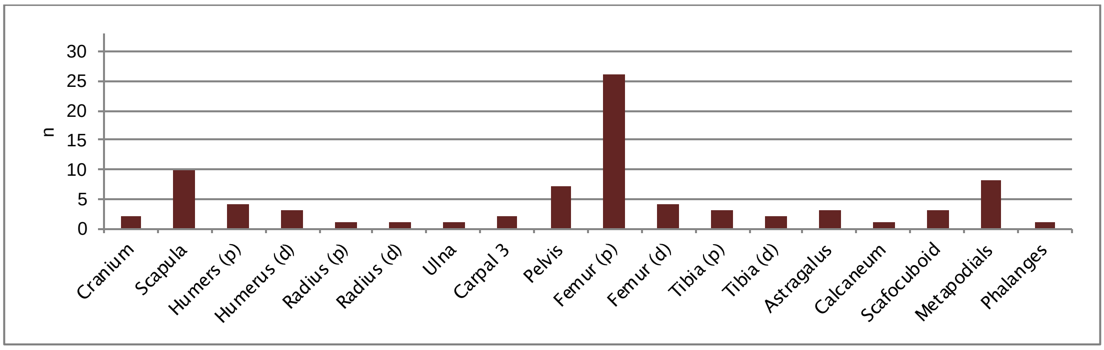


Figure 4.6.2 Cattle body part distribution – all archaeological phases
Max MAU = 24.5 (lower M1+2). Unfused epiphyses excluded. cf. Table 3.6.1 for MAU calculations.

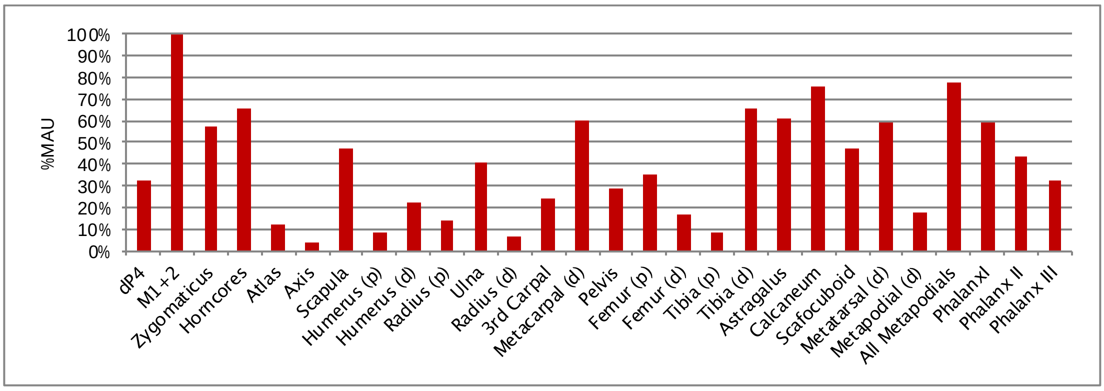


Figure 4.6.3 Cattle body part distribution including cattle/red deer specimens – all archaeological phases
Max MAU = 24.5 (lower M1+2). Unfused epiphyses excluded. cf. Table 3.6.1 for MAU calculations.

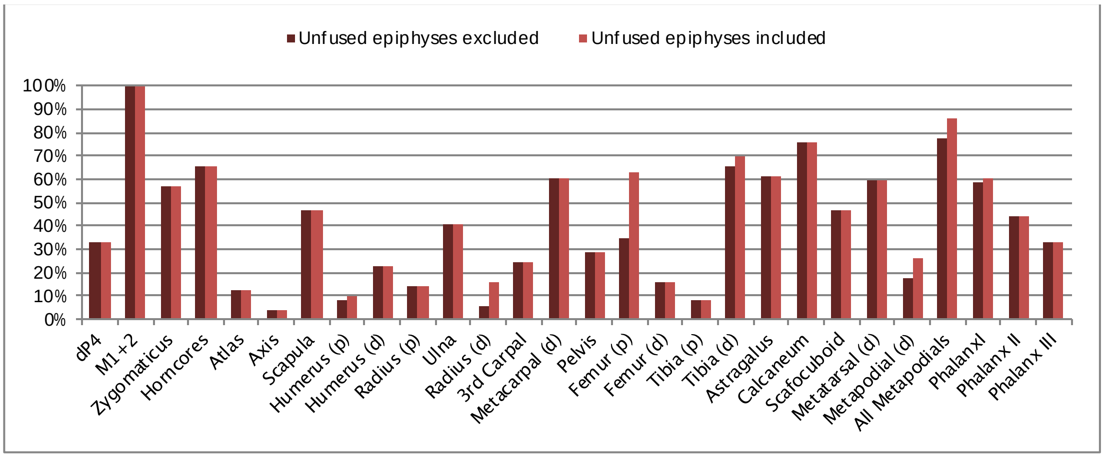
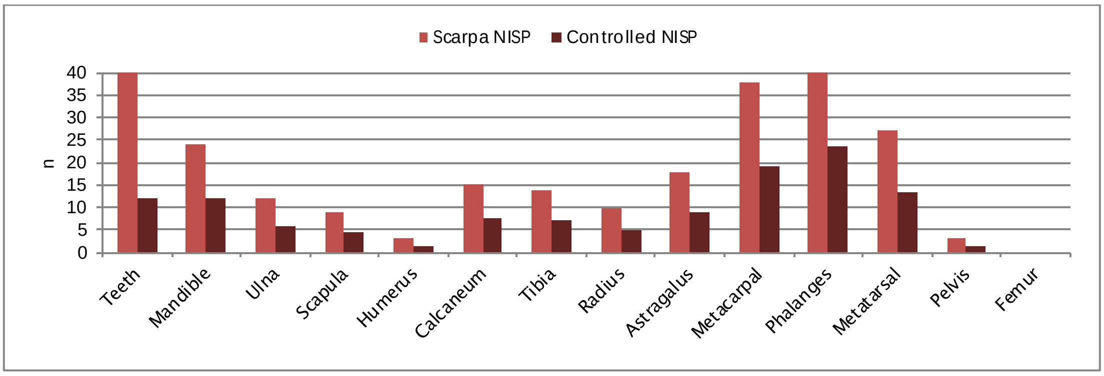


Figure 4.6.4 Total number of cattle elements from Scarpa (1988) and adjusted NISP
Adjusted NISP = n/2, except for teeth (n/12), metapodials (n/4), and phalanges (n/8)



Analysis of cattle body part distribution indicates a different treatment of long, meat-bearing bones, especially the forelimb, and lower meat yield parts of the body. Without an export economy, these prime cuts of meat and their associated bones were probably consumed locally, although this may have occurred in a different area of the settlement. Alternatively they may be underrepresented in the recording protocol for taphonomic reasons. Because the methodology requires more than half of a long bone epiphysis to be present in order to be counted, fragmented bones will not be included. Long bones contain large quantities of meat and marrow, and they are frequently the focus of both human and carnivore activity resulting in their fragmentation (Madrigal and Capaldo 1999). The inhabitants of Forcello may have been breaking cattle limbs down into smaller portions (e.g. to fit into pots) or processing bones for marrow. There is no strong indication of left/right side preference (Table 4.6.7).

4.6.3 Butchery, burning, and gnawing

Butchery modifications are more common on cattle bones than on those of the other main domesticates (Table 4.6.8). Chop marks are the most frequent type of butchery on cattle bones; cut marks are more frequent on pig and sheep/goat bones. The higher proportion of chop marks relates to the size of animal – more effort is needed to break down a larger carcass. Evidence of sawing is also present on horncores (Figure 4.6.5). Construction fills contain the highest proportion of butchered cattle bones, while pits and postholes contain the least (Table 4.6.9). The distribution of butchered cattle bones is more variable than for other livestock. Gnawing marks are focused on tarsals, metapodials, and the distal tibia (Table 4.6.10). These dense elements are not easily broken by carnivores and will therefore have an elevated proportion of gnawing marks. Like in pig and sheep/goat, the distribution of gnawing marks on cattle bones is similar in different context types (Table 4.6.11). Evidence of burning on cattle bones is rare (Tables 4.6.12–13).

Figure 4.6.5 Cattle horncores from Forcello
ID # 3199 (sawn), 3197, 3198. Photo by the author.

4.6.4 Age and sex

The majority of cattle at Forcello lived until adulthood, and approximately a third lived into old age (Figure 4.6.6). Cattle fusion data supports age information from mandible wear stages (Figure 4.6.7). There is some indication of a shift toward the culling of older animals in the Late period, but small sample size prevents confident assessment of this trend (Table 4.6.14). Fusion information was not considered by period, because sample sizes were too small. Age analyses indicate a mixed system of cattle use. Juvenile and immature mandibles account for a small proportion of the total wear stages, and no neonatal or fetal cattle bones were recovered from archaeological phases. Sub-adult cattle were likely killed for meat when the animal reached its full size. The high proportions of mature cattle allude to the animal's role in traction. Experienced draught animals would have been important in agricultural work, since older animals were valuable guides in the training of younger draught cattle (cf. Columella, *De Re Rustica* 6.2.6–11; Johannsen 2011). Considering the relative lack of very young animals, it seems likely that older cattle were kept primarily for traction rather than milking. Bulls, oxen, and cows could be used to plow; cows would have the added benefit of providing milk throughout their working and breeding lives. Unfortunately the use of female cattle in draught work at Forcello is impossible to test – no morphological data is available for the distinction of cattle sex. Very few pelvises were recovered and none could be sexed. Similarly, only eight complete metacarpals were identified and no sex groups were visible in their measurements.

Figure 4.6.6 Cattle mandible wear stages for all archaeological phases
Number of specimens = 39. Wear stages follow O'Connor (1988).

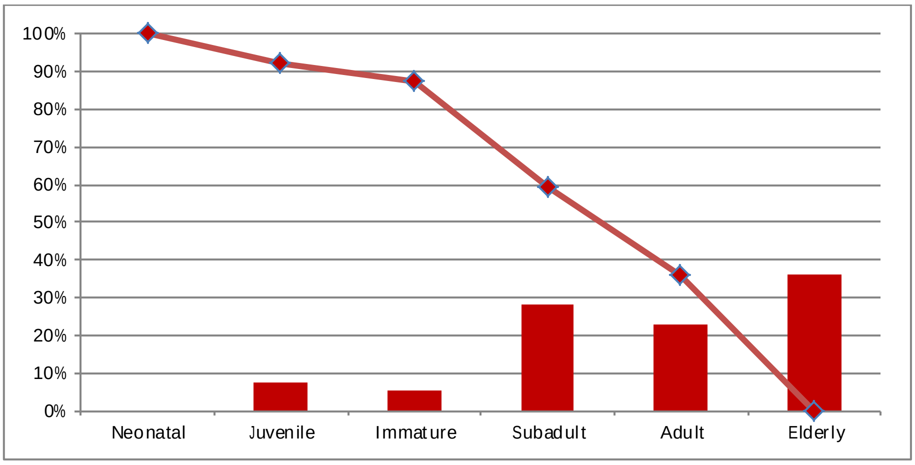
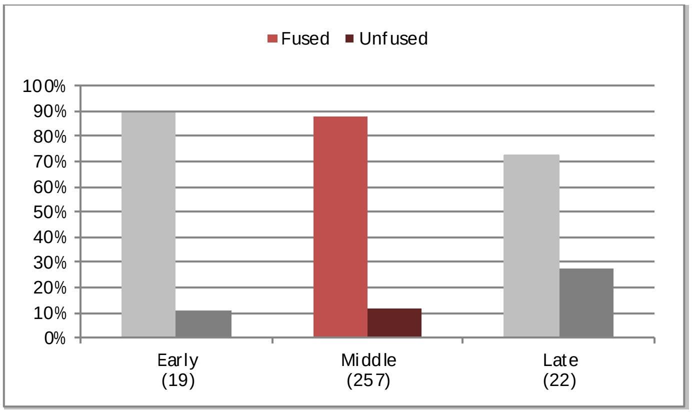


Figure 4.6.7 Cattle fusion stages for all archaeological phases
(n) = number of specimens. Samples size ≤ 25 in gray.



4.6.5 Biometry

Tooth measurements indicate that cattle size is evenly distributed within the population and no outliers are present (Figure 4.6.8). Cattle size also remained stable through time (Figure 4.6.9). Cattle reached larger sizes than red deer, but many cattle and red deer elements overlap (Figure 4.6.10–11). Measurements from the earlier report are comparable to new results (Figure 4.6.11). Because of lower sample sizes, a limited number of measurements were available for cattle. Typically metacarpal measurements are used to identify sex groups, but very few complete specimens were recovered from Forcello. Instead, comparison of cattle metapodial condyle widths (Figure 4.7.12–13) presents some indication of two size groups, possibly males and females, within the cattle population at Forcello. Two separate groups are especially visible in metatarsal condyle widths, but there is not sufficient data to assuredly identify these trends. Interestingly there is little evidence of metapodial asymmetry, a characteristic that is often associated with traction stress (Bartosiewicz et al. 1993), although several metapodials with a perceived asymmetry were noted during recording. A limited investigation of cattle shape identified one especially robust specimen is amongst cattle metacarpals (Figure 4.6.14), most likely a bull.

Figure 4.6.8 Cattle M_3 width (WA)

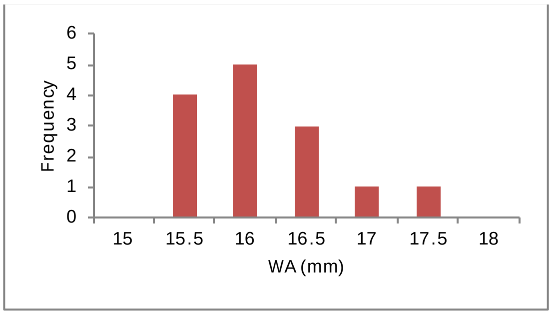


Figure 4.6.9
Cattle M_3 width (WA) v. length (L) by period

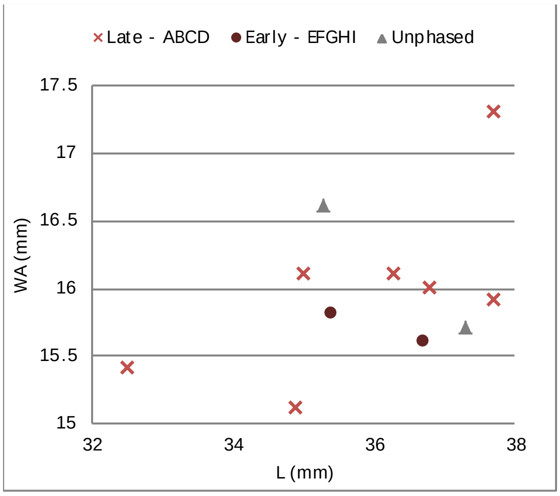


Figure 4.6.10
Cattle and red deer tibia: Dd vs. Bd

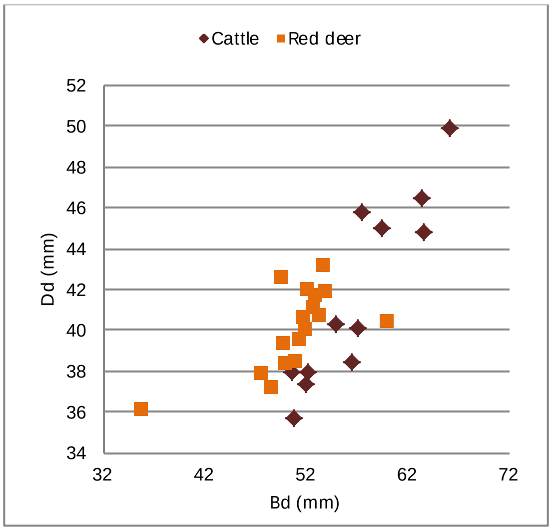


Figure 4.6.11
Cattle and red deer astragalus: GLm vs. GLl

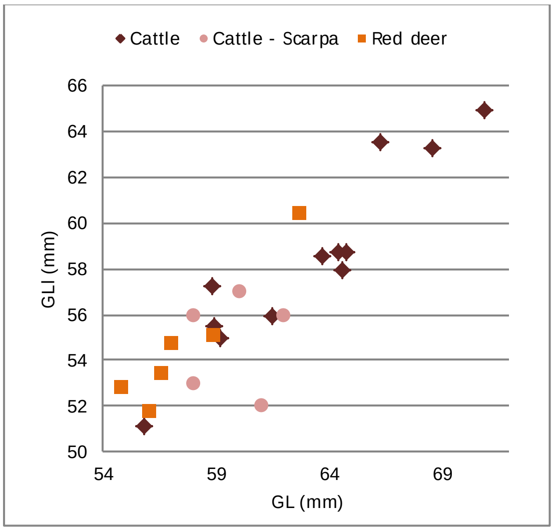


Figure 4.6.12 Cattle metacarpal: b vs. a

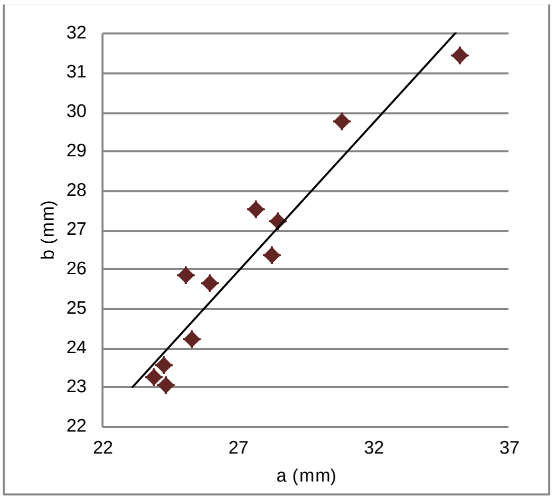


Figure 4.6.13 Cattle metatarsal: b v. a

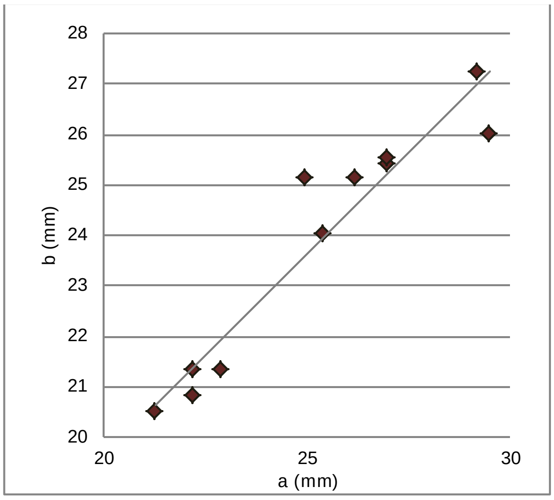


Figure 4.6.14 Cattle metacarpal shape

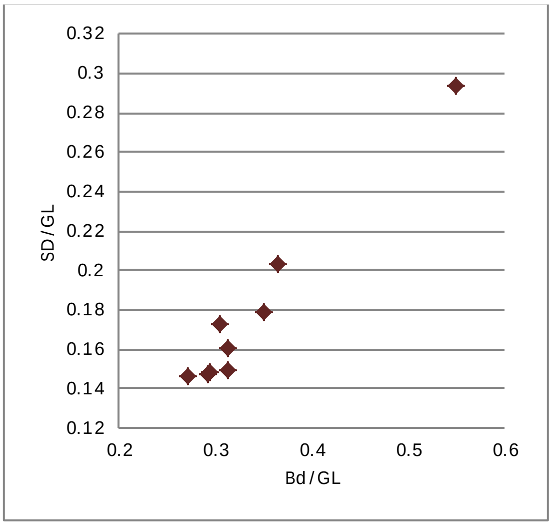


Figure 4.6.15 Cattle P2 with lipping
Specimen #2455. Photo by the author.

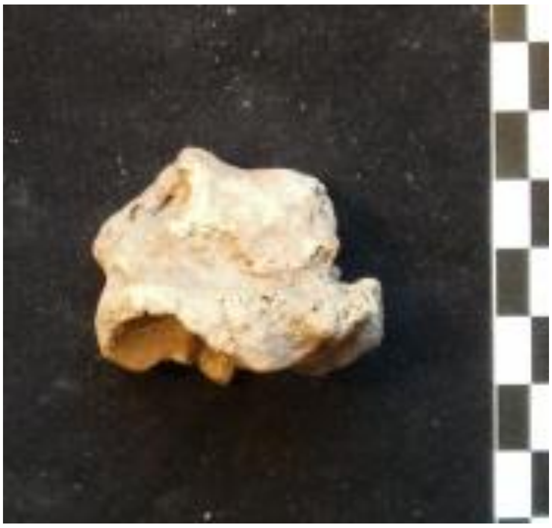
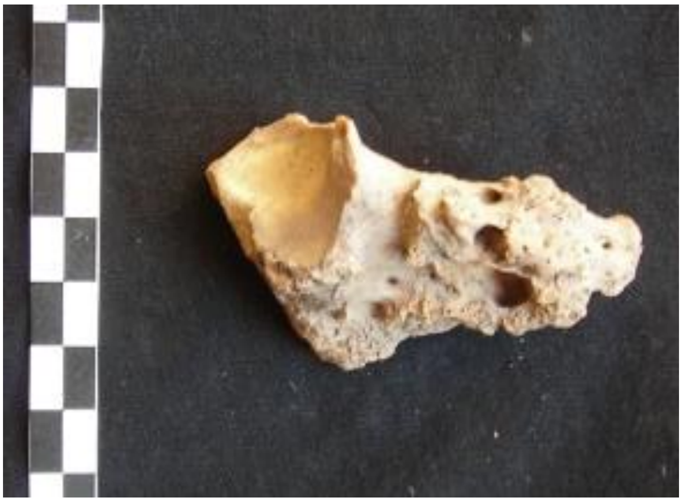


Figure 4.6.16 Cattle P3 with lipping and exostosis
Specimen #6220. Photo by the author.



4.6.6 Pathology

Pathologies on cattle remains occurred primarily on the bones of the foot. Five instances of exostosis/lipping on the articulations and edges of phalanges were noted (e.g. Figure 4.6.15). Such growth is frequently indicative of degenerative joint disease and arthritis. Similar osseous growth was recorded on a cattle calcaneum, metacarpal, and tibia, and a fused scafocuboid/cuneiform was also noted. Similar pathologies were recorded on bones from contexts that could not be accurately phased (Phase X). The pathological bone growth on the exterior of the third phalanx illustrated in Figure 4.6.16 may also related from age or traction-related stress. While osteoarthritis and exostosis on metapodials and phalanges may relate to the heavy work of draught cattle, care must be taken when linking the formation of such pathologies to the use of cattle for traction. Joint disease and the formation of bone around articular surfaces is also age related, and the presence of these conditions alone is not proof of draught exploitation (Johannsen 2005). Osseous growth unrelated to a joint articulation is more indicative of illness or injury. The significant distortion of the cattle metacarpal in Figure 4.6.17 illustrates what is probably the result of a trauma to the bone and subsequent infection. One unphased cattle tooth had coral-like roots.

Figure 4.6.17 Cattle metacarpal with exostosis
Specimen #4411. Photo by the author.

4.6.7 Summary and interpretation

The exploitation of cattle for meat, milk, and traction has been of major socioeconomic importance throughout the ancient world. Cattle were the primary source of power in Etruscan agriculture and transport, and as a result, their use and management is closely linked to agricultural strategy. The analyses above indicate that cattle at Forcello were raised as part of a mixed system of animal husbandry. Body part distribution indicates a focused exploitation of meat-bearing limbs, which were likely chopped and broken during food preparation. The distribution of butchery, gnawing, and burning varies more than for other domesticates. Some cattle had large, impressive horns (Figure 4.6.18), that provided an important material in craft production. Kill-off patterns indicate that cattle provided several products and services across the duration of their lives. A peak in the killing of sub-adult animals, the age at which cattle reach more or less their full size, indicates that some cattle were slaughtered for meat. However, most cattle at Forcello lived into adulthood and some lasted into old age. Milk would have been an important secondary product provided by adult cattle, but without evidence for the culling of very young animals, it does not appear to be the main goal in cattle management. Rather, muscular power was probably the primary reason for keeping cattle at Forcello. Cattle would have been central to draught work and transport. Pathologies on cattle lower limb bones may also attest to these animals' role in labor, although we cannot rule out that they may also result from age related stress. No information is available on cattle sex ratios, but both male and female animals would have been kept for breeding. Although historic sources and iconographic evidence indicates that oxen were the preferred draught animal of the Romans (Columella. *De Re Rustica* VI.24), cows may also have been used in traction. Males may be physically stronger, but cows have to potential to produce both milk and offspring, and as a result, they allow for a greater level of flexibility.

Figure 4.6.18 Cattle cranium with horncores
Specimen# 9415. Photo by the author.

4.7 OTHER DOMESTIC TAXA

4.7.1 Equids

Equids are represented by very few remains from Forcello – teeth/jaws, phalanges, carpals, and a distal metapodial. A small number of equid bones and teeth are also mentioned in the previous report. Their scarcity is related to the fact that horses and donkeys were not normally consumed. As a result, they are not disposed of in the same manner as other domestic livestock. In some rare circumstances equids may have been eaten, but no butchery marks to support this practice were found at Forcello. The equid bones from the site may derive from both horses (*Equus caballus*) and donkeys (*Equus asinus*). These species are difficult to distinguish with certainty. Two mandibles from Forcello were identified as horse. However, one came from a context without accurate dating information and it could not be confidently assigned to the Etruscan period. Horses were the more common species in the Iron Age (de Grossi Mazzorin 1996d), and other equid elements on site probably also derive from horse; the large measurements from one first phalanx are certainly suggestive of horse rather than donkey. However, donkeys may also have been present on site. Domestic horses arrived in Italy during the Chalcolithic period, and became common during the Bronze Age (de Grossi Mazzorin 1995a). Similarly, donkeys were rare before the Final Bronze Age (Minniti 2012:109). For much of Italian pre- and proto-history, horses would have been a status symbol restricted to the higher classes. In the Roman period horses were used in military exercises and racing, but not in agricultural labor (White 1970:288–293). In contrast, donkeys and mules were used primarily as pack animals, although they were also used plow light soils (Varro *Rerum rusticarum* 1.20.4; 2.6.5; Columella, *De Re Rustica* 7.1.2, Pliny, *Natural History* 8.167; 18.3.41; MacKinnon 2004a). Mules provided vehicular transport (White 1970:300).

4.7.2 Dogs

Dog (*Canis familiaris*) bones are present throughout the assemblage, but only represent about 1% of the NCSP. The presence of gnawing marks on the bones' of other species also attests to the activity of dogs on site. Bones and teeth illustrate the presence of adult and juvenile dogs; neonatal bones indicate that the animals were breeding within or very close to the settlement. All parts of the dog skeleton are present, and there is no evidence of the differential transport of dog remains. Scarpa's study reported similar results. Measurements from dog remains are limited, but they indicate that dogs were variable in size. Small individuals are visible in both lower fourth deciduous premolar (Figure 4.7.1) and first molar (Figure 4.7.2) measurements. Likewise dog mandibles (Figure 4.7.3) and humeri (Figure 4.7.4) also support a wide range of dog sizes. One pathological dog bone was recorded – a proximal radius with significant osseous growth on the mid shaft, probably related to trauma and a subsequent infection.

Figure 4.7.1 Dog dP_4 width (W) vs. length (L)

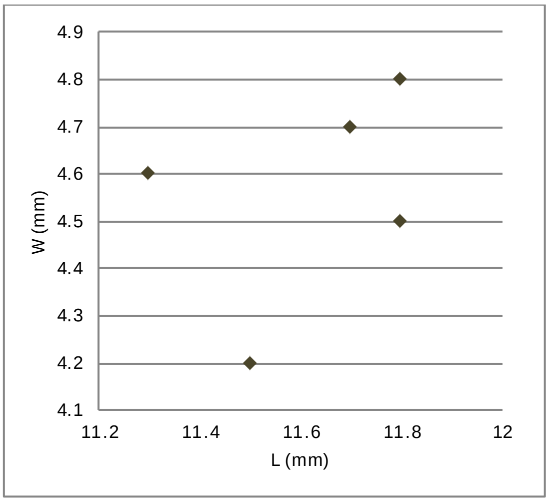


Figure 4.7.2 Dog M_1 width (W) vs. length (L)

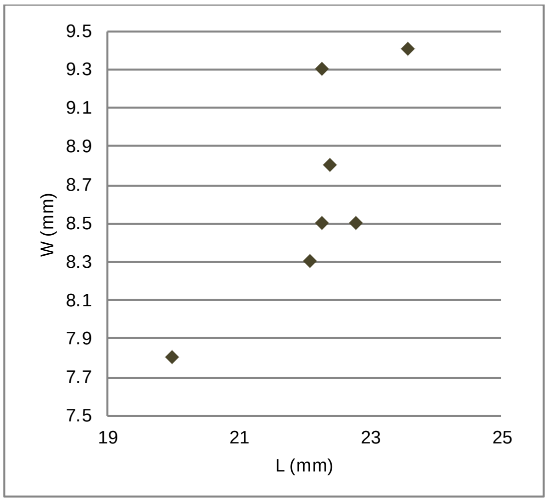


Figure 4.7.3 Dog mandible size

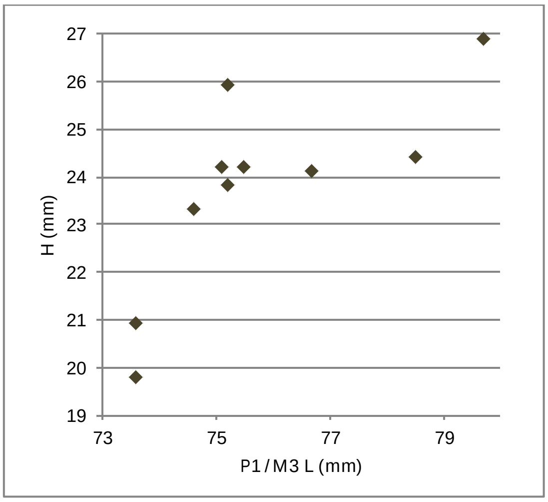


Figure 4.7.4 Dog humerus: HTC vs. Bd

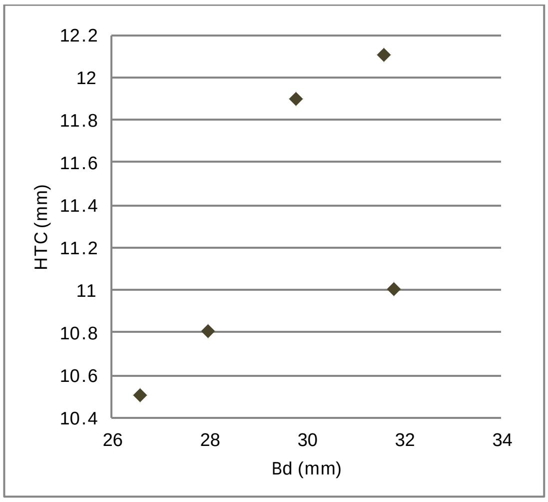


Figure 4.7.5 Dog skull with cuts (not pictured) on occipital lobe
Specimen ID #7400. Photo by the author.

One of the most interesting aspects of dog bones from Forcello is the relatively high incidence of butchery marks on these remains (18% of remains bear butchery marks, Table 4.7.5). In contrast, evidence of gnawing and burning on dog bones is rare. Although dogs were not commonly eaten by the Etruscans, the prevalence of butchered bones points to their consumption at Forcello. All the butchery marks encountered on dog bones were cut marks made by knives, and all but one the marks was associated with dismemberment. Marks cluster on the pelvis, humerus, and other long bones, areas that allude to a process of carcass division/dismemberment. Cuts on a metatarsal may relate to skinning. One complete (Figure 4.7.1) and two partial dog skulls with cuts on the bullae and occipital condyles were also recovered. Two of these skulls are from mixed fills and could not be securely identified as Etruscan. The third skull (pictured) came from an area of rubbish between two houses. Other dog remains with butchery marks were retrieved from similar contexts like middens, rubbish pits, and construction fills.

Dogs had a special role in sacrifices and other funerary/cultic activities in pre-Roman Italy, but the mixture of their remains with food refuse at Forcello points to a more economic explanation of their use. Outside of rubbish pits and middens, no articulating dog remains or dog skulls were recovered from construction fills, so it is unlikely that excavators failed recognize some type of foundation deposit or other symbolic context. Dogs may have been dismembered to utilize parts of the skeleton for tool manufacture, but the incidence of butchery marks on dog bones is equal to or greater than the frequency of such marks on the remains of domestic livestock. In this instance, a repeated consumption of dog meat seems probable. One reason for this could be hardship. The Late period contains a slightly higher proportion of butchered bones than the Early period, but very low sample sizes and the equally large quantity of unphased dog bones prevent serious consideration of this trend. Additionally, no other lines of evidence point to a period of environmental or political stress at the site. Cultural factors could also have influenced the use and exploitation dogs. Without evidence for hardship, cultural preferences are a more plausible explanation for dog consumption at the site. These factors are discussed further in the next chapter.

4.7.3 Cat

No cat (*Felis catus*) remains were identified during either this or the previous program of research.

4.7.4 Chicken

The twenty chicken (*Gallus gallus domesticus*) bones recovered from Forcello are a significant early testament to the presence this domestic bird in Italy (cf. Table 4.3.3). Chicken remains were recovered from both the Early and Late period from use surfaces, rubbish deposits, construction fills, a post hole, and a storage pit. The presence of these remains in Phase H (c. 530–520 BC) indicates that domestic fowl were a part of life at Forcello from its earliest phases. Nearly half of the chicken remains (n=9) were juvenile, but these remains may only represent one individual (MNI=1). Therefore, it is difficult to appreciate the role of young birds in chicken mortality patterns. There is no evidence for the differential transport of different body parts; the wing and the leg of the bird are evenly represented, but the sample size is small. One bone – a coracoid – had a cut mark, providing further evidence of the disarticulation and consumption of chicken at the site.

4.8 WILD MAMMALS

4.8.1 Cervids

Domestic taxa account for the majority of the fauna recovered from Forcello, and wild animals are rare (c. 3% in all periods) in comparison (Table 4.3.3). Amongst wild taxa, red deer (*Cervus elaphus*) is the most common species. Red deer is also better represented than dog – compared to dog bones, twice as a many red deer remains were recovered from archaeological phases (not including antlers; red deer NISP 275; dog NISP 137). Many antler fragments were identified as a general red/fallow deer taxon, but no fallow deer remains were found in the assemblage. Although morphologically similar, red and fallow deer did not both inhabit Italy during the Etruscan period. The distribution of fallow deer (*Dama dama*) was restricted to southeast Asia and parts of the eastern Mediterranean, and the species is unknown in Italy before the Roman period. The absence of this species from the Forcello assemblage supports its accepted distribution. For this reason, we can assume that all of the large cervid remains in the assemblage derive from red deer.

The modest number of red deer bones and teeth does not permit a detailed analysis of body part distribution, but antler fragments, metapodials, and tarsals are more frequent than other elements (Table 4.8.1). The presence of multiple groups of articulating tarsals (e.g. Figure 4.8.1) indicate that this portion of this limb was disposed of at the same point in time. In addition, analysis of body part distribution only counts antler fragments with a complete transverse section; many more small fragments were also recovered. A limited number of unfused red deer bones and a mandible with a lower fourth deciduous premolar attest to the presence of immature individuals, but the majority of red deer remains derive from adult animals. No morphological information on red deer sex was documented, though of course antlers are only present in males. While the simple presence of antlers does not necessarily indicate the killing of the animal, because shed specimens could have been collected, the recovery of several antler fragments still attached to the skull illustrates that these animals were indeed hunted. The prevalence of gnawing and burning on red deer bones is similar to domestic taxa, but butchery marks appear in a higher proportion (Table 4.8.2). Cut and chop marks occur on both red deer bones and antlers, but saw marks are restricted to the latter (e.g. Figure 4.8.2). Although they are present on other elements, cut marks are focused on phalanges, metapodials, and tarsals. The concentration of marks on these elements relates to the use of deer antler, bone, and hide in the production of tools or other objects. As a malleable material that could be collected in the surrounding woodland, deer antler could be used for a variety of ornamental or craft-related purposes. A number of deer antlers were sawn, cut and chopped or smoothed to a point. If a large proportion of female sheep were indeed hornless, deer antler would have been of even greater importance.

Figure 4.8.1 Joining red deer calcaneum, astragalus and scafocuboid
Specimen #705, 706, and707. Astragalus has a chop mark. Photo by the author.

Figure 4.8.2 Red deer antlers with evidene of sawing
Specimen #6121 and 6053. Photo by the author.

Measurements from red deer astragali and tibiae show that the species overlapped in size with the cattle at Forcello (see above, Figures 4.6.10–11). Biometric data from red deer calcanea (Figure 4.8.3) and metapodials (Figures 4.8.4–5) indicate the presence of two red deer size groups. Red deer, like other cervid species, are highly sexually dimorphic. Males invest energy into greater size, while females focus on reproductive quality (Post et al. 2013; Weckerly 1998). The two groups visible in the red deer biometric data likely represent male and female individuals. If these groups are accurate, males outnumber females. Considering the large number of worked antler fragments, males may have been the preferred prey. A proximal metacarpal with exostosis surrounding the articulation (specimen #5505) and a mandible with an abnormally rotated third molar were the only pathological cervid specimens identified (#2929).

Information on red deer in the earlier Scarpa report is limited, but her results are broadly in agreement with those presented here. After cattle, sheep/goat, and pigs, red deer was the most frequent taxon, but it still accounted for less than 3% of the total assemblage. Body part distribution indicates a comparable concentration on lower leg bones, but antlers are less frequent than noted here. On the whole, the role of red deer is similar between the two studies.

Figure 4.8.3 Red deer calcaneum: D vs. GL

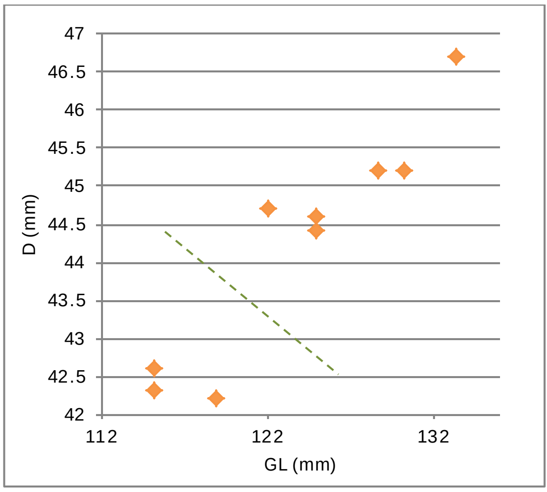


Figure 4.8.4 Red deer metacarpal condyle depth

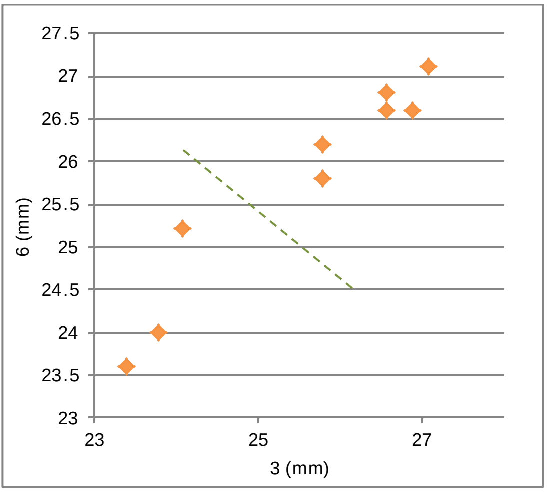


Figure 4.8.5 Red deer metatarsal condyle depth

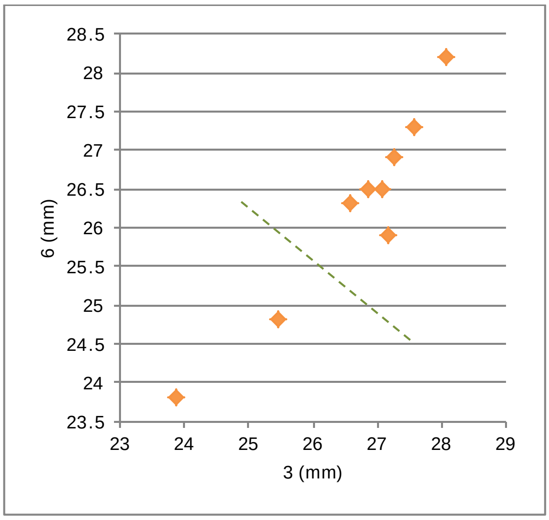
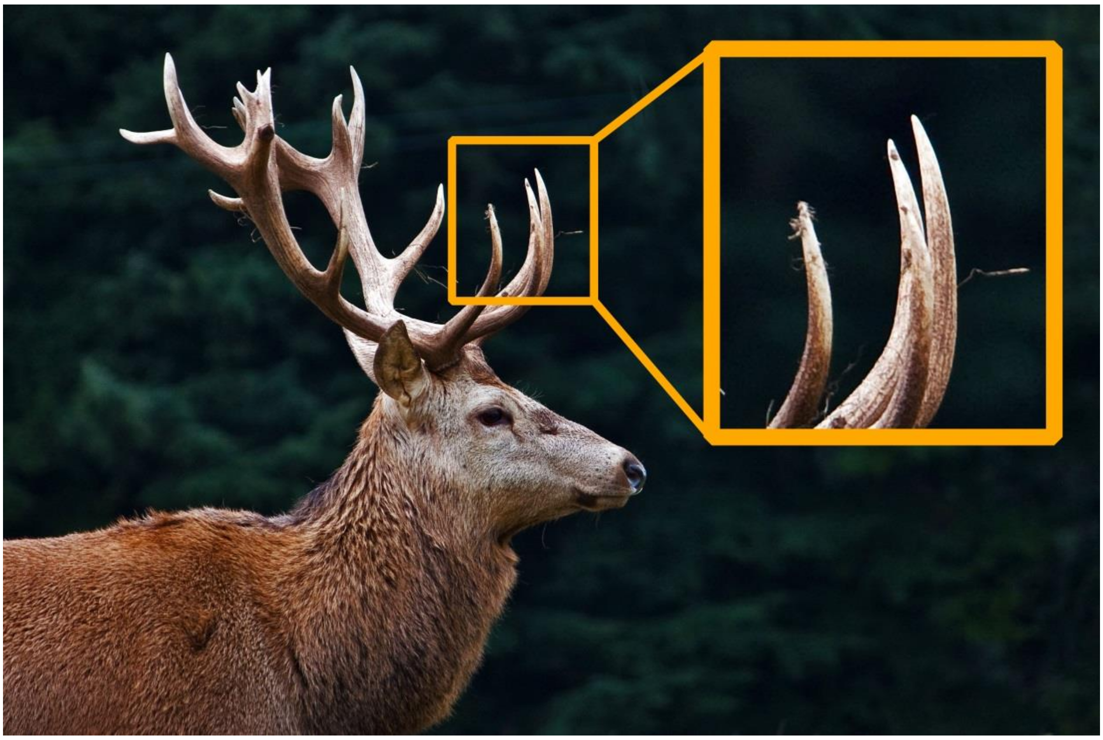


Figure 4.8.6 Deer antler tine sawn at the base
Specimen #9474. Photo by the author.

The only other cervid present in the Forcello assemblage is the roe deer (*Capreolus capreolus*). Several bones, antler fragments, and a mandible attest to the presence of this species. Like red deer, roe deer were also native inhabitants of the forests of the Po Plain. The presence of cut marks on a humerus is indicative of dismemberment, while those around a metacarpal and the base of an antler point to skinning. Roe deer is was not identified in the previous faunal study at Forcello, but considering its limited presence in this study, its absence in a smaller assemblage is not surprising.

Wild species, including cervids, made a negligible contribution to the diet of the inhabitants of Forcello. But while deer were not a primary food source, their skins and antlers were clearly a valuable raw material that could be used for a variety of purposes. Numerous red deer antler fragments have indications of working, a practice discussed further in section 4.11 below. Many antler tines may also have been smoothed or shaped into a point (e.g. Figure 4.8.6), but because deer antler naturally wears in this fashion (Figure 4.8.7), it is difficult to separate human use from normal wear. Although red deer remains far outnumber those of roe deer, the smaller species seems to have been treated similarly. The presence of shed antler pedestals from both species indicates that some of the antlers were collected rather than cut from a hunted animal.

Figure 4.8.7 Modern red deer with detail of antlers
© 2010 Mark Robinson. Detail added by author. http://www.flickr.com/photos/66176388@N00/4395385130/
Used under a Attribution-Non Commercial 2.0 Generic license: http://creativecommons.org/licenses/by-nc/2.0/



4.8.2 Wild boar

Analysis of pig measurements identified the presence of several especially large pigs (see section 4.4.7); these outliers are indicative of wild boar (*Sus scrofa*). Compared to the larger group of domestic pigs, wild boar are relatively rare, although small wild individuals may be concealed within the main measurement group. Wild boar are native to northern Italy and would have thrived in the extensive forests of the Po Plain. After red deer, they are the most common wild species encountered in Italian pre- and proto-historic assemblages.

4.8.3 Fox

Five specimens identified as fox (*Vulpes vulpes*) were recovered from Forcello, but one came from a plowzone layer that cannot be securely dated. The four other fox specimens are all mandibles or loose mandibular teeth. The species was also identified in the previous faunal report. Foxes were and still are found throughout the Italian peninsula, and they would have lived in the landscape surrounding Forcello in the past. Foxes were probably hunted in Etruscan times for their fur, and the inhabitants of Forcello may not have had to journey far – as opportunists and occasional scavengers, foxes probably visited the area to investigate the site's rubbish and food debris.

4.8.4 Beaver

Several beaver (*Castor fiber*) bones and teeth attest to the presence of this species at Forcello. Beavers are no longer present in Italy today, having been hunted to extinction, but in Etruscan times they would have lived in the river and fluvial lakes adjacent to the site. Scarpa also identified a beaver bone in the earlier report. Like foxes, beavers were probably trapped for their fur; beaver fur is especially warm due to its thick underfur, and it has been a valuable commodity throughout history. A cut mark on a beaver calcaneum attests to the skinning/disarticulation of this animal at Forcello. Beavers also were valuable for their teeth and *castoreum*, an oily substance secreted by the animal's castor sac scent glands. Both the Romans and Greeks believed this substance to have medicinal uses (Pliny, *Natural History* 8.47; Celsus, *de Medicina* 3.16; Herodatus, *Histories* 4.109; Aretaeus, *De curatione diuturnorum morborum libri duo* 1.2; King 2007) .

4.8.5 Other mammals

Other wild mammals identified in the faunal assemblage include otter (*Lutra lutra*), badger (*Meles meles*), hare (*Lepus sp.*), hedgehog (*Erinaceus europaeus*), mole (*Talpa* sp.), and small rodents (including small Murinae). All of these species occur naturally in northern Italy and would have been present in the countryside surrounding the site. Like foxes and beavers, otters were probably trapped for their fur. Badgers may also have been hunted or trapped for their pelts. The presence of a cut mark on a badger femur illustrates that these animals were sometimes butchered. Hares would have inhabited local clearings and provided another source of fur and meat. The bones from a hedgehog and a mole probably reflect local species that naturally became incorporated in the assemblage during the past, although their consumption cannot be ruled out. Likewise, numerous small rodents would have lived in the area surrounding the site, or even as commensal species within Forcello itself. The presence of house mouse (*Mus* sp.) provides evidence of agricultural storage at the site. This is a wider range of taxa than identified in the previous report; of the wild species discussed in this section only *Lepus* appeared in the previous study. Given that these species are only represented by a very small number of remains, their absence from the earlier work is not surprising.

4.9 WILD BIRDS

The wild birds from Forcello demonstrate links with the abundant environment adjacent to the site. Ducks are the most common type of bird, and they are represented by both dabbling (*Anser* sp.) and diving (*Aythya* sp.) varieties. Geese (*Anser* sp.) are also present. The Etruscans, like the Romans, may have been kept captive ducks and geese for food and feathers (Albarella 2005). The presence of cut marks on duck and goose bones from Forcello indicates that they were a source of food and possibly raw materials as well. Many of the other wild bird species identified in the assemblage are still found in region: swan (*Cygnus* sp), coot (*Fulica atra*), pigeon (*Columba* sp.), gull (*Larus* sp), and corvids (*Corvus* sp.). Butchery marks on swan and coot bones indicate that these birds may also have been eaten, or at least dismembered. One swan humerus bears a man-made hole in its distal end (Figure 4.9.1). Curlew (*Numenius arquata*) and birds of prey, including a small owl (Strigidae sp.) are also present. The Forcello assemblage also contains the remains of rarer avian taxa. Crane (*Grus grus*), bittern (*Botaurus stellaris*), small heron (Ardeidae sp.), and pelican (*Pelecanus* sp.) were also documented. The presence of pelican bones is of some significance because this species is all but absent from Italy today. Many of these birds may have been hunted or trapped for their feathers as well as for food; several crane bones have cut marks which evidence their use by humans.

Figure 4.9.1 Swan humerus with man-made hole
Specimen #11837. Photo by the author.

4.10 MOLLUSCS AND AMPHIBIANS

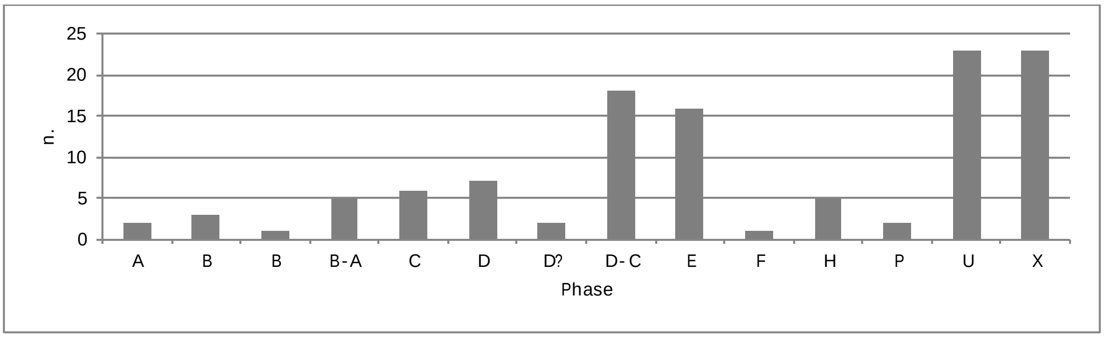
Three cuttlebone fragments were identified at Forcello. These derive from the internal shell of the cuttlefish. The two cuttlefish bones that could be assigned to an archaeological phase (the third specimen comes from an undated context) came from the site's earliest phases: H and I. The cuttlefish is a marine animal that lives in temperate and mostly shallow salt water. The presence of this species at Forcello provides further evidence for inter-regional contact and trade. The animal was probably not consumed on site – unless preserved, a cuttlefish would go off quickly and the transport of a live animal seems unlikely. Cuttlefish ink may also have been of value. The Romans used the substance for both pen ink and medicines (Cicero, *De Natura Deorum* 2.50; Persius, *Satires* 3.12–13; Celsus, *de Medicina* 2.29). Cuttlebone itself also had medicinal uses (Pliny, *Natural History* 32.28). Although no evidence of working was found on the cuttlebones from Forcello, this bone can be used a mold for casting jewelry (Untracht 1986). The cuttlebone, which is made of mostly calcium carbonate, is both easily carved and able to withstand high temperatures, making it an ideal material for casting sockets.

The remains of several frogs/toads were also identified in the Forcello assemblage. These amphibians would have lived in the environment surrounding the site, especially near the waters of the Mincio and in man-made canals. Although no cut marks were found on frog/toad bones, these animals may have been eaten in the past, as they are still in Mantova today.

4.11 WORKED BONES

Numerous semi-worked fragments and broken bone/antler objects attest to bone and antler working at Forcello. Many finished objects were separated from the faunal material during excavation. Those available for this project were recorded with the other faunal remains; their find numbers are included in their database entry in Appendix C. Over one hundred worked or potentially worked specimens were identified (n=110), the majority coming from archeological phases (n=94). Phases contained different quantities of worked specimens (Figure 4.11.1), but all phases contained a similar proportion of worked remains. Worked/potentially worked specimens accounted for 0–1.5% of remains for all phases except Phase C (2.1%), which was only slightly higher. The most common object type was an awl shape: a long, pointed spike. Small versions may have been used as pins; larger ones could be used to make holes in leather or textiles. One awl-like object was pierced at the blunt end, suggesting its use as a needle (specimen #11719). An awl with a bone/antler handle and metal point was recovered from the phase D workshop (Casini et al. 2007:fig. 33); an antler (#11675) worked into a similar handle was found in a phase E context. A few other object types were also noted, including several small incised rings/hoops (#9488, 11706, 11738), a flat oval bead/washer (#808), a cylindrical washer (#11725), and flat, cylindrical boss-like object (#11704).

Figure 4.11.1 Number of worked bones by phase
Includes potentially worked deer antler tines.



4.12 HUMAN REMAINS

An interesting collection of human remains was also recorded during the course of studying the faunal assemblage from Forcello (Table 4.12.1). All remains had been collected and bagged with the animal bone and were encountered while recording the faunal material. A total of 90 human bones, representing a minimum of 15 individuals: 14 neonates (quantified using the right tibia) and one adult. Based on the information supplied by the excavator, not all of the contexts containing human remains were securely dated to the Etruscan period. Human remains were not noted in the previous report or any other past publications. Most bones were from infants, but a fragmented adult metacarpal was recovered from a fill, and an adult metatarsal and first phalanx were recovered from a rubbish pit. The recovery of adult metapodials and phalanges is not particularly unusual in faunal assemblages. These small, dense bones survive well and can easily become separated from the body in life (on account of an accident) as well as after death. More interesting are the 87 neonatal/very young human bones. These bones most likely represent perinatal fatalities, based on their age and the fact that they all look slightly “weird” (A. Chamberlin and L. McIntyre pers. comm.). The presence of a cavity, possibly caused by a cyst, in the proximal epiphysis of one neonatal femur provides further evidence of pathology.

Infant remains were recovered from twenty-five contexts, which include construction fills, rubbish pits/middens, unspecified stratigraphic levels, postholes, and the fill of a furnace. Eleven other contexts contained two or more neonatal bones, which may be from the same individual. Context types with more than one human bone include middens and rubbish pits, post holes, unspecified stratigraphic levels, destruction debris, and construction fills. Only two contexts, both large rubbish dumps/middens, contained more than one individual. Two interesting contexts are number 476, a level of debris related to the phase F house in section R18 (two tibiae, two fibulae), and 1784, a level of fill or other deposit related to phases C–D (humerus, radius, ulna, tibia, fibula, ribs). Both these contexts were listed as being in primary position. Context 476 contained a mix of unexceptional fauna and a collection of unidentified burned fragments (NCSP = 26); very little faunal material was recovered from context 1784

(NCSP = 4). Nothing else appears to separate the deposits containing human remains from the rest of the faunal assemblage.

In general, the distribution of bones across these context types suggests that they mm have been deposited elsewhere before becoming disarticulated through the continuous development and re-working of the site. Individual bones may derive from older burials that became mixed over the life of the settlement. Considering the level of recovery bias, more neonatal remains were probably missed during excavation. Burials may also have occurred, but not been recognized as such; future investigation of the other materials from these contexts is needed to further explore the pattern of infant deposition. Nevertheless, these are the first human bones to be recovered from the site, and they indicate that the burial of infants within the settlement was a repeat occurance. The last point to consider is the extent of current excavation. Only about 3% of the site has currently been explored, and whether this treatment of infants is household-specific or practice across the settlement is currently unclear.

4.13 SUMMARY

Because of its large size and tight chronology, the faunal assemblage from Forcello offers an unprecedented look at animal management and use in an Etruscan settlement. The remains themselves were in a good state of preservation, although recovery bias significantly influenced the final assemblage. A very limited program of sieving recovered an interesting assemblage of bird, fish, amphibian, and small mammal remains. The recovery of these tiny bones provides further evidence of the excellent preservation at the site and the presence of small taxa, but it had little effect on the representation of the main domesticates because of the small amount of material involved. The assemblage is dominated by pig remains, followed by sheep/goat, with a low percentage of cattle. The proportion of pigs increases slightly in the Late period at expense of sheep/goat. Species frequencies are similar across context types. Because of the large number of pig remains, a wide set of analyses were possible for this species. Pig body part distribution is primarily mediated by density with no clear evidence for differential transport. The unusual abundance of the scapula could not be totally explained, but it most likely results from taphonomic factors rather than transportation. Pig body part distribution was constant across all context types. Pig kill-off patterns focused on sub-adult animals and those just entering adulthood. The proportion of sub-adult and immature pigs increases in the Late period. This increased focus on younger animals and the rise in pig percentages during the Late period may indicate that pig husbandry intensified in the later phases of the site. Pig size remained constant between the two periods. Large outliers indicate the presence of wild boar.

Both sheep and goat were present on site, although sheep were the more numerous. Post-crnaial caprine remains were underrepresented compared teeth, a pattern most likely linked to recovery bias and the taphonomic loss of these remains. Sheep/goat kill-off patterns indicate a mixed system of animal management where sheep were raised primarily for milk, tender meat and wool, while goats were kept for milk and the meat of full-size animals. Sheep/goats were similarly sized between the two periods. Cattle were the least frequent species at Forcello. Body part distribution indicates a preferential destruction of meat-bearing limb bones, likely resulting from the greater fragmentation of these bones, possibly for cooking, marrow exploitation, or bone working. Age analysis indicates that most cattle lived into adulthood and even to an elderly age. These animals would have been used in traction, particularly in agricultural labor. A smaller peak in the slaughter of sub-adult cattle indicates that some animals were also killed for meat. Cattle were similarly sized between periods. Butchery marks were recorded on all three of the main domestic taxa. Butchery was done primarily with knives, and the placement of marks indicates that animal horn and hide was exploited in addition to meat.

Equids were rare in the assemblage. Only the remains of horses were identified to species level. A low number of equid remains is to be expected, because these animals were not normally eaten, and they would have been disposed of differently than the livestock discussed above. Dog remains also made up a small portion of the assemblage, but the high frequency and placement of cut marks on their remains indicates that these animals were sometimes consumed. Measurements from dog bones indicate the presence of dogs of different sizes. Compared to the large number of domestic remains, wild animals made a small contribution to the assemblage. Hunting focused on red deer and wild boar, although other smaller mammals and birds were also hunted or trapped. Cuttlefish remains provide further evidence of links with the Adriatic Sea. Worked bone and antler fragments illustrate the importance of these materials in craft production. Interestingly, most of the worked remains seem to have been crafted to a similar awl-like form. Lastly, a large collection of perinatal human bones mixed with faunal remains is a significant find for an Etruscan site.

The analysis presented here is generally in agreement with Scarpa's previous report, but these studies differ on several important points. Firstly, Scarpa identified a high proportion of adult pigs. Using this information and in conjunction with the absence of the pork hindlimb, she concluded that Forcello was had a complex system of pig management focused on exporting the hindquarter of these animals. In contrast, this analysis has shown that the relative lack of the pig hindlimb is the product of density-mediated bias. Likewise, while this analysis has demonstrated that a significant proportion of pigs from Forcello were killed in adulthood, the majority of those animals were killed in very early adulthood – a mortality pattern is conducive with an extensive system of pig management. Scarpa also reported a higher proportion of adult sheep/goat than was found in this analysis, and there is no mentioned of human remains in previous reports. Because she studied different material than that included in this project, these results may reflect the particulars of that assemblage. However, the results presented here provide a higher-resolution picture of animal management at Forcello because of the larger sample size included, the larger suite of analyses involved, and the greater detail of the results.

CHAPTER 5

ANIMALS ON THE EDGE: ZOOARCHAEOLOGY AT FORCELLO IN CONTEXT

5.1 CONTEXTUALZING THE FORCELLO ASSEMBLAGE

5.1.1 Introduction

The previous chapter presented an analysis of the hitherto unstudied faunal material from Forcello and integrated the new results with those from Scarpa's previous zooarchaeological report. In this chapter, animal remains from Forcello are placed in a wider chronological and geographic context through comparison with relevant Bronze Age, Iron Age, and Etruscan sites in both northern and central Italy. These comparisons help clarify animal management at Forcello while they attempt to untangle broad Italian patterns from specifically Etruscan developments. Because of its large assemblage, Forcello provides a unique opportunity to investigate how established models of Etruscan animal husbandry (presented in Chapter 2) apply to a single site. The comparisons presented in this chapter examine several lines of inquiry based on existing models: the role of wild animals, the relative abundances of the three main domesticates, age and sex profiles, and animal size/shape. Lastly, the equid, dog, chicken, and human remains from Forcello are contextualized within a larger Italian framework. Data from the comparative sites introduced earlier in this thesis facilitate these comparisons, but their use is limited to this task. Although new lines of inquiry sometimes arise, the focus remains on contextualizing human–animal relationships at Forcello.

5.1.2 A note on comparisons

The challenges and limitations of inter-site comparison previously discussed (section 2.1.4) remain true for the investigation below. This chapter uses the comparative site list presented in Chapter 2 to address specific questions about Forcello and the development of the Po Plain in the first millennium BC. References for comparative sites are also found in that chapter. This strategy will not only help to contextualize Etruscan activity at Forcello, but also to refine our understanding of animal use in an area that has not been recently investigated in depth. Species frequencies and age and sex data are compared across all sites, but biometric data focuses on direct comparisons with a selected suite of sites that have a large number of measurements available. These sites have been repeatedly used to evaluate of long-term animal size trends (cf. section 2.5.1–3), and comparing Forcello to these assemblages will help position the site in relation to established developments in animal size. In northern Italy, sites within the Po Plain were selected from the Bronze Age (Canar, Barche, Isolone) to evaluate trends through time. Colognola ai Colli and Castelrotto (abbreviated 'COL' and 'CSR' in figures) provide comparative data for northern non-Etruscan settlements roughly contemporaneous with Forcello. The Greek–Etruscan site of Spina would have been the ideal foil for Forcello, because of its large assemblage, but only a brief and preliminary study of the material is available. Therefore we must turn to other assemblages. In central Italy, biometric investigation focuses on Fidene, Ficana, and Populonia, sites whose chronologies account for most of the first millennium BC. Where necessary, data from other northern and central sites are used to support these comparisons. A reconstruction of animal size based on so few sites presents obvious problems with geographic gaps and complicates interpretation of environmental versus intrinsic differences within animal populations. However, few other opportunities were available. A full three-dimensional re-evaluation of biometric data from the study area was beyond the scope of this project. Additionally, while some data from other sites are available, the majority of biometric data derive from a handful of large assemblages. The inclusion of a few data points from smaller samples would do little to change prevailing trends, and grouping sites together in such a manner would mask the influence of the predominant settlements. Thus, comparison focuses only on these major assemblages in order to be expressly clear about precisely which animal populations are compared in each analysis.

This chapter draws together zooarchaeological data originally presented in a variety of forms. Where possible, direct comparisons are made to data from other reports. For example, some authors use Payne's (1973) system to record sheep/goat tooth wear, allowing a direct comparison of mortality profiles from some sites. However, Payne's system is not the most commonly employed aging method, and in most cases a direct comparison is not possible. Likewise, not all measurements taken for this project are available for other sites. Measurements for teeth are particularly problematic because of the variety of ways to measure their dimensions. As a result, tooth width – an especially useful measurement because of its resistance to environmental pressure – is rarely available. Additionally, measurements are frequently presented as ranges rather than raw figures, sometimes accompanied by a histogram (e.g. Canar, Barche, Isolone). Measurements may also be rounded to the nearest 0.5 (e.g. Ficana and Populonia), or even to the nearest whole millimeter, as in Scarpa's work at Forcello. I attempt to respond to these limitations by adapting to the published data. Histogram intervals were established based on those provided in the comparative reports; as a result, the interval spacing is not always ideal. Where possible, tooth lengths were considered if widths are not available, so as to provide some indication of tooth size.

5.2 SPECIES REPRESENTATION AND RELATIVE FREQUENCY

5.2.1 Hunting strategies and the importance of wild species

Wild animals are rare at Forcello. Excluding wild boar, they account for only 3% of the total assemblage. While biometric comparison identified the presence of a few wild pig remains, the addition of a small number of wild boar will not alter their minimal contribution. The limited presence of wild species is typical of the period and indicates that wild animals represented a minor part of Etruscan subsistence. Hunting at Forcello focused on the two most popular wild species of the time – red deer and wild boar – animals that would probably have been hunted for sport and to protect crops, as well as for meat. The large number of worked deer antler fragments from Forcello resembles those from other sites, for example Marzabotto (Figure 5.2.1). Fragments, wasters, and semi-formed items provide further evidence of a widespread cottage industry of antler and horn working assisted by saws as well as knives and cleavers. The appearance, but relative rarity, of other wild species (e.g. roe deer, fox, badger, beaver, otter, hare) in the Forcello assemblage is consistent with other Etruscan sites in the Po Plain.

Figure 5.2.1
Worked deer antler from Marzabotto, sawn similarly to those from Forcello (Curci 2010:fig. 329)
[Resti di palco lavorato e resti ossei di cervo. CURCI, A. 2010. I dati archeozoologici. In: GOVI, E. & SASSATELLI, G. (eds.) Marzabotto. La casa della regio IV - insula 2. Vol. 2. I materiali, p. 397–420. Bologna: Ante Quem.]

Small mammals (smaller than hares) are especially rare in assemblages from the study area, most likely because of the limited use of sieving. Attributions to genus and species level are very few because of the difficulty of identifying these small remains. Faunal assemblages from the wells at Pyrgi contain the largest range of small taxa, including shrew (*Crocidura russula*), vole (*Arvicola amphibious*), dormouse (*Dryomys nitedula*), and wood mouse (*Apodemus sylvaticus*). Small rodents have also been recorded at Narce, Blera, Arginone, Monte Bibele, and Bologna (Castenaso). Two small mammal species found in the Forcello assemblage is are unique to the site – the hedgehog (*Erinaceus europaeus*) and house mouse (*Mus* sp.) – animals each identified from a single specimen. The absence of hedgehogs from other sites of the period is probably related to their small size and preference for fields, hedges, and open woodland rather than populated habitats. The house mouse arrived in Italy from the Eastern Mediterranean during the Neolithic, and rapidly spread across Europe in the first millennium BC (Cucchi et al. 2005). Its presence at Forcello is indicative of the growth of systematic agricultural and cereal storage in Italy during the Late Bronze and Iron Age.

The wild bird bones from Forcello constitute the largest avian assemblage recovered from an Etruscan site, and they enhance our understanding Etruscan bird exploitation as well as the past distribution of these animals. The most common type of bird at Forcello, ducks, are present in both northern and central assemblages. The Etruscans did not have domestic ducks, but wild ducks may have been trapped and reared for food and feathers (Albarella 2005). Domestic geese have not been positively identified in Italy during the Etruscan period, and the goose bones from Forcello, Miseria Vecchia, Bologna (Castenaso and Via Foscolo-Frassinago) and Ficana (zone 3 b-c) could be from hunted or captive birds. Other common wild birds found in the Forcello assemblage (e.g. *Corvus corax, Columba* sp., *Fulica atra*) are also present on other sites. In addition to Forcello, the bittern is also present at Lagazzi di Piadena. A black kite (*Milvus migrans*) bone from Poggio Moscini is the only comparative example for the birds of prey from Forcello. Lastly, crane and pelican bones from Forcello are unique amongst Etruscan settlements.

Frog and toad bones have been recorded on several sites in both northern and central Italy. The fish remains recovered from Forcello primarily represent freshwater species still common in the Mincio today. The assemblage, although only in a preliminary state of analysis, indicates s fishing strategy focused on pike and cyprinids like tench, rudd, and chub – the same species present in Bronze Age assemblages from Canar and Frattesina. However, unlike these earlier sites, pike is clearly the predominant species at Forcello; at the Bronze Age sites cyprinids and pike are more evenly represented. Because the Forcello material is hand collected, it is unclear whether the predominance of pike reflects a recovery or other taphonomic bias. In either case, the species of fish present at Forcello were common throughout the Po Plain in pre- and proto-history. Sporadic fish bone finds from northern sites (e.g. Pilastri, Lagazzi, Castenaso, Padova, Arginone, Marzabotto) are also typically pike and cyprinids. Further study of the Forcello fish bone assemblage will reveal new information on fishing strategies and the local environment, but for the moment, preliminary work demonstrates a focus on exploiting the fluvial lake immediately adjacent to the settlement.

5.2.2 Livestock frequencies – cattle, sheep/goat, and pig

The high percentage of pigs in the Forcello assemblage is a noteworthy characteristic of the site that links it closely with other Etruscan settlements, both in northern and central Italy. High pig percentages are found at other Etruscan settlements in the Po Plain and in Etruria (Figure 5.2.2).

This emphasis on swine production separates Etruscan settlements from contemporaneous Celtic and Alpine sites. Cattle and caprines are more important than pigs on sites in Verona and South Tyrol – a preference that is likely culturally, as well as environmentally, linked. Pigs may not have been economically viable in mountainous Trentino-Alto Adige, but similar constraints were not present throughout the Veneto and Friuli. Differences are also visible within Etruscan sites from northern and central Italy. Central sites are more likely to emphasize sheep/goat production, while northern sites have greater pig percentages. The relative presence of cattle is roughly equal in both Etruscan regions.

Like the results of Scarpa's earlier report, species frequencies from this project resemble those of other contemporaneous urban settlements in Po plain. The ratio of the main domesticates at Marzabotto is very similar to that of Forcello. Interestingly, the village of Case Vandelli and the elevated site of Monte Bibele more acutely resemble Forcello than the urban site of Spina. While assemblages from Spina and Bologna (Via Santa Caterina) are also similar to Forcello, cattle, rather than sheep/goats, follow pigs as the second most common species. Sheep/goat and cattle frequencies fluctuate between Etruscan sites, but the marked focus on pig husbandry at Forcello and other Etruscan settlements separates them from other cultures.

Figure 5.2.2 Species frequencies sites dated from the 9th-2nd centuries BC
Forcello marked by 'x'. Forcello includes only data from this thesis.

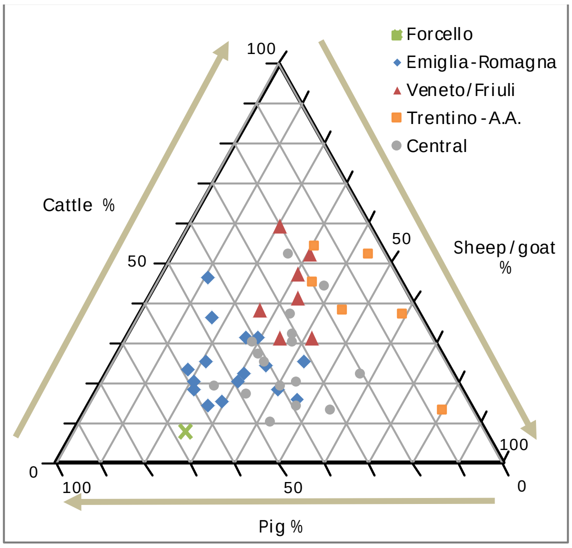
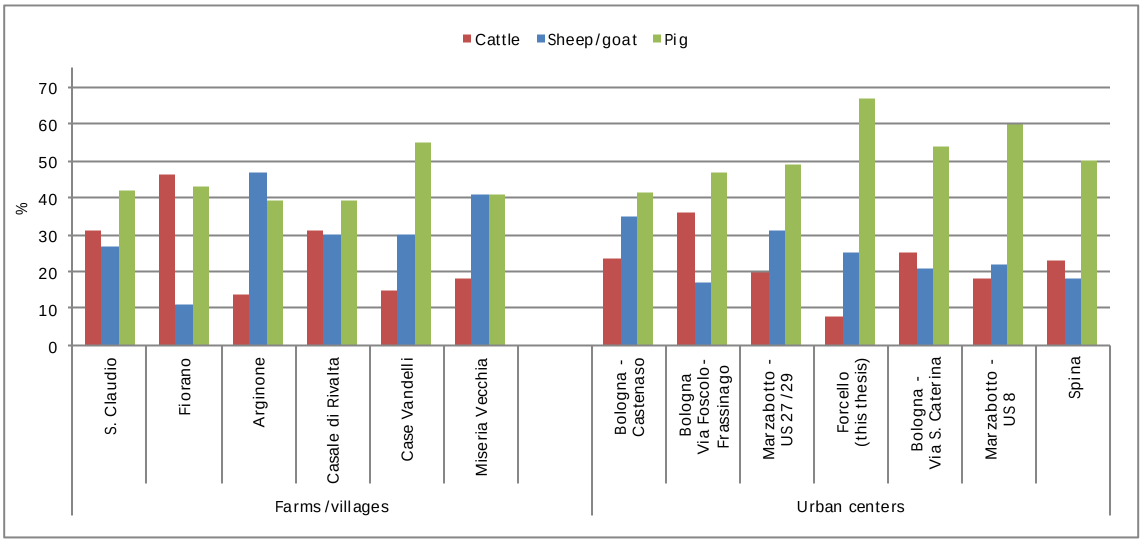


Figure 5.2.3 Species frequencies from northern Etruscan sites from the 8th–4th centuries BC.
Settlements organized chronologically within groups. See table 2.1.2. for sample size. Forcello data from this project.



The disparity between Etruscan animal management and that of other cultural groups becomes even clearer when the results of this project are considered across both the Bronze and Iron Ages (Figure 5.2.4). Bronze Age assemblages from the Po Plain tend to focus on sheep/goat or cattle husbandry over that of pigs. Pigs frequencies sometimes match those of caprine, but only rarely are pigs the predominant species. The Early Bronze Age site of Canar and the Middle Bronze Age site of Poggio Rusco are the main exceptions to this trend; both sites register relatively high proportions of swine (over 40%). Between the Final Bronze Age and eighth century BC, pig frequencies jump to over 40% and continue to climb throughout the Etruscan period. Unfortunately data is not available for the Final Bronze Age or Early Iron Age in the central Po Valley – a gap of circa five centuries. Still, the amplitude of the increase in pig frequencies and the steady continuation of this trend indicate a break from past practices and a new, Etruscan style of animal husbandry. This preference for pig husbandry then continues to develop through time. Pig frequencies continue to increase between the eighth to third centuries BC and into the Roman period. This trend is also visible within Etruscan sites that span several centuries of continuous habitation. Like Forcello, Bologna and Marzabotto both demonstrate a similar escalation of pig production through time (Figure 5.2.5). Cattle frequencies remain mostly unchanged at Forcello and Marzabotto, but there is a larger drop in cattle frequencies at Bologna. Pfatten-Vadena, a settlement in Trentino-Alto Adige, demonstrates a completely separate trend; pig frequencies drop rather than rise across a similar period.

Figure 5.2.4 Pig frequencies from Bronze and Iron Age sites in Emilia-Romagna, Lombardia, and the Veneto arranged chronologically
Forcello highlighted. Space indicate break between Bronze and Etruscan Ages.
Figure by the author. BA = Early Bronze Age. MBA = Middle Bronze Age. RBA = Recent Bronze Age. Numbers indicate century BC.

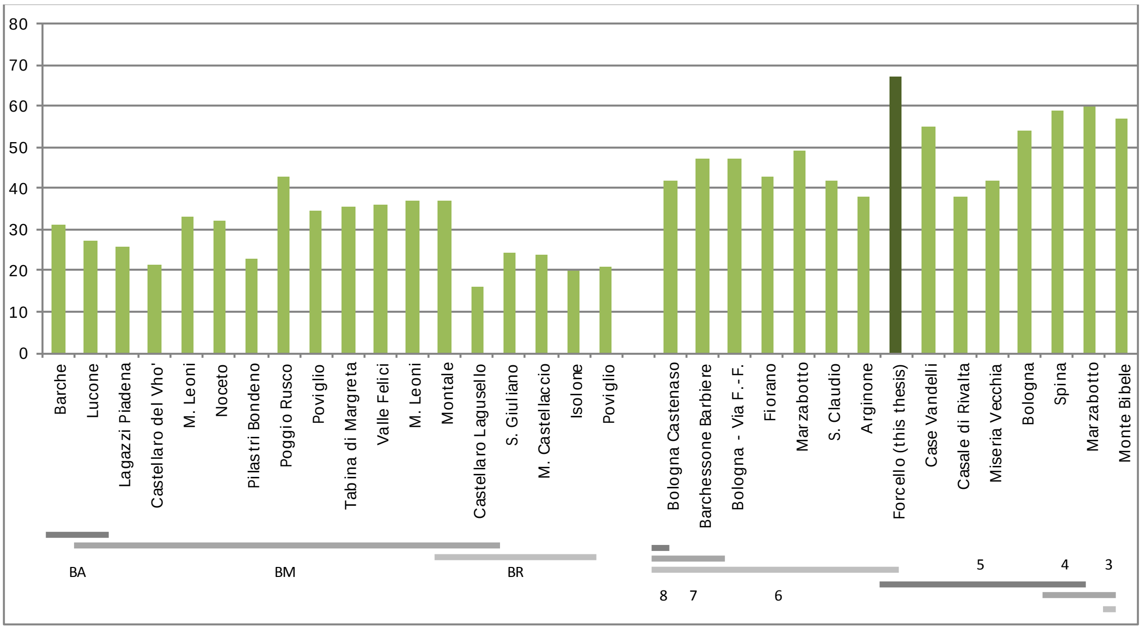
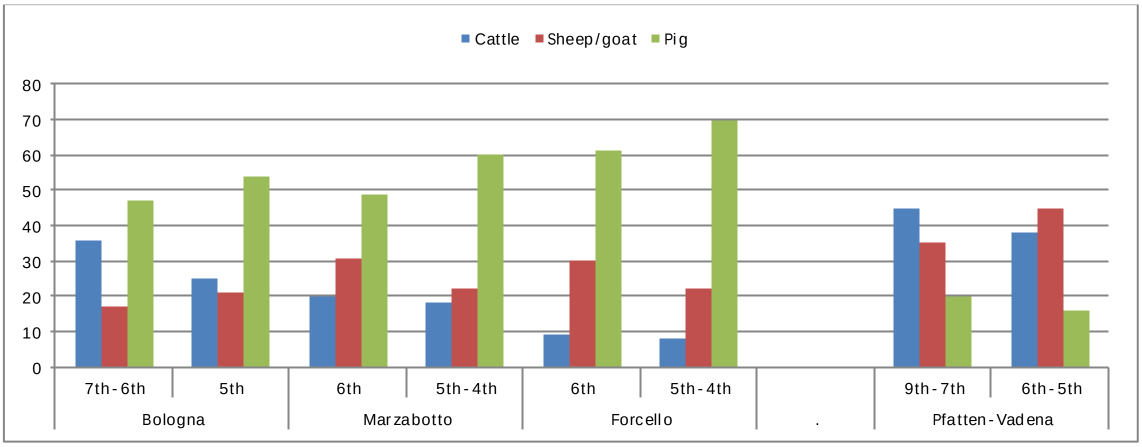


Figure 5.2.5 Changes in species frequencies within settlements between the 9th-4th centuries BC
Forcello data from this project.



A clear increase in the relative importance in pig also characterizes the development of central Italian animal husbandry during the first millennium BC, but the articulation of this trend differs from that seen in northern regions. An increase in pigs is particularly noticeable at population centers like Tarquinia, Roselle, and Populonia, a shift probably driven in part by rising demographic pressures. However, despite the overall trend toward a greater reliance on pork meat, pig frequencies are lower than those in the Po Valley. Percentages over 40% are uncommon in central Italy before the third century BC (see Table 2.6.1). Pigs are more frequent in some of Rome's early contexts, where they make up c. 50% of the sample – specifically from the 'capanna Puglisi' (c. 55%) and Velia (c. 53%). However, not all Roman assemblages demonstrate this pattern, and the relatively modest presence of pig remains at Tarquinia and Rome is still far from the 60–70% seen at Forcello. With the exception of Rome, Forcello and other northern Italian sites adopted a management strategy focused on pigs earlier than their central Etruscan neighbors.

The emphasis on pig production and the relative increase in this species through time place Forcello firmly within the broader network of northern Etruscan cities; yet, the relative quantity of pigs at Forcello remains unparalleled in Etruscan times. The challenges of urban provisioning in a changing landscape probably drove major centers toward pig husbandry; however it is unlikely that Forcello, a site on the northern periphery of Etruscan territory, faced the same demographic pressure as the larger, ancient cities of Rome or Bologna. Even if considered together with the Etruscan settlement upriver, Mantova and Forcello were relatively modest sites, and the specialized focus on pig production is still unlikely to be linked to the same demographic trends as central Italy. Instead, the marked presence of pigs at Forcello is likely the result of the local environment. Palynological research has demonstrated that Forcello had access to ample tracks of mature forest, an environment well suited to pig rearing. Both northern Bronze Age sites that have pig frequencies over 40%, Canar and Poggio Rusco, also lie in the central part of the Po Plain; Poggio Rusco is only about thirty kilometers from Mantova. The suitability of this region for swine husbandry also continued into the Roman period. In the second century BC Polybius (*Histories* 2.15) describes the abundance of the Plain and its suitability for pig-keeping:

> *…the amount of acorns grown in the woods dispersed over the plain can be estimated from the fact that, while the number of swine slaughtered in Italy for private consumption as well as to feed the army is very large, almost the whole of them are supplied by this plain* (Paton 2010:303).

Considering the evidence for mature forest in the Etruscan period and the long history of pig husbandry in the central Plain, the Etruscans seem to have capitalized on the local environmental situation at Forcello. The region's landscape, combined with a growing demand for pig meat helped lead to the high frequencies visible at the site. Changes in population size and settlement structure clearly also influenced changes in pig husbandry, but zooarchaeology at Forcello and other northern Etruscan sites indicates that this shift in animal management was also closely linked to culture and access to certain environments. The implications of these conclusions are discussed further in the next chapter.

Forcello is one of only a few Etruscan settlements where a comparison of species frequencies was made across context type. At Forcello, all contexts presented a similar relationship between the main livestock species; no contexts significantly departed from this trend. A similar situation is visible at Marzabotto, where faunal material from different areas surrounding Casa 1 was compared. Three of the four areas of excavation at Monte Bibele also produced very similar livestock frequencies; the only area that differed from the overall pattern had a sample size significantly smaller than the other three. Although on-going zooarchaeological work at Murlo may have revealed some of the first evidence for differences between high and low status areas of the site (S. Whitcher Kansa pers. comm.). Instances where species frequencies deviate drastically from the normal pattern are typically linked to cultic activity, for example at Sorgenti della Nova (grotto 10), San Giovenale (spring building), and Veii (pozzo 469).

5.3 AIMS OF HUSBANDRY AND THE ROLE OF SECONDARY PRODUCTS

5.3.1 Pigs

Throughout Italian pre- and proto-history, pigs were predominately killed at or just before maturity, typically between the second and third year of life. Pigs were exploited across the Italian peninsula for the same product – meat – and as a result, a similar culling strategy existed throughout different ages and areas. Etruscans sites, including Forcello, display a related pattern. At Forcello, approximately half of the pig population was killed as sub-adults or in very early adulthood. In the later phases at Forcello, a modest shift toward the culling of juvenile and sub-adult animals occurs at the expense of adult pigs. Information on pig mortality patterns is too coarse to identify similar chronological changes within other sites, but an intensification of pig husbandry resulting in a younger age at slaughter would be coherent with a wider trend towards an increase and intensification of pig husbandry. Forcello, Marzabotto, and Bologna all register an increase in pig frequencies between the sixth and fourth centuries BC, signaling an increased emphasis on pork production. A relative decrease in pig age at death at Forcello may be another signal of an intensification of swine husbandry.

Subtle differences in pig culling strategies are not well understood on a sub-regional or short term basis, but variation is visible between sites. Some central Italian settlements, like Ficana (zone 2) and Rome (Velia), have a higher percentage of animals killed in their first year, indicating a surplus of piglets and an emphasis on the consumption of tender meat (Minniti 2012). A larger proportion of pigs reach adulthood at Monte Bibele (approximately half) than at Spina (one third). Pigs were probably raised more intensively at the urban site of Spina than in the peripheral settlement at Monte Bibele and therefore culled earlier as a result. Some evidence for changing pig culling strategies on northern Etruscan sites has been noted by Farello (1995b), who claims that the majority of pigs were slaughtered before two years in the sixth century BC, but during the fifth century BC the culling pattern developed two peaks – one before 12 months and the other between 2–3.5 years. Unfortunately, this proposition cannot be evaluated because the publication draws from numerous unpublished reports. Local variation in pig culling strategies could result from a focus on different types of pig meat, the importance of pork fat, local environmental conditions, or the trade of pigs or their derived products. Overall, pig age data from Forcello illustrates well-established trends in Italian pig management, but also provides evidence for short-term changes in pig exploitation in the Po valley.

Comparative information on pig sex ratios is limited by sample size. At Forcello, pig canines are fairly evenly split between the sexes. Male canines outnumber those of females, but when alveoli are considered, females predominate. The same trend is visible in numerous other assemblages when data from both canines and mandibles is presented. Because of the clear bias toward the recovery of larger male canines, it is difficult to unravel inter-site differences in sex representation when only teeth are reported. For instance, Farello (1995b) estimates the percentage of males to females to be about 3:1 on settlements in Emilia in the sixth and fifth centuries BC. At Castenaso, the number of male canines is reported to be more than twice that of females. However, males do not always predominate, and female animals are more common at Spina and Monteriggioni (Campassini). When collection bias is considered, most authors estimate a fairly equal split between the sexes. Pig sex ratios at Forcello, therefore, are not out of place with those on contemporaneous sites, and indicate a mixed pig herd that contained sows, boars, and probably castrates.

5.3.2 Sheep/goat

On nearly all sites of the period (except Montecatino and Monte Bibele, which have very low sample sizes) sheep are more common than goats, and Forcello is no exception. For the first time, we are able to separate sheep and goat mortality curves, because of the large number of sheep/goat mandibles identified to species level. What emerges is a mixed management strategy that exploits meat, milk, and wool; however, the emphasis of production is clearly divided between sheep (milk, wool, lamb) and goats (milk, mature meat). On occasion, each species was probably used for other purposes, but it is clear that sheep and goats were raised in a husbandry system with a specific set of products in mind. Unfortunately, directly comparative data for sheep and goat exploitation on this level of resolution is unavailable. Sheep and goat mandibles are not normally identified to species level on Etruscan sites. For this reason, we cannot compare sheep and goat mortality curves across contemporaneous settlements. Instead, we must investigate the broader sheep/goat taxon. When data from the two species are combined, the mortality curve indicates a mixed husbandry strategy. The combined curve averages the patterns of the individual species and masks important differences in their management. The same issue will affect the other sites considered in this thesis, obscuring differences in the management of these two species. This issue is compounded by the small size of many of the samples.

Bronze Age sites in both northern and central Italy place an emphasis on meat production, although both young and mature animals are also present. Compared to Bronze Age mortality curves from northern Italy (Figure 5.3.1), a larger percentage of animals under one year of age were culled at Forcello. Excluding Castenaso, the same is true on other Etruscan settlements (Figure 5.3.2). Interestingly, the overall proportion of caprines that live past four years of age does not change significantly, although elderly animals appear in the Etruscan period at Castenaso and Marzabotto. Senile animals are absent from Forcello, which falls between the wool-oriented patterns of these two sites and the meat-oriented curve of Casale di Rivalta. Meat may have been the main product at Fiorano and San Claudio as well, considering the absence or rarity of caprines over 4 years of age (Farello 1995b). However, all these samples are very small (sometimes only a few specimens), which contributes to the variability of the results.

Sheep/goat kill-off patterns on non-Etruscan northern sites are also variable. Sheep/goat culling at Forcello resembles that of Padova (Figure 5.3.3), but the small sample size prevents further interpretation. Similarities can also be drawn with Castelrotto, where a significant proportion of caprines were culled in their first year (c. 30% under one year, n=42). In contrast, lamb mortality at Santorso is very low. For central Italy, caprine mortality at Forcello is similar to that at both Ficana and Populonia (Figure 5.3.4). The slightly earlier site of Monteriggioni has a lower proportion of animals less than two years of age.

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Figure 5.3.1 Sheep/goat mortality curves from northern Bronze Age sites and Forcello
Wear stages follow Payne (1973). Noceto sample size not published.

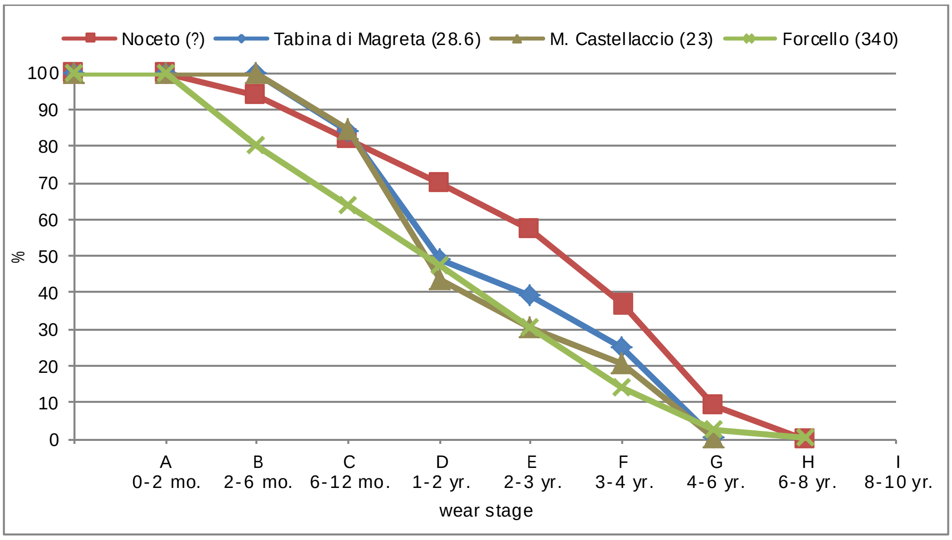


Figure 5.3.2 Sheep/goat mortality curves from northern Etruscan sites
Wear stages follow Payne (1973). Castenaso sample size not published.
Note the change on the horizontal access. Farello (1995b) presents graph in the manner. Without the raw data to re-make the graph I have chosen not to change it.

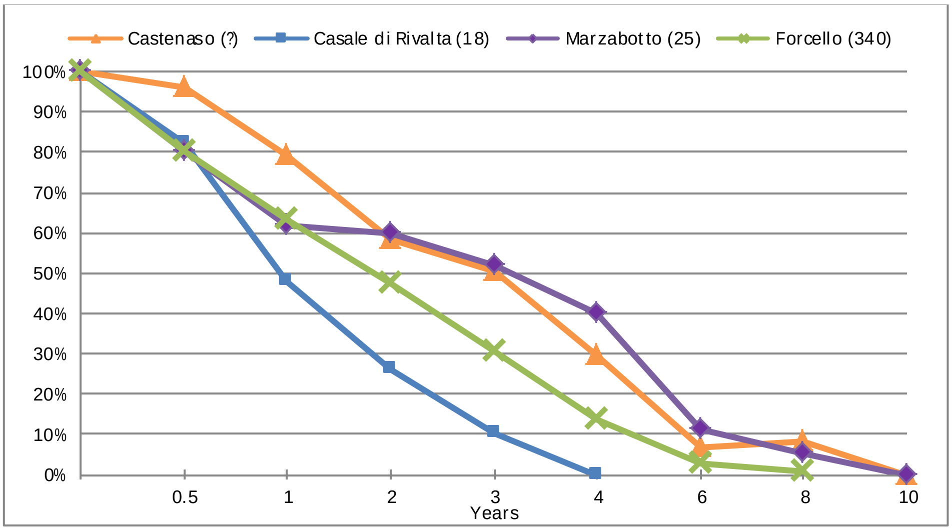


Figure 5.3.3 Sheep/goat mortality curves from northern non-Etruscan sites and Forcello
Wear stages follow Payne (1973).

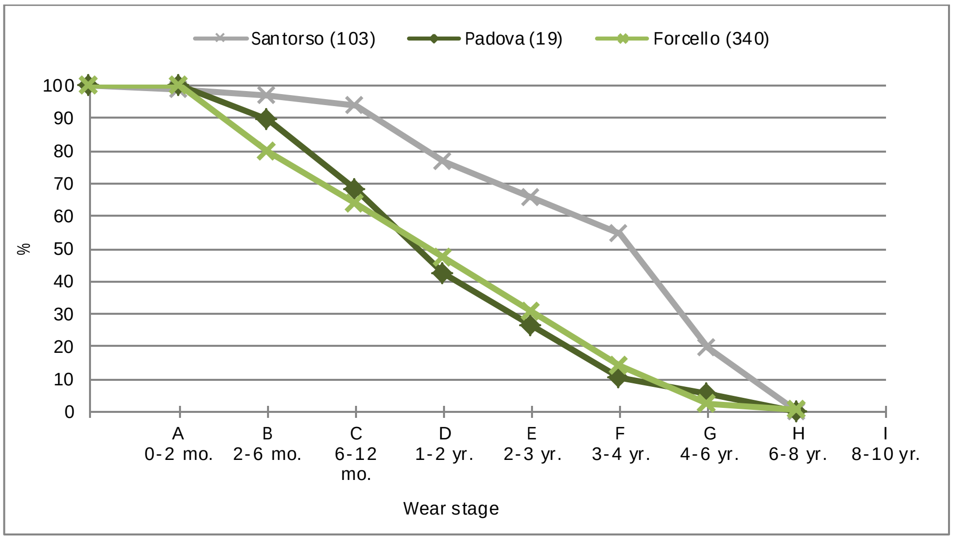
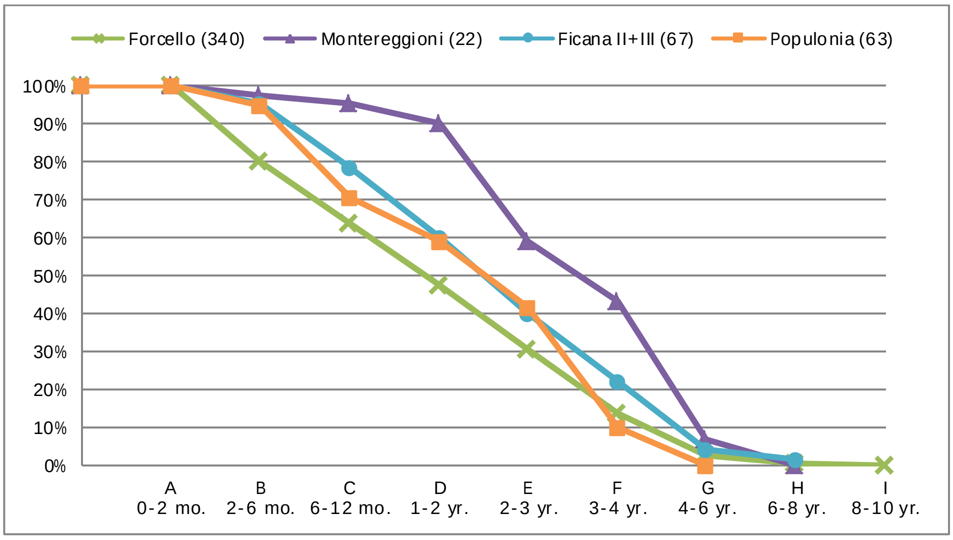


Figure 5.3.4 Sheep/goat mortality curves from central sites and Forcello
Wear stages follow Payne (1973).



Through time, sheep/goat culling patterns at Forcello shift slightly to favor younger animals. The percentage of the population surviving beyond the fourth year remains the same, but a larger proportion of young animals are killed, especially in the first year of life. Like for pigs, this change may indicate an intensification of caprine husbandry. Interestingly, this change moves Forcello's mortality curve in the opposite direction of the broader trend toward an increase in wool production. A shift toward the culling of younger animals may indicate the presence of surplus animals; similarly, the increase in very young animals could indicate the increasing focus on milk production and tender meat. Although the traditional model of a milk-specialized culling strategy has a peak in mandible stage A (zero and two months; Payne 1973), many traditional herders choose to keep lambs longer, especially if they are not raising them for trade (Halstead 1998). Lambs are then slaughtered at the middle and end of the first year (stage B and C). As a result, humans can exploit both the milk and meat of the animals (Helmer et al. 2007; Vigne and Helmer 2007). Another reason for the shift to younger animals at Forcello may result from a change in relative presence of sheep to goats, which appears to increase in favor of the former in the later period. With fewer goats, combined sheep/goat culling profiles would tip towards a pattern based on sheep, which were slaughtered a younger age.

As noted in Chapter 2, the main trend in sheep/goat husbandry is the increasing importance of milk and wool. Of these two products, Forcello appears more concerned with the former. Nearly a third of caprines are culled in the first year, but the presence of animals over four years of age is not dissimilar to some *terramare* sites. Comparison across relevant Etruscan and non-Etruscan sites indicates that Forcello, like other settlements of its time, developed a system of sheep/goat management that suited local objectives and environmental constraints. Throughout Italy, meat, milk and wool were exploited, although the emphasis of production changed through time to increasingly favor secondary products. Age profiles from Forcello clearly demonstrate the separate management of sheep and goats in the sixth/fifth centuries BC on the periphery of Etruscan civilization – a conclusion that illustrates the importance of separating these species when constructing mortality curves and that also encourages us to re-examine other assemblages in hope of finding similar trends.

Little information is available on caprine sex ratios, both at Forcello and elsewhere. In the small sample of pelvises from Forcello, females outnumber males, a sex ratio that supports milk production on the site. On other sites, the sexes are split roughly equally, although when one sex predominates it is typically female (e.g. Pfatten-Vadena). Considering the percentage of lambs culled in their first year at Forcello, we might expect adult females to predominate; presumably, male lambs would have been preferentially slaughtered. In central Italy similar trends can be expected, although these are not universal, as the greater presence of males Early Iron Age site of Tortoreto demonstrates (Minniti 2012).

5.3.3 Cattle

At Forcello, about a third of cattle were killed in very old age and about half as younger adults (23%) or subadults (28%). Very few animals were slaughtered before this point. This kill-off pattern denotes the keeping of animals primarily for labor (signified by the presence of numerous mature and senile cattle) and meat (indicated by the peak in sub-adult animals). In northern Italy, similar culling strategies had been employed since the Bronze Age and were in place on contemporaneous settlements. The predominance of younger animals at Barche and Canar suggests that cattle were important meat producers during the Early Bronze Age, although older individuals also evidence cattle's other roles. Later *terramare* cattle were generally killed when mature, and only secondarily used for the production of meat and milk (de Grossi Mazzorin and Riedel 1997). Interestingly, during the same period at the Alpine site of Albanbühel, a traditional milk pattern dominates, and nearly half of the cattle population was culled in their first year. The majority of cattle at Isolone are adult or elderly, indicating that the labor-oriented use of cattle in the Po Plain continued into the Recent Bronze Age.

In the Late Bronze and Early Iron Age in central Italy, cattle age at death at Fidene, Gran Carro, and Monte Rovello provide some indication of the culling of younger animals for meat; however, these sites all have small samples. Ficana, Tarquinia (Cretoncini), and Cerveteri provide evidence for animals killed later than their fourth year of life. A similar pattern is visible in the third century BC at Populonia, where the majority of cattle live past their fourth year. Cattle management in northern Italy during the Etruscan period followed similar patterns. The majority of cattle lived into adulthood; like at Forcello only about a quarter of the population was killed as sub-adults (Farello 1995b). Similar trends are visible on contemporaneous non-Etruscan sites. Over half of the cattle at Santorso were killed as adults or senile animals. The sample from Castelrotto is very small, but also suggests the rearing of older cattle.

Overall, the culling strategy at Forcello is not dissimilar to these other settlements and also suggests the rearing of cattle for both meat and secondary products. However the high proportion (over a third) of elderly cattle may be unique. The modest overall sample size of 39 mandibles complicates the picture somewhat, but the percentage of senile animals at Forcello still seems appreciably higher than at settlements like Populonia, Monte Bibele, and Santorso. However, because these sites do not use the Grant's tooth wear system, variation may result from methodological differences in defining age groups, rather than real differences in culling profiles.

No definitive information on cattle sex was available in the Forcello assemblage. On central Italian settlements during the Bronze and Early Iron Age, a comparison of metapodial size and shape indicates that female animals were more common. The situation is less clear on northern settlements where the sexes are more evenly split. At some sites, like Colognola ai Colli, many remains were identified as female/castrate, a designation which clouds interpretation of sex ratios.

5.4 TRENDS IN ANIMAL SIZE

5.4.1 Cattle

Cattle at Forcello are comparably sized with those from Iron Age sites in both the Po Plain and central Italy. The astragalus (Figure 5.4.1) clearly demonstrates an overlap in cattle size between Forcello, Colognola ai Colli/Castelrotto, and the earlier central settlement of Ficana. Two astragali from the third century BC at Populonia are noticeably larger. Similar trends are visible in tibia (Figure 5.4.2–3) and metapodials (Figures 5.4.4–7). Here again, Iron Age cattle are similar in size to those at Forcello, but later animals at Populonia are larger. Lower third molar measurements (Figure 5.4.8–9) indicate a similar pattern, although one tooth width from

Populonia is surprisingly small. This variation is may due to differences in how the tooth width measurement is taken (perhaps on the occlusal surface versus the overall largest part of the molar). The tendency of cattle measurements at Forcello to surpass those of the Colognola ai Colli/Castelrotto and Ficana (which have a greater number of small measurements) may tie the site to central Italian trends of livestock improvement, illustrating an interim point between small cattle and an improved type that developed in southern Etruria in the later centuries of the first millennium BC. However, higher resolution regional comparison is needed to confirm this hypothesis.

Previous research has demonstrated that cattle improvement, which begins early in the Iron Age, escalated during the fifth–third centuries BC, resulting in the larger animals visible at Populonia (de Grossi Mazzorin 1995a). Log ratios from cattle post-cranial bones from Ficana, Forcello, and Populonia allow us to observe this process across Italy during the first millennium BC. Log ratios from Forcello illustrate an increase in cattle size from those at Ficana. Cattle at Populonia are visibly larger still, both in terms of maximum values and the mean.

Figure 5.4.1 Iron Age and Etruscan cattle astragalus distal width (Bd) vs. greatest lateral length (Gl)

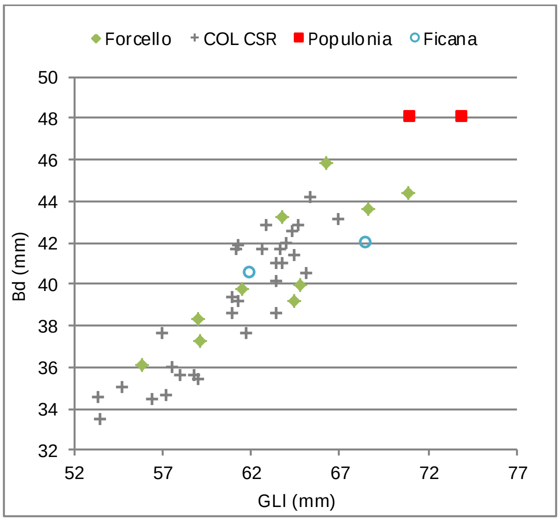


Figure 5.4.2 Iron Age and Etruscan cattle tibia distal depth (Dd) vs. width (Bd)

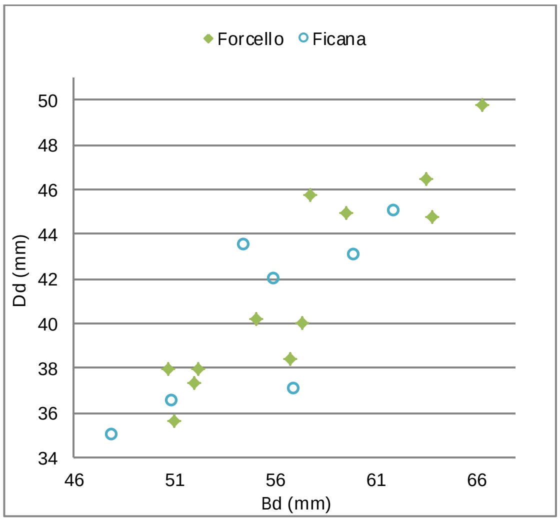


Figure 5.4.3 Iron Age and Etruscan cattle distal tibia width (Bd)

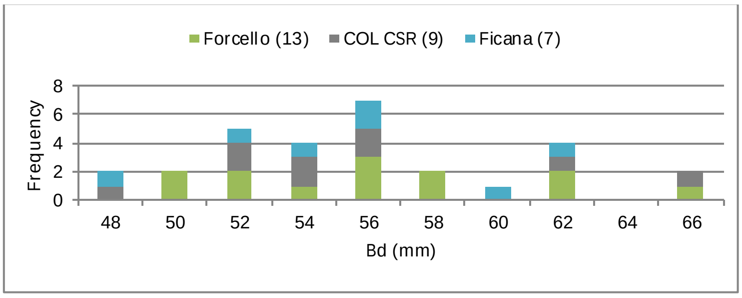


Figure 5.4.4 Iron Age and Etruscan cattle metacarpal distal width (Bd) vs. greatest length (GL)

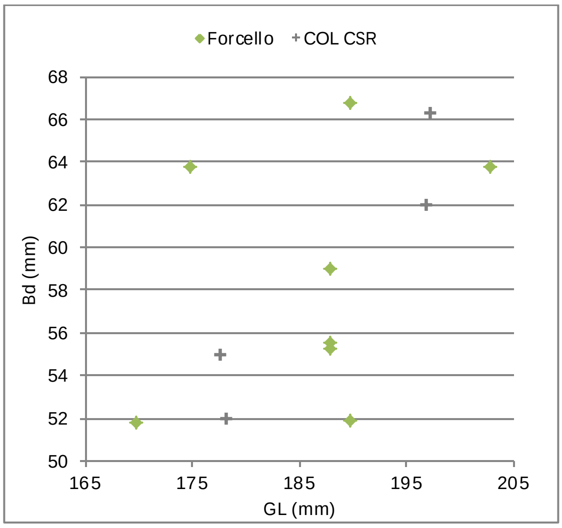


Figure 5.4.5 Iron Age and Etruscan cattle metatarsal distal width (Bd) vs. greatest length (GL)

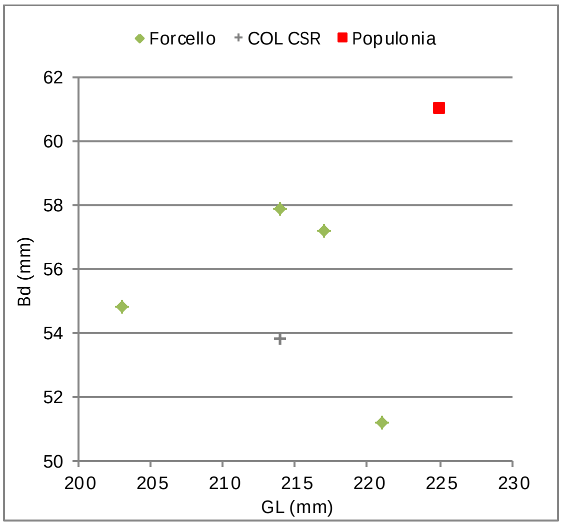


Figure 5.4.6 Iron Age and Etruscan cattle distal metacarpal width (Bd)

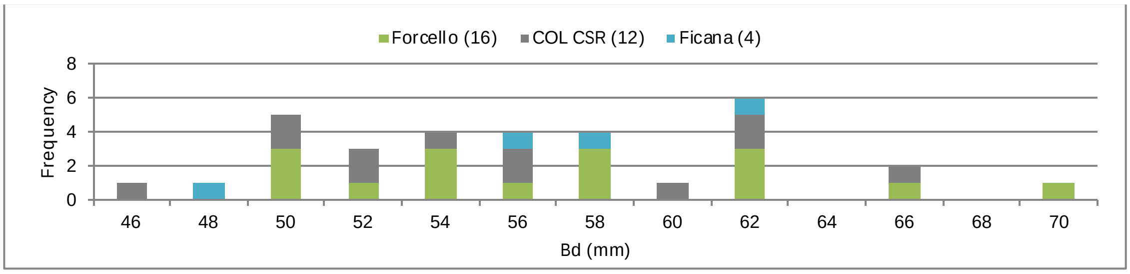


Figure 5.4.7 Iron Age and Etruscan cattle distal metatarsal width (Bd)

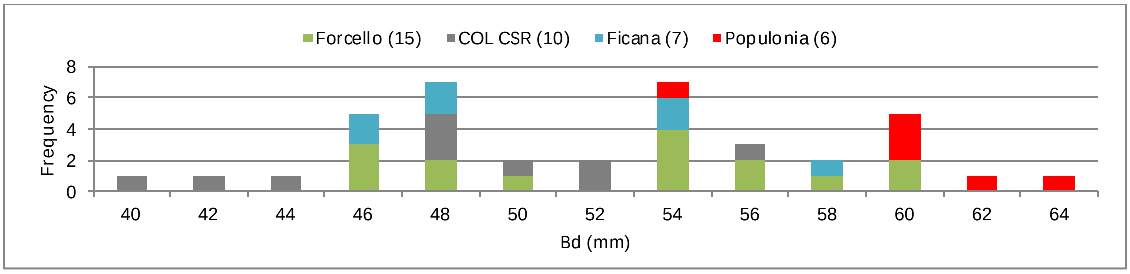


Figure 5.4.8 Iron Age and Etruscan cattle third molar width (W) vs. length (L)

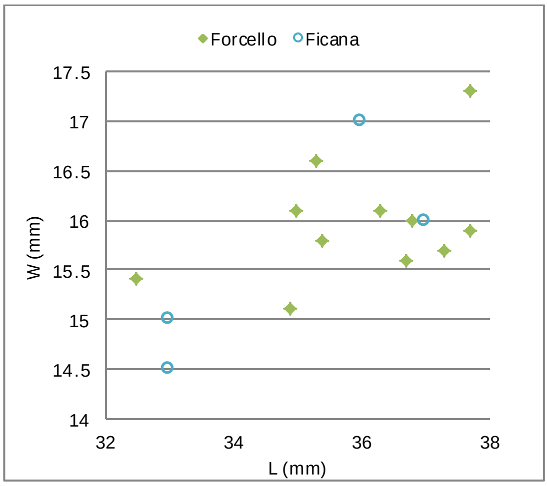


Figure 5.4.9 Iron Age and Etruscan cattle M_3 length (L)

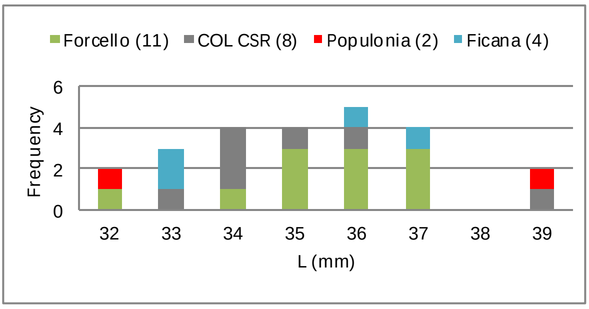
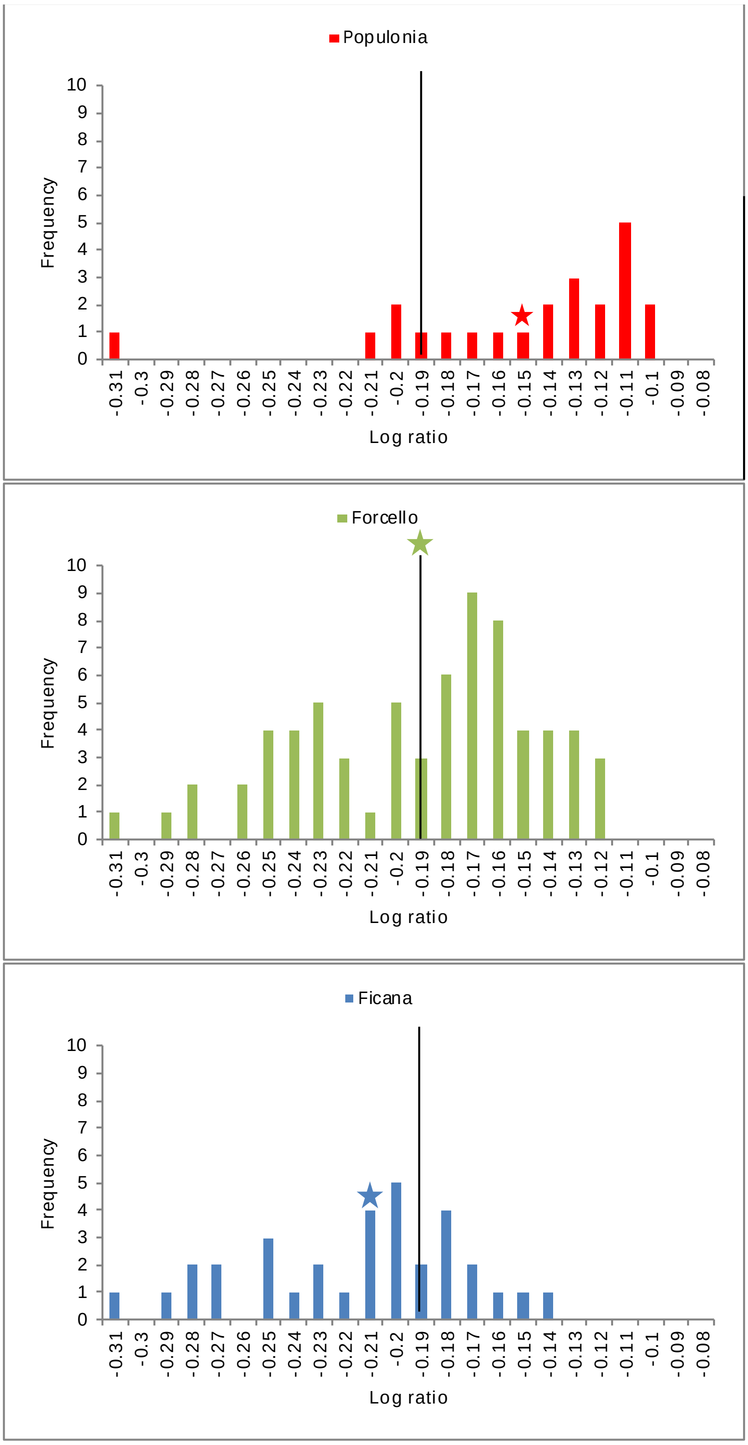


Figure 5.4.10 Log ratios for cattle post-cranial bones

Bar marks Forcello mean. Star marks site mean. See section 3.6.5 for methods.

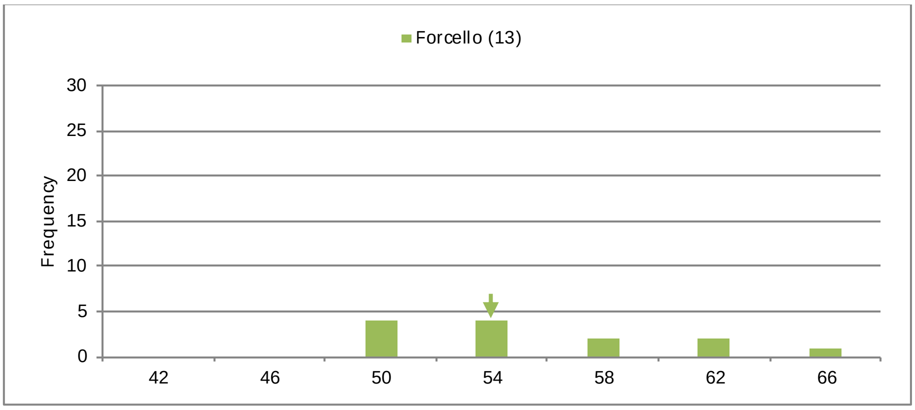


Cattle measurements from Forcello also allow us to better appreciate long-term livestock development in the Po Plain. As throughout central Europe, cattle in Val Padana decreased in size across the whole of the Bronze Age, from the Early period (e.g. Canar, Barche, Ledro), through the Middle Bronze Age (*terramare* sites), to the very small animals visible at Isolone (Riedel 1976b; 1994). Local environmental conditions also played a role in animal size and regional/local variation occurred, but the predominant trend is a size decrease until late prehistory. In the Iron Age, northern Italy broke from central European trends: cattle continue to diminish in size in central Europe across the Iron Age, and only increase again after the Roman conquest and introduction of new, larger cattle types (Bökönyi 1974). Cattle also remain small on Alpine sites (e.g. Pfatten-Vadena). Conversely, cattle size in the Plain began to increase in the Final Bronze and early Iron Ages. New breeds may also have been introduced at this point (de Grossi Mazzorin and Riedel 1997) – a hypothesis supported by the appearance of differently shaped horncores (Riedel 1994) and metacarpals (de Grossi Mazzorin 1996c). By the mid first millennium BC, larger cattle had become common throughout the region. These animals are visible on both Etruscan sites (e.g. Forcello, Spina) and non-Etruscan settlements (Colognola ai Colli and Castelrotto). Larger cattle are also present in the far eastern Plain near modern Udine at Gradiscutta (Riedel et al. 2006) in the fifth century BC.

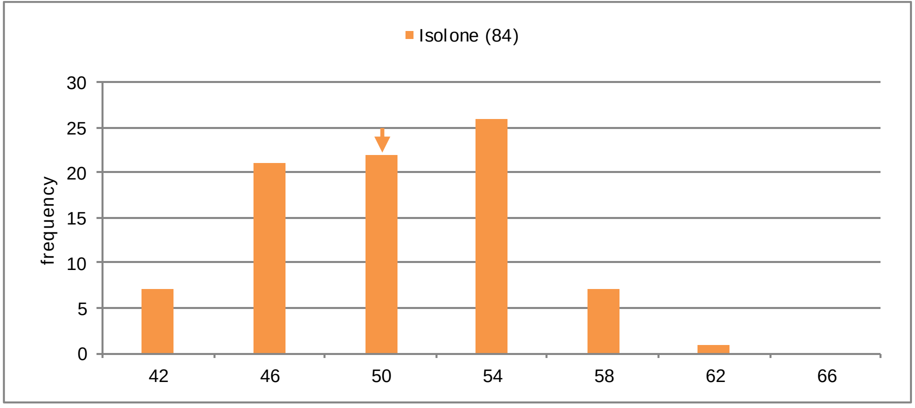
Size differences are clearly illustrated when Forcello is compared to Isolone, Canar and Barche. Size shifts are visible in the tibiae (Figure 5.4.11), astragali (Figure 5.4.12), and metapodials (Figure 5.4.13–14). Molar lengths also support this trend (Figure 5.4.15), despite the tiny sample from Forcello. Recent Bronze Age cattle at Isolone are small compared to Early Bronze Age and Etruscan animals. Several particularly robust cattle metacarpals are present as Forcello, which are not only larger than those from Isolone, but also different in shape (Figure 5.4.16), and these may indicate a complete male or a non-native cattle type. Combined with data from the Iron Age, these changes at Forcello support current understanding of the development of cattle in the Po Plain. Cattle at Forcello are larger than late Bronze Age animals and similarly sized to those on other northern Iron Age sites. The appearance of especially robust specimens and non-native horncore types may provide evidence of the introduction of animals from elsewhere, but a comparison of cattle biometry from northern sites and Populonia illustrate that larger cattle were not being imported on a grand scale.

Figure 5.4.11 Bronze Age cattle tibia distal width (Bd)
(n) = number of specimens. Arrows indicate mean: Forcello = 57.3, Isolone = 52.3, Canar = 55.4, Barche = 59.

5.4.11a Forcello



5.4.11b Recent Bronze Age



5.4.11c Early Bronze Age

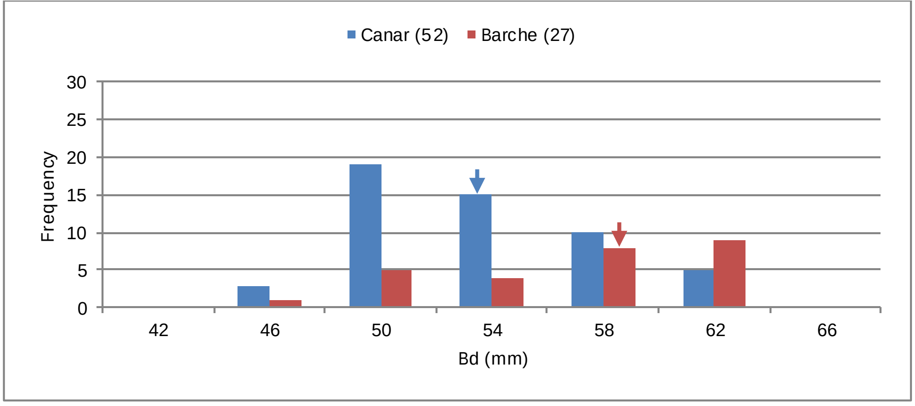
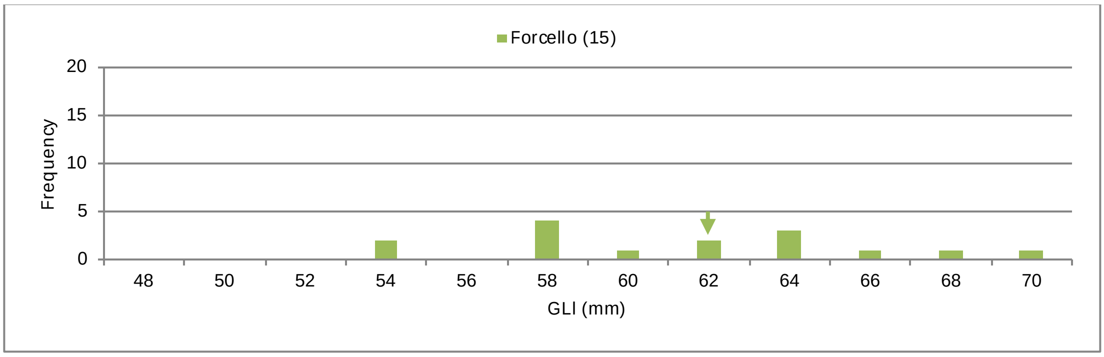
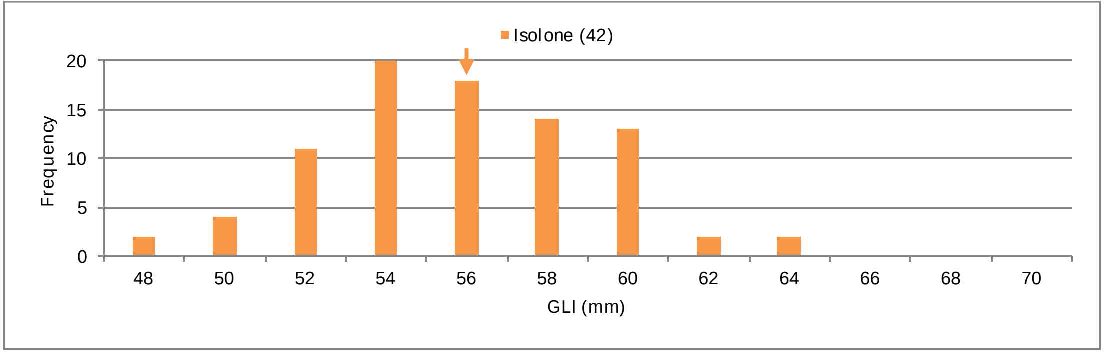


Figure 5.4.12 Bronze Age cattle astragalus greatest lateral length (GLl)
(n) = number of specimens. Arrows indicate mean: Forcello = 62.4, Isolone = 56.8, Canar = 60.4, Barche = 60.2

5.4.12a Forcello



5.4.12b Recent Bronze Age



5.4.12c Early Bronze Age

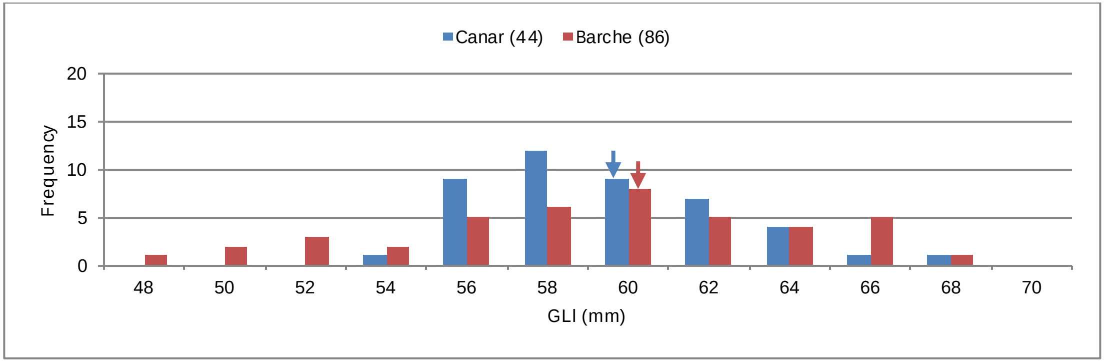
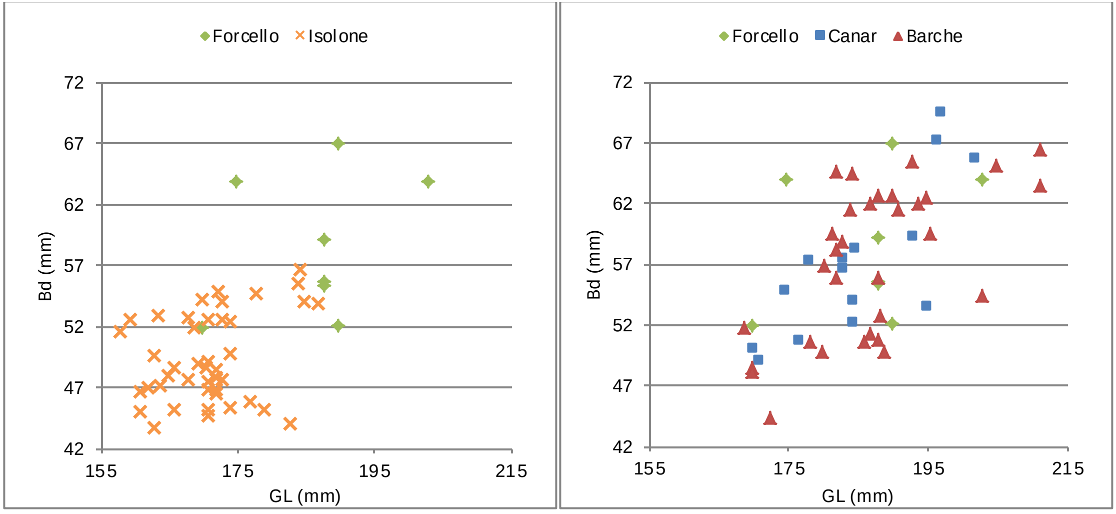


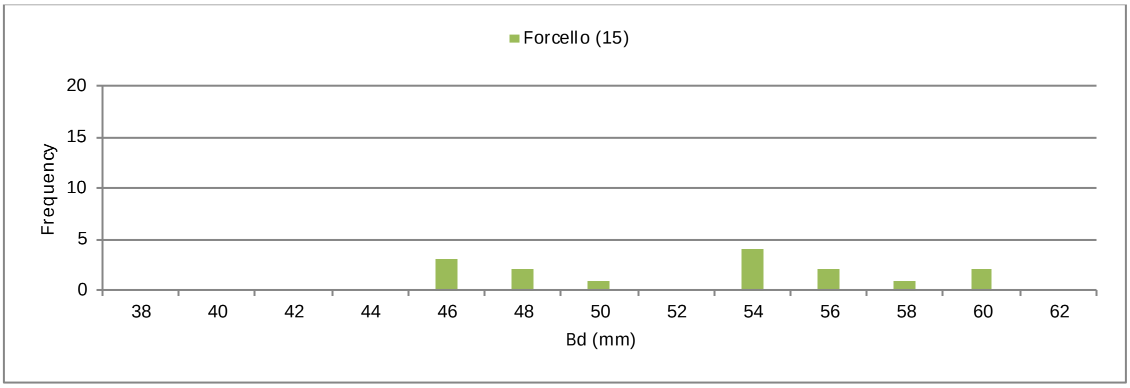
Figure 5.4.13 Bronze Age cattle metacarpal distal width (Bd) vs greatest length (GL)


5.4.13a Recent Bronze Age

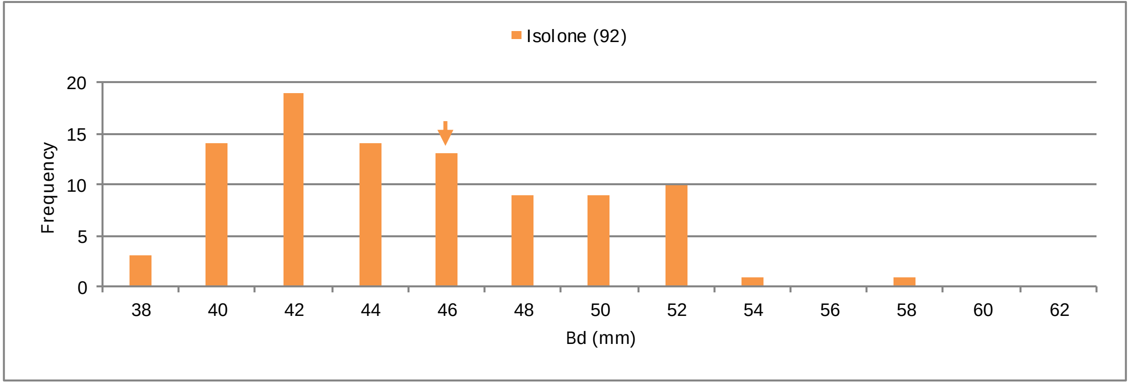
5.4.13 Early Bronze Age

Figure 5.4.14 Bronze Age cattle metatarsal distal width (Bd)
(n) = number of specimens. Arrows indicate mean: Isolone = 46.1, Canar mean not unavailable, Barche = 51.5. Forcello not provided because sample size <20.

5.4.14a Forcello



5.4.14b Recent Bronze Age



5.4.14c Early Bronze Age

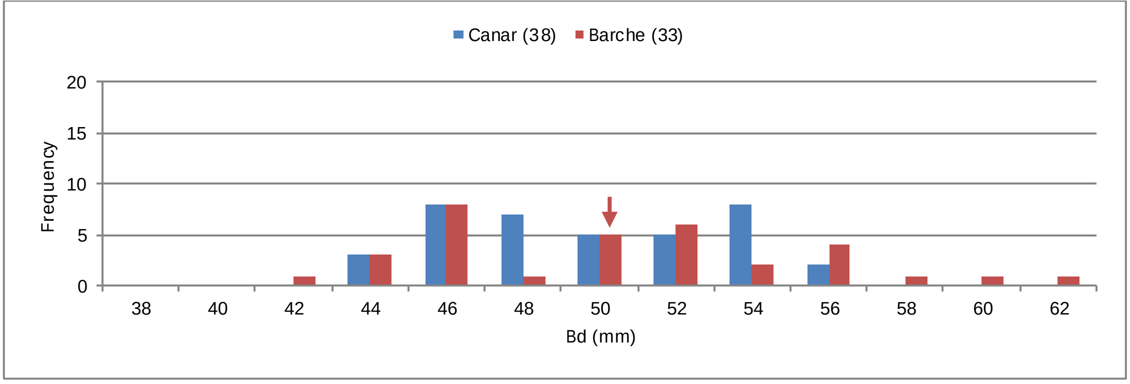
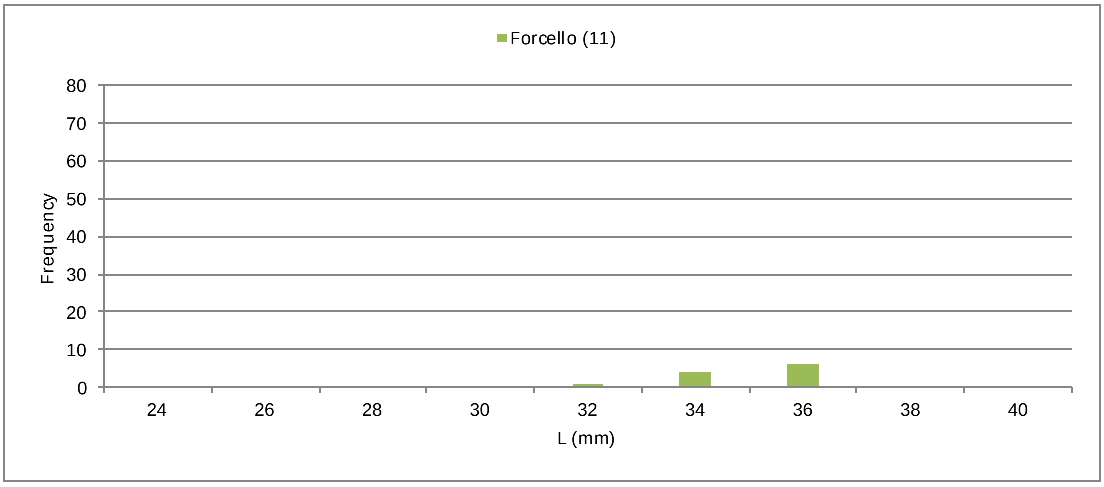
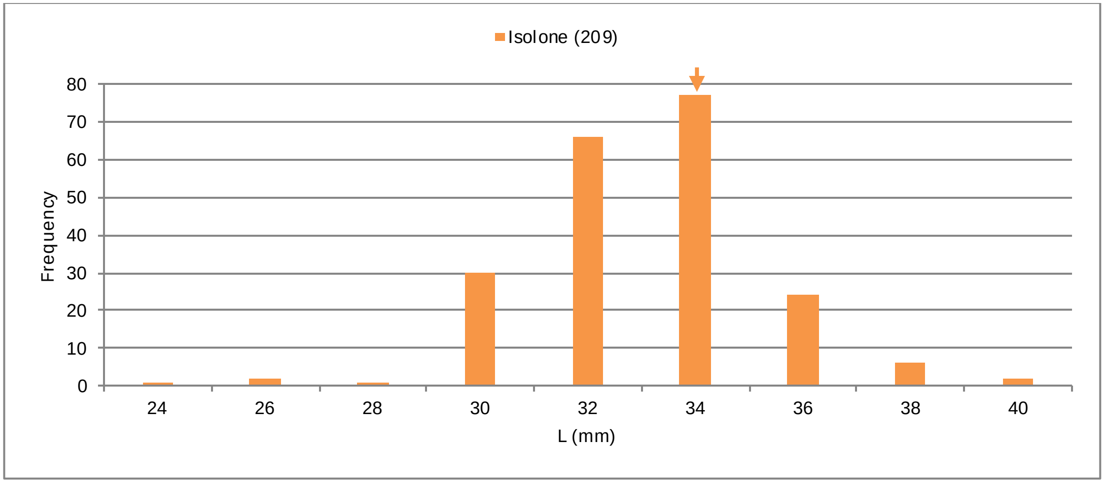


Figure 5.4.15 Bronze Age cattle M_3 length (L)
(n) = number of specimens Arrows indicate mean: Isolone = 34, Canar = 35.4, Barche = 36.
Forcello mean not provided because sample size <20.

5.4.15a Forcello



5.4.15b Recent Bronze Age



5.4.15c Early Bronze Age

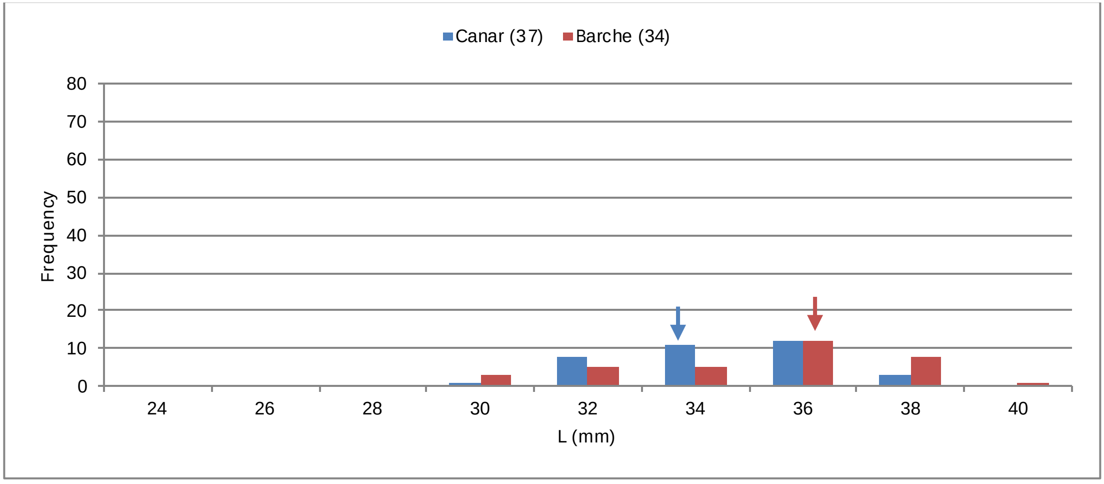
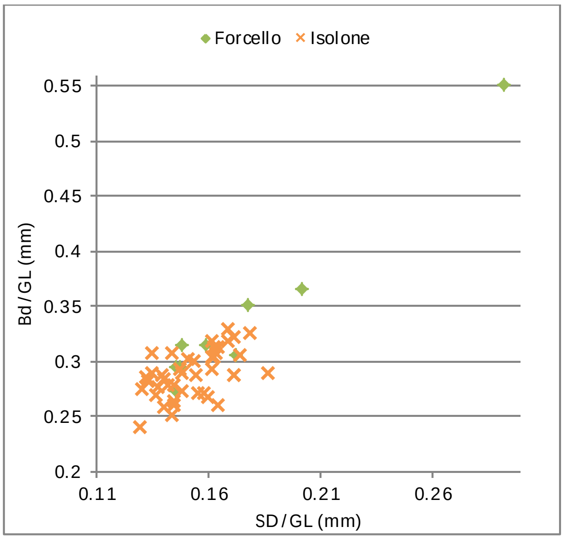


Figure 5.4.16 Cattle metacarpal shape



5.4.2 Sheep/goat

Sheep at Forcello are a similar size to those found on other northern and central Italian sites; however some differences are visible. Sheep from Colognola ai Colli/Castelrotto are slightly larger than those at Forcello. Astragalus (Figure 5.4.17) measurements predominantly overlap, but the Colognola ai Colli/Castelrotto sample contains a number of uniquely large measurements. While cattle from Populonia were notably larger than those from Forcello and the northern settlements, this does not seem to be the case for sheep. Sheep metacarpals from Forcello, Populonia, and Colognola ai Colli/Castelrotto are similarly sized (Figure 5.4.18), although the fewer measurements provide a rougher picture. The distal tibia (Figures 5.4.19) again demonstrates the presence of slightly larger sheep at Colognola ai Colli/Castelrotto.

Sheep and goat measurements for the tibia were grouped together in the Populonia and Ficana publications. Considering that sheep are in the majority at both sites, the main trend will likely reflect sheep, rather than goat size. Compared to sheep/goat from Forcello a large overlap is again visible in distal tibia widths (Figure 5.4.20). Ficana is an especially close fit to Forcello, particularly at the smaller end of the spectrum. Log ratios of sheep/goat post-cranial measurements provide some indication of a size increase that is not visible when individual elements are considered. Compared to animals at Forcello, an increase in sheep size at is visible at Populonia in the third century BC (Figure 5.4.21); however the increase is not as pronounced at in cattle. Previous research has provided evidence for an increase in the variability of sheep/goat stature during the Final Bronze Age, followed by a gradual increase average size between the Early Iron Age and Roman period (de Grossi Mazzorin 1995a; Minniti 2012), but this trend is not as clear as the changes seen in cattle populations. Love (2008) points out that regional differences in sheep/goat size were also not as pronounced in caprines as they were in cattle.

Figure 5.4.17 Sheep astragalus distal width (Bd) vs. greatest lateral length (GLl)

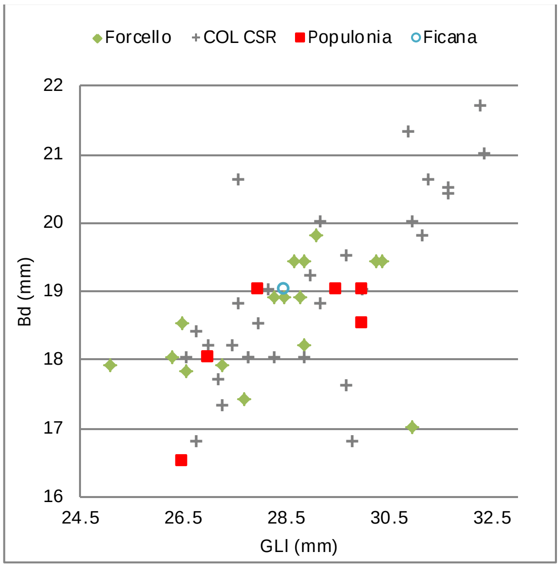


Figure 5.4.18 Sheep metacarpal distal width (Bd) vs. greatest length (GL)

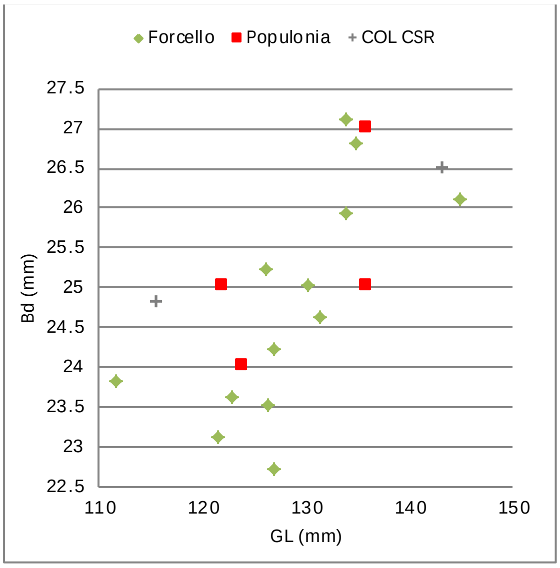


Figure 5.4.19 Sheep tibia distal width (Bd) from Forcello and Colognola ai Colli/Castelrotto
(n) = number of specimens Arrows indicate mean: Forcello = 25.1.
Colognola/Castelrotto (COL CSR) mean not provided because sample size <20.

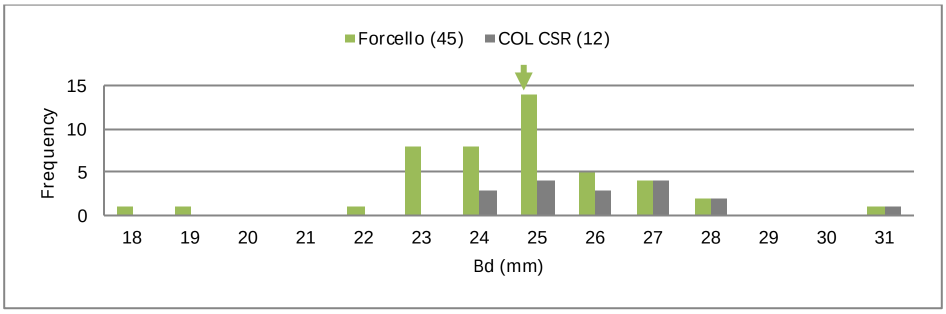


Figure 5.4.20 Sheep/goat tibia distal depth (Dd) vs. distal width (Bd)

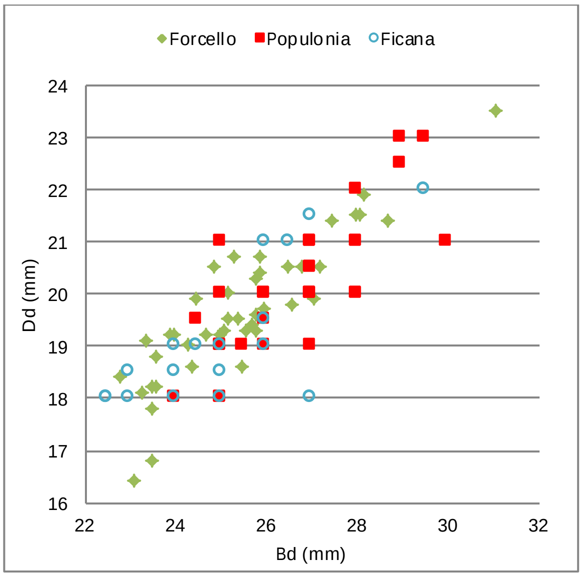
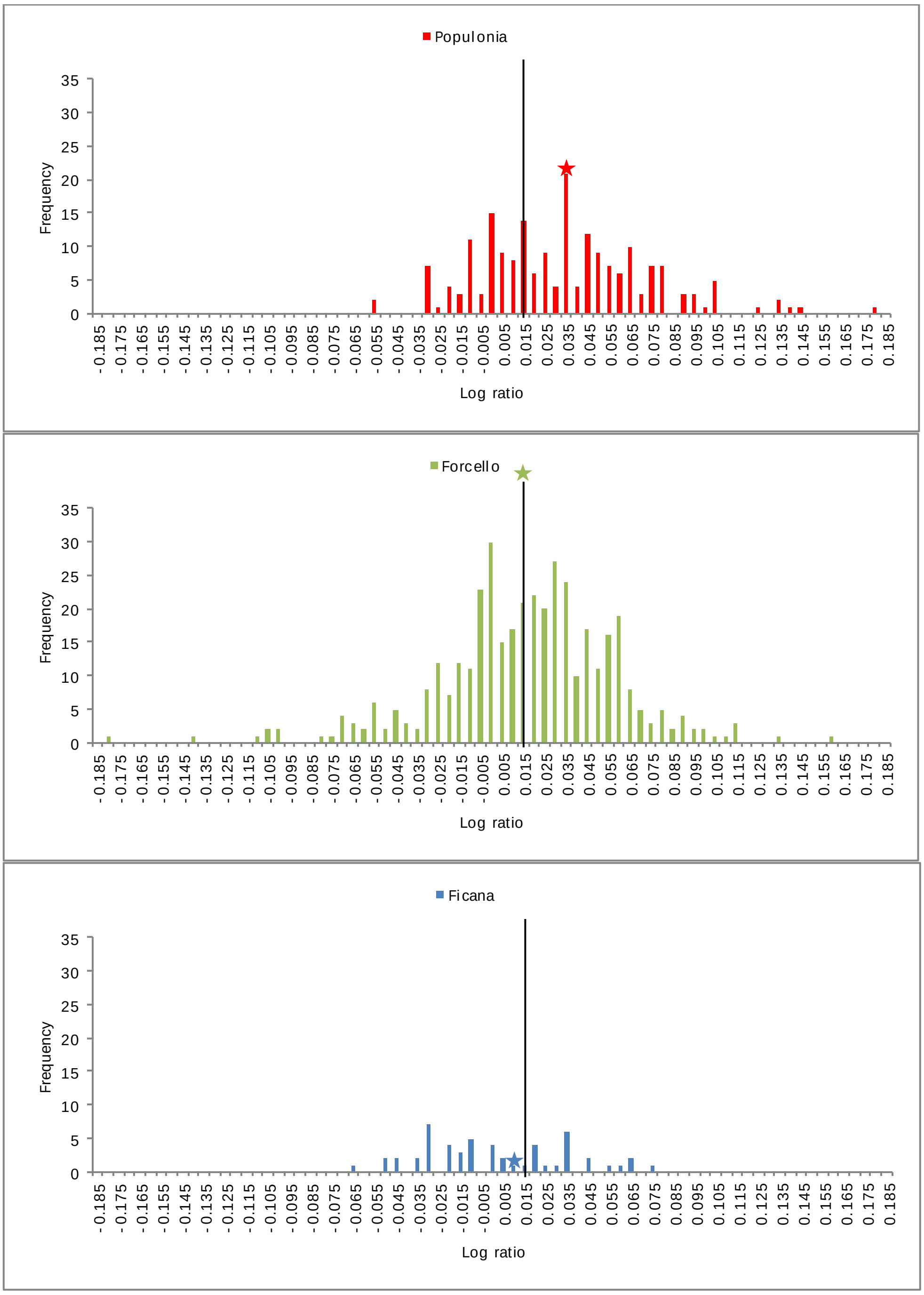


Figure 5.4.21 Log ratios for sheep/goat post-cranial bones

Bar marks Forcello mean. Star marks site mean. See section 3.6.5 for methods.



Like in cattle, northern Italian sheep also experienced a decrease in size during the Bronze Age and subsequent size increase in the Final Bronze Age and Iron Age. Sheep increased in size rather swiftly at the turn of the Iron Age; larger animals appeared in the Po Plain at Fondo Paviani, as well as in the mountains at Appiano-Eppan, Sabbionara, and Pfatten-Vadena (Riedel 1994; de Grossi Mazzorin 1996c). Similar trends are visible in central and eastern Europe, although regional variation is also notable (Bökönyi 1974). Sheep biometry at Forcello fits with these long-term trends. Over the course of the second millennium BC, sheep decrease in size to a very small form visible at Isolone in the Recent Bronze Age, only to increase again to produce the larger animals visible at Forcello. This change is identifiable in both distal tibia (Figure 5.4.22) and third molar length (Figure 5.4.23). The large size increase between Isolone and Forcello is especially visible in third molar widths (Figure 5.4.24), a measurement that is less susceptible to environmental pressures and therefore a good indicator of animal size. Data from sheep astragali, although less detailed, also reinforce this trend (Figure 5.4.25). Metapodials (Figures 5.4.26–27) also demonstrate a drop in sheep size in the Bronze Age before an increase in the Iron Age, although this pattern is clearer in metatarsals than metacarpals. A comparison of metapodial shape (Figures 5.4.28–29) indicates that animals had not just increased size by the Etruscan period, but also became, on average, more robust. Isolone has a greater proportion of slender metapodials than other sites. In contrast, Forcello has some particularly robust specimens.

The introduction of different sheep breeds/types was probably a reoccurring phenomenon throughout northern Italian pre- and proto-history. The appearance of larger sheep in the Final Bronze Age may point to livestock trade or movement; however, unlike cattle, there is no mention of a change in horncore form that supports the appearance of a new animal type. New sheep breeds may also have been introduced to central Italy at this point, evidenced by a greater variation in sheep size (Minniti 2012). Similarly, the Etruscans would also have been involved with the movement of animals into and around the Po Plain; perhaps the appearance of one extremely robust metatarsal points to a non-native animal. However, it may simply be a ram. No clear differences between Etruscan and non-Etruscan sheep size are visible in the comparison presented here. In contrast to the focused development of cattle in central Italy in the last centuries of the first millennium BC, sheep/goat improvement proceeded on a more gradual scale. Caprines were increasingly exploited for milk and wool, products that, unlike power, are not directly linked to overall body size. As a result, we might expect to see some improvement in sheep/goat populations and an interest in increasing productivity, but, without a selective breeding program focuses on animal strength or size, these changes would occur on a more gradual timeline.

Figure 5.4.22 Sheep tibia distal widths (Bd) from Forcello, Isolone and Canar
(n) = number of specimens. Arrows indicate mean. Forcello = 25.1, Isolone = 23, Canar = 24.2.

Figure 5.4.21a Forcello

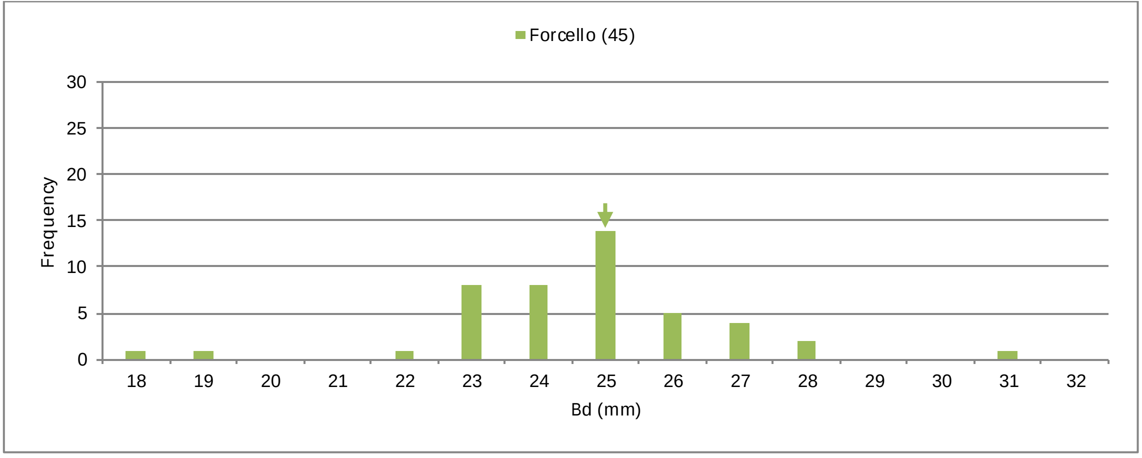


Figure 5.4.21b Bronze Age

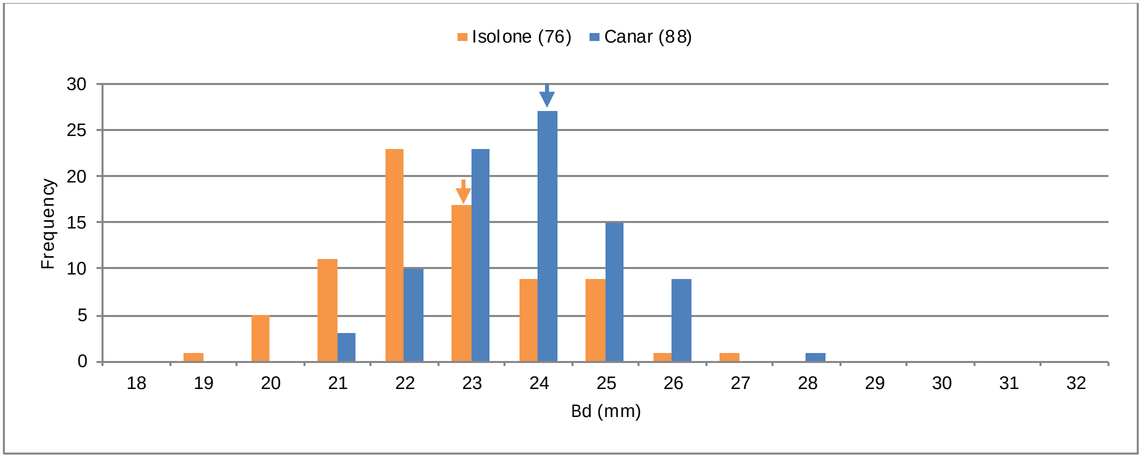


Figure 5.4.23 Sheep/goat M_3 length (L)
(n) = number of specimens. Arrows indicate means: Forcello = 22.8, Isolone = 20.9, Canar = 21.6. Barche mean not indicated because n < 20.

Figure 5.4.21a Forcello

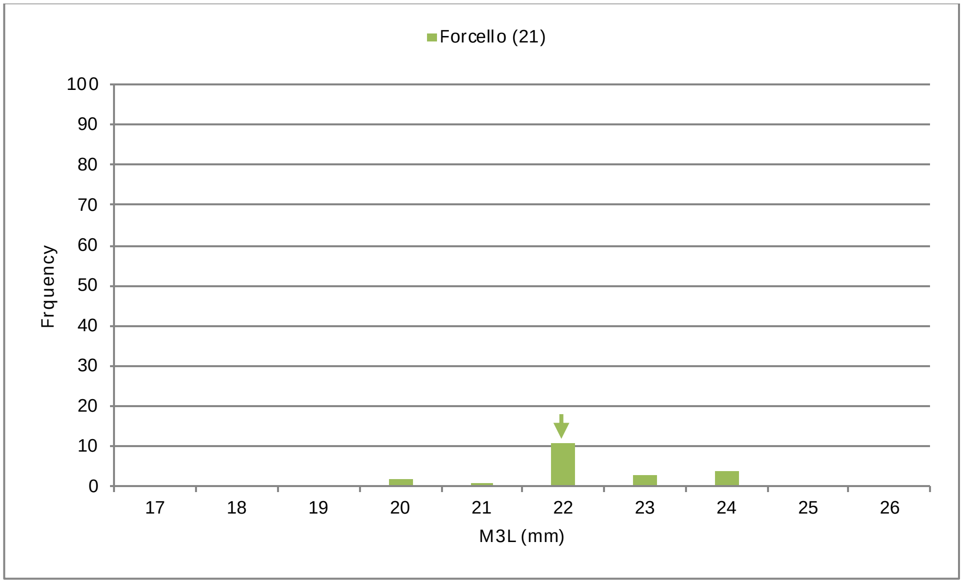


Figure 5.4.21b Bronze Age

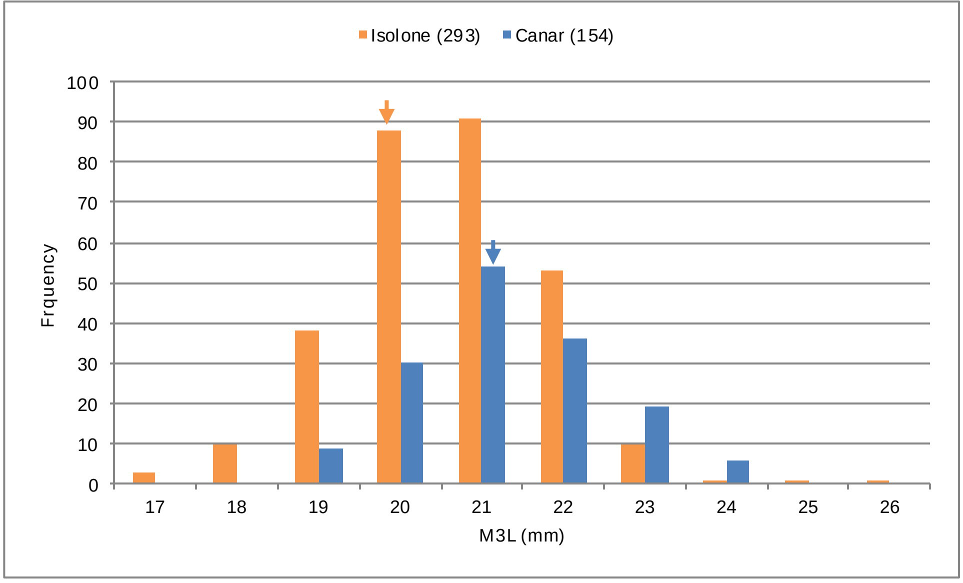


Figure 5.4.24 Sheep/goat M_3 width (W) from Forcello and Isolone
(n) = number of specimens. Arrows indicate mean. Forcello = 8.6, Isolone = 7.6.

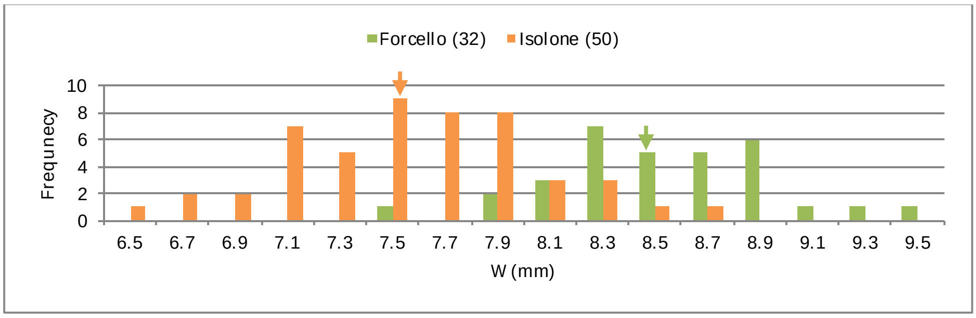


Figure 5.4.25 Sheep astragalus measurements from Forcello, Isolone, and Canar
Number of specimens = (Dl, Bd, GL)

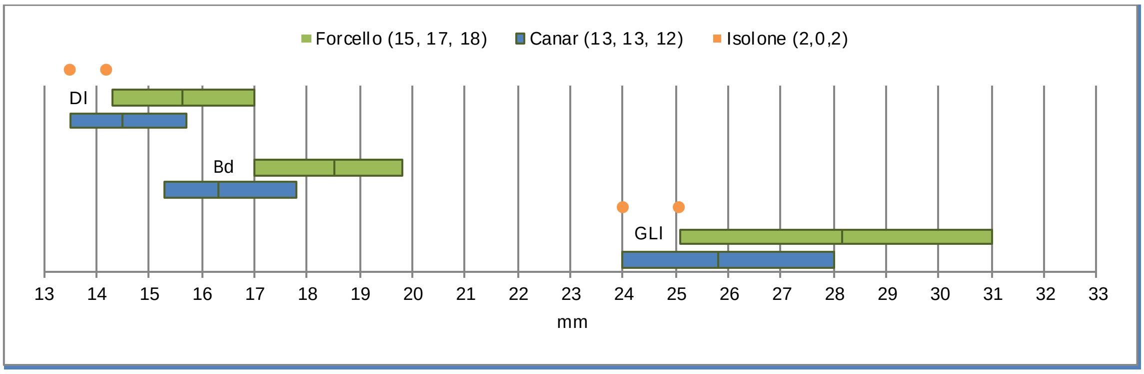


Figure 5.4.26 Sheep metacarpal distal width (Bd) vs. greatest length (GL)

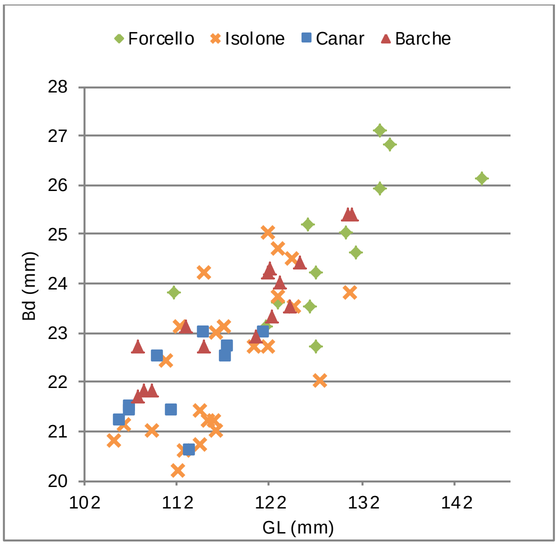


Figure 5.4.27 Sheep metatarsal distal width (Bd) vs. greatest length (GL)

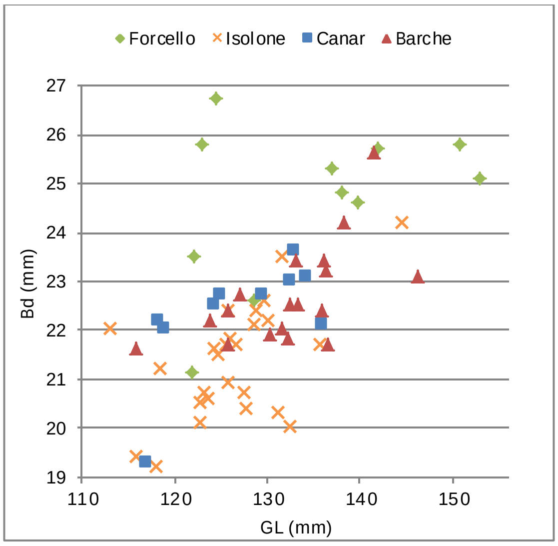


Figure 5.4.28 Sheep metacarpal shape

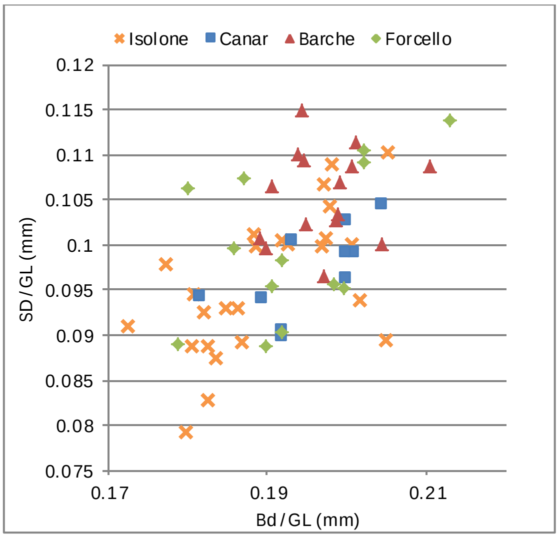
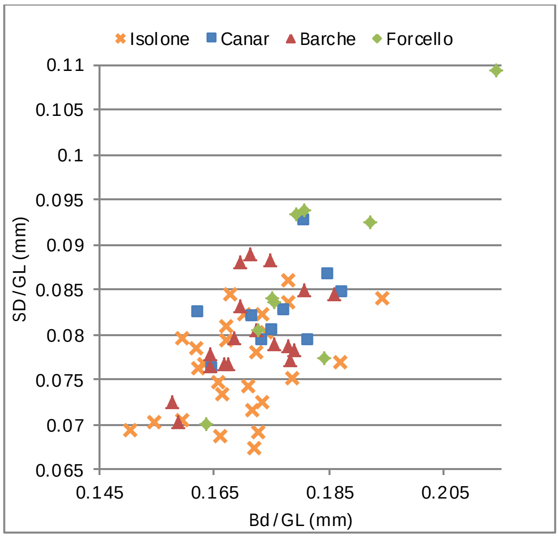


Figure 5.4.29 Sheep metatarsal shape



The limited number of goats in these assemblages does not permit a similarly detailed analysis of goat size change. Very few goat measurements are available for a regional Iron Age comparison. Goat astragalus measurements overlap for the four locations considered (Figure 5.4.30), generally mirroring the situation with sheep astragali. Distal tibia widths (not pictured) also do not indicate any significant size differences between goats at Forcello and Populonia. Goat measurements are not available for Ficana. Overall, this limited comparison does not indicate any major size differences between Forcello and the non-Etruscan sites considered. Goat measurements from the distal tibia (Figure 5.4.30) illustrate an increase in animal size between the Recent Bronze Age and Etruscan period, a pattern that mirrors the size increase seen in sheep, but the sample size from Forcello is small. More substantial changes in goat size occurred during the Roman period (Bökönyi 1974). Goat biometry from Forcello, therefore, tentatively provides some indication of an increase in animal size between the Recent Bronze Age and Etruscan period. Size data from Forcello are too few to elaborate on regional differences with the Iron Age/Etruscan period.

Figure 5.4.30 Iron Age goat astragalus lateral depth (Dl) vs greatest lateral length (GLl)

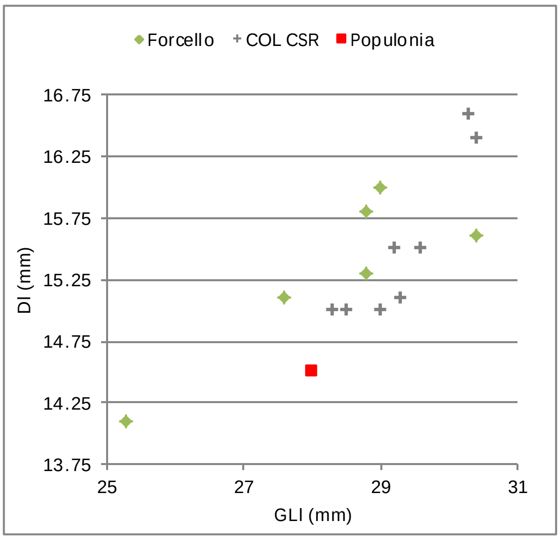
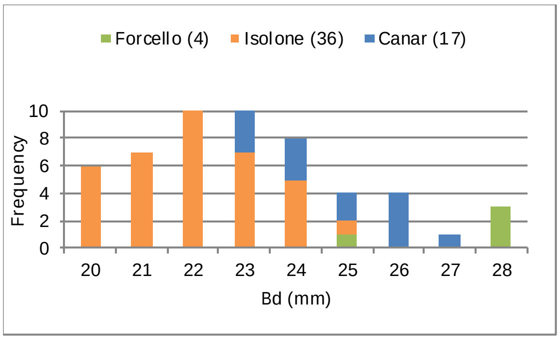


Figure 5.4.31 Bronze Age goat tibia distal width (Bd)

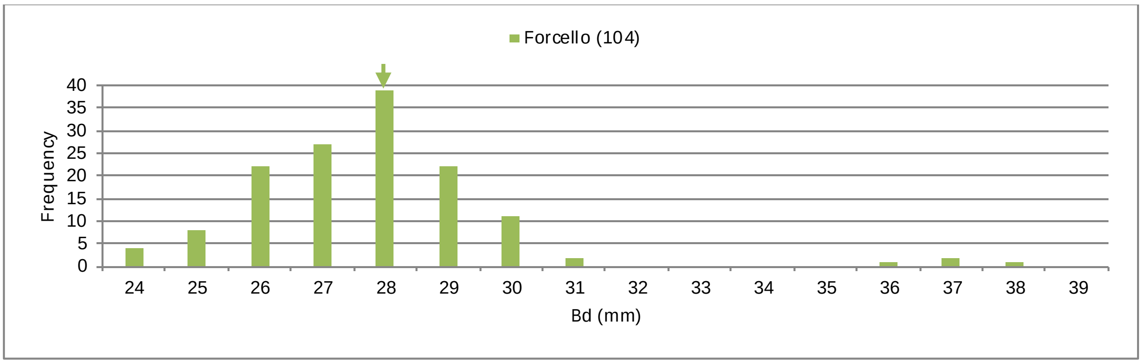


5.4.3 Pigs

Pig size at Forcello is similar to that at other Iron Age and Etruscan settlements, both in northern and central Italy. Similarities in pig size are visible in the distal tibia (Figure 5.4.32–33), astragalus (Figure 5.4.34–35), metapodials (Figure 5.4.36), and teeth (Figure 5.4.37). Large outliers indicative of wild boar are visible in data from Forcello and Colognola ai Colli/Castelrotto; wild boar were identified at Populonia, but no measurements were listed. Although few in number, wild boars at other northern settlements are similarly sized to those found at Forcello. Log ratios from post-cranial bones (Figure 5.4.38) reinforce the situation illustrated by individual elements; no size differences are visible between the three sites.

Figure 5.4.32 Iron Age pig tibia distal width (Bd)
(n) = number of specimens. Arrows indicate means: Forcello = 28.4. Colognola (COL)/Castelrotto (CSR) and Populonia mean not provided because n < 20.

5.4.34a Forcello



5.4.34b Colognola/Castelrotto and Populonia

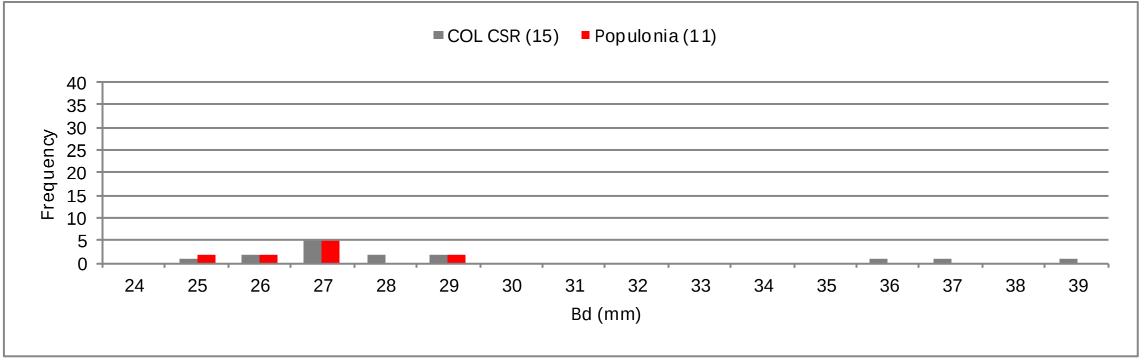


Figure 5.4.33 Etruscan pig tibia distal depth (Dd) vs. width (Bd) from Forcello and Populonia

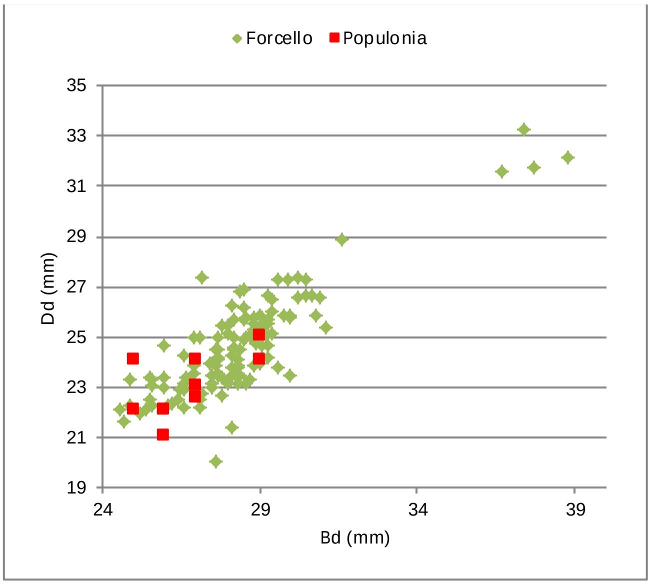
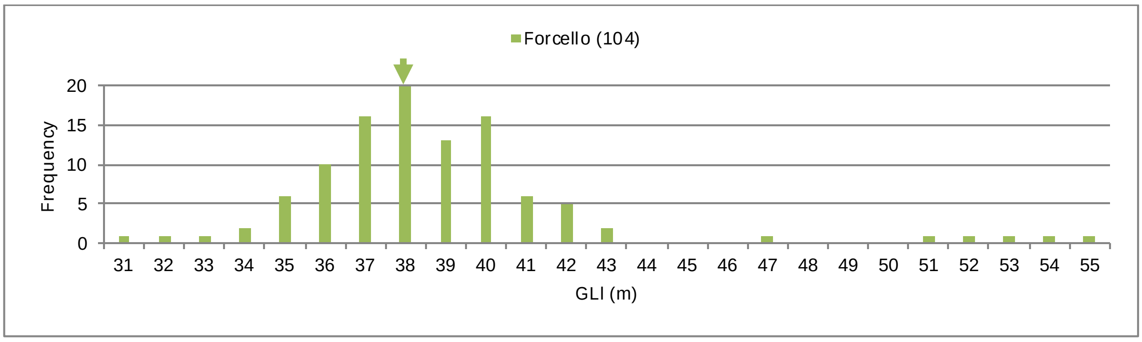


Figure 5.4.34 Pig astragalus greatest lateral length (GLl) from Iron Age/Etruscan sites
(n) = number of specimens. Arrows indicate means: Forcello = 38.5. Colognola (COL) and Castelrotto = 37.5.
Populonia mean not provided because n < 20.

5.4.36a Forcello



5.4.36b Colognola/Castelrotto and Populonia

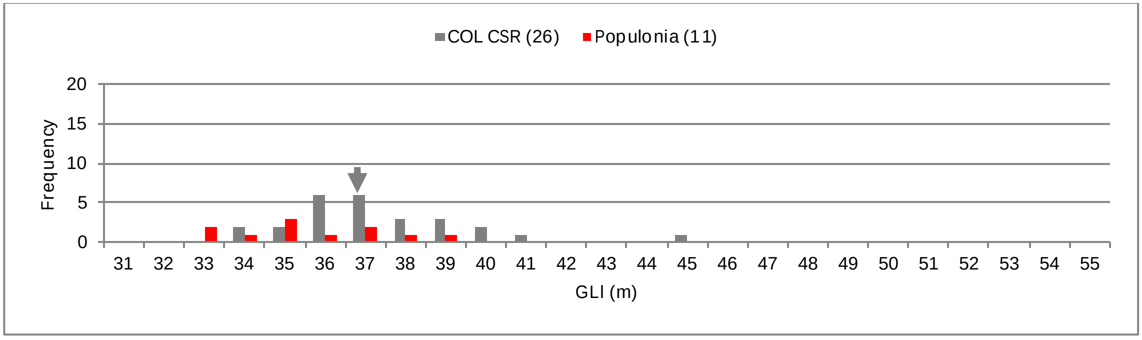


Figure 5.4.35 Etruscan pig astragalus greatest medial length (GLm) vs. greatest lateral length (GLl) from Forcello and Populonia

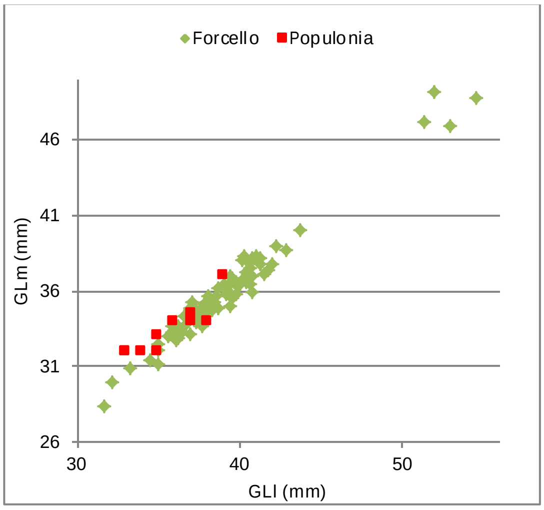
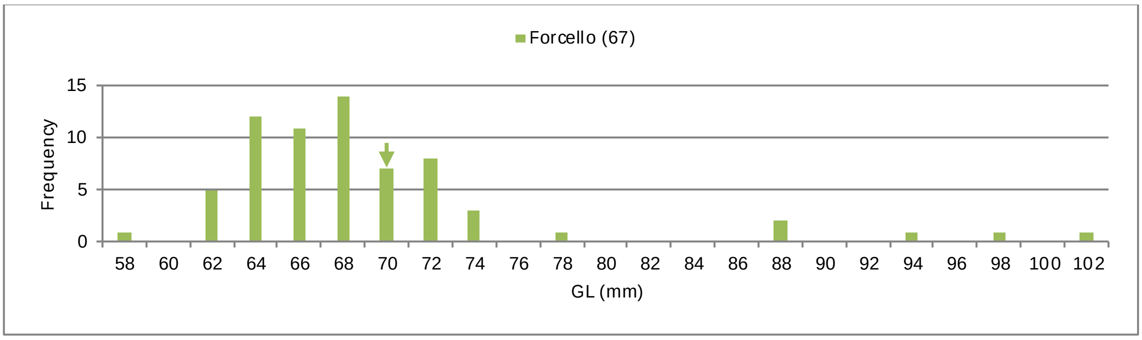


Figure 5.4.36 Pig metacarpal IV greatest lengths (GL) from Iron Age/Etruscan sites
( ) = n. Arrows indicate means: Forcello = 28.4.
Populonia and Colognola (COL) and Castelrotto (CSR) means not provided because n < 20.

5.4.38a Forcello



5.4.38b Colognola/Castelrotto and Populonia

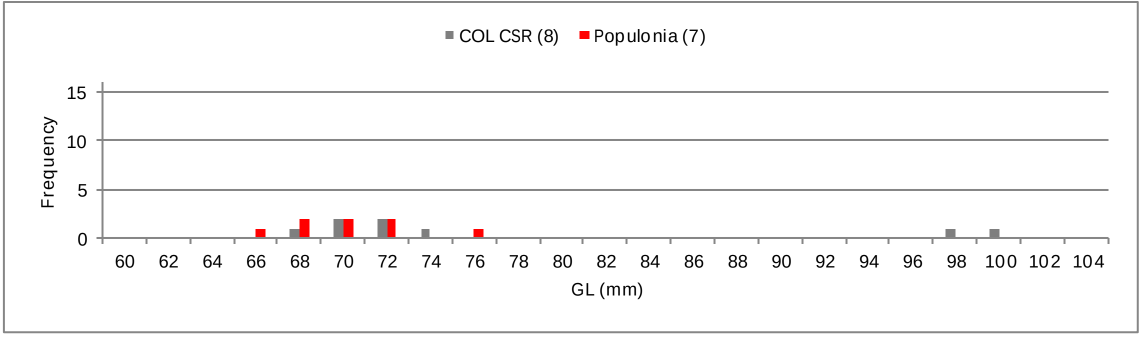


Figure 5.4.37 Etruscan pig M_3 width (WA) vs. length (L)

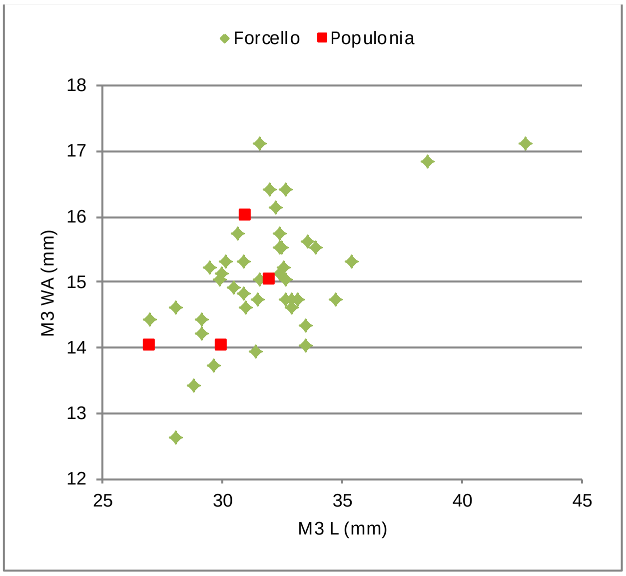
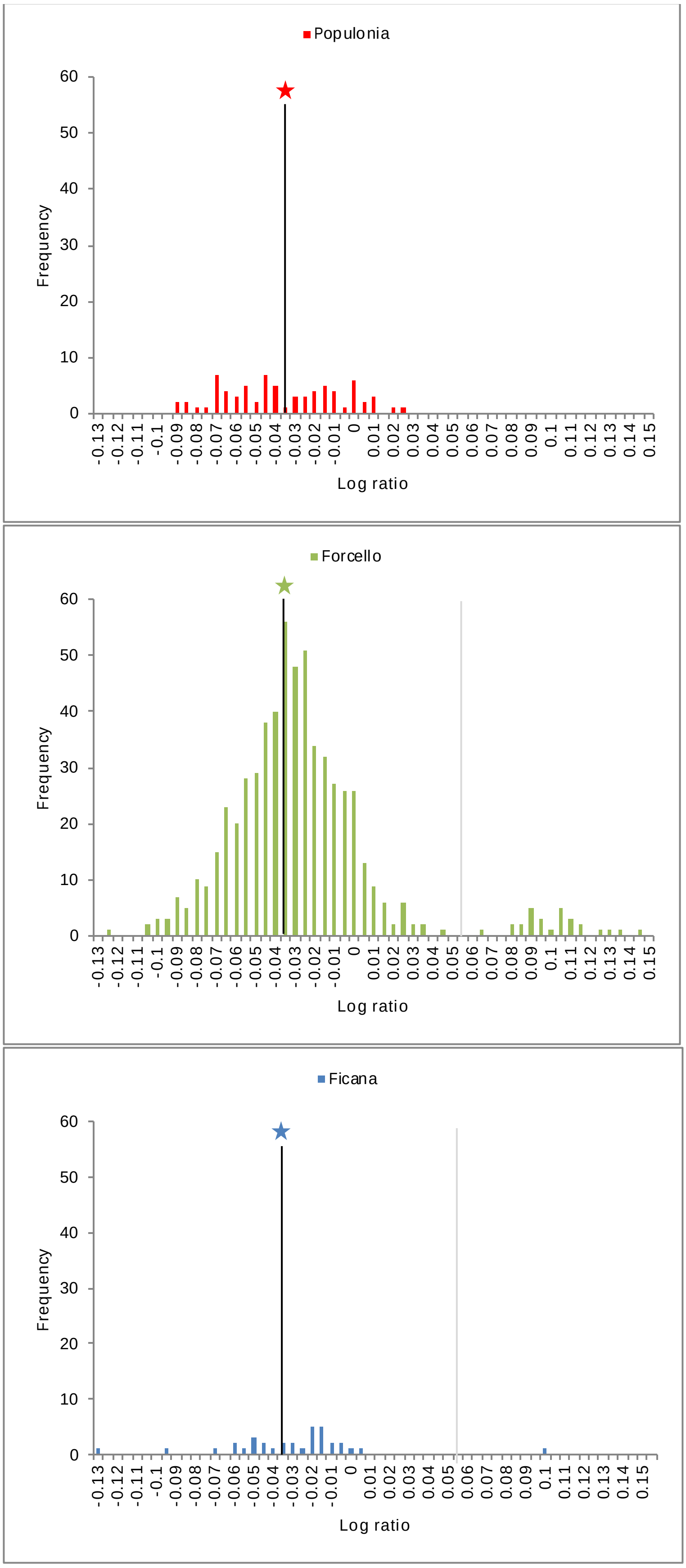


Figure 5.4.38 Pig post-cranial log ratios

Black bar marks Forcello mean; gray bar separates wild and domestic pigs. Star makes site mean (includes only domestic pigs).
See section 3.6.5 for methods.



Previous research has shown that pig size is more stable than that of cattle or caprines across the Bronze and Iron Age, although it varies between regions (cf. section 2.5.3). With the large sample of pig measurements available from Forcello, new regional trends can be identified. Unlike cattle and sheep, which increase in size in the Late Bronze Age and Iron Age, pigs continue decrease in size into the Etruscan period. This continuous diminution is visible in third molar lengths (Figure 5.4.39). Fewer measurements are available for other elements, but this trend is also apparent in metacarpals (Figure 5.4.40) and the distal tibia (5.4.41). Few measurements from Isolone are available for the astragalus and calcaneum, but both these bones illustrate a significant decrease in pig size between the Early Bronze Age and Etruscan period (Figure 5.4.42–43). A decrease in pig size over the same timeframe is also recognized in central and eastern Europe (Bökönyi 1974). This modest diminution of pig size between the Late Bronze and Iron Ages is linked to a long term trend of size decrease that began with the domestication of species during the Neolithic (Albarella et al. 2006). Wild boar measurements from Forcello are similar to those from Canar, Barche and Isolone. Previous research has illustrated an increase in wild boar size across Italian prehistory (ibid.), and the data from Forcello confirm this trend. The Forcello wild boar are similar in size to those from other late prehistoric sites in Italy but larger than Mesolithic wild boar. The clear separation between domestic pigs and wild boar at Forcello is indicative of a physical separation between the two populations, which would not have interbred regularly. Pigs therefore were probably partly enclosed, at least during the breeding season. Consequently, with comparatively limited access to pasture pigs may have adapted a small body size in response to restricted feeding.

While the precise character of pig development in northern Italy is still not well understood, the changes in pig size visible at Forcello certainly indicate a management strategy totally separate from that of cattle and caprines, which increase in size over the same period. Interestingly, the increasing demand for pork did not translate into larger pig body size. Maximum withers heights increase slightly in central Italy during the Roman Imperial period, but this trend is not universal and means remain roughly the same (cf. Tables 2.5.5–6). Although few in number, the data presented here also do not provide evidence of an increase in pig breadth or the development of stockier animals of a similar height. Perhaps it was more economical or convenient to raise a greater number of animals, rather than invest in developing pig carcass size. Discussion of the motivations behind animal improvement continue in the next chapter.

Figure 5.4.39 Pig M_3 lengths (L)
(n) = number of specimens. Arrows mark means: Forcello = 31.8, excludes outliers. Canar = 34.2, Barche 33.9, excludes specimens classified as wild boar. Isolone mean not provided because sample size <20.

Figure 5.4.40a Forcello

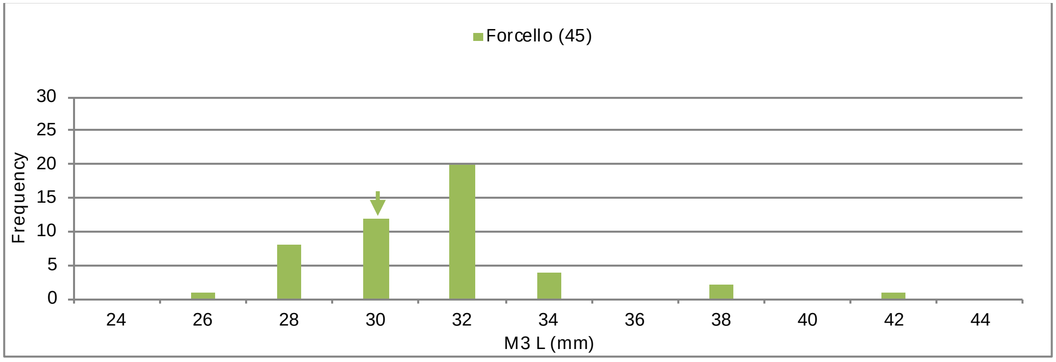


Figure 5.4.40b Recent Bronze Age

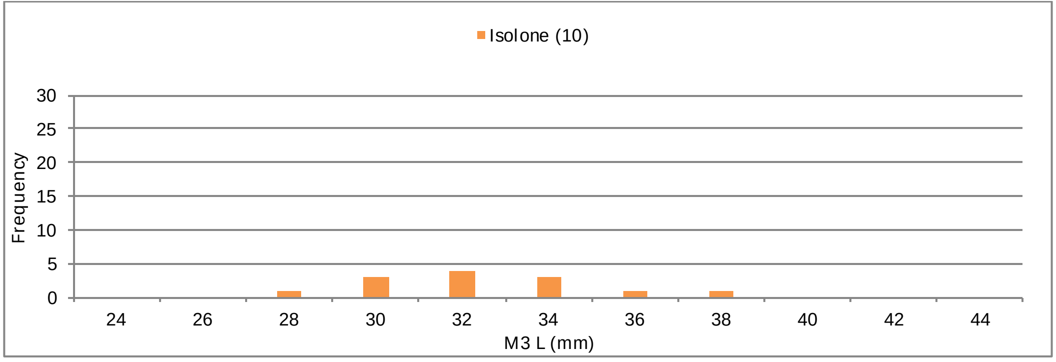


Figure 5.4.40c Early Bronze Age

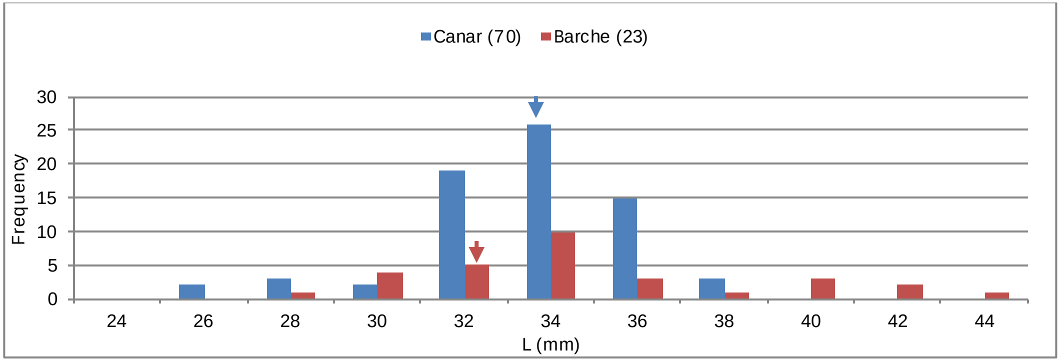


Figure 5.4.40 Pig metacarpal IV lengths (GL)
(n) = number of specimens. Canar includes specimens identified as domestic pig and as wild boar.

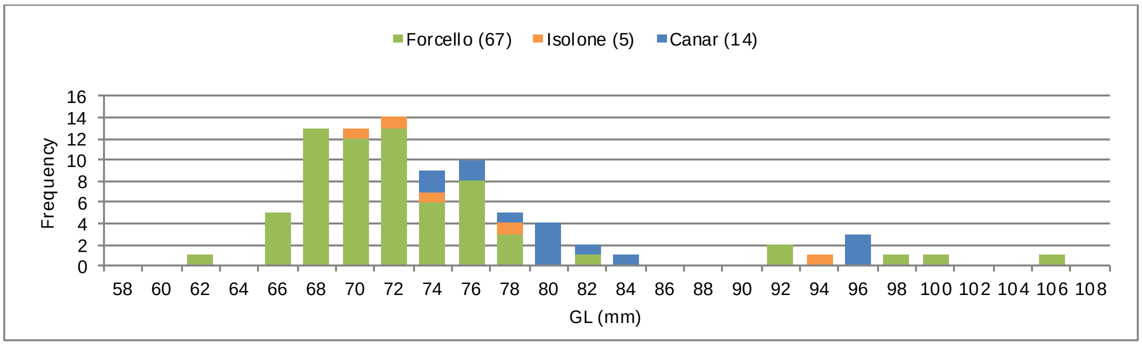


Figure 5.4.41 Pig tibia distal widths (Bd)
(n) = number of specimens. Orange bar marks Isolone size range (n=8); dot marks Isolone wild boar. Blue bar indicates Canar wild boar range. Arrows mark means: Forcello = 28, excludes outliers. Canar = 29.8.

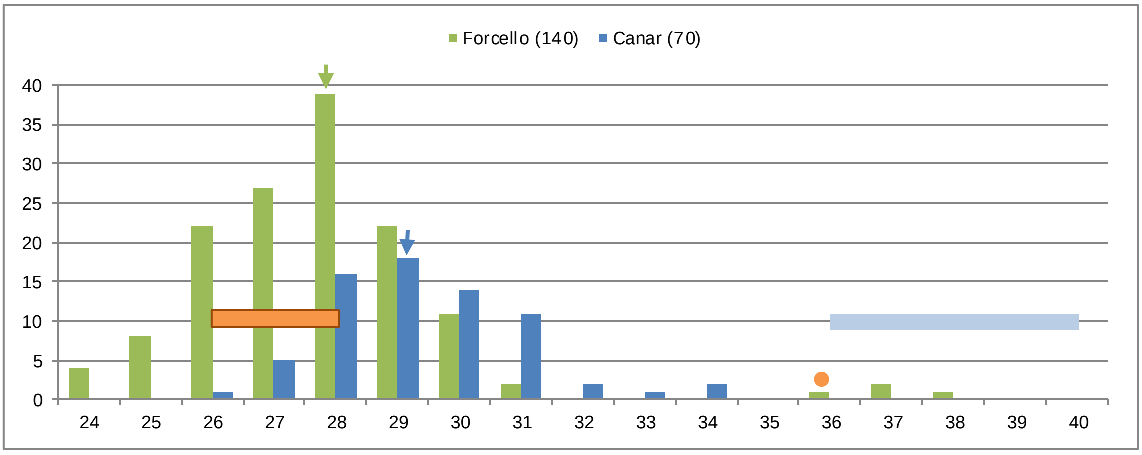


Figure 5.4.42 Pig astragalus length (GLl)
(n) = number of specimens. Orange dots mark Isolone measurements (n = 3). Blue bar indicates Canar wild boar size range. Arrows mark means: Forcello = 38.5, excludes outliers. Canar = 41.1, excludes specimens classified as wild boar.

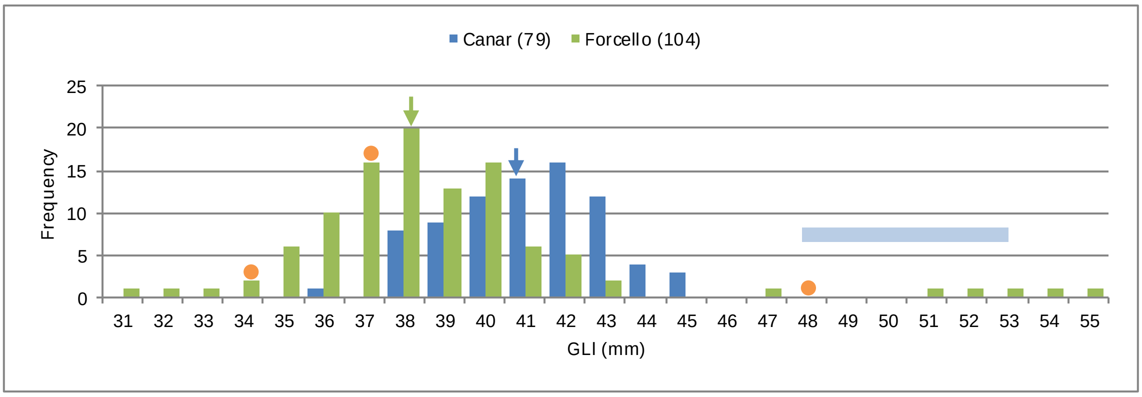


Figure 5.4.43 Pig calcaneum length (GL) from Forcello and Canar
(n) = number of specimens. Arrows mark means: Forcello = 76.2, excludes outliers. Canar = 80.5, excludes specimens classified as wild boar.

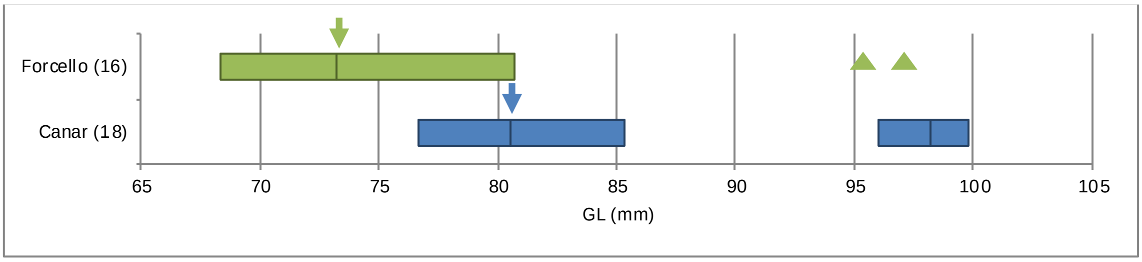
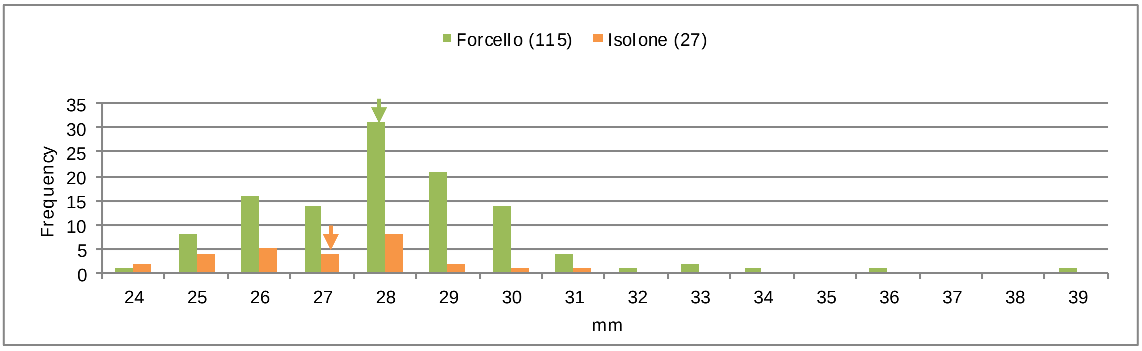


Figure 5.4.44 Pig humerus BT from Forcello and Isolone
(n) = number of specimens. Arrows mark means: Forcello = 28.5, excludes outliers. Isolone = 27.3.



5.5 OTHER DOMESTIC ANIMALS

5.5.1 Equids

Equids are rare at Forcello; only a few remains attest to their presence. The recovery of this small collection of bones and teeth mirrors the situation at many other Etruscan settlements. Horses were not normally consumed, and therefore they were disposed of differently than domestic debris. No butchery marks were found on equid bones from Forcello. Small, dense elements like carpals/tarsals, phalanges, and teeth that tend to survive well are frequently recovered during archaeological excavations. Both the equid jaws identified to species level were classified as horses. Donkeys were comparatively rare during this period, so their apparent absence from the small collection of equid remains from Forcello is not surprising. Because of the relative scarcity their remains, the distribution and evolution of horse and donkey size during the Etruscan period is not well understood. Previous research has shown that horses increased slightly in stature between the Bronze and Iron Ages, although this pattern is complicated by the existence of differently-sized populations within Italy (de Grossi Mazzorin 1996d). Further increases in horse size are visible in the Roman period. The few measurements taken on an equid phalanx from Forcello are comparable to those of horses from other sites (Table 5.5.1). However, a distal metapodial registers between contemporaneous horse and donkey measurements. Overall, the few equid remains recovered from Forcello reflect wider Italian patterns and reinforce current understanding of horse/donkey exploitation.

5.5.2 Dogs

As on other sites of the period, dog remains account for about 1% (n=137) of the Forcello faunal assemblage. A common domestic animal, the dog is found on most Etruscan and Iron Age sites, although they typically represent only a small proportion of the total assemblage (one or two percent). Since dogs are not thought to have been commonly consumed, dead animals would have been disposed of differently than food debris. Thus the relative frequency of dogs at Forcello fits well with their occurrence on other sites; however, the high frequency of cut marks on dog bones from Forcello suggests a somewhat difference usage of these animals. Butchered bones attest to the slaughter and use of dogs throughout Italian prehistory (cf. de Grossi Mazzorin and Tagliacozzo 1997), but such remains are relatively rare. Several Italian sites have produced dog bones with butchery marks: Luni sul Mignone, Trasacco, Tortoreto, Rome (Domus Reggia), Monte Pallano (Love 2008), and Montecatino in central Italy; and Albanbühel, Santorso, Fiorano, Casale di Rivalta, and Marzabotto in the north. This sample includes Bronze Age sites in both regions as well contemporaneous Etruscan and Iron Age settlements. At all these sites only one or two bones with butchery marks were recovered, in contrast to the eighteen remains from Forcello. The presence of butchered dog bones is also not linked to the overall number of dog bones recovered. No traces of butchery were found on the dog bones in the large Bronze Age assemblages from Barche (dog NISP=75), Canar (180), or Isolone (43), nor on those from the early Etruscan settlements at Castenaso (121) or Fidene (40). Butchered dog bones are all but absent for Roman contexts, although historical sources and zooarchaeological evidence allude to their sacrifice and occasional consumption (e.g. Pliny, Natural History 29.14; Livy, *Ab urbe condita* 40.6.1–2; Tagliacozzo 1989; Caloi and Palombo 1980). Dog sacrifice is also mentioned in the Umbrian *Tabulae Ig*uvinae (Poultney 1959:176–189). However, as explained in the previous chapter, butchered dog remains from Forcello were recovered from rubbish deposits and construction fills, rather than ritual contexts. In general, their character reflected that of other domestic food refuse.

The recovery of a dog bone worked into a handle from Santorso suggests that dog bones were sometimes used to manufacture tools or other items, but no evidence of canid bone working was found at Forcello. The high incidence of bones with cut marks – a proportion comparable to that of domestic livestock – the association of these marks with dismemberment of the carcass, and the recovery of these remains from rubbish deposits, alludes to the occasional, but repeated, consumption of dog meat. Currently, no parallels for this activity exist on Etruscan settlements. Some evidence of dog consumption has been found on Greek sites (Chenal-Velarde 2006), but this practice was far more common in central Europe, especially during the Hallstatt and La Tène periods (eg. Yvinec 1987; Horard-Herbin 2000; Chrószcz et al. 2013). The situation at Levroux in central France is a particularly good foil for Forcello: butchery marks were observed on over 17% (n=1026) of the dog bones. Additionally, the site contained a large number of puppies and juvenile dogs, indicating that dogs were raised for meat as well other purposes (Horard-Herbin 2000). Most dog bones from Forcello are fused, but juvenile mandibles (first mandibular molar not yet in wear) outnumber those of adults when mandibles with at least one premolar or molar are considered (n=19).

At Forcello, numerous Hallstatt and La Tène fibulae attest to the influence, if not the real presence, of central European culture and people. In addition to these fibulae, other aspects of Celtic culture may also have been adopted or practiced by non-Etruscans on site, including the consumption of dogs. However, these conclusions may not be applicable to the whole settlement at Forcello. Considering the relatively limited area under excavation in comparison to the whole site – a few houses and workshops and the spaces that surround them – it is interesting to think that we may be evaluating the diet on a household level. Like the presence of a small collection of central European personal ornaments, the butchered dog bones further reinforce the possibility of close cultural links with the central European area.

When the size of dogs is compared across Italian sites, several mandibles from Forcello are notably larger (Figure 5.5.1). The only complete dog tibia from Forcello is also rather large (Figure 5.5.2), but width measurements from the distal humerus fall in the middle of the graph (Figure 5.5.3). The reason behind this slight disconnect is puzzling. The measurements were all taken according to the same standard, and data from Forcello fall on the same axis as that from other sites. Thus a recording error is unlikely to be responsible. Perhaps it is a product of sample size; alternatively, dogs at Forcello may have been of a tall, but slender type with a long snout. It is interesting to note the similarities between this description and that of early Celtic sight hounds like the *vertragus* described by the Greek author Arrian (*On Coursing*). Hares and rabbits, the most common prey in coursing, are not particularly common in the Forcello assemblage (although recovery bias will inhibit their recovery), but sight hounds would have proved useful in deer hunting. Indeed, scenes of both deer and hare coursing and common in Etruscan art (Camporeale 1984). The presence of such dogs at Forcello may point to an early Italian adoption of a greyhound-type dog from the Celts.

Although dogs in Italy increased in stature between the Bronze Age and Roman period, they tend to remain slender despite an increase in withers height (de Grossi Mazzorin and Tagliacozzo 2000). Dog mandibles from Forcello are similarly sized, if not smaller than those on the contemporaneous Hallstatt site of Durezza in Austria (Figure 5.5.4). Larger individuals from Durazza exceed the size of other Hallstatt dogs (Galik 2000:135), so the mandibles from Forcello are comparably sized to some central European animals. While previous research has demonstrated an increase in Italian dog size between the Bronze and Iron Ages in Italy (de Grossi Mazzorin and Tagliacozzo 2000; de Grossi Mazzorin and Tagliacozzo 1997), further comparisons with central Europe are needed to contextualize dog size at Forcello. Large dogs were present in central Europe during the Etruscan period, and the appearance of dogs of this stature at Forcello may relate to the movement of these animals within Italy. Also interesting is the absence of very small dogs from the Forcello assemblage. New dwarf dog breeds developed during the Iron Age and become more common during the Roman period. At Forcello, there are no remains that could belong to this new small breed.

Figure 5.5.1 Dog mandible size through time
Comparative data from
de Grossi Mazzorin and Tagliacozzo (1997) and
Cassoli and Tagliacozzo (1990).

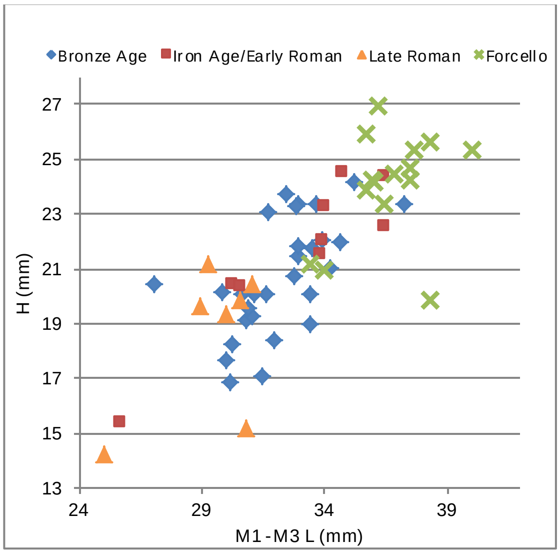


Figure 5.5.2 Dog tibia size through time
Comparative data from
de Grossi Mazzorin and Tagliacozzo (1997).

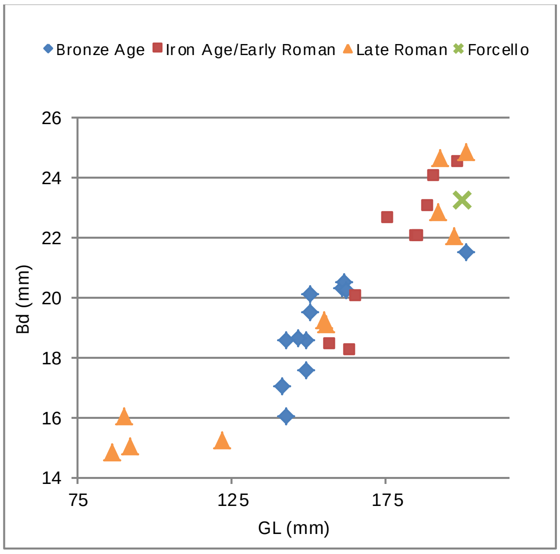


Figure 5.5.3 Dog distal humerus breadth (Bd) through time
Comparative data from de Grossi Mazzorin and Tagliacozzo (1997) and Cassoli and Tagliacozzo (1990)

Figure 5.5.3a Bronze Age

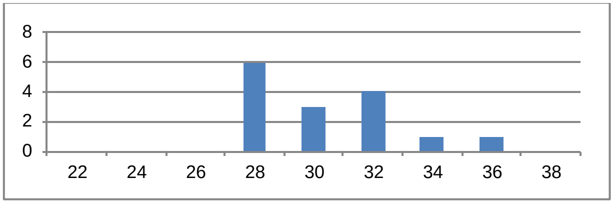


Figure 5.5.3b Iron Age/Early Roman

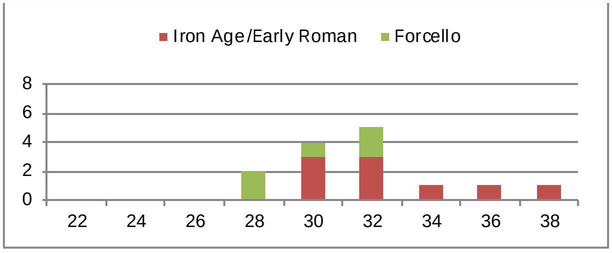


Figure 5.5.3c Late Roman

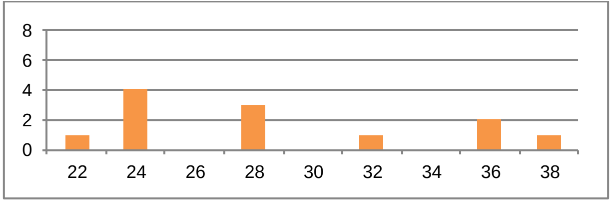
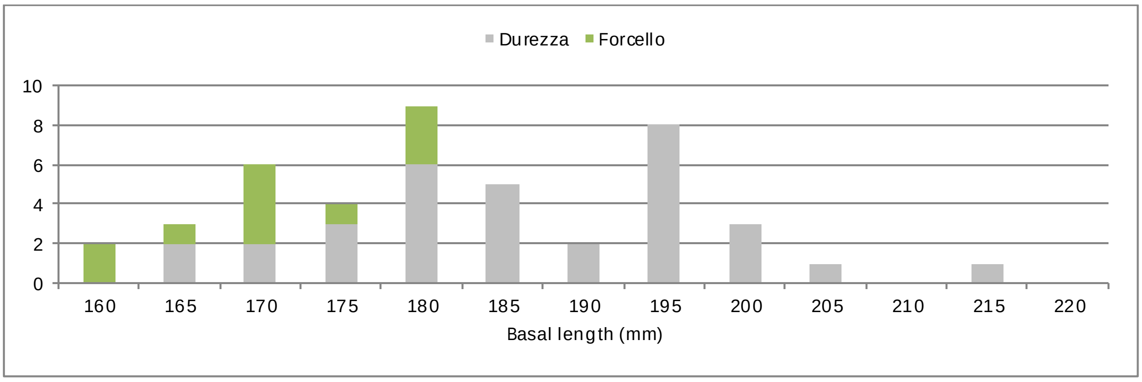


Figure 5.5.4 Dog mandible basal length from Forcello and Chimney Cave Durezza
Data from Galik (2000). Basal length = 2.8(P1-M3 L)-44



5.5.3 Cats

Domestic cats were extremely rare in Etruscan Italy, and their absence from the Forcello confirms their status as a rare and exotic animal. The remains of a cat have been identified at Fidene in the eighth century BC (de Grossi Mazzorin 1997a; although this identification has been challenged, cf. Masseti 2000:139). Cats have also been identified at Cures Sabini during the end of the eight century BC (Ruffo 1988) and at Ficana during the second half of the seventh century BC (de Grossi Mazzorin 1989). Wild cats are also rare in central and northern assemblages, but they are encountered more frequently than domestic cats. In addition to emphasizing their place as elite animals, the absence of domestic cat bones from Forcello supports current understanding of the introduction of this species into southern Italy (de Grossi Mazzorin 1997a).

5.5.4 Chickens

Domestic chickens first appeared in northern Italy during the ninth century BC (de Grossi Mazzorin 2005), and their introduction into Central Europe occurred along a similar timeframe – during the late Hallstatt period, around the eighth–seventh centuries BC (Ha C/D, Benecke 1993). Although present on several northern Italian sites, chicken remains are limited to funerary contexts until the sixth century BC, at which point they become more widely diffused. In addition to Forcello, chicken bones have been recovered from the northern Etruscan settlements of Marzabotto, Casale di Rivalta, and Case Vandelli, and they also occur on non-Etruscan sites in northern Italy (e.g. Santorso). The presence of chicken in central Italy increases after the sixth century BC, although they remain restricted to funerary and elite contexts until the fourth century BC (de Grossi Mazzorin 2005). The chicken bones from Forcello confirm the status of this bird as small but increasingly important part of Etruscan life. Additionally, the presence of chicken bones in the earliest phases of the site also indicates that these birds were available to non-elite Etruscans by c. 530–520 BC. A cut mark on a chicken bone from Forcello suggests that these birds were probably consumed, but chicken eggs were likely equally important as a food source and a religious symbol. Eggshells are frequent offering in Etruscan tombs (Bertani 1995; de Grossi Mazzorin and Minniti 2009a), and they are also depicted in Etruscan tomb paintings, where they are held by funerary banqueters (e.g. Figure 5.5.5).

Figure 5.5.5 Tomb of the Leopards
Tarqunia, c. 480 BC. ©2011 http://www.flickr.com/photos/fionabarclay/8365405514/

This image has been removed by the author for copyright reasons.

5.6 PERINATAL HUMAN REMAINS

The burial of very young infants within the home or other domestic structures was a practice common throughout prehistoric Europe (Scott 1999), and the recovery of neonatal remains from within settlement contexts is also known in Etruscan archaeology. Unless otherwise specified this discussion classifies infants as perinatal/neonatal individuals aged between approximately one month pre-partum and several month post-partum, possibly up to one year of age. Very young human remains are difficult to age precisely and many publications provide general terms (e.g. "fetus", "neonate") rather than a specific age. Limiting the definition of "infant" to this age range ensures we are not unconsciously excluding any sub-group within this category. Children are classified as individuals between one and twelve years of age; specific ages are provided where possible. Older human remains are not included in this comparison.

Perhaps the most notable example of Etruscan infant burialin a settlement context is the internment of five neonates within the Monumental Complex at Tarquinia (Bonghi Jovino 2010). The burial of these infants occurred between the eighth and sixth centuries BC in an area associated with cultic activity on the site. Although they were placed in simple graves, the association of these burials with an area of special significance and the presence of four other individuals (two children, two adults), indicates that the motivation behind the placement of these remains was different from that of the human bones encountered at Forcello. (The Tarquinia excavators have identified them as human sacrifices.) Infant burials have also been identified within the settlements of Ficana, Rome, and Ardea (Bietti Sestieri and De Santis 1985; Bietti Sestieri 1992; Modica 1993; Becker 1996). Many of these deposits were formally organized in relation to surrounding structures. Infant remains were sometimes placed in urns and other containers, and several burials contained grave goods.

Because the human bones from Forcello were encountered during faunal identification, it is difficult to directly compare them with the burials mentioned above. Information on associated objects (other than animal remains) is currently unavailable. While the recovery of perinatal human remains from post-holes and preparation layers may indicate a connection with domestic structures, the presence of infant bones in canals, rubbish pits/middens, and destruction debris is divergent from other published Etruscan infant remains from central Italy. However, recent discoveries at Murlo (Poggio Civitate) provide a closer analog to the situation at Forcello. In 2011 neonatal bones were found in contexts associated with mixed industrial debris and building floors (S. Whitcher Kansa pers. comm.). The loose neonatal bones were identified in midden deposits during recording of the site's large backlog of faunal remains. More neonatal bones have been recovered in the following seasons, thanks to increased awareness and the introduction of sieving. Study of these remains is currently in progress, and their publication will provide an important Etruscan comparison for the material from Forcello.

Fetal and infant remains from northern Italy provide further *comparanda* for the material from Forcello. Zanoni (2011) has recently cataloged and discussed human remains encountered outside cemetery contexts. Her work illustrates the presence of child burials (two to ten years of age) within settlements in north-central and eastern Italy during the tenth–ninth centuries BC (e.g. at Brescia, Montereale Valcellina, Castelliere, and Padova). Infant remains are not recorded for this period, although the recovery of a child's (approximately ten years of age) skull from an refuse pit cut into a frequentation layer at Castelliere (Udine) has parallels with human remains recovered from similar contexts at Forcello. In the eighth–sixth centuries BC, child/infant remains have been recorded at Padova (Via San Eufamia) and Bologna (Castenaso and Via Foscolo-Frassinago). At Padova, the partial remains of a child (age not specified) were found in a pit cut into a frequentation later; although this context was located within the settlement, the area was identified as a center for on-going symbolic/religious activity marked by the cremation of animal remains and cereals and the burial of multiple individuals (Facciolo and Tagliacozzo 2006; Zanoni 2011:22–24). Infant remains from Bologna provide a better analog for those from Forcello. At Castenaso the remains of two perinatal individuals were recovered from a pit that also included animal bones and several grave goods (Zanoni 2011:26). A perinatal humerus was found in the fill above the burial. In contrast to this structured deposit, the partial skeleton of an infant (approximately one month old) was excavated from a seventh century BC rubbish pit at Bologna (Via Foscolo-Frassinago). Disarticulated animal bones were also found in the pit, along with the skeletons of a dog, horse, and mallard. Like at Forcello, the human remains were identified during analysis of the faunal assemblage.

The archaeological presence of infants remains within settlements is particularly well documented during the fifth–third centuries BC in the Po Plain (Zanoni 2011). This practice is especially notable in the Veneto, where numerous newborn infants have been recovered from within domestic structures. These human remains are sometimes encountered in intact burials; in other instances the bones are disarticulated (Zanoni 2011:32–35). The settlement at Palazzo Zabarella (Padova) contained several newborn burials (MNI=3), each associated with the floor of a domestic structure. At Castelrotto (MNI=8) the partially disarticulated bones of several infants were recovered from two pits under the floor of another domestic structure. Similarly, the disarticulated remains of multiple newborns were also recovered from under the floor of a domestic building at Colognola ai Colli (MNI=8). These remains were associated with animal bones and waste from a metal workshop. At Santorso, several infant and child burials (infant MNI=5, fetal MNI=3, one child 6–10 years) follow a more systematized form. The remains were typically interned under or adjacent to walls. While the fetal remains were recovered in anatomical order, three of the neonatal remains were partially disarticulated. One infant burial and the older child were accompanied by grave goods (cf. Zanoni 2011:33). Eleven disarticulated fetal individuals mixed with animal remains were recovered from under the floor of a complex structure at Castelraimondo (Udine), but this center seems to have had a ceremonial rather than domestic nature (Zanoni 2011:51). Like in several other examples presented above, these remains were also identified during analysis of the site's faunal material (Giusberti 1992).

In contrast to rather limited evidence from central Italy, Iron Age infant burials within settlements are well documented for settlements in the Alps and central Europe. Infant burials are especially numerous at Gamsen, Switzerland, where eighty burials have been excavated in various houses, workshops, and even cowsheds (Savioz 2012). Like at Forcello, these individuals are primarily full term fetal/neonatal babies, but earlier fetal and older infants are also present. The burials are always associated with structural elements, typically along interior walls. Numerous newborn and infant burials have been recorded in domestic structures in central and southern France (Baillis-Talbi and Blanchard 2006; Dedet 2008). One important example is the site of Lattes in southern France (Fabre 1990; Fabre and Gardeisen 1999). Numerous complete and partial perinatal burials have been recovered from within the settlement in association with domestic structures. The site is of further relevance to Forcello because of the association of animal remains with several infant burials. When present, these remains were always from common, typically domestic, species and resembled other domestic debris. Also of interest are the excavations at Gailhan (Gard, France), which have revealed the remains of over twenty fetuses, newborns, and infants buried in houses dated to the fifth and fourth centuries BC (Dedet et al. 1991). Through a wider comparison with other pre- and proto-historic sites in the Languedoc, the authors concluded that this mode of infant burial was a normal practice indigenous to the region.

In the Veneto and Italian Alps, the internment of infants and newborns within domestic structures continues into the Roman period. These burials are typically found intact and the skeletons within them in anatomical order. Older child remains are documented in the southern Plain during this period at Monte Ricò (approximately four years old) and Marzabotto (unspecified *bambino*) (Zanoni 2011:47). At the former settlement a mandible was founded mixed with other materials; at the later, a child skeleton was found along with those of three other individuals in a series of pits marked by cairns near the temple of Tina. Young children continued to be buried within settlements during the Roman period, especially in central Europe (Carroll 2012).

Within the context of northern Italy and central Europe, the presence of infant remains within the settlement of Forcello is far from unique, and represents a tradition repeatedly documented across the region during the first millennium BC. The examples presented above also illustrate that the presence of infant remains in contexts related to building collapse, rubbish deposits, and construction layers is not unique to Forcello. Zanoni (2011:53) notes that over half perinatal and infant burials from northern Italian settlements of the fifth–third centuries BC were found in 'non-prepared' context types rather than pits or formal graves. She also points out that while infant remains are typically associated "with domestic structures or specific elements of domestic structures" (Zanoni 2011:54), this is not always the case. For example, at Bologna (Castenaso and Via Foscolo-Frassinago), Santorso, and Oderzo infant remains were recovered from marginal areas, fire pits, or in association with fortification walls. At Castelliere and Bologna (Via Foscolo-Frassinago) child and infant remains were recovered from areas specifically described as relating to rubbish/dumping. Compared to this body of evidence, the human bones recovered from Forcello add to an expanding picture of infant burials outside of cemetery contexts. However the quantity of infant human remains at Forcello is unique in Etruscan culture.

Neither the location of these remains within Forcello nor the context types in which they were located is a novel discovery; there are parallels for recovery of infant remains from destruction debris, refuse, construction fills/floors, and even industrial spaces. At the moment, Poggio Civitate and Bologna (Castenaso and Via Foscolo-Frassinago) provide the main analogous Etruscans example of these practices. With the exception of the examples mentioned above, the internment of children in settlements is less documented in Etruria. A specialized infant cemetery dated to the Late Roman period has been unearthed in Lugnano in Umbria (Soren and Soren 1999); however, the excavators believe the cemetery was constructed in response to an epidemic, so it does not necessarily reflect typical mortuary practices of the time. Other infant cemeteries dated to the Late Iron Age and Roman period have been found outside of Italy (ibid.), but nothing similar has so far been noted for Etruscan times. Other than Forcello, there are no infant burials within northern settlements over the same period (sixth–third century BC). Adult remains have been recovered from within the settlement at Marzabotto, but child and infant remains are not present at the site.

CHAPTER 6

BEYOND BONES: DIET, ECONOMY, AND SOCIETY AT FORCELLO

6.1 INTRODUCTION

Having placed the faunal remains from Forcello in a larger zooarchaeological context in Chapter 5, in this chapter we move beyond bones to a larger range of archaeological themes. Previous chapters have discussed what animals were present at Forcello and how these animals were managed; this discussion attempts to unite zooarchaeological data with other sources to answer why these situations developed and to discuss their implication for our broader understanding of Etruscan culture. For the contemporary civilizations of Rome and Greece we have ample written evidence to aid us in this task; however, without similar historic sources this is a greater challenge for the Etruscans. Without Etruscan texts to directly comment on Etruscan practices, this chapter occasionally draws from Roman authors to provide some historic perspective; however, rather than putting Roman words into Etruscan mouths, I have tried to limit the use of Classical sources to places where Roman explanations enhance Etruscan archaeological material. As two neighboring peoples, many aspects of Roman and Etruscan culture were exchanged and shared, but without Etruscan sources to equal Roman accounts, the application of Roman ideas to Etruscan tastes must be done with caution. Etruscan civilization was adjacent to but independent from Rome, and even the Romans characterize the Etruscans as a people sometimes dramatically different from themselves (e.g. Izzet 2012).

The topics addressed in this chapter can broadly be grouped into three main themes. The discussion of diet addresses what foods, and especially meats, people ate and the conservation and preparation of these ingredients. Economic considerations treat the scale of production and the role of trade in animal management. The final theme, society, touches upon both individual and group identity. This discussion does not define the limit of the Forcello assemblage's usefulness, nor is it able to address all of the possible avenues present in a faunal collection this size; rather I have chosen to build on areas where previous work has proved promising and to bring zooarchaeology into the discussion of a few new and relevant topics in Etruscology. In many instances, the animal remains raise more questions than they answer, but I hope that the selected themes illustrate the potential of zooarchaeology to address a wider range questions than it traditionally has in Etruscan archaeology.

6.2 PIGS ON THE PERIPHERY

6.2.1 A penchant for pork

The emphasis on pig production and the relative increase in this species through time place Forcello firmly within the broader network of northern Etruscan cities; yet, the relative quantity of pigs at Forcello remains unparalleled in Etruscan times. De Grossi Mazzorin's (2001a; 2004; 2009) proposal that intensive pig breeding expanded in order to supply meat to growing urban populations would apply to major urban centers like Rome and Bologna; however, it is unlikely that Forcello, a site on the northern periphery of Etruscan territory only twelve hectares in size, faced the same demographic pressure as these larger, ancient cities. Additionally, the pig mortality pattern from Forcello does not suggest intensive breeding, because a quarter of pigs were not killed until after the first stage of adulthood. The specialized focus on pig production, therefore, is unlikely to be linked to the same demographic trends as central Italy or to the same pressures as very large urban settlements. Instead, the one reason for the marked presence of pigs at Forcello likely relates to the local environment. Environmental evidence has demonstrated that Forcello had access to ample tracks of mature forest (Castelletti and Rottoli 1988; Cremaschia et al. 2006; Ravazzi 2010), a landscape well suited to pig rearing. Bronze Age sites in the region have varying pig frequencies, but the only two sites that have pig frequencies over 40%, Canar and Poggio Rusco, also lie in the central part of the Po Plain; Poggio Rusco is only about thirty kilometers from Mantova. Later authors confirm the suitability of this region for swine husbandry during Roman period. In the second century BC, Polybius (*Histories* 2.15) describes the abundance of the Plain and its suitability for pig-keeping:

> *...the amount of acorns grown in the woods dispersed over the plain can be estimated from the fact that, while the number of swine slaughtered in Italy for private consumption as well as to feed the army is very large, almost the whole of them are supplied by this plain* (Paton 2010: 303).

Polybius (*Histories* 12.4.8) also notes, with some hyperbole, that the same areas interested in pig production during the Etruscan period continued to focus on this species in later times:

> *For owing to the large laboring population and the general abundance of food the herds of swine in Italy are very large, especially in Gallia, so that a thousand pigs and sometimes even more are reared from one sow* (Paton 2011:34).

The importance of northern Italy for pig rearing and the impressive size and productivity of its pigs are echoed by Varro (*Rerum rusticarum* 2.4.11–12):

> *The Gauls usually make the best and largest flitches of them; it is a sign of their excellence that annually Comacine and Cavarine hams and shoulders are still imported from Gaul to Rome. With regard to the size of the Gallic flitches, Cato uses this language: 'The Insubrians in Italy salt down three and four thousand flitches; in spring the sow grows so fat that she cannot stand on her own*

> *feet, and cannot take a step; and so when one is to be taken anywhere it is placed in a wagon.'..."I recall that I went to look at a sow which was so fat that not only could she not rise to her feet, but actually a shrew-mouse had eaten a hole in her flesh, built her nest, and borne her young. I have heard that the same thing occurred in Venetia."* (Hooper 1960:355–357).

Considering the evidence for mature forest in the Etruscan period and the long history of pig husbandry in the lower Plain, the inhabitants of Forcello probably capitalized on the local environmental situation. The mature oak-hornbeam forest of the Po, with its abundance of acorns, would have supported the large-scale pig production at Forcello and other urban northern sites. But environment and demography are not enough to explain the sudden and striking emphasis on pork consumption. High pig frequencies are also present on other non-urban sites in the Etruscan period. Case Vandelli, an Etruscan farmstead near Modena, has species frequencies that resemble those of Marzabotto, and pig frequencies climb significantly in the small Apennine sanctuaries at Poggio Colla (Trentacoste 2013) and Monte Bibele (Curci et al. 2000; Curci et al. 2006).

Rather than only reflecting the size or geographic location of Etruscan sites, species frequencies on northern Etruscan settlements also share some links with major networks of exchange. Instead of evidencing demographic pressures, livestock frequencies at the small settlements of Case Vandelli, Poggio Colla, and Monte Bibele may reflect specific Etruscan dietary preferences. These sites lay along major routes linking Spina to Fiesole in central Italy via Bologna and Modena. Northern Italian sites farther from these trade routes, like Arginone and Misera Vecchia, San Claudio, Casale di Rivalta are less interested in emphasizing pig production. The correlation of pig consumption with these exchange pathways further suggests that decisions about diet were not simply a product of environmental conditions.

Additionally, while the forests of the Plain were well-suited to swine rearing, a focus on pig production was not dictated by agricultural constraints. Over two thirds of the Plain is occupied by deep loamy soils with good water retention – optimal conditions for agriculture and cultivation of a wide range of crops (Giupponi 2000) – and classical authors attest to the fertility of the Po Plain and its suitability for both farming and herding (Camporeale 2011:397). While the Etruscans would have inhabited a Plain that was more densely forested, once cleared the land would have been extremely productive. Equally, archaeological evidence of extensive caprine pastoralism by the *terramare* and historical testament from later authors of sheep herding in the same region illustrate that pig rearing was not the only, or even the most obvious, mode of subsistence available to Etruscans living in the Po Plain.

While there is no scientific data for human diet specifically in the Po Plain, studies of Etruscan populations elsewhere indicate that Etruscans ate a mixed agriculturally based diet that was not heavily dependent on meat. Zinc and strontium levels in human remains from Tarquinia support a diet rich in cereals and vegetables, with less meat consumption than in Athens during the same period (Forniciari and Mallegni 1987). Scarabino et al.'s (2006) isotopic study of

Etruscan remains from southern Italy demonstrated a mixed diet based on plants, supplemented by the consumption of herbivorous animals. However, Kron (2012) points out that because the study has not been controlled with isotopic values from ancient animals, the results may not necessarily be inconsistent with the consumption of a significant amount of meat from livestock. Meat consumption increases in the Roman period (Forniciari and Mallegni 1987), but the Etruscans appear to have enjoyed slightly better health and nutrition (Kron 2012). Marine foods made a significant contribution to the diet of two individuals at Populonia in the second century AD (Scirè Calabrisotto et al. 2009), but their reliance on meat from domestic livestock is more obscure. While the overall evidence on this topic is limited, none of the existing studies point to a diet heavily dependent on meat.

Therefore, the emphasis on pig rearing and pork consumption appears to be a matter of cultural preference enhanced, rather than dictated, by local conditions. We already recognize the appetite for pig meat as an integral part of Roman culture. By the end of the first millennium BC, pork had become central to the Italian diet (de Grossi Mazzorin 2001a; 2004; 2009; Minniti 2012), a position linked to both cultural preferences and economic pressures. Pig frequencies in central Italy increase from an average of around 30% in the eighth to fifth centuries BC, to 40% in the third and second centuries. This trend is especially notable in later Roman contexts, where, by the last few centuries of the first millennium BC, pig frequencies are consistently higher than 60%. Pig frequencies over 70% are common on imperial Roman sites in the first and second centuries AD, and increased pork consumption can be associated with the 'romanization' of provincial peoples (King 1999; MacKinnon 2001). Well in advance of these developments, a similar taste for pig meat appears to have developed in northern Italy by the sixth century BC. Because we lack zooarchaeological data for the Final Bronze and early Iron Ages, a period integral to the formation of Etruscan culture, we are unfortunately unable to trace the specific origins of this dietary trend further back in time. Nevertheless, the amplitude of pig frequencies in sixth–fifth centuries BC on northern Etruscan sites implies a well-developed dietary preference and husbandry system. The data from Forcello and other northern sites clearly demonstrate that the wider Italian interest in pig meat dates back to the Etruscan period.

Demographic changes and access to particular environments were clearly two factors that influenced the move toward large-scale pig husbandry; however, they are not enough to explain its dramatic expansion or persistence through time. Zooarchaeology shows us that there were a myriad of ways to feed people both in and out of cities; the Etruscans and Romans decided on a solution that suited them culturally, as well as economically. Because food is such an integral part of culture and commerce, unraveling the ephemeral pressures and preferences behind the construction of this foodway is of central importance to both Roman and Etruscan studies. Whether or not the expansion of swine rearing in these two cultures is an affiliated or a separate phenomenon has serious implications for our understanding of the evolution these two peoples.

The rest of this section explores other possible factors that may have influenced the development and exploitation of pigs in central and northern Italy. Two distinct but inseparable spheres of Etruscan culture and subsistence are considered: 1) food production and distribution; and 2) religious activity and social display. Like many aspects of Etruscan society, trade, agriculture, and religious activity were controlled by the elites (Barker and Rasmussen 2000:215; De Grummond and Simon 2006:39; Riva 2010), and production/consumption, gifting/receiving, and sacrifice/feasting were all bound together. Concrete answers remain elusive, and none of the proposed models completely explain the situation – most likely all of them contributed to some degree. The data presented and analyzed in this dissertation cannot hope to solve this Etruscan mystery, but it does allow a new discussion of Etruscan subsistence, trade, religion, and identity.

6.2.2 Food production and the expansion of trade

The increasing frequency of maritime and terrestrial trade and the expansion of trade networks during the Early Iron Age and Etruscan period would have required ever larger amounts of preserved foods. Body part distribution at Forcello does not indicate the export of pig meat, but in the Roman period pork was generally boned before being preserved (Columella, *De Re Rustica* 12.55.1). If cities and towns acted as processing and distribution centers for the export of preserved meat off the bone, either to other regions of Italy or further afield, it would leave a pattern very similar to that visible at Forcello – where one species is emphasized without evidence for differential transport of different body parts. (Of course this would require more or less all exported meat to be removed from the bone). Additionally, sealing items in lard (pig fat) would have been a primary means of food preservation in the ancient world alongside salting, smoking, drying, and pickling – techniques expressly mentioned by later Roman authors (cf. MacKinnon 2004a:173–174). Further evidence for the use of pork fat is provided by tablets from the first century AD Roman fort at Vindolanda in Britain which demonstrate that pig fat was a commodity traded separately from other pork meat (TVII Tablet:182). Even today pig fat remains important in many parts of the Mediterranean because of its ability to preserve and flavor foods (Albarella et al. 2011; Halstead and Isaakidou 2011). Lard's usefulness was not limited to culinary purposes; it was also burnt in lamps, applied to care for leather, used as grease, and made into ointments for cosmetic and medicinal use. Animal fat was also an essential ingredient in soap, an invention Pliny attributes to the Celts (Pliny, *Natural History* 28.191; Aretaeus, *The Cappadocian* 2.7). Based on these authors' remarks, this sort of soap does not appear to have been widely used by Romans, and we have no idea if the Etruscans also used these products.

Many of these uses of lard overlap with those of olive oil, but in regions where olives were difficult or impossible to grow, animal fats, especially those from pigs, would have been an important ingredient in a range of foods and products. The Po Plain and central Europe were areas where olive oil was primarily imported, and animal fat would have been its primary substitute. As Archaic Italy witnessed an increase in trade, expansion of industrial activity, and growth of the middle classes – three areas that utilized fats from either vegetable or animal sources – the demand for these ingredients would also expand. Problematically, animal fats are archaeologically invisible in pre-Roman Italy. Few scientific studies have investigated Etruscan materials with modern techniques, and only two studies investigate organic compounds in Etruscan vessels. One study, by Garnier et al. (2002), identified the presence of beeswax in an Etruscan cup. More recently Colombini et al. (2009) studied the composition of ointment found in an Etruscan tomb at Chiusi. The ointment was contained within an alabaster *unguentarium* (small oil/ointment jar) from Egypt. This ointment had a vegetable oil base, probably from the moringa tree. Considering the exotic origin of both the ointment and the vessel, both were probably made in Egypt and imported to Etruria. No similar studies of lipids in ceramics or the use of animal fats have yet been conducted.

While we lack direct evidence for fat exploitation in the past, we may be able to find parallels in the use of another important ingredient – salt. Like fat, salt was instrumental for preserving foods in the past. Food conservation was not its only use, however, and salt was also important to human and animal nutrition, tanning, and cloth dyeing (Barber 1991). For all of these reasons, by the Early Iron Age salt was already a valuable resource. Classical authors trace conflicts over salt production between Rome and Veii to the time of Romulus (cf. Camporeale 2011:53). (However, currently no archaeological evidence of these sites has yet been uncovered (Attema and Alessandri 2012)). By the Roman period salt had become central to the preservation of pig meat, and the link between pork and salt is particularly strong in northern Italy. The quotes presented above illustrate the region's important role in pork production, and Strabo tells us that "Rome is fed mainly on the herds of swine that come from there" (*The Geography* 5.1.12). Varro (*Rerum rusticarum* 2.4.11–12, see above) also speaks about the movement of significant quantities of pork meat from northern Italy to Rome, and he expressly states that the meat was salted. A connection between salt production and the mass export of pig meat also exists in the case of the famous Menapian hams from the Belgian/Dutch coast. These hams are noted as being the highest quality in the Price Edict of Diocletian (4.8) and Martial's Epigrams (13.54); that area of the coast was also home to a salt industry (Thoen 1975; Besuijen 2008). The close association of pigs and salt even colored popular culture. Cicero (*De Finibus* 5.13) in his discussion of animal intellect states that:

> *…hence it is cleverly said, as I think, about the pig; that a mind has been bestowed upon this animal to serve as salt and keep it from going bad* (Rackham 1914:435).

This pithy saying is echoed by Pliny (*Natural History* 8.207). While this expression certainly speaks to the Roman opinion of pig intelligence, it also illustrates the very intimate relationship between swine and salt.

The Etruscan period was not subject to the same commercial and economic pressures that led to the wide-scale meat trade of the final century B.C. Equally, we have no evidence for specific Etruscan culinary or preservation practices that would allow us to freely apply Roman history to this very different people. What is visible, however, is the expansion of European salt production and trade over the first millennium BC (Nash Briggs 2003). Considering the close link between salt and meat preservation and the many non-culinary uses of both salt and lard, perhaps we can infer, in tandem, a similar expansion of salted pork production and trade over the same period. Problematically, in central Italy evidence for salt production is available for the late Bronze Age, but it becomes obscure in the Iron Age and Etruscan period – possibly because a change in production to a less archaeologically visible method (Attema and Alessandri 2012). However, considering the archaeological evidence for Bronze Age salt production in Italy, the historical testament of a struggle over this important resource in Italy during the Iron Age, and the vast expansion of salt production and trade in central Europe, it is probably safe to assume a similar expansion in salt usage during the Etruscan period because of its many culinary and industrial uses. Like salt, pig production and consumption, especially in northern Italy, may have expanded for similar, if not interconnected, reasons.

6.2.3 Elite expression and religion influence

Religious or elite influence may have been another factor that contributed to the rise in pork consumption. The association of pig consumption with elite Etruscan society relates to the model already proposed by de Grossi Mazzorin. All of the early central Italian sites where pigs predominate are population centers (at least for their region) that faced unique provisioning challenges; however, as large, populous settlements they were also a focus for religious activity and social display, and for the powerful and high status families that controlled these areas of Etruscan society. In tandem with settlement nucleation and population increases, Etruscan culture became increasingly concerned with the articulation of social differences (Izzet 2007). Considering the pervasiveness of this distinction throughout Etruscan material culture, iconography, and architecture, food seems another probable medium for expressing status and identity (cf. Harris and Ross 1987). Pigs were not widely consumed in the Early Iron Age, and increasing their culinary use would have been a simple way of introducing a degree of difference to a plant and caprine-focused diet. In this scenario, we see pig consumption move from an activity with religious or elite connotations to a more democratic affair – one in which the adoption of the practice is based on differences in class or status, rather than population size or density. At this point it is important to draw a distinction between Etruscan religion and animal consumption and the role of meat in the Greek world, where some scholars have argued that all (or nearly all) meat derived from sacrificial animals consumed in a ritual context (cf. Ekroth 2007). There is no evidence for meat consumption being limited to the religious sphere in Italy. Thus, the increased consumption of pig meat should not be seen as an expansion in the ritualized or non-domestic consumption of pork; rather it could be interpreted as the diffusion of a practice popularized by the Etruscan elite who controlled religious centers. Temples and sanctuaries provided a forum from aristocratic material and political display, and they acted as redistribution centers (Becker 2009). Practices in these religious spaces formed a “meaningful and constant element of Etruscan socio-economic life” (Becker 2009:97), and the food consumed in an elite religious sphere or supplied to the populous by temples/sanctuaries may also have influenced wider Etruscan non-elite and secular habits.

The selection of pig meat for this purpose would not have been coincidental. Animal sacrifice in Etruscan Italy is not well understood, and sanctuary and domestic debris overlap to a large degree (Rask 2014). Still, if one animal separates itself from the others in Italian religious contexts it is the pig. The use of pigs in cultic and ritual activity has deep roots in Italian prehistory (Wilkens 1995; de Grossi Mazzorin 1997b), and archaeological and historical evidence point to pigs as the preferred victim in many Etruscan sacrifices (Donati and Rafanelli 2004:57). Zooarchaeologically, this concern manifests itself in the differential treatment of pigs and their remains, rather than the simple quantity of pigs slaughtered. Pigs are not always the most prevalent species in religious contexts (e.g. Wilkens 2009), but other features mark them as unique and important offerings. Pig canines from Tarquinia and Veii bear traces of red pigment (Bedini 1997; de Grossi Mazzorin and Cucinotta 2009), and pig remains from San Omobono (Tagliacozzo 1989) and Este (Balista et al. 2000; Fiore and Tagliacozzo 2002) evidence the sacrifice of pregnant and neonatal animals. Of course, high status people were not the only individuals sacrificing animals in pre-Roman Italy, but the close association of elite families with Etruscan religion practice and display – most notably those of writing and the definition of sacred areas (typified by the monumental Complex at Tarquinia) (cf. De Grummond 2006) – firmly places the ritual use of animals within their sphere of influence.

The Final Bronze Age site of Sorgenti della Nova is the first settlement in central Italy where pigs emerge as the dominant species. A major feature of this site is the hypothesized use of cave 10 as a focus of cult activity, in particular the sacrifice of an exceptional number of very young pigs (de Grossi Mazzorin and Minniti 2002; de Grossi Mazzorin 1998). Significant pig frequencies next appear at Rome in the ninth–eighth centuries BC on the Palatine Hill, an area that became the home of elite residences and one historically associated with the founding of the city (Grandazzi 1997). The animal remains presented in the report derive from the area surrounding several huts excavated in front of the later Temple of Cybele (Puglisi 1951). Likewise, Rome’s Velia hill also had a symbolic character, and it supposedly housed the residence of Rome’s third king in the seventh century BC (e.g. Cicero, *On the Commonwealth* 2.53; Vout 2012:78). Whether or not king Tullus Hostilius did indeed live there, activity on the Velia would have been closely linked to that of the Palatine, the larger hill with which it connects and an on-going center of high-status activity. Roselle, another central Italian site with high pig frequencies, was also a population center that saw changes in social stratification, and the excavation within the city walls of impressive houses and banqueting vessels (Camporeale

2011:349–356) indicates that here too we are dealing with people of a relatively elite class. In the fourth century BC, exceptionally high pig frequencies are visible in Pozzo 469 at Veii, a well associated with cultic activity; material from the acropolis, dated several centuries earlier, does not demonstrate the same trend (cf. Table 2.1.3). The animal remains from two of these sites are distinguished from typical domestic debris by another feature: Sorgenti della Nova and Velia in Rome represent also exceptions to pig body part distribution trends. Unlike on other sites of the period, anterior pig limbs are more prevalent than the posterior (Minniti 2012).

Even in smaller settlements the appearance of significant pig frequencies can be linked to high status and religious characteristics. San Giovenale is a small site compared to Etruria and Latium's coastal cities, but it was a center of activities for the interior of southern Etruria. Pig frequencies increase in the seventh–sixth centuries BC – the same period that "new fashions and probably also ideas poured into the life of the community and were assimilated" (Pohl 1981:84) and a spring sanctuary became archaeologically recognizable on the site. Interestingly, while rising pig frequencies are notable in habitation contexts, the animal bones from the spring building are characterized by an elevated presence of cattle bones and deer antler fragments. However, considering that San Giovenale's Etruscan identity maintained "a strong Faliscan flavor modified…by lingering primitive local characteristics" (ibid.), cult activity may have been slower to respond to outside influence than culinary practices.

In the Po Plain, high pig frequencies in the eighth and seventh centuries BC are less clearly associated with religious and elite areas. The faunal material from Bologna - Castenaso was recovered from an area characterized by refuse pits and artisanal debris. Animal remains from Bologna - Via Foscolo-Frassinago may be more related to elite consumption because they came from a preferential location at the center of the settlement. If there ever was an association between pigs and high status/religious contexts in northern Italy, it appears to have been lost by the sixth century when significant pig frequencies are visible on small villages and farmsteads with no elite or cultic connections (e.g. San Claudio and Mirandola - Barchessone Barbiere). Thus, while in central Italy a link is visible between social stratification and ritual activity on the one hand and pig consumption on the other, a similar situation does not appear to be present in northern Italy during the mid and late first millennium BC.

6.2.4 A matter of taste

Lastly, we must consider the growing popularity of pork products simply as a matter of taste, or at least as a preference not primarily based on environmental or social determinants. Today pork products certainly inspire a level of enthusiasm unparalleled by other cuts: bacon currently has over six million 'likes' on Facebook; hamburgers, beef, chicken, and lamb do not even come close. Many people find that the addition of even a few lardons enhances many dishes – perhaps the people in the past felt the same. Likewise, a distaste for other fats may have led to a greater reliance on lard. Pork fat may have been in high demand in northern Italy because of a Celtic aversion to olive oil. Dietler (2010) points out that, despite the enthusiastic adoption of wine, Celts in southern France did not equally embrace olive oil. Writing in the third century AD, Athenaeus notes that the Celts "used not oil, on account of its scarcity; and because they are not used to it, it seems disagreeable to them" (*Deipnosophists* 4.36). Of course, the applicability of this comment to the sixth century BC is tenuous, especially given the archaeological evidence for oil pressing and olive stones on Celtic settlements in France (Dietler 2010:230). However, these remains are not extensive, and olive oil may have been consumed by Greek traders or residents, made into sauces like *garum* for export, or used for non-culinary purposes like lamp oil. But if we do believe the words of Athenaeus, lard would have been of even greater importance in northern areas of Italy, because of its larger Celtic population. A similar situation may have also existed in the Languedoc-Roussillon region of France, were pig frequencies increase with Etruscan influence (Columeau 2002).

Many Etruscan culinary traditions are difficult to detect archaeologically, and without written sources we are unable to closely trace changing tastes in the past. Like many characteristics of Etruscan civilization, the more nuanced aspects of food culture will likely remain invisible for some time. At some sites the shift toward greater pig consumption (an animal raised exclusively for meat) may imply an increase in overall meat consumption more generally, but without a clear understanding of the economic and cultural factors that underlie this shift, we cannot assume a universal increase in meat consumption. Likewise, it is difficult to articulate precisely how an increase in pork consumption altered the existing Italian diet (other than the obvious increase in pork). Different cuts and animal parts have distinct culinary characteristics and nutritional values, and we are unable to pinpoint the period of time underlying individual animal consumption (days versus months) and how many people were consuming each animal. Without sources to comment on Etruscan approaches to food, feasting, and raw ingredients, it is also difficult to conceptualize the broader role of meat in society and the significance of dietary changes even when we are able to identify them archaeologically. However, there is hope that some these questions may be answered in the future. In some circumstances, zooarchaeology is able to provide evidence for differing meat preparation practices (Isaakidou 2007). New scientific methods, like lipids analysis, are also proving useful on other Iron Age sites (Copley et al. 2005), and interdiciplinary studies are revealing new data on food preparation in the Roman world (Banducci 2013). Further isotopic studies, which are currently limited (see pages 201–202), could also shed new light on the contribution of meat to the Etruscan diet.

Regardless of the motivation behind these changes to the Italian diet, the origin and timing of these shifts in consumption is of great archaeological interest. Food is a fluid means of expressing, differentiating, and reinforcing individual and cultural identity (Koestlin 1981), and ccontextualized with contemporary assemblages, the animal bones from Forcello have demonstrated that later 'Roman' dietary patterns are in fact already presented in the Etruscan Po

Plain. We might assume that Roman and Etruscan habits are in some way linked, but further work is needed to examine *if*, *why* and *how* they are. The development and exchange of dietary practices, just like the creation and movement of other, more archaeologically visible, materials, has implications for our understanding of the relationship between areas of Italy over the first millennium BC. The development of these practices north of the Apennines challenges a traditional model in favor of a more balanced exchange and an intimate relationship between northern and central Italy and lends further support to the idea recently proposed by Perkins (2013) – that these mountains acted as a link, rather than a boundary, between two zones of Etruscan Italy between the seventh to the fifth centuries BC.

6.3 SECONODARY PRODUCTS, SPECIALIZATION, AND IMPROVEMENT

6.3.1 Caprine specialization

Another interesting result from zooarchaeological analysis at Forcello was found in sheep and goat mortality patterns. For the first time in pre-Roman Italy, we are able to separate sheep from goat kill-off curves. These identifications were made possible through the especially large sample available at Forcello and the application of recent sheep/goat identification criteria for teeth (see section 3.5.2). Although zooarchaeologists have long hypothesized the increasing importance of secondary products over the Final Bronze and Iron Age based on sheep/goat mortality profiles (de Grossi Mazzorin 2001a), Forcello provides the first Etruscan site where this specialization is clearly visible. Sheep and goat remains from the site show that a well-developed and species-specific management pattern was in place on the margins of Etruscan civilization in sixth–fifth centuries BC. Of the two species, the kill-off pattern for sheep is of particular interest for two reasons. Firstly, it confirms the importance of wool production and the conscious management of sheep for this product; secondly, the mortality profile also emphasizes milk and lamb production, a product hitherto not widely discussed in an Etruscan context.

The zooarchaeological evidence for the exploitation of secondary products complements Forcello's material culture. Loom weights were recovered from houses of Phase C and F in sector R18 (de Marinis 1988c; Vay 1988; Casini et al. 2007). This material was preserved *in situ* during the destruction of the building, and the limited spatial distribution of these weaving implements suggests an area dedicated to textile production. The especially large number of used looms weights from the phase C house and the variety of the shape and weight suggests that the house was also a textile workshop, producing a range of textiles of different types or qualities (Vay 1988). Interestingly, the inhabitants of this house were not equally concerned with spinning, and despite the recovery of over a hundred loom weights, no spindle whorls were recovered from the structure. Spinning seems to have taken place elsewhere, implying a well-organized and differentiated system of production. This evidence for organized textile production in Forcello's material culture mirrors that seen in caprine bone data. Thus, it seems likely that the settlement was producing textiles for consumption outside individual households, probably for local exchange, if not trade further afield.

The identification of a focus on wool production at Forcello has important implications for a growing field within Etruscan studies – textile production and trade. Although the Etruscans also wore linen cloth (Gleba 2012a), wool was major textile material in pre-Roman Italy, especially for clothing (Gleba 2008b). Unlike plant fibers, wool has the ability to felt, is an excellent insulator, and can easily be dyed to a range of bright colors. Analysis of ancient wool fibers supports zooarchaeological evidence and suggests the development of sheep for wool between the Final Bronze and Roman period (Gleba 2012b). Weaving was an important social, economic and ritual activity in Etruscan culture, and textile trade was a significant part of the Etruscan economy (Gleba 2000; 2007a; Meyers 2013). Luxury textiles embellished with gold would have been particularly valuable in elite exchange (Gleba 2008a), and weaving and spinning equipment made from valuable materials mark high status burials (Gleba 2008b:171–178). Textile production equipment is also found in sanctuaries, where weaving tools have been recovered from votive contexts (Meyers 2013). Wool was not only a utilitarian product for household use, but also a valuable raw material linked to female identity, elite display, trade, and religious practice.

Like other forms of craft production, the scale of textile production expanded during the Etruscan period, presumably in tandem with the specialized exploitation of sheep. No centers of textile production existed in Bronze Age Italy, and weaving and spinning were done on a household or small workshop scale (Gleba 2008b:196; Nijboer 1998). In the Early Iron Age, a greater diversity of weaving tools appears, indicating the production of a wider range of textiles. Weaving tools also began to appear in burials, where they evidence textile production as an important economic activity and source of wealth. In the Orientalizing and Archaic periods, equipment clusters can be found inside houses (like at Forcello) and other structures. The appearance of object groups related to textile production illustrates the increasing scale of this practice and the creation of dedicated space for it within homes and workshops. The significant quantity of weaving materials recovered from Poggio Civitate indicate that centers of production, probably associated with elite households, had developed by the seventh century BC (Gleba 2007a). Weaving in this period also illustrates Celtic connections, and Etruscan iconography features cloth decorated with "plaids, diagonals, chevrons, diamonds, and elaborate borders," a significant feature of Etruscan textiles that is shared with Hallstatt cloth (Gleba 2008b:83).

Within this context the focused caprine management strategy at Forcello provides a good fit for the increasing evidence of textile production on a household or small workshop level. However, the exploitation and use of dairy products is less archaeologically visible in pre-Roman Italy. As discussed above, we lack scientific studies that analyze residues in ceramics for the Etruscan period. Without scientific studies, archaeologists have typically used the presence of perforated ceramic 'strainers' and 'milk boiling pots' as evidence of cheese production, although their actual usage is still debatable (Depalmas and di Gennaro 2013). However, the visibility of cheese in Roman historical sources implies that the Etruscans may have also been interested in dairying. In the third century BC, Cato (*De agri cultura* 76.2) references cheese making, including one cheese specifically made from ewe's milk. Columella (*De Re Rustica* 7.2.1) also notes that sheep were raised primarily for wool, but secondly for milk and luxury foods. Cheese was widely consumed in the Roman period both in soft and aged varieties (Frayn 1984:127–141), but further work on Etruscan dairying and dairy products is needed to contextualize this evidence.

6.3.2 Animal improvement – size change

Considering the evidence for specialization in sheep and goat husbandry, it is not surprising that an increase in sheep size is visible over the same period. Although body size is not directly linked to wool or milk production, the increase in sheep size over the Final Bronze and Iron Ages was probably connected to an increase in the intensity of caprine husbandry, if not from a conscious desire to increase carcass size. An interest in creating larger animals seems to be particularly applicable to the development of cattle during the first millennium BC. Unlike sheep, which improved at a fairly gradual pace, cattle size in central Italy increased comparatively rapidly during the fifth–third centuries BC. This increase may have been driven by a demand for meatier animals, a decision to invest in a smaller number of large animals, or an intensification of agricultural production (King 1978:216; MacKinnon 2004a:92). This last explanation was probably at the heart of the issue. Cattle provided the primarily source of farm labor; horses were not involved in agricultural production until the later Roman period (de Grossi Mazzorin 1996d; Langdon 2002). The small number of horse remains recovered from Etruscan settlements including Forcello alludes to their place as elite animals. Instead, draught cattle would have been in high demand, particularly in central Italy were wealthy Romans had gained control of extensive estates on the *ager publicus* (Stockton 1979).

The introduction of breeds from elsewhere may also have contributed to the development of animal size change. Archaeology has provided ample information on the movement and settlement of populations and individuals in northern Italy during the first and second millennia BC. In addition to their traditions and belongings, these people also would have brought animals to the Po Plain. Zooarchaeology has produced some information on the introduction and movement of people and livestock around the Italian peninsula. Clear indications of this change are the appearance sudden changes in bone and horncore shape. In central Italy, the greater variability of sheep size in the Final Bronze and Iron Ages may signal the introduction of new animal types. Northern Italian cattle and sheep increase in size around the same time, so that larger forms are common by sixth–fifth centuries BC. At the same time, Greek colonists were introducing animals to other parts of Italy (Sanford 2012). They, as well as the Etruscans, probably brought animals to the Po Plain. Likewise, dog biometry from Forcello also indicates links with Central Europe.

One of the most interesting results of biometric analysis was from a species that did not change in size – pigs. Unlike cattle and sheep, which developed over the Late Bronze and Iron Ages and later during the Roman period, pig size does not change. Rather, it remains fairly constant, if geographically variable, during the same period in which swine became systematically exploited by Etruscan and early Roman populations. The differences between biometric trends in pigs and bovids suggest an intrinsic separation in the management of these animals and attitudes towards them. Despite an increasing reliance on pig husbandry, people were not interested in developing animals that were osteologically larger. A number of reasons may have affected this practice. Pigs were often kept free-range rather than in pens, and it may have been impractical to extend tight control over reproduction. However, the clear separation between domestic and wild pig populations suggests some control over pig breeding. Perhaps concerns over pig reproduction may have focused on osteologically invisible attributes, like the quantity or quality of fat on each animal or the number of offspring they produced. Alternatively, the Etruscans may not have been interested in manipulating pig reproduction for improvement purposes. This attitude would be very different from that of the Romans and more line with earlier prehistoric cultures.

6.4 DOGS FOR DINNER

The previous chapter provided comparative examples of butchered dog bones and evidence of dog consumption from Etruscan Italy and neighboring cultures. These comparisons point to ties with central Europe rather than practices from Etruria and Greece. The material culture recovered from Forcello also supports a link with Celtic populations and even provides evidence for the presence of Celts within the settlement. While Greek imports constitutes the main foreign presence at the settlement (de Marinis 2007c; 2007d), small metal finds demonstrate the presence of people from elsewhere in the Po Plain, the Alps, and central Europe (de Marinis 2007a; 2007f). Metal goods and ceramics from Forcello indicate a particularly strong commercial relationship with the Golasecca culture, which inhabited the area around Lake Como (Marinis 1987); these people mediated trade moving up from the Po and into/out of central Europe. If found, evidence of dog consumption on Golaseccan sites would neatly explain the appearance of this practice at Forcello. However, Golaseccan sites have produced very few faunal remains, and butchered dog bones are not present in this small amount of material (Boscato and Casini 1999). Strong comparisons come from further afield – in France, at Levroux (Horard-Herbin 2000) and Villeneuve-Saint-Germain (Yvinec 1987), and in Eastern Europe at Liptovská Mara (Chrószcz et al. 2013). However, if this lack of evidence does indeed reflect the situation in the past, it does not necessarily discount a Celtic origin for this practice at Forcello. Fibulae types from the site illustrate a broad range of Celtic associations, including the presence of people from Hallstatt and La Tène cultures (de Marinis 2007a), where the consumption of dogs is securely documented.

While the archaeological material illustrates the presence of Celtic individuals and a link between Central European cultures and dog consumption, it is less able to explain why this practice, so abhorrent to the Romans, was acceptable in neighboring areas. The use of dogs in Italian cultic activity (Wilkens 2006; de Grossi Mazzorin and Minniti 2006; de Grossi Mazzorin 2008; Donati and Rafanelli 2004) and their deposition in graves (de Grossi Mazzorin and Minniti 2001a; Amoroso et al. 2005; de Grossi Mazzorin 2001b; Gräslund 2004) does not differ significantly from Celtic practices. The attitudes of central Europeans toward their dogs also appears very similar to that of the Etruscans; in both regions dogs occupied similar roles as hunting companions and guardians, and they were frequently associated with the underworld and chthonic deities (Kmeťová 2005; 2006). Just as in the discussion of pork consumption above, zooarchaeology is able to identify a trend associated with a particular group of people, but the material remnants of the past remain silent on the meaning of these practices.

6.5 AMONG THE ANIMALS: INFANT HUMAN REMAINS

6.5.1 Infant burials in context

Although they fall outside the zooarchaeological focus of this dissertation, the perinatal human remains recovered from Forcello offer a suggestive glimpse at concepts of cultural and individual identity within the settlement. Funerary practices, like diet, can help in delineating archaeological groups, and the post-mortem treatment of infant remains provides evidence for the start of public personhood (Lagia 2007). A broad discussion of these topics is beyond the scope of this dissertation, and a detailed analysis of these contexts and their full complement of materials is not possible at this point. However, some exploration of the meaning and significance of these infant remains is necessary in order to contextualize a theme more in line with the zooarchaeological nature this dissertation: the production, treatment, and disposal of domestic and symbolic debris in an urban Etruscan setting. The repeated recovery of infant remains mixed with faunal material asks two parallel questions: Were these infants treated like domestic rubbish and simply thrown away? And if they were not disregarded as waste, how should we interpret variety of contexts from which they are recovered?

The recovery of such a great number of infant human remains from the within the settlement challenges our understanding of the separation between domestic and funerary debris and our ability to appropriately identity and excavate this material. While the quantity of infant remains recovered from Forcello may initially seem disproportionately large, it is not incongruous with our understanding of infant mortality. Perinatal mortality (defined as the third trimester to one month of age) was high in the past, and it remains significant in pre-industrialized societies (World Health Organisation 2006). Estimates for Roman Italy as many as a third of children died in their first year (Hopkins 1966). Despite the expectation of high mortality rates, infant remains are present in cemeteries in varying proportions, and they are frequently underrepresented in pre-Roman necropoli in central Italy (Bietti Sestieri 1992; Becker 2007; 2011), although such graves are not entirely unknown (e.g. Etruscan Tarquinia and Veii, Bietti Sestieri 1992; Pacciarelli 2001; Trucco et al. 2005). While collection or preservation bias may contribute somewhat to the preferential recovery of adults, these issues are not enough to account for the overall lack of infant graves, and the vast majority of Etruscan children must have been deposited outside of known cemeteries (Becker 2007). Investigators agree that these remains are often underrepresented, but no consensus on their real location has yet been reached.

Several possible explanations exist. One proposed location for these individuals is in special cemeteries for children or in specific areas of larger adult cemeteries (Becker 2007; cf. Carroll 2012). An infant cemetery dated to the Late Roman period has been unearthed in Lugnano, near Terni (Soren and Soren 1999); however, the excavators believe the cemetery was constructed in response to an epidemic, so it does not necessarily reflect typical mortuary practices of the time. In addition, it is much later in date than the material at Forcello. Other infant cemeteries dated to the Late Iron Age and Roman period have been found outside of Italy (Becker 2007; Beilke-Voigt 2008), but nothing similar has so far been noted within Etruscan culture.

A second, and more plausible, location for these remains is within settlements. The previous chapter outlined the ample archaeological testament for this practice in central Europe and the growing body of evidence for infant burials in pre-Roman settlements in Italy. Interestingly, infant burials in cemeteries decrease over the same period. In central Italy, changes in the treatment of infant remains begin in the Late Iron Age, when burial practices shift in from elaborate child/infant burials (for individuals less than twelve years of age) to older groups. At the same point, child and infant burials within settlements increase (Bietti Sestieri and De Santis 1985; van Rossenberg 2008). Zanoni's (2011) recent work illustrates a similar situation north of the Apennines. This change implies an increased focus on the social standing of the deceased who had reached a marriageable age, and perhaps a decrease in the public/social role of the youngest family members (Bietti Sestieri and De Santis 1985; Modica 1993). The infant bones from Forcello and the recent discovery of similar remains at Poggio Civitate provide new evidence of infant deposition within Etruscan settlements during the first millennium BC. Furthermore, while the quantity of remains is not enough to definitively resolve the location of underrepresented infant skeletons, their recovery from mixed faunal remains illustrates that they are systematically missed in the field, even during modern excavations. The difficulty of identifying these remains during excavation and their restriction to specialist reports further contributes to the low profile of infant burials within settlement contexts (Crawford 2008:199).

On the whole, the recovery of infant remains from within settlement contexts is not unexpected in pre-Roman Italy; although it appears to be less common in southern Etruria than in northern Etruria and the Po Plain. However, it is difficult to appreciate whether the lack of these individuals relates to differences in burial practices or taphonomic factors. For example, excavations at Marzabotto began in the nineteenth century, and other northern Etruscan settlements at Bologna, Reggio Emilia, Casalecchio di Reno, and San Polo d'Enza were first investigated in the mid-twentieth century or earlier. While these sites have yielded adult human remains, infant burials could easily have been missed, especially if disarticulated or mixed with other materials. The relatively recent discovery of human remains mixed with animal bone deposits at Forcello, Poggio Civitate, and Bologna (Via Foscolo-Frassinago) illustrate the continuing difficulty of identifying these features in the field. In an age when animal remains and other 'unimportant' materials were routinely discarded, it is easy to imagine that infant remains in mixed or un-prepared contexts were routinely missed. Additionally, the recovery of infant remains would also be affected by the focus of excavation (on temples or elite residences) and the length of occupation and continued redevelopment of the site (which would displace earlier burials). In general, animal bone assemblages are smaller in central than northern Italy, which would also result in a lower quantity of infant remains. For these reasons, it is difficult to determine if geographic differences in infant settlement burials relate more to bone degradation, recovery techniques, or documentation practices, than to past behaviors.

6.5.2 Rubbish or ritual?

The deposition of infants within northern Italian and Celtic settlements was widely practiced, and while the presence of infant remains within settlements is non-controversial, the significance of their presence in refuse areas and other domestic contexts is less clear. When present within settlements, infant remains are typically found in association with floors, walls, and other aspects of domestic architecture. However, a number of the infant remains from Forcello depart from this model, and the recovery of partial skeletons from rubbish deposits suggests they might have been thrown away or otherwise treated like domestic debris. This interpretation was proposed for one-hundred-plus infants found in late Roman sewer at Ashkelon, Israel. Like Forcello infants, the infants were around neonatal age, and Smith and Kahila (1992) argued that infanticide was the only plausible explanation for the recovery of so many newborns from a gutter. A similar line of reasoning has been employed in Roman Britain on sites where infant remains have been recovered from within the settlement and their age at death is focused around birth (Mays 1993; Mays and Eyers 2011). Because infanticide rarely leaves marks on the skeleton, it is difficult to detect osteologically (Scott 1999:67), and archaeological context and age and sex data provide the primary means of investigating this practice.

While it is tempting to draw parallels between the quantity and context of the infant remains from Forcello and these apparent examples of infanticide, other scholars have challenged these assumptions and presented a more convincing narrative of infant burial in Iron Age and Roman Europe. Firstly, Gowland and Chamberlain (2002) critiqued the statistical techniques used by Mays (1993) to estimate infant age at death and also challenged his use comparative data from twentieth century Britain to estimate natural mortality profiles. Although the original author replied to their statistical critique (Mays 2003), criticism of the basis of the paper – that only infanticide would result in an unnatural peak in neonatal deaths – was left unanswered. The modern morality data used in May's analysis showed an even distribution of infant deaths across the perinatal period. This data, however, has little relevance to the pre-industrialized modern world, let alone to the Roman period. In fact, even data from modern developing countries indicates the opposite. Early neonatal deaths (defined as occurring within seven days of a live birth) are roughly equal to the total number of fetal/still born deaths throughout pregnancy (World Health Organisation 2006).

Modern infant mortality data is also able to challenge another assumption made by Smith and Kahila (1992:669) for infants at Ashkelon. The researchers "dismissed the possibility that they were stillborn because of the large number of individuals represented." Modern infant mortality in the world's least developed countries fell from 199 deaths per 1000 live births to 113 between 1950 and 1990 (United Nations 2013). The fertility rate for these countries over the same period dropped from 6.55 to 6.2 children per woman. Even if we assume a low mortality and fertility rate of 110 and 6, respectively, approximately 167 women could account for the number of infants recovered from Ashkelon. Over a century timescale, several generations of even a small population could be subject to this number of deaths without resorting to infanticide. That is not to say that this practice never occurred. As Mays (1993) points out, infanticide is well attested to in historical sources and myth. Modern data shines some light in this area as well; in 2008 approximately 40% of pregnancies in less developed regions were unintended (Singh et al. 2010). The applicability of this statistic to the Etruscan and Roman world is questionable, but without modern contraceptive methods the number of unintended, and possibly unwanted, pregnancies might have been quite high. Infanticide would have been one, albeit probably frowned on (Scott 1999:70; Becker 2011:25), way of dealing with these children. However, this practice should not be confused with abandonment, which is better attested to historically and was seemingly a more common method for dealing with unwanted infants (cf. Gowland et al. 2014). The final assumption employed at Ashkelon that needs to be challenged is that idea that victims of infanticide would simply be disregarded as rubbish. The decision to end an infant's life was not necessarily an easy one, and even if so, a respectful burial may nevertheless have been required – indeed, superstition may have made it mandatory if the family hoped for children at a later date (see Stefanović and Borić (2008) and Beilke-Voigt (2008) for an ethnographic discussion of domestic infant burials).

Drawing together a diverse body of literature, Gowland et al. (2014) have provided a convincing conclusion to the argument surrounding infanticide in Roman Britain. The authors present a thorough discussion of the complicated and often contradictory nature of historical evidence on the perception of infants; the distinction between abandonment and infanticide; and the development of the statistical debate surrounding Romano-British infant demography. They demonstrate that many assumptions surrounding supposed cases of infanticide (e.g. a bias toward female offspring, the number of skeletons involved, cf. Mays 2001) to be unfounded, and conclude "[i]n short, bioarchaeological evidence for infanticide (sex-specific or otherwise) in Roman Britain does not exist" (Gowland et al. 2014:82). Instead, the authors advocate a more sophisticated explanation (e.g. Carroll 2011) that considers pre- and post-natal infants buried within settlements in context with Roman perceptions of personhood and the wider archaeological evidence.

In central Europe and northern Italy, interpretation of infant remains with settlement contexts views this practice as a common mode of burial for young infants and one with roots in local prehistory (cf. Beilke-Voigt 2008; Dedet 1991). Zanoni (2011) goes further to propose an additional role for the disarticulated and semi-complete skeletons of infants from non-funerary contexts including ditches, construction debris, and workshops: examples of skeletal curation. "These find should not be considered as isolated, occasional or accidental events, but rather should be recognized as structured events, which are characterized by planning and intentionality" (Zanoni 2011:103). Infant remains appear to be involved with the delineation of delineation domestic versus non-domestic space, both spatially and chronologically. They mark not only both the edges of domestic spaces, but also the construction (preparation layers under floors, post-holes) and destruction/dismantling of these spaces (cleaning of domestic hearths, destruction debris). Although some authors have suggested a functional interpretation of these deposits (e.g. Becker 2007), the common and reoccurring features of infant deposits suggest their use in delineating the life cycle of a structure – foundation, reconstruction, abandonment (Zanoni 2011:87). The repeated presence of partial burials and individual remains suggests a link to a belief system more complex than the simple disposal of a body (Fabre 1990:413). Even disarticulated skeletons and loose bones from rubbish, building collapse, ditch fills and construction layers at Forcello have parallels elsewhere, and these remains may have been purposefully added after the primary was burial dismantled (Zanoni 2011:92).

Perhaps the infant human bones from Forcello should not be considered as domestic waste, and that their role as participants in a well-articulated but poorly understand act of delineation should also be explored. The complex relationship between functional contexts, human and animal burial, and domestic debris is recognized in Iron Age Britain (Cuncliffe 1992; Morris 2008; Morris 2010; Randall 2010). Etruscan contexts should be approached similarly. Not all deposits can necessarily be classified as either ritual or functional (Morris 2008); past societies did not necessarily observe this dichotomy (Serjeanston 2000). Rather than representing a unique Etruscan example of infant discard, the use of infant remains in a symbolic act of delineation would not be out of place in our understanding of Etruscan religious practice. The rich array of Etruscan anatomical votives certainly implies a pronounced concern and knowledge with both internal and external elements of the body (Turfa 1994) – an attitude that also probably extended to the sacrifice and treatment of animal remains (Trentacoste 2013; Rask 2014). Additionally, in a culture where necropoli and cinerary urns frequently mimic cities and houses, the deposition of infant remains in domestic structures is not wholly without symbolic precedent. The inhabitants of the modestly sized site certainly would have been able to bury infants outside of the settlement if they had wished, and there is little evidence adults were treated in the same manner. Ultimately, access to the other materials from and information related to contexts with human remains is needed in order to resolve the issue.

Whether or not we should position infant burials at Forcello in a larger ritualized framework of this sort, their place among a long and pan-regional history of domestic infant burials is apparent. The most convincing interpretation of this practice in the Roman world links the treatment of infants with perceptions of personhood and the start of public life, rather than with indifference or infanticide (Carroll 2011; Gowland et al. 2014; cf. Mays and Eyers 2011 for a dissenting opinion). We should see Etruscan infant burials in the same light – whatever level of 'ritual' these depositions involved, there is no reason to believe they were rubbish.

These remains contribute to our understanding of Etruscan burial practices and individual and household identity, but they also demand greater attention to the post-mortem treatment of infant remain and the relationship between domestic debris and symbolic activity. The difficulty of identifying these burials during excavation and the perception that such depositions were casual, functional, or otherwise of lesser value has detracted from the study of these contexts. These preconceptions need to be challenged (Crawford 2008; Zanoni 2011). Like for many other Iron Age peoples, the patterns in the use of space and discard of material on Etruscan settlements are complex and do not necessarily divide dichotomous ritual and domestic spheres. The infant remains from Forcello raise new questions about the past and remind us of the improvements to archaeological method and theory still required.

CHAPTER 7

SUMMARY AND CONCLUSIONS

7.1 SUMMARY

The Etruscan city at Forcello was a prominent settlement in the *Val Padana*. Established during a period of growing Etruscan influence in northern Italy, this city flourished between the sixth and fourth centuries BC. Although located on the margins of Etruscan civilization, Forcello was an important link in a network of northern Etruscan cities that mediated trade routes connecting Etruria, the Adriatic, and central Europe. A rich array of material culture illustrates these inter-regional networks and provides evidence for the movement of both objects and people. The settlement encompassed a series of superimposed houses and workshops involved in metalworking and textile production. Palynological and palaeobotanical analyses indicate that the site lay amid the ancient forests of the Po Plain, and its inhabitants farmed cereals and legumes in areas cleared for cultivation. Fish and mollusk remains provide evidence of local exploitation of the Mincio and indicate links with the Adriatic Sea. The excavations at Forcello have also uncovered an exceptional quantity of animal remains, an assemblage that provides a unique opportunity to study animal management and use in Etruscan society. Integrated with zooarchaeological research from northern and central Italy, the Forcello faunal assemblage allows for a new evaluation of human–animal relationships in pre-Roman Italy.

This dissertation explored animal exploitation at Forcello through zooarchaeological analysis, and contextualized the results of this study more broadly in the Etruscan world by combining data from Forcello with previous research. Chapter 1 outlined this project, provided a brief overview of Etruscan civilization, and introduced the Etruscan site of Forcello. Chapter 2 synthesized zooarchaeological research from northern and central Italy into a single narrative. During the Bronze Age local patterns of animal management were highly regionalized. In the Iron Age, animal exploitation on Etruscan settlements became more intensive and hierarchical. A greater emphasis was placed on the secondary products of caprines and cattle. These taxa also increased in size, while pig stature remained roughly constant. Species frequencies became increasingly focused on one species – pig – a pattern that later became a defining characteristic of Roman animal management. These changes were more pronounced at urban centers, and sites that deviate from the predominant pattern frequently have evidence of cultic/ritual activity. Developments in animal husbandry have been linked to increased wool production, economic intensification, and settlement urbanization (de Grossi Mazzorin 2001a; 2004; 2009); however, northern Etruscan centers adopted swine-focused husbandry regimes several centuries earlier than central Italy. Although this phenomenon was probably influenced by the availability of large swathes of woodland ideal for raising pigs, the widespread appearance of high pig frequencies in northern Italy during the sixth–fifth centuries BC challenges the link between pork consumption and urban demographic pressures.

After Chapter 3's introduction to the materials and methods employed in zooarchaeological analysis of the Forcello assemblage, Chapter 4 presented the results of this analysis. Results established the contribution of wild resources, patterns of livestock management, and the cultural significance of animals at Forcello. A variety of wild animals were hunted for food, sport, hides, and other raw materials, but, on the whole, they made a small contribution to subsistence at the site. Livestock husbandry focused on rearing pigs for meat, and these animals were probably herded in the woodland surrounding the settlement. Caprines were managed more intensively, and mortality profiles indicate divergent goals in sheep and goat husbandry. Cattle were kept primarily for labor, although they were sometimes killed for prime meat. Dogs account for a small proportion of the assemblage, but evidence for dog consumption at Forcello is a noteworthy characteristic of the site. The rarity of equids relates to the status of horses as elite animals and the general aversion to their consumption. Chicken remains provide evidence of the growing importance of this recently introduced domestic bird. Lastly, the significant number of perinatal human remains mixed with the site's faunal assemblage represents an important testament to the deposition of society's youngest members.

These results were compared to previous research in Chapter 5, highlighting chronological and regional trends in animal management in northern and central Italy during the first millennium BC. Chapter 6 integrated animal remains and other forms of archaeological and historical evidence, illustrating a thriving network of northern Etruscan cities linked by ceramic traditions, visual language, and now animal consumption. Rather than supporting the traditional view of an Etruscan colonial expansion into northern Italy, zooarchaeology supports more recent studies which propose a shared Etruscan heritage that developed in tandem across the Apennines. With the evolution of Etruscan cities in the Po Plain, livestock management strategies break from Bronze Age practices. Urban centers and well-linked villages developed a characteristic pig-focused method of animal management, which appears to be culturally as well as environmentally determined. Like other forms of technological development, livestock husbandry intensified throughout Etruscan Italy, particularly in urban centers. The timing of these changes in animal management, particularly the shift toward pig production, suggests an earlier northern Etruscan origin for dietary practices traditionally viewed as Roman, and encourages us to re-evaluate the relationship between northern and central Etruscan culture and that of early Rome. Within Forcello, animal remains also indicate the presence of non-Etruscan culinary traditions, and the marked presence of infant human remains provokes further consideration infant burial practices and the treatment of domestic and ritual debris.

7.2 FUTURE DIRECTIONS

Like many areas of archaeological investigation, this dissertation has raised as many questions as it has answered. The recorded faunal data from Forcello is unique in the Etruscan world, and this study has provided a new foundation for further research. The assemblage itself is useful for answering additional questions about life at Forcello and more broadly within Etruscan Italy: a wider comparison of butchery techniques or animal paleopathology could highlight regional or cultural trends; higher resolution taphonomic analysis would reveal new details on the treatment and deposition of urban debris; and the identification of the unstudied mollusk remains would provide further information on diet and the local environment. These are just a few of the many avenues for future research. From among these potential future directions, I would like to highlight three promising areas that I have repeatedly encountered during this project.

7.2.1 Biometry

One avenue for future research is presented by the growing volume of biometric information now available for Forcello and throughout northern and central Italy. This dissertation compared animal size data from Forcello to a selected suite of large assemblages. This comparison confirmed established patterns of animal size change and provided new information about relationship of animals in northern and central Italy. Clear changes occurred in cattle, sheep/goat, and dog size during this period, and further study would help untangle the origins of these trends. The Celts, Etruscans, and Greeks who inhabited the Po Plain were most probably exchanging animals as well as other forms of material culture, and the region remains a fertile area for future research. Previous work has already demonstrated zooarchaeology's ability to identify animal movement in the ancient world (e.g. Albarella et al. 2008; Sanford 2012), and a higher resolution look at animal size change would help clarify such movement in Iron Age Italy. In particular, it could comment on whether biometric changes resulted from imported animals or local practices – a conclusion with important implications for the development of pre-Roman Italian cultures. Ideally, this study would require a broader re-analysis of past biometric data and the re-examination of older assemblages to collect additional measurements. Biometric data from Italy could be then integrated with measurements from central Europe, southern Italy, and selected areas of Greece to look for wider patterns. The scientific testing of normal sized and outlying specimens, possibly using isotopes, may also help chart the origins of differently sized or shaped animals. Overall, this dissertation has demonstrated the complexity of animal size development in pre-Roman Italy; future research could help identify *where* and *when* changes occurred, as well as *why* and *how* they did.

7.2.2 Sheep and the expansion of textile production

In a way different from other livestock, sheep are linked to the movement and development of past cultures because of the great social and economic importance of wool in textile production (Gleba 2007a). Although less archaeologically visible than more resilient materials, the development of textiles, and thus wool, mirrors changes in the production and exchange of other craft industries and provides an important line of evidence for growing social and economic complexity (Nijboer 1998; Gleba 2008b). Analysis of ancient textiles has suggested that wool fibers began a process of development in the Final Bronze Age, at the same point that zooarchaeological data indicates the introduction of new types of sheep (Gleba 2012; Minniti 2012). Around the seventh century BC textile production moved from a household activity to one also undertaken in workshops (Gleba 2007b), a change evidenced by the large quantities of weaving materials found in settlements like Poggio Civitate, Acquarossa, and Forcello. While some of these products would have satisfied simple demand, the production of luxury textiles adorned with vibrant dyes, gold thread, and ornaments would have been the provenience of the Etruscan elite (Gleba 2008a). Further study of textile development in conjunction with zooarchaeological analysis of caprine remains has the potential to address economic changes at all levels of society throughout the first millennium BC. Here too, scientific studies using isotopes could help reveal the origins and movement of sheep, but simpler methods can also contribute to this discussion. For example, identification of caprine mandibles to species level allowed for a separation of sheep and goat mortality patterns at Forcello. The application of these techniques to older assemblages would be a relatively inexpensive method of investigating the development of sheep/goat husbandry. Likewise, the expanded use of biometric data, particularly through a comparison of log ratios from different sites, would allow for a correlation between management strategy and animal size. Tied in with data from weaving and textile technology, investigation of sheep husbandry has the power to link agro-pastoral strategy and the development of craft production a new way.

7.2.3 Human remains

The last area for further research discussed here is the issue of human infant remains recovered from faunal assemblages. At Forcello, the obvious next step in investigating these remains is to review excavation maps and photos of the contexts with human remains and to integrate this information with the other archaeological materials recovered from these contexts. This integration with other available data is crucial to understanding how and why these infants were deposited (Maltby 2010; Maltby and Morris 2010). Outside of Forcello, there needs to be a greater awareness of the issue as well as increased cooperation between the excavators and zooarchaeologists who encounter these remains. Like Zanoni's (2011) investigation of northern Italy, a comprehensive study of human remains from non-cemetery contexts in central Italy would also shed new light on the issue. In contrast to the repeated identification of infant bones among faunal remains in northern Italy and at Poggio Civitate in central Tuscany, zooarchaeologists in central Italy have not encountered the same phenomenon despite studying a large array of assemblages (C. Minniti pers. comm.). While this discrepancy may result from more sensitive excavation techniques in central regions, better integration of data from northern and central Italy and from excavations and osteological and faunal reports would go a long way in helping resolve, or at least clarify, the issue.

7.3 CONCLUSION

This project has produced new data on animal exploitation and urban life in an underrepresented region of Etruscan civilization, and it has helped clarify chronological and regional trends in Etruscan animal use during the first millennium BC. In this context, zooarchaeology has demonstrated the ability not only to address issues of diet and subsistence, but also economic development and cultural identity. Faunal analysis has revealed the aims and evolution of agricultural strategies, challenged our understanding of inter-regional developments, provided evidence for the presence of foreign individuals, and questioned the division between funerary and settlement archaeology. As a result, we now have a more vibrant picture of the world of the Etruscans. In this world animals were tightly bound to many aspects of society – agriculture, trade, social display – and their presence pervades domestic, industrial, and symbolic space; they were witnesses to Etruscan life whose remains represent a largely untapped line of inquiry for this period. Hopefully this dissertation has demonstrated the ability of these remains to comment on Etruscan society as eloquently as other, more renowned, types of archaeological material while adding to a more vibrant picture of Etruscan–animal relationships.

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APPENDIX A | TABLES

CHAPTER ONE

THE ETRUSCANS AND THEIR ANIMALS

Table 1.1.1 Etruscan chronology with important dates
Dates from Camporeale (2011).

Cultural Period	Date	Notes
Final Bronze Age	10th c. BC	First recognizable traces of Etruscan civilization
Villanovan	9th–8th c. BC	Formation of Etruscan culture and an aristocratic class Occupation of sites that would become major urban centers Arrival of the alphabet and foreign trade
		753 BC - Foundation of Rome
Orientalizing	late 8th–6th c. BC	Greek colonies in Italy Development of urban city–states Escalation of trade with the eastern Mediterranean
Archaic	Early 6th– early 5th c. BC	City-states flourish Development of princely residences Etruscan expansion into the Po Plain and Campania
		507 BC - Expulsion of kings from Rome
Classical	Early 5th–4th c. BC	War between Rome and Etruscan cities Rebirth of coastal urban centers and re-affirmation of power by aristocracy
		396 BC - Veii conquered by Rome
		390 BC - Rome sacked by Celts
Hellenistic	Late 4th–2nd c. BC	Punic Wars Roman conquest of Italy Enrollment of Etruscans in Roman army
		295 BC - Rome wins Battle of Sentinum to unite central Italy
		90–88 BC - Social War and extension of Roman citizenship to all Italians south of the Po river

Table 1.1.2 Bronze Age chronology
Cultural phases in gray. Adapted from Harding (2000) and Bogucki and Crabtree (2004).

Date BC	Central Europe	Northern Italy	Central Italy
700			Orientalizing
800	Hallstatt C Early Iron Age	Este	
900		Golasecca & Villanovan Early Iron Age	Villanovan Early Iron Age
1000	Hallstatt B		
1100			
1200	Hallstatt A	Proto-goloasecca Final Bronze Age	Proto-Villanovan Final Bronze Age
1300		Recent Bronze Age	Sub-Apennine Recent Bronze Age
1400	Late Bronze Age		
1500			
1600	Middle Bronze Age		Apennine Middle Bronze Age
1700		Terramare Middle Bronze Age	
1800			
1900			
2000			
2400/2300	Early Bronze Age	Polada Early Bronze Age	Early Bronze Age

Table 1.3.1 Main occupation phases at Forcello
Information from Casini and de Marinis (2007).

Phase	Approximate years BC	Type	Notes
A, B	450–380	Habitation	Heavily disturbed by agriculture
C	470–450	Habitation	Houses found in areas R18 & R19; includes workspace and storeroom; large quantity of burned material on house floors; House in R19 may have remained in use from phase D
D	490–470	Habitation	Buildings constructed in log-cabin style; area re-ordered for construction of larger house with 3 hearths; House re-organized to enlarge one area; dismantled at end of phase; later phase C construction complicates stratigraphy
E	Several months or years between 500–590	Open Workspace	Series of pit hearths and silt floors for metalworking; cleaned and leveled to prepare surface for next phase
F	510–500	Habitation	Two habitation events (F I and F II); Buildings constructed in log cabin style; House F I follows dimensions of house from phase G; Phase destroyed by fire; rather than clean surface, much material left *in situ* and covered with earth
G	520–510	Habitation	Large house including hearth and floor surface; house disassembled and surface prepared for subsequent habitation possibly as result of problems with dampness/flooding
H	530–520	Open Workspace	Open-air area for metalworking
I	540?–530	Habitation?	Likely the earliest level, corresponding to the foundation of the city; only evidence is partial pavement and wall debris; area remains under investigation

CHAPTER TWO

ZOOARCHAEOLOGY: PAST RESEARCH AND PRESENT CONSIDERATIONS

Table 2.1.1 Species frequencies from Bronze Age sites in northern Italy
BA = Early Bronze Age; BM = Middle Bronze Age; BR = Recent Bronze Age; BF = Final Bronze Age
*Original publication unavailable. Data from de Grossi Mazzorin and Riedel (1997) and de Grossi Mazzorin (2009)

Site	Province	Date	n.	Cattle%	Sheep/goat%	Pig%	Reference
Emilia-Romagna							
Pilastri di Bondeno	FE	BM	*	20	57	23	(Farello 1995a)*
Tabina di Margreta	MO	BM	520	16	48	36	(de Grossi Mazzorin 1988)
Monte Leoni	PR	BM	494	12	52	36	(Ammerman et al. 1976; Bonardi and Scarpa 1982)
Noceto	PR	BM	601	42	26	32	(de Grossi Mazzorin 2009)
Valle Felici	RA	BM	94	15	49	36	(Farello and Lacchini 2006)
Poviglio	RE	BM	797	19	46	35	(Riedel 1989)
Monte Castellaccio	BO	BM	405	46	29	24	(de Grossi Mazzorin 1996c)
San Giuliano	BO	BM-R	86	45	30	24	(de Grossi Mazzorin 1996b)
Montale	MO	BM-R	*	12	51	37	(de Grossi Mazzorin and Ruggini 2004)*
Poviglio	RE	BR	1411	19	58	22	(Riedel 1989)
Lombardia							
Barche	MN	BA	2470	39	30	31	(Riedel 1976a)
Lucone	BS	BA-M	*	32	41	27	(Catalani 1980-81)*
Lagazzi di Piadena	CR	BA-M	1546	31	43	26	(Cavallo 2000)
Castellaro del Vhò	CR	BM	722	29	49	21	(di Martino 1997)
Poggio Rusco	MN	BM	132	36	20	43	(Catalani 1984)
Castellaro Lagusello	MN	BM-R	3192	35	49	16	(Malerba et al. 2005)
Isolone	MN	BR	2925	44	36	20	(Riedel 1976b)
Veneto							
Canar	RO	BA	15642	22	28	50	(Riedel 1998)
Ca' Nova di Cavaion	VR	BA-M	2309	50	36	14	(Malerba and Fasani 1999)
Cisano	VR	BA-M	583	34	50	15	(Riedel 1990)
Muraiola	VR	BM	5394	34	47	19	(Riedel 1997)
Nogarole Rocca	VR	BM	998	38	42	21	(Riedel 1992a)
Quarto del Tormine	VR	BM	257	39	47	14	(Riedel 1987)
Peschiera	VR	BM-R	385	42	36	22	(Riedel 1982a)
Cavalzara	VR	BM-R	145	41	30	28	(Riedel 1979)
Sabbionara di Veronella	VR	BR	*	69	22	9	(Riedel 1993)*
Feniletto	VR	BR	99	40	44	15	(Riedel 1982b)
Terranegra	VR	BR-F	212	41	31	28	(Riedel 1979)
Fondo Paviani	VR	BR-F	244	53	24	23	(Riedel 1979)
Trentino-Alto Adige/South Tyrol							
Lasino	TN	BA	1963	33	52	15	(Riedel and Tecchiati 1992)
Nössing	BZ	BA-M	1742	47	44	10	(Riedel and Tecchiati 1999)
Fiavè	TN	BA-M	4938	32	60	8	(Jarman 1975; Gamble and Clark 1987)
Ledro	TN	BA-M	8967	28	63	9	(Riedel 1976c)
Albanbühel	BZ	BM	10258	40	53	6	(Riedel and Rizzi 1995)
Sotćiastel	BZ	BM-R	2037	46	50	4	(Riedel and Tecchiati 1988)
Appiano - Eppan	BZ	BR-F	1318	54	23	23	(Riedel 1985a)
Barbiano	BZ	BR-8	207	44	49	7	(Cavalieri et al. 2010)

Table 2.1.2 Species frequencies from Etruscan and Iron Age sites in northern Italy
Parentheses '( )' indicate taxa listed as 'small ruminant'.

Site	Prov.	Cen. BC	n	Cattle%	Sheep/goat%	Pig%	Reference
Emilia-Romagna							
Bologna - Castenaso	BO	8-6	1287	24	35	42	(Farello 1994)
Bologna – Via Foscolo-Frassinago	BO	7-6	355	36	17	47	(Farello 2002)
Mirlandola – Barchessone Barbiere	MO	7-6	74	22	31	47	(Farello 1993)
Mirlandola – Arginone	MO	6	155	16	46	38	(Farello 1992a; 1995b)
Marzabotto – US 27/29	BO	6	197	20	31	49	(Farello 1995b)
Fiorano	MO	6	107	46	11	43	(Farello 1989)
San Claudio	RE	6	245	31	27	42	(Farello 1990b; 1995b)
Bologna – via S. Caterina	BO	5	180	25	21	54	(Farello 1995b)
Casale di Rivalta	RE	5	543	31	30	39	(Farello 1990a; 1995b)
Case Vandelli	MO	5	182	15	30	55	(Farello 1995b)
Miseria Vecchia	MO	5	43	18	41	41	(Farello 1992b)
Spina	FE	5-4	c. 10000	23	18	59	(Riedel 1978)
Marzabotto	BO	5-4	425	18	22	60	(Farello 1995b)
Marzabotto – Casa 1	BO	5-4	4783	20	21	59	(Curci 2010)
Tabina di Magreta		5-4	72	25	43	32	(de Grossi Mazzorin 1994)
Monte Bibele	BO	5-2	1743	14	27	59	(Curci et al. 2000; 2006; Curci and Cattabriga 2005)
Lombardia							
Forcello	MN	6-4	7772	8	23	69	(Scarpa 1988)
Veneto							
Padova	PD	6-5	177	31	42	27	(Tagliacozzo and Cassoli 1992)
Castelrotto	VR	5-4	2395	47	31	22	(Riedel 1985b)
Santorso	VI	5-2	1837	59	21	20	(Cassoli and Tagliacozzo 1985; 1990)
Colognola ai Colli	VR	4-2	1829	38	27	35	(Riedel 1984b)
S. Giorgio di Valpolicella	VR	4-1	579	52	31	17	(Riedel 1992b)
Trentino-Alto Adige/Süd Tirol							
Pfatten-Vadena (II)	BZ	9-7	1579	45	35	20	(Riedel 2002)
Thalerbühel di Tires	BZ	9-7	255	13	80	6	(Marconi and Tecchiati 2006)
Stufels H. Dominik	BZ	7-4	1227	54	31	15	(Riedel 1986)
Pfatten-Vadena (I)	BZ	6-5	1377	38	45	16	(Riedel 2002)
Stufels H. Stremitzer	BZ	6-5	128	49	(62)	17	(Riedel 1986)
Bressanone-Stufles Russo	BZ	6-3	521	37	59	4	(Rizzi Zorzi 2006)
Bressanone-Villa Kranebitt	BZ	6-3	1786	52	44	4	(Rizzi Zorzi 2006)
Friuli							
Pozzuolo	UD	10-7	1972	41	22	37	(Riedel 1984a)
Gradiscutta	UD	5	205	31	37	32	(Riedel and Tecchiati 2003; Riedel et al. 2006)

Table 2.1.3 Species frequencies from Bronze Age, Iron Age, and Etruscan central Italy
BA = Early Bronze Age; BM = Middle Bronze Age; BR = Recent Bronze Age; BF = Final Bronze Age
Parentheses ( ) includes identified shaft fragments. Highlighted sites have evidence of cultic activty and are excluded from drect comparisons of species frequencies.

Site	Area	Prov.	Date	n	Cattle%	Sheep/goat%	Pig%	Reference
Pitigliano	Strata V	GR	BM	24	54	13	33	(de Grossi Mazzorin 1985a)
Luni sul Mignone	C+D=Appl+II	VT	BM	1947	49	27	25	(Gejvall 1967)
Castiglione		VT	BM	265	46	39	15	(Minniti 2012)
Narce	I+II	VT	BM-R	379	31	53	16	(Barker 1976)
Banditella	US 7-8-14	VT	BR	82	50	37	13	(de Grossi Mazzorin 1995b; de Grossi Mazzorin 1992)
Vejano Borgo		VT	BR	263	32	37	31	(Cosentino and de Grossi Mazzorin 2000)
M. Rovello	livelli 8–10	RM	BR	138	41	39	20	(Caloi and Palombo 1986)
Rome	Campidoglio	RM	BR	474	31	47	21	(Minniti 2012)
Pitigliano	Strata III	GR	BR-F	22	45	36	18	(de Grossi Mazzorin 1985a)
Luni sul Mignone	Large Iron Age Building	VT	BR-F	215	39	55	6	(Lepiksaar 1975)
San Giovenale	Area B Strata 3+4	VT	BR-R	149	16	54	30	(Sorrentino 1981b)
Narce	III+IV	VT	BR-F	994	28	53	24	(Barker 1976)
Sorgenti della Nova	Va-Ve	VT	BF	376	24	33	42	(de Grossi Mazzorin 1998; Minniti 2012)
Luni sul Mignone	G - Tre Erici Trincea I	VT	BF	45	38	33	29	(Gejvall 1967)
Monte Rovello	livelli 7–6	RM	BF	215	53	33	13	(Caloi & Palombo 1986)
Electo		VT	BF	236	34	54	11	(Caloi and Palombo 1996)
Monte Sant'Elia		VT	BF	36	31	58	11	(Minniti 2012)
Ficana	zona 2	RM	BF	932	34	40	26	(Minniti 2012)
Narce	Phase IV–Vi & M	VT	10–8	1237	23	53	24	(Barker 1976)
Gran Carro	1965-6 & 1980	VT	9	273	29	49	22	(de Grossi Mazzorin 1995a; Costantini et al. 1987)
Tarquinia	Poggio Cretoncini	VT	9	197	31	51	18	(de Grossi Mazzorin 1995b)
Fidene	capanna	RM	9	326	28	49	29	(de Grossi Mazzorin 1989)
Rome - Palatine	capanna Puglisi	RM	9-8	58	19	26	55	(de Grossi Mazzorin 1989)
Tarquinia	Phase 1	VT	9–7	511	25	34	41	(Bedini 1997)
Tarquinia	Phase 1	VT						(Sorrentino 1986)
Fidene	U.P.F	RM	8	233	44	38	18	(de Grossi Mazzorin 1989)
Monteriggioni		SI	8–7	293	14	47	38	(Bartoloni et al. 1997)
San Giovenale	Spring building	VT	8–7	280	62	16	22	(Sorrentino 1981a)
Rome	Domus Regia	RM	8–7	61	20	44	36	(Minniti 2012)
Ficana	3b-c II-III & zone 5a	RM	8–6	1281	30	38	32	(de Grossi Mazzorin 1996a; de Grossi Mazzorin 1989)
Ficana	zone 5a	RM	7					(Minniti 2012)
San Giovenale	Acropolis str. 5	VT	7–6	64	19	41	41	(Sorrentino 1981b)
Acquarossa	Zone A	VT	7–6	374	(83)	13	4	(Gejvall 1982)
Acquarossa	trial trenches	VT	7–6	167	52	26	21	(Tagliacozzo 1994)
Rome	Velia	RM	7-6	222	7	41	53	(Minniti 2012)
Veii	acropolis	RM	7–6	346	24	40	37	(Cucinotta et al. 2010)
Roselle		GR	6	140	30	29	41	(Corridi 1989)
Cerveteri		RM	6–5	472	37	34	29	(Clark 1989)
Tarquinia	Phase 2	VT	6–5	392	17	34	49	(Bedini 1997)
Montecatino		LU	5	262	32	37	31	(Ciampoltrini et al. 1991)
Veii	Pozzo US 469	RM	4	626	4	19	77	(Cucinotta et al. 2010)
Cetamura	Refuse Pits I & II	SI	4	130	13	55	32	(Wilkens 2009)
Narce	Phase IX–X	RM	4–2	77	22	57	21	Barker 1976
Populonia	acropolis	LI	3	1988	10	43	47	(de Grossi Mazzorin 1985b; de Grossi Mazzorin 1987)
Tarquinia	phase 3	VT	3–2	85	27	32	41	(Bedini 1997)
Populonia	Saggio IX Periods V–VI	LI	2–1	346	13	42	45	(de Grossi Mazzorin and Minniti 2008)
Bolsena	Poggio Moscini	VT	2BC–1AD	1093	12	50	38	(Tagliacozzo 1995)
Populonia	Period VII	LI	1 AD	202	20	37	36	(de Grossi Mazzorin and Minniti 2008)

Table 2.5.1 Cattle withers heights from northern Italy
Height calculation from Matolcsi (1970). Data from Riedel (1994), MacKinnon (2004:tab. 24), and individual reports.

Site	n.	min	max	mean
Barche	59	103.6	103.7	116
Canar	37	100.6	124.8	112.8
Ledro	66	93.6	128.8	110.3
Noceto	-	90	110	-
Monte Castellaccio	49	95.2	119.7	107.2
Isolone	99	92.4	120.9	106.2
Fondo Paviani/Cavalzara/Terranegra	5	103.4	128.5	114.4
Sabbionara	17	98.1	115.7	107
Pfatten-Vadena/ Appiano–Eppan/Stufels	24	96.8	122.3	102.6
Bologna - Castenaso	3	114.8	129	122.6
Casale di Rivalta	1	-	-	120
Castelrotto	8	109.8	121.2	121.3
Spina	11	108.5	125.0	118.5
Santorso	1	-	-	93
Colognola ai Colli	7	104.6	121.8	114.7
Roman – Republican	12	93.2	128.1	114.4
Roman - Imperial	12	103.4	145.5	121.7
Roman – Imperial/Late	42	103.8	140.6	122.2

Table 2.5.2 Cattle withers heights from central Italy
Height calculation from Matolcsi (1970). Data from Minniti (2012:tab. 17), MacKinnon (2004:tab. 24), and individual reports.

Site	n.	min	max	mean
Rome - Capidoglio	6	101.3	118.6	109.8
Luni sul Mignone	1	-	-	114.9
Narce – phases III-IV	1	-	-	101.9
Ficana - zone 2	3	109.4	117.4	113.8
Sorgenti della Nova	2	116.8	131	123.9
Celano	1	-	-	100.7
Monte degli Angeli	3	99.7	112.4	108
Gran Carro	1	-	-	100.9
Fidene - U.P.F.	2	106.3	107.5	106.9
Rome - domus Regia	2	106.3	126.3	116.3
Acquarossa – trial trenches	1	-	-	108
Tarqunia – phase 2	1	-	-	128.5
Roman – Republican	4	112	130	123.2
Roman - Imperial	-	-	-	-
Roman – Late	11	105.2	140.8	129.1

Table 2.5.3 Sheep and sheep/goat withers heights from northern Italy
* = sheep/goat. Height calculation from Teichert (1969). Data from Riedel (1994), MacKinnon (2004:tab. 36), and individual reports.

Site	n.	min	max	mean
Barche	82	52.7	67.1	58.7
Canar	58	51.8	67.6	57.6
Ledro	771	48.8	72	59.6
Noceto	-	53	61	-
Tabina di Magreta	3	52.4	56.3	54.5
Monte Castellaccio	40	49	75.7	56.9
Isolone	95	49	67.8	57
Fondo Paviani/Cavalzara/Terranegra	8	58.8	67.9	63.8
Appiano-Eppan	15	58.1	76.9	66.1
Sabbionara	21	58.2	68.6	62.9
Bologna – Via Foscolo Frassinago	1	-	-	61.5
Casale di Rivalta	3	60.8	70.9	64.1
Castelrotto	34	58.9	73.5	(62.5)
Spina	26	57.7	70.1	63.3
Santorso	11	58.2	73.7	66.4
Colognola ai Colli	20	53.8	70.1	62.7
Monte Bibele	?	57.3	70	-*
Roman – Republican	103	56.6	77.1	65.5*
Roman - Imperial	62	58.7	77.1	68.2*
Roman – Imperial/Late	43	57.6	71.8	64.0*

Table 2.5.4 Sheep and sheep/goat withers heights from central Italy
* = sheep/goat. Height calculation from Teichert (1969).
Data from Minniti (2012:tab. 18), MacKinnon (2004:tab. 36), and individual reports.

Site	n.	min	max	mean
Vejano	3	56.9	60.6	64.8*
Rome - Capidoglio	4	58.7	65.9	61*
Sorgdenti della Nova	1	-	-	58*
Ficana - zone 2	3	56.1	60.1	58.1*
Monte Rovello – levels 7-6	I	-	-	61.9*
Gran Carro	1			58.1*
Fidene – capanna	1			52.5*
Monteriggioni	3	56	61.9	57.8
Ficana – II-III b-c	3	55.6	64.6	60.2*
Veii – acropolis	4	62.8	66.4	65.4
Tarqunia – phase 2	3	65.8	68.5	66.2*
Montecatino	1			56.9
Veii – pozzo 469	1			68.7
Cetamura	2	57.5	63.4	61.1
Roman – Republican	48	56.2	75.8	66.2*
Roman - Imperial	5	64.4	74.1	68.7*
Roman – Imperial/Late	73	59.2	79.4	68.9*

Table 2.5.5 Pig withers heights from northern Italy
Height calculation from Teichert (1969). Data from Riedel (1994), MacKinnon (2004:tab. 44) and individual reports.
**wither's height calculated from averages for each element.

Site	n.	min	max	mean
Barche	41	59.1	87.6	73.3
Canar	121	64.4	91.5	79.2**
Ledro	44	52.3	79.8	72.8
Noceto	-	76	82	-
Paviani/Cavalzara/Terranegra	4	68.5	81.1	73.4
Monte Castellaccio	8	73	82.8	77.9
Casale di Rivalta	1	-	-	79.8
San Claudio	1	-	-	66.5
Castelrotto	18	61.5	72.4	66.6
Spina	101	59.9	82.6	70.6
Santorso	12	62.1	75.5	70.2
Colognola ai Colli	13	64.8	81	71.9
Monte Bibele	2	67.7	74.6	71.2
Roman – Republican	35	61.6	80.9	68
Roman - Imperial	10	65.3	73.4	68.9
Roman - Imperial-Late	31	59.8	78.8	70.4

Table 2.5.6 Pig withers heights from central Italy
Height calculation from Teichert (1969). Data from Minniti (2012:tab. 19), MacKinnon (2004:tab 44), and individual reports.

Site	n.	min	max	mean
Pitigliano – strata V	1	-	-	73.7
Rome – Campidoglio	3	65.5	79.6	70.7
Vejano	2	65.5	75.2	70.4
Pitigliano – strata III	1	-	-	70
Ficana – zone 2	6	65.3	75.2	70.1
Celano	4	63.6	68.5	66.1
Monte Rovello – levels 7-6	1	-	-	61.3
Sorgenti della Nova	2	68	72.4	70.2
Tarqunia – Cretoncini	1	-	-	69.8
Fidene – U.P.F	1	72.3	79.3	73.9
Ficana - II-III b-c	17	68	74.7	72.1
Veii – acropolis	1	-	-	66.2
Tarqunia – phase 2	6	70.9	84.6	75.9
Veii – pozzo 469	5	51.9	68	59.2
Cetamura	1	-	-	63.5
Bolsena	4	61.2	70.5	64.8
Roman – Republican	25	59.1	74.7	66
Roman - Imperial	15	57.9	85.9	72.1
Roman - Imperial-Late	28	57.3	84.1	70.1

CHAPTER THREE

THE FORCELLO FAUNAL ASSEMBLAGE: MATERIALS AND METHODS

Table 3.2.1 Number and frequency of identified taxa by phase from the Scarpa report
Data from Scarpa (1988:tab. 2).

	Pig		Sheep/goat		Cattle		Red Deer		Other		Total
	n	%	n	%	n	%	n	%	n	%	
Recent	4628	68%	1491	22%	498	7%	95	1%	54	1%	6766
Ancient	725	61%	276	23%	154	13%	27	2%	13	1%	1195

Table 3.2.2 Number and frequency of identified taxa by context type from the Scarpa report
Data from Scarpa (1988:tabs. 3–4).

	Houses		Dumping		Canals		Areas between houses and canals		Sector V-W 10-11	
	n	%	n	%	n	%	n	%	n	%
Recent										
Cattle	45	7%	269	7%	26	*	59	12%	99	8%
Sheep/goat	166	25%	843	20%	21	*	94	19%	367	29%
Pig	440	68%	3001	73%	48	*	334	69%	805	63%
Total	651		4113		95		487		1271	
Ancient										
Cattle	86	15%	40	13%	2	*	0	*	26	9%
Sheep/goat	146	26%	67	22%	2	*	0	*	61	22%
Pig	332	59%	197	65%	1	*	0	*	195	69%
Total	564		304		5		0		282	

Table 3.2.3 Mollusks identified at Forcello
Data from Franchini (1988).

Species Name	Common name	n.
Marine		
Cypraea (Monetaria) annulus	ring cowrie/gold ringer snail	2
Murex (Phyllonotus) trunculus	banded dye-murex snail	1
Murex (Bolinus) brandaris	Purple dye murex snail	10
Glycymeris violacescens	bittersweet clam	185
Glycymeris pilosa	pilose bittersweet clam	1
Mytilus galloprovincialis	Mediterranean mussel	1
Pinna nobilis	fan mussel	1
Pecten jacobaeus	Saint James Scallop	1
Cerastoderma edule	common cockle	7
Acanthocardia tuberculata	rough cockle	5
Mactra stultorum	rayed trough shell clam	3
Freshwater		
Planorbis corneus	great ramshorn snail	1
Planorbis planorbis	margined ramshorn snail	1
Viviparus ater	Italian river snail	51
Bithynia tentaculata	common Bithynia snail	5
Unio elongatulus	freshwater mussel	229
Anodonta cygnea	swan mussel	1
Terrestrial		
Pomatias elegans	round-mouthed snail	79
Carychium minimum	land snails (various)	1
Oxychilus draparnaudi		23
Oxychilus cellarius		8
Helicella itala		9
Monacha cartusiana		24
Cepaea nemoralis		4
Cepaea hortensis	white-lipped snail	31

Table 3.3.1 Forcello phases

Phase	Description
A, B, C, D, E, F, G, H, I	Habitation phases
P	plowzone
U	unphased archaeological (Etruscan) material
X	unknown/mixed
M	modern
≤	material concurrent with or later than the indicated phase
≥	material concurrent with or earlier than the indicated phase

Table 3.3.2 Forcello context types
a-q provided by the excavators; r-z assigned based on the written description.

Conext code	Description
a	fill of modern cuts and trenches
b	fill of post-holes and rubbish pits whose cut is immediately below the plowzone
c	post-hole fill + cut
d	fill of rubbish pits
e	contrusction fill and leveling deposits for new use surfaces
f	fill of fire pits/hearths
g	fill of pit forges
h	rubbish fills from canals and dumped material
i	fill of foundation trenches for structures
k	hearth fill
l	hearth structure
m	fill of storage pits (in primary context)
n	use surface/floor (in primary context)
o	level of anthropic accretion (in primary context)
p	use surface outisde of a structure (in primiary context)
q	level of destruction debris caused by fire (in primary context)
r	other level, strata, or construction fill
s	other surface/floor
t	pit
u	unknown
v	other 'small canal' or canal cut/fill
w	surface find
x	cleaning
y	later intrusion or modern feature
z	plowzone

Table 3.3.3 Phases by period

Phases	M		A		B		C		D		E		F		G		H		I	U	X	P
General Phases		M-A		A-B		B-C		C-D	D?	D–E	E?	E-F				G-H		H-I				
Period			Late Etruscan								Early Etruscan											
Older than or equal to					B≥		C≥		D≥		E≥		F≥		G≥		H≥					
More recent than or equal to							≥C															

Table 3.5.1 Common and scientific names of animals identified at Forcello

Common name	Scientific name	Common name	Scientific name
Cattle	*Bos taurus*	Chicken	*Gallus gallus*
Sheep	*Ovis aries*	Duck	*Anas/Aythya* sp.
Goat	*Capra hircus*	Dabbling duck	*Anas* sp.
Pig	*Sus scrofa*	Diving duck	*Aythya* sp.
Equid	*Equus* sp.	Goose	*Anser* sp.
Donkey	*Equus asinus*	Swan	*Cygnus* sp.
Horse	*Equus caballus*	Mute swan	*Cygnus olor*
Dog	*Canis familiaris*	Coot	*Fulica atra*
Red deer	*Cervus elaphus*	Coot/moorhen	*Fulica/Gallinula*
Fallow deer	*Dama dama*	Crane	*Grus grus*
Roe deer	*Capreolous capreolous*	Bittern	*Botaurus stellaris*
Fox	*Vulpes vulpes*	Small heron	Ardeidae
Badger	*Meles meles*	Pelican	*Pelecanus* sp.
Beaver	*Castor fiber*	Crow/Rook	*Corvus* sp.
Hare	*Lepus* sp.	Raven	*Corvus corax*
European hare	*Lepus europaeus*	Pigeon	*Columba* sp.
Otter	*Lutra lutra*	Curlew	*Numenius arquata*
Mole	*Talpa* sp.	Gull	*Larus* sp.
Hedgehog	*Erinaceus europaeus*	Small owl	Strigidae
		Starling	*Sturnus vulgaris*
Cuttlefish	Sepiidae	Frog/Toad	Anura

Table 3.5.2 Tooth measurements
*Only teeth which can be positioned.

Taxon and Tooth		Measurements
Equids		
P_1 P_2 P_3 M_1 M_2 M_3 M_1 M_2 M_3	L_1, W_a W_d*	Davis (2002): L_1 = crown length; W_a = anterior enamel fold width W_d = distance between central enamel folds
Cattle		
dP^4 / dP_4 M^1 M^2 M^3 / M_1 M_2 M_3 M_3	W W L	W = greatest width at any point L = crown length (as in Payne and Bull 1988)
Caprines		
dP_4 M_1 M_2 M_3 M_3	W L	W = greatest width at any point L = crown length (as in Payne and Bull 1988)
Pigs		
dP^4 / dP_4 M^1 M^2 & M^{12} / M_1 M_2 & M_{12} M^3 / M_3 Mandible	L, WP L, WA, WP L, WA, WC H	L = crown length (Payne and Bull 1988) WP = posterior cusp width (Payne and Bull 1988) WA = anterior cusp width (Payne and Bull 1988) WC = center cusp width (Albarella et al. 2005) H = height of mandible (von den Driesch 1976)
Carnivores		
P_4 M_1	L, W	W = greatest width (von den Driesch 1976) L = crown length (von den Driesch 1976)
Canids		
P_1–M_3 P_2–M_3 P_1–P_4 P_2–P_4 M_1–M_3 Mandible	L L L L L H	von den Driesch (1976): L = Length of the cheek tooth row, measured along the alveoli H = height of mandible on buccal side in front of M_1

Table 3.5.3 Post-cranial measurements

* Calcaneum greatest depth is measured is a slightly different way from the original definition. GD is perpendicular to von den Driesch's GB, but does not include the sustentaculum.

Anatomical Element	Measurement	Description	Reference
Atlas	H	Height	Albarella and Payne (2005)
	BFcr	Width of cranial articular surface	von den Driesch (1976)
Scapula	SLC	Smallest width of the neck	von den Driesch (1976)
Humerus	GLC	Greatest length (from caput/head)	von den Driesch (1976)
	BT	Width of trochlea condyle surface	Payne and Bull (1988)
	Bd	Greatest breadth of distal end	von den Driesch (1976)
	HTC	Height of the trochlea condyle	Payne and Bull (1988)
	SD	Smallest breadth of diaphysis	von den Driesch (1976)
Radius	GL	Greatest length	von den Driesch (1976)
	SD	Smallest breadth of diaphysis	
Metacarpal	GL	Greatest length	von den Driesch (1976)
	SD	Smallest breadth of diaphysis	von den Driesch (1976)
	Bd	Greatest breadth of distal end	von den Driesch (1976)
	BatF	Breadth at line of fusion	von den Driesch (1976)
	a	Breadth of the medial condoyle	Davis (1992)
	b	Breadth of the lateral condoyle	Davis (1992)
	1, 3	Width of medial outer, inner condoyle	Davis (1992)
	4, 6	Width of lateral outer, inner condoyle	Davis (1992)
	Dd	Greatest depth of distal end	von den Driesch (1976)
Pelvis	LAR	Diameter of acetabulum	von den Driesch (1976)
	H1, H2	Height of the medial wall of the acetabulum	Greenfield (2006)
Femur	GL	Greatest length	von den Driesch (1976)
	SD	Smallest breadth of diaphysis	
	DC	Greatest depth of the caput femoris/head	
Tibia	GL	Greatest length	von den Driesch (1976)
	SD	Smallest breadth of diaphysis	
	Bd	Distal width	
	Dd	Distal Depth	
Astragalus	GLl	Greatest length of the lateral side	von den Driesch (1976)
	GLm	Greatest length of the medial side	
	Bd	Distal width	
	Dl	Depth of the lateral length	
Calcaneum	GL	Greatest length	von den Driesch (1976)
	Gd	Greatest depth	Albarella and Payne (2005)*
Metacarpal	GL	Greatest length	von den Driesch (1976)
	SD	Smallest breadth of diaphysis	von den Driesch (1976)
	Bd	Greatest breadth of distal end	von den Driesch (1976)
	BatF	Breadth at line of fusion	von den Driesch (1976)
	a	Breadth of the medial condoyle	Davis (1992)
	b	Breadth of the lateral condoyle	Davis (1992)
	3	Width of media inner condoyle	Davis (1992)
	6	Width of lateral inner condoyle	Davis (1992)
	Dd	Greatest depth of distal end	von den Driesch (1976)

Table 3.6.1 Calculation of the minimum number of animal units (MAU) for different taxa
n=number of elements

Element		Calculation
Upper or lower incisors		Cattle and sheep/goat = n/8 Pig = n/6
Unidentified incisors		Cattle and sheep/goat = n/8 Pig = n/12
Premolars		n/6
P/M		n/12
M1/2		n/4
Phalanges		Cattle, sheep/goat and pig = n/8 Horse = n/4
Vertebrae		n/1
Metapodials		MC1=complete distal metacarpal; MC2=half distal metacarpal MT1=complete distal metatarsal; MT2=half distal metatarsal MP1=complete distal metapodial; MP2=half distal metapodial
	Metacarpal	Cattle and sheep/goat = n/2; n =(MC1 + MC2/2) Pig = n/2; n = MCIII+MCIV
	Metatarsal	Cattle and sheep/goat = n/2; n = (MT1 + MT2/2) Pig = n/2; n = MTIII+MTIV
	Metapodial	Cattle and sheep/goat = n/4; n= (MP1 + MP2/2) Pig = MP2/8
	Metapodial Total	Cattle and sheep/goat = (MC1 + MC2/2)/2 + (MT1 + MT2/2)/2 + (MP1 + MP2/2)/4 Pig = (MCIII + MCIV + MTIII + MTIV)/2 + MP2/8
All other body parts		n/2

Table 3.6.2

Pig dP$_4$ wear stage to mandible wear stage

Definitely staged mandibles only. Phases M, P, and X excluded. Wear stages follow O'Connor (2003).

	Mandible wear stage				
dP$_4$ wear stage	N	J	I1	I2	Total
H	2				2
U	11				11
a		9			9
b		1			1
c		2			2
d		1			1
e		2	2	1	5
f			1		1
g				2	2
h				2	2
i					
j					
k					
l				2	2
Total	13	15	3	8	39

Table 3.6.3

Pig P$_4$ wear stage to mandible wear stage

Definitely staged mandibles only Phases M, P, and X excluded. Wear stages follow O'Connor (2003).

	Mandible wear stage				
P4 wear stage	SA1	SA2	A1	A2	Total
a	1	1			2
b		5	4	2	11
c				1	1
d			2	1	3
e			1	2	3
Total	1	7	8	7	23

Table 3.6.4 Pig M_1 wear stage to mandible wear stage

Definitely staged mandibles only. Phases M, P, and X excluded. Wear stages follow O’Connor (2003).

	Mandible wear stage								
M_1 wear stage	J	I1	I2	SA1	SA2	A1	A2	A3	Total
C	5								5
V	2								2
U	3								3
a		2							2
b		4	1						5
c			6						6
d		1	1	1	3				6
e					2	1			3
f					2	3	1		6
g					7	8	3		18
h						2	4		6
j						1			1
k							1		1
l							3		3
m						1	3	1	5
Total	10	7	11	3	14	18	16	1	80

Table 3.6.5 Pig M_2 wear stage to mandible wear stage

Definitely staged mandibles only. Phases M, P, and X excluded. Wear stages follow O’Connor (2003).

	Mandible wear stage							
M_2 wear stage	I1	I2	SA1	SA2	A1	A2	A3	Total
V	2							2
C	5							5
E		4						4
H		2						2
U		6						6
a			5	1				6
b				4	1			5
c				10	8			18
d				4	7			11
e				2	15	8		25
f					7	12		19
g					3	13		16
h						2	1	3
k							1	1
Total	7	12	5	22	44	38	2	130

CHAPTER FOUR

RESULTS OF ZOOARCHAEOLOGICAL ANALYSIS AT FORCELLO

Table 4.2.1 Pig unfused metapodials and mandibular first and second molars by period

	Late - ABCD		Early - EFGHI		Other archaeological	
Unfused metapodials	n	%	n	%	n	%
Diaphyses	221	93%	87	85%	188	86%
Epiphyses	17	7%	15	15%	31	14%
Total	238		102		219	
Lower M1 and M2	n	%	n	%	n	%
In mandible	182	89%	98	87%	199	89%
Loose	22	11%	15	13%	24	11%
Total	204		113		223	

Table 4.2.2 Bones with butchery, gnawing and burning marks by period

	Cattle							Sheep/goat							Pig						
	Total	Butch	%	Gnaw	%	Burnt	%	Total	Butch	%	Gnaw	%	Burnt	%	Total	Butch	%	Gnaw	%	Burnt	%
Late - ABCD	223	41	18%	22	10%	2	1%	445	51	11%	11	2%	12	3%	2163	355	16%	112	5%	82	4%
Early - EFGHI	137	13	9%	6	4%		0%	290	26	9%	5	2%	3	1%	900	85	9%	36	4%	22	2%
Other arch.	220	29	13%	12	5%	4	2%	593	47	8%	13	2%	8	1%	2106	259	12%	46	2%	40	2%

Table 4.2.3 Bones with butchery, gnawing and burning marks by context type
Percentages given when sample size ≥ 25.

Context type	Total elements	Butchery		Gnawing		Burning	
	n	n	%	n	%	n	%
Pits and postholes							
b	50	11	22%	5	10%	1	2%
c	412	54	13%	14	3%	16	4%
d	321	29	9%	17	5%	13	4%
Total	783	94	12%	36	5%	30	4%
Construction fills							
e	1774	225	13%	82	5%	35	2%
i	129	20	16%	5	4%	3	2%
Total	1903	245	13%	87	5%	38	2%
Hearths and forges							
f	9	0		0		0	
g	40	6	15%	2	5%	3	8%
k	1	0		0		0	
k/l	2	0		0		0	
l	36	4	11%	1	3%	2	6%
Total	88	10	11%	3	3%	5	6%
Middens and ditches							
h	3135	369	12%	92	3%	76	2%
o	683	82	12%	34	5%	11	2%
Total	3818	451	12%	126	3%	87	2%
Storepits							
m	74	8	11%	0	0%	6	8%
Floors, pavements, and destruction debris							
n	308	36	12%	10	3%	4	1%
p	100	10	10%	3	3%	0	0%
q	385	60	16%	26	7%	12	3%
Total	793	106	13%	39	5%	16	2%

Table 4.2.4 Total butchery marks for cattle, sheep/goat and pig
.

Butchery mark type	n	%
Chop	248	18%
Chop and cut	39	3%
Saw	20	1%
Cut	1054	77%
Cut and saw	11	1%
Total	1374	100%

Table 4.2.5 Incidence of gnawing by rodents and digested bones
All phases.

	Period	Pig	Sheep/goat
Rodents	C	1	
	D–C	3	
	E	2	
	X		2
Digested	U		2
Total		6	4

4.3 SPECIES REPRESENTATION AND RELATIVE FREQUENCY

Table 4.3.1 Number of Counted Specimens (NCSP) by period
* Taxon represented only by uncounted elements. cf. table 3.5.1 for scientific names.

Period	Late	Early	Other archaeological	Modern, plowzone and unknown
Main Phases	A B C D	E F G H I	U	M P X
Cattle	317	213	314	231
Cattle?	4	1	*	
Sheep/goat	641	509	798	406
Sheep	163	102	202	90
Sheep?	10	5		2
Goat	73	60	84	39
Goat?	13	5	2	1
Pig	2841	1414	2908	1658
Equid		2	10	1
Donkey			1	
Horse				1
Dog	38	44	55	45
Red deer	126	63	86	42
Red deer?	5	1		
Red deer/fallow deer	3	1	1	*
Roe deer	3	3	1	
Fox			4	1
Badger			1	
Beaver	3	7	2	1
Hare			4	*
European hare	1			
Otter		1		
Mole		1		
Hedgehog			1	1
Small Murinae		4	2	
Small rodent	4	3	2	1
Cattle/red deer	39	30	28	22
Sheep/goat/roe deer	4	1	2	
Chicken	4	10	6	
Other bird	43	24	93	19
Frog/Toad	1	7	3	1
Cuttlefish		2		1
Total	4336	2513	4610	2563
	Archaeological total 11459			Grand total 14022

Table 4.3.2 Number of Counted Specimens (NCSP) by phase - mammals

* Taxon represented only by uncounted elements. cf. table 3.5.1 for scientific names.

	Late										Early													Other arch.					Modern			
	A	B	C	D	B?	A-B	B-C	C-D	D?	≥C	E	F	G	H	I	E?	E-F	G-H	H-I	E≥	F≥	G≥	H≥	U	D-E	B≥	C≥	D≥	A-M	M	P	X
Cattle	25	44	17	78		51		99	2	1	172	7	6	17		1	1		7			2		306		3	4	1	1	47	15	168
Cattle?				4							1													*								
Sheep/goat	63	93	48	115		99	1	216	5	1	293	55	45	71	8	6	1	2	21	6		1		769	1	12	6	10	6	70	34	296
Sheep	18	31	16	21		23		54			70	1	9	12		1			7	1		1		194		1	4	3	1	18	5	66
Sheep?		3		2				5			5																			1		1
Goat	8	10	7	17		4		26	1		42	4	6	5				1	2	*				77		6		1		8	*	31
Goat?	2	2		2		2		5			5													1		1						1
Pig	252	525	184	439		532	11	880	16	2	911	63	96	197	34	22		4	71	8	1	6	1	2816	2	41	30	19	13	290	120	1235
Equid											2													10						*		1
Donkey																								1								
Horse																																1
Dog	7	7	4	3		3		14			17	5	2	15	4							1		53		2			1	8	1	35
Red deer	3	18	8	42	*	12		43			57	3	1	2	*									81	2	1	1	1		2	1	39
Red deer?				1		1		3			1																					
Red deer/fallow deer	2	*	*	1		*		*			1	*		*										1		*						*
Roe deer		*	1	1		1		*			1	1							1					1								
Fox																								4							1	
Badger																								1								
Beaver		1				1			1		3		1	3										2							1	
Hare																								4								*
European hare				1																												
Otter															1																	
Mole											1																					
Hedgehog																								1								1
Small Murinae											1	3												2								
Small rodent	1			1				2			1	2												2								1
Cattle/red deer	4	4	5	6		4		16			25	1	3	1										26				2		2	1	19
Sheep/goat/roe deer	3							1			1													2								
Total	388	738	290	734	0	733	12	1364	25	4	1610	145	169	323	47	30	2	7	109	15	1	11	1	4354	5	67	45	37	22	446	179	1895
	4288										2470													4508					2542			
	All archaeological 11266																															

Table 4.3.3 Number of counted specimens (NCSP) by phase – birds and other fauna
cf. table 3.5.1 for scientific names.

	Late									Early							Other arch.				
	A	B	C	D	A-B	B-C	C-D	D?		E	F	G	H	I	E≥		U	B≥		M	X
Birds																					
Chicken							4			1			9				6				
Galliforme																					1
Duck	3	3		5			2			7	1	1	1				32	1		1	2
Dabbling duck		1	1	1		1	2			3					1		10				2
Diving duck										1							5				1
Goose							3	1									1				1
Swan				2																	
Mute swan																	3				
Anseriforme	1																4				1
Coot (Fulica atra)	1	1		1	2		3			3		1	2				8	1		1	6
Coot/moorhen							1										1				
Crane																	5				
Bittern	1																				
Small heron																				1	
Pelican							1														
Starling				1																	
Crow/Rook		1					1										1				
Raven																	9				2
Pigeon					2		1										7				
Curlew																	1				
Gull										1											
Charadriiforme																	2				
Small owl																	1				
Accipitriforme										2							1				
Total	6	6	1	10	4	1	18	1		18	1	2	12	0	1		97	2		3	16
	47									34							99			19	
	All archaeological 180																				
Other fauna																					
Frog/Toad							1			5	1		1				3				1
Cuttlefish													1	1							1
Total							1			5	1	2	1				3				2
	1									9							3			2	
	All archaeological 13																				

Table 4.3.4 Wild and domestic taxa by period

	Late - ABCD		Early – EFGHI		Unphased	
	n	%	n	%	n	%
Domestic mammals	4100	97%	2355	97%	4374	98%
Wild mammals	145	3%	84	3%	104	2%
Total	4245		2439		4478	
Chicken	4	9%	10	29%	6	6%
Other birds	43	91%	24	71%	93	94%
Total	47		34		99	

Figure 4.3.5 Number of Counted Specimens (NCSP) from sieved faunal material

Phase	D	E	F	G	U	Archaeological Total		X
Cattle				1	1	2		
Sheep/goat	1	2	9		11	23		
Goat		*			2	2		
Pig	8	2	19		8	37		2
Dog			1		1	2		
Mouse (Mus sp.)					1	1		
Small Murinae	3	1	1		2	7		
Small rodent		1	2			3		
Frog/toad	1				1	2		
Grand Total	13	6	32	1	27	79		2

Figure 4.3.6 Species frequencies from contexts most affected by sieving
Includes all specimens both specimens labelled as sieved and those not indicated as such.

Context	292	476	876
Cattle	5%	1%	7%
Sheep/goat	25%	43%	25%
Pig	70%	56%	68%
Total NCSP	217	90	2270

4.4 PIG

Table 4.4.1 Pig skeletal element distribution – all archaeological

Unfused epiphyses excluded. cf. table 3.6.1 for MAU calculations.

All archaeological phases											
TEETH								BONES			
LOWER	MNE	MAU	%MAU	UPPER	MNE	MAU	%MAU		MNE	MAU	%MAU
I1	171	85.5	33%	I1	120	60	23%	Zygomaticus	73	36.5	14%
I2	169	84.5	33%	I2	34	17	7%	Atlas	160	160	62%
I3	19	9.5	4%	I3	22	11	4%	Axis	26	26	10%
I	16.00	2.67	1%	I	1	0.17	0%				
dI1	12	6	2%	dI1	8	4	2%	Scapula	520	260	100%
dI2	23	11.5	4%	dI2	4	2	1%	Humerus (p)	76	38	15%
dI3	1	0.5	0%	dI3	0	0	0%	Humerus (d)	308	154	59%
dI/dC	22	2.75	1%	dI/dC	2	0.25	0%	Radius (p)	249	124.5	48%
C	266	133	51%	C	143	71.5	28%	Radius (d)	129	64.5	25%
dC	1	0.5	0%	dC	1	0.5	0%	Ulna	393	196.5	76%
								3rd Carpal	8	4	2%
dP2	42	21	8%	dP2	23	11.5	4%	Metacarpal III (d)	192	96	37%
dP3	83	41.5	16%	dP3	46	23	9%	Metacarpal IV (d)	201	100.5	39%
dP4	107	53.5	21%	dP4	56	28	11%				
P1	39	19.5	8%	P1	56	28	11%	Pelvis	234	117	45%
P2	85	42.5	16%	P2	91	45.5	18%	Femur (p)	90	45	17%
P3	146	73	28%	P3	137	68.5	26%	Femur (d)	126	63	24%
P4	169	84.5	33%	P4	150	75	29%	Tibia (p)	82	41	16%
P	17	2.125	1%	P	1	0.125	0%	Tibia (d)	305	152.5	59%
								Astragalus	173	86.5	33%
M1+M2	540	135	52%	M1+M2	439	109.75	42%	Calcaneum	250	125	48%
M3	206	103	40%	M3	120	60	23%	Cuboid	52	26	10%
M	8	1.33	1%	M	16	2.67	1%	Metatarsal III (d)	165	82.5	32%
P/M	2	0.1429	0%	P/M	0	0	0%	Metatarsal IV (d)	126	63	24%
All archaeological max MAU 260											
								Metapodial (d)	171	21.375	8%
								Metapodial total	855	106.88	41%
								Phalanx I	390	48.75	19%
								Phalanx II	191	23.875	9%
								Phalanx III	126	15.75	6%

Table 4.4.2 Pig skeletal element distribution - Late

Unfused epiphyses excluded. cf. table 3.6.1 for MAU calculations.

Late - ABCD

TEETH								BONES			
LOWER	MNE	MAU	%MAU	UPPER	MNE	MAU	%MAU		MNE	MAU	%MAU
I1	55	27.5	39%	I1	32	16	23%	Zygomaticus	21	10.5	9%
I2	64	32	46%	I2	7	3.5	5%	Atlas	59	59	49%
I3	5	2.5	4%	I3	9	4.5	6%	Axis	11	11	9%
I	6	1	1%	I	1	0.167	0%				
dI1	5	2.5	4%	dI1	3	1.5	2%	Scapula	243	121.5	100%
dI2	6	3	4%	dI2	3	1.5	2%	Humerus (p)	36	18	15%
dI3	0	0	0%	dI3	0	0	0%	Humerus (d)	147	73.5	60%
dI/dC	5	0.625	1%	dI/dC	0	0	0%	Radius (p)	114	57	47%
C	104	52	74%	C	39	19.5	28%	Radius (d)	64	32	26%
dC	0	0	0%	dC	1	0.5	1%	Ulna	178	89	73%
								3rd Carpal	1	0.5	0%
dP2	22	11	16%	dP2	14	7	10%	Metacarpal III (d)	91	45.5	37%
dP3	38	19	27%	dP3	19	9.5	14%	Metacarpal IV (d)	93	46.5	38%
dP4	41	20.5	29%	dP4	22	11	16%				
P1	17	8.5	12%	P1	14	7	10%	Pelvis	86	43	35%
P2	35	17.5	25%	P2	29	14.5	21%	Femur (p)	35	17.5	14%
P3	57	28.5	41%	P3	39	19.5	28%	Femur (d)	59	29.5	24%
P4	65	32.5	46%	P4	43	21.5	31%	Tibia (p)	32	16	13%
P	4	0.5	1%	P	0	0	0%	Tibia (d)	136	68	56%
								Astragalus	65	32.5	27%
M1+M2	204	51	73%	M1+M2	148	37	53%	Calcaneum	118	59	49%
M3	70	35	50%	M3	48	24	34%	Cuboid	14	7	6%
M	3	0.5	1%	M	4	0.667	1%	Metatarsal III (d)	77	38.5	32%
P/M	0	0	0%	P/M	0	0	0%	Metatarsal IV (d)	52	26	21%
								Metapodial (d)	69	8.625	7%
								Metapodial total	382	47.75	39%
Late max MAU 121.5								Phalanx I	153	19.125	16%
								Phalanx II	63	7.875	6%
								Phalanx III	38	4.75	4%

Table 4.4.3 Pig skeletal element distribution - Early

Unfused epiphyses excluded. cf. table 3.6.1 for MAU calculations.

Early - EFGHI

TEETH

LOWER	MNE	MAU	%MAU
I1	41	20.5	43%
I2	46	23	48%
I3	6	3	6%
I	6	1	2%
dI1	3	1.5	3%
dI2	7	3.5	7%
dI3	0	0	0%
dI/dC	9	1.125	2%
C	64	32	67%
dC	0	0	0%
dP2	5	2.5	5%
dP3	12	6	13%
dP4	20	10	21%
P1	7	3.5	7%
P2	17	8.5	18%
P3	28	14	29%
P4	36	18	38%
P	6	0.75	2%
M1+M2	113	28.25	59%
M3	64	32	67%
M	4	0.667	1%
P/M	1	0.071	0%

UPPER	MNE	MAU	%MAU
I1	40	20	42%
I2	10	5	10%
I3	7	3.5	7%
I	0	0	0%
dI1	1	0.5	1%
dI2	0	0	0%
dI3	0	0	0%
dI/dC	2	0.25	1%
C	30	15	31%
dC	0	0	0%
dP2	2	1	2%
dP3	7	3.5	7%
dP4	6	3	6%
P1	12	6	13%
P2	20	10	21%
P3	38	19	40%
P4	41	20.5	43%
P	0	0	0%
M1+M2	103	25.75	54%
M3	32	16	33%
M	8	1.333	3%
P/M	0	0	0%

Early max MAU 32

Bones

	MNE	MAU	%MAU
Zygomaticus	11	5.5	17%
Atlas	28	28	88%
Axis	1	1	3%
Scapula	60	30	94%
Humerus (p)	11	5.5	17%
Humerus (d)	51	25.5	80%
Radius (p)	38	19	59%
Radius (d)	20	10	31%
Ulna	60	30	94%
3rd Carpal	1	0.5	2%
Metacarpal III (d)	33	16.5	52%
Metacarpal IV (d)	28	14	44%
Pelvis	32	16	50%
Femur (p)	17	8.5	27%
Femur (d)	15	7.5	23%
Tibia (p)	13	6.5	20%
Tibia (d)	39	19.5	61%
Astragalus	35	17.5	55%
Calcaneum	41	20.5	64%
Cuboid	13	6.5	20%
Metatarsal III (d)	24	12	38%
Metatarsal IV (d)	19	9.5	30%
Metapodial (d)	58	7.25	23%
Metapodial total	162	20.25	63%
Phalanx I	103	12.86	40%
Phalanx II	46	5.75	18%
Phalanx III	38	4.75	15%

Table 4.4.4 Pig skeletal element distribution – other archaeological

Unfused epiphyses excluded. cf. table 3.6.1 for MAU calculations.

Unphased and other archaeological

TEETH								Bones			
LOWER	MNE	MAU	%MAU	UPPER	MNE	MAU	%MAU		MNE	MAU	%MAU
I1	75	37.5	54%	I1	48	24	34%	Zygomaticus	41	20.5	19%
I2	59	29.5	42%	I2	17	8.5	12%	Atlas	73	73	67%
I3	8	4	6%	I3	6	3	4%	Axis	14	14	13%
I	4.00	0.67	1%	I	0	0	0%				
dI1	4	2	3%	dI1	4	2	3%	Scapula	217	108.5	100%
dI2	10	5	7%	dI2	1	0.5	1%	Humerus (p)	29	14.5	13%
dI3	1	0.5	1%	dI3	0	0	0%	Humerus (d)	110	55	51%
dI/dC	8	1	1%	dI/dC	0	0	0%	Radius (p)	97	48.5	45%
C	98	49	70%	C	74	37	53%	Radius (d)	45	22.5	21%
dC	1	0.5	1%	dC	0	0	0%	Ulna	155	77.5	71%
								3rd Carpal	6	3	3%
dP2	15	7.5	11%	dP2	7	3.5	5%	Metacarpal III (d)	68	34	31%
dP3	33	16.5	24%	dP3	20	10	14%	Metacarpal IV (d)	80	40	37%
dP4	46	23	33%	dP4	28	14	20%				
P1	15	7.5	11%	P1	30	15	21%	Pelvis	116	58	53%
P2	33	16.5	24%	P2	42	21	30%	Femur (p)	38	19	18%
P3	61	30.5	44%	P3	60	30	43%	Femur (d)	52	26	24%
P4	68	34	49%	P4	66	33	47%	Tibia (p)	37	18.5	17%
P	7	0.875	1%	P	1	0.125	0%	Tibia (d)	130	65	60%
								Astragalus	73	36.5	34%
M1+M2	223	55.75	80%	M1+M2	188	47	67%	Calcaneum	91	45.5	42%
M3	72	36	51%	M3	40	20	29%	Cuboid	25	12.5	12%
M	1	0.17	0%	M	4	0.67	1%	Metatarsal III (d)	64	32	29%
P/M	1	0.071	0%	P/M	0	0	0%	Metatarsal IV (d)	55	27.5	25%
								Metapodial (d)	44	5.5	5%
								Metapodial total	311	38.875	36%
								Phalanx I	134	16.75	15%
								Phalanx II	82	10.25	9%
								Phalanx III	50	6.25	6%

Other archaeological max MAU 108.5

Table 4.4.5 Combined *Sus scrofa* mineral bone density from Pugsley (2002) and corresponding Forcello diagnostic zone

	%MAU	Slice code	Density (g/cm3)
Scapula	100%	SP1	0.891
	100%	SP2	1.498
Main bones			
Atlas	62%	AT1	1.498
Humerus (p)	15%	HU1	0.791
Humerus (d)	59%	HU5	1.16
Radius (p)	48%	RA1	1.109
Ulna	76%	UL2	1.519
Radius (d)	25%	RA5	0.915
Metacarpals	38%	MC5	1.054
Pelvis	45%	AC1	0.943
Femur (p)	17%	FE1	0.695
Femur (d)	24%	FE6	0.745
Tibia (p)	16%	TI1	0.658
Tibia (d)	59%	TI5	1.162
Astragalus	33%	AS1	1.079
Calcaneum	48%	CA3	1.221
Metatarsals	28%	MT5	0.937
Phalanges			
Phalanx I	19%	P11	1.086
Phalanx II	9%	P22	1.373
Phalanx III	6%	P31	1.179

Table 4.4.6 Pig left vs. right body part distribution

Probability (p) calculated using a chi squared test (x^2).

	Observed			Expected		x^2	p
	Left	Right	Total	Left	Right		
Zygomaticus	36	37	73	36.5	36.5	0.0137	0.9068
Scapula	261	254	515	257.5	257.5	0.75773	0.7577
Humerus (p)	53	47	100	50	50	0.3600	0.5485
Humerus (d)	139	174	313	156.5	156.5	3.9137	0.0479
Radius (p)	135	116	251	125.5	125.5	1.4382	0.2304
Ulna	211	180	391	195.5	195.5	2.4578	0.1169
Radius (d)	96	78	174	87	87	1.8621	0.1724
Metacarpal III	93	98	191	95.5	95.5	0.1309	0.7175
Metacarpal IV	102	97	199	99.5	99.5	0.1256	0.7230
Pelvis	107	127	234	117	117	1.7094	0.1911
Femur (p)	67	80	147	73.5	73.5	1.1497	0.2836
Femur (d)	105	94	199	99.5	99.5	0.6080	0.4355
Tibia (p)	76	53	129	64.5	64.5	4.1008	0.0429
Tibia (d)	154	163	317	158.5	158.5	0.2555	0.6132
Astragalus	97	64	161	80.5	80.5	6.7640	0.0093
Calcaneum	127	123	250	125	125	0.0640	0.8003
Metatarsal III	81	84	165	82.5	82.5	0.0545	0.8153
Metatarsal IV	71	55	126	63	63	2.0317	0.1540

Table 4.4.7 Pig bones with butchery marks
Cut and chop percentages provided for sample sizes ≥ 25.

	Cut		Chop		Cut and chop		Butch total		Total	% butch
	n	%	n	%	n	%				%
Zygomaticus	3		0		0		3		73	4%
Atlas	17		0		0		17		160	11%
Axis	0		1		0		1		26	4%
Scapula	128	78%	34	21%	3	2%	165		520	32%
Huermus (p)	2		2		0		4		100	4%
Humerus (d)	64	83%	11	14%	2	3%	77		314	25%
Radius (p)	62	83%	10	13%	3	4%	75		251	30%
Ulna	76	85%	7	8%	6	7%	89		393	23%
Radius (d)	10		1		0		11		174	6%
Carpal 3	0		0		0		0		8	0%
Metacarpal	7		2		0		9		393	2%
Pelvis	34	89%	4	11%	0	0%	38		234	16%
Femur (p)	8		2		0		10		151	7%
Femur (d)	1		4		0		5		199	3%
Tibia (p)	4		2		0		6		130	5%
Tibia (d)	13	50%	12	46%	1	4%	26		318	8%
Astragalus	19	76%	6	24%	0	0%	25		173	14%
Calcaneum	27	71%	11	29%	0	0%	38		250	15%
Cuboid	6		0		0		6		52	12%
Metatarsal	12		0		0		12		291	4%
Phalanx I	6		1		1		8		399	2%
Phalanx II	0		0		0		0		198	0%
Phalanx III	2		1		0		3		126	2%
Grand Total	501	80%	111	18%	16	3%	628		4933	13%

Table 4.4.8 Pig bones with butchery marks by context type
Cut and chop percentages provided for sample sizes ≥ 25.

	Pits and postholes				Construction fill			Hearths and forges						Middens and ditches			Store pits	Floors, pavements and destruction debris			
context	b	c	d		e	i		f	g	k	k/l	l		h	o		m	n	p	q	
n butch.	6	39	20	65	150	12	162	0	3	0	0	4	7	269	56	325	5	23	6	38	67
Total	32	311	192	535	1235	73	1308	6	29	1	0	25	61	2193	464	2657	47	200	53	256	509
% butch.	19%	13%	10%	12%	12%	16%	12%		10%			16%	11%	12%	12%	12%	11%	12%	11%	15%	13%

Table 4.4.9 Pig bones with gnawing marks

Percentages provided for sample sizes ≥ 25.

	Late - ABCD			Early - EFGHI			Other archaeological		
	gnawed	total	%	gnawed	total	%	n	total	%
Zygomaticus	0	21		0	11		0	41	0%
Atlas	1	59	2%	2	28	7%	0	73	0%
Axis	0	11		0	1		0	14	
Scapula	32	243	13%	6	60	10%	11	217	5%
Huermus (p)	0	45	0%	0	15		0	40	0%
Humerus (d)	21	148	14%	10	52	19%	8	114	7%
Radius (p)	3	115	3%	3	39	8%	2	99	2%
Ulna	12	178	7%	2	60	3%	4	155	3%
Radius (d)	1	82	1%	0	29	0%	0	62	0%
Carpal 3	0	1		0	1		0		0%
Metacarpal	3	184	2%	1	61	2%	0	148	0%
Pelvis	5	86	6%	2	32	6%	3	116	3%
Femur (p)	0	52	0%	0	27	0%	0	68	0%
Femur (d)	0	81	0%	0	25	0%	3	97	3%
Tibia (p)	1	50	2%	0	22		1	58	2%
Tibia (d)	7	137	5%	0	42	0%	3	139	2%
Astragalus	6	65	9%	2	35	6%	4	73	5%
Calcaneum	13	118	11%	5	41	12%	6	91	7%
Cuboid	0	14		0	13		0	25	0%
Metatarsal	2	129	2%	0	43	0%	0	119	0%
Phalanx I	2	156	1%	2	106	2%	1	138	1%
Phalanx II	0	64	0%	0	46	0%	0	88	0%
Phalanx III	2	38	5%	0	38	0%	0	50	0%
Grand Total	111	2077	5%	35	827	4%	46	2031	2%

Table 4.4.10 Pig bones with gnaw marks by context type

Percentages provided for sample sizes ≥ 25.

	Pits and postholes				Construction fill			Hearths and forges						Middens and ditches			Store pits	Floors, pavements and destruction debris			
	b	c	d		e	i		f	g	k	k/l	l		h	o		m	n	p	q	
n gnaw	2	11	11	24	59	2	61	0	1	0	0	1	2	57	24	81	0	8	2	15	25
Total	32	311	192	535	1235	73	1308	6	29	1	0	25	61	2193	464	2657	47	200	53	256	509
% gnaw	6%	4%	6%	4%	5%	3%	5%		3%			4%	3%	3%	5%	3%	0%	4%	4%	6%	5%

Table 4.4.11 Pig bones with evidence of burning

Percentages provided for sample sizes ≥ 25.

	Burnt		Calcined		Singed		Burnt total		Total	% burnt
	n	%	n	%	n	%				%
Zygomaticus	0		0		0		0		73	0%
Atlas	0		0		1		1		160	1%
Axis	0		0		0		0		26	0%
Scapula	0		5		2		7		520	1%
Huermus (p)	1		0		1		2		100	2%
Humerus (d)	3		0		3		6		314	2%
Radius (p)	1		3		5		9		251	4%
Ulna	2		4		4		10		393	3%
Radius (d)	0		1		0		1		174	1%
Carpal 3	0		0		0		0		8	
Metacarpal	0		1		0		1		393	0%
Pelvis	0		1		2		3		234	1%
Femur (p)	0		0		0		0		151	0%
Femur (d)	1		1		2		4		199	2%
Tibia (p)	2		1		1		4		130	3%
Tibia (d)	3		4		3		10		318	3%
Astragalus	4		4		0		8		173	5%
Calcaneum	2		6		6		14		250	6%
Cuboid	0		0		0		0		52	0%
Metatarsal	0		1		0		1		291	0%
Phalanx I	5		7		4		16		399	4%
Phalanx II	4		6		5		15		198	8%
Phalanx III	4		3		1		8		126	6%
Grand Total	56	23%	127	53%	58	24%	241		5642	4%

Table 4.4.12 Burnt pig bones with by context type

Percentages provided for sample sizes ≥ 25.

	Pits and postholes				Construction fill			Hearths and forges						Middens and ditches			Store pits	Floors, pavements and destruction debris			
	b	c	d		e	i		f	g	k	k/l	l		h	o		m	n	p	q	
n burnt	1	15	8	24	28	3	31	0	3	0	0	1	4	58	11	69	4	3	0	8	11
Total	32	311	192	535	1235	73	1308	6	29	1	0	25	61	2193	464	2657	47	200	53	256	509
% burnt	3%	5%	4%	4%	2%	4%	2%		10%			4%	7%	3%	2%	3%	9%	2%	0%	3%	2%

4.5 SHEEP/GOAT

Table 4.5.1 Sheep/goat skeletal element distribution – all archaeological phases
Unfused epiphyses excluded. cf. table 3.6.1 for MAU calculations.

ALL archaeological phases											
TEETH								ELEMENT			
LOWER	MNE	MAU	%MAU						MNE	MAU	%MAU
I1	3	1.5	1%					Zygomaticus	47	23.5	16%
I2	2	1	1%					Horncores	73	36.5	24%
I3	7	3.5	2%					Atlas	26	26	17%
I	51	6.375	4%					Axis	2	2	1%
dI1	1	0.5	0%								
dI2	0	0	0%					Scapula	61	30.5	20%
dI3	0	0	0%					Humerus (p)	14	7	5%
dI/dC	19	2.375	2%					Humerus (d)	115	57.5	38%
C	0	0	0%					Radius (p)	58	29	19%
dC	0	0	0%					Radius (d)	55	27.5	18%
				UPPER	MNE	MAU	%MAU	Ulna	61	30.5	20%
dP2	148	74	49%	dP2	50	25	17%	3rd Carpal	1	0.5	0%
dP3	213	106.5	71%	dP3	90	45	30%	Metacarpal (d)	86	43	29%
dP4	258	129	86%	dP4	95	47.5	32%				
P1	0	0	0%	P1	0	0	0%	Pelvis	67	33.5	22%
P2	56	28	19%	P2	28	14	9%	Femur (p)	32	16	11%
P3	116	58	39%	P3	38	19	13%	Femur (d)	28	14	9%
P4	133	66.5	44%	P4	48	24	16%	Tibia (p)	27	13.5	9%
P	0	0	0%	P	30	5.00	3%	Tibia (d)	114	57	38%
								Astragalus	49	24.5	16%
M1+M2	600	150	100%	M1+M2	334	83.5	56%	Calcaneum	59	29.5	20%
M3	164	82	55%	M3	128	64	43%	Scafocubois	17	8.5	6%
M	21	3.50	2%	M	13	2.17	1%	Metatarsal (d)	101.5	50.75	34%
P/M	0	0	0%	P/M	0	0	0%				
ALL archaeological max MAU 150								Metapodial (d)	20	5	3%
								Metapodial total	207.5	51.875	35%
								Phalanx I	55	6.875	12%
								Phalanx II	47	5.875	4%
								Phalanx III	18	2.25	2%

Table 4.5.2 Sheep/goat skeletal element distribution - Late

Unfused epiphyses excluded. cf. table 3.6.1 for MAU calculations.

Late - ABCD

TEETH

LOWER	MNE	MAU	%MAU
I1	1	0.5	1%
I2	1	0.5	1%
I3	1	0.5	1%
I	20	2.5	5%
dI1	1	0.5	1%
dI2	0	0	0%
dI3	0	0	0%
dI/dC	4	0.5	1%
C	0	0	0%
dC	0	0	0%
dP2	70	35	66%
dP3	95	47.5	90%
dP4	105	52.5	99%
P1	0	0	0%
P2	22	11	21%
P3	42	21	40%
P4	41	20.5	39%
P	0	0	0%
M1+M2	212	53	100%
M3	56	30	57%
M	9	1.5	3%
P/M	0	0	0%

UPPER	MNE	MAU	%MAU
dP2	11	5.5	10%
dP3	23	11.5	22%
dP4	28	14	26%
P1	0	0	0%
P2	9	4.5	8%
P3	10	5	9%
P4	16	8	15%
P	6	1.00	2%
M1+M2	113	28.25	53%
M3	41	20.5	39%
M	6	1	2%
P/M	0	0	0%

Late max MAU 53

ELEMENT

	MNE	MAU	%MAU
Zygomaticus	13	6.5	12%
Horncores	25	12.5	24%
Atlas	11	11	21%
Axis	0	0	0%
Scapula	19	9.5	18%
Humerus (p)	2	1	2%
Humerus (d)	45	22.5	42%
Radius (p)	22	11	21%
Radius (d)	19	9.5	18%
Ulna	14	7	13%
3rd Carpal	0	0	0%
Metacarpal (d)	35.5	17.75	33%
Pelvis	22	11	21%
Femur (p)	11	5.5	10%
Femur (d)	7	3.5	7%
Tibia (p)	7	3.5	7%
Tibia (d)	31	15.5	29%
Astragalus	15	7.5	14%
Calcaneum	26	13	25%
Scafocubois	9	4.5	8%
Metatarsal (d)	40.5	20.25	38%
Metapodial (d)	4	1	2%
Metapodial total	80	20	38%
Phalanx I	55	55	6.875
Phalanx II	10	1.25	2%
Phalanx III	4	0.5	1%

Table 4.5.3 Sheep/goat skeletal element distribution - Early

Unfused epiphyses excluded. cf. table 3.6.1 for MAU calculations..

Early - EFGHI

TEETH

LOWER	MNE	MAU	%MAU
I1	2	1	2%
I2	1	0.5	1%
I3	3	1.5	4%
I	18	2.25	6%
dI1	0	0	0%
dI2	0	0	0%
dI3	0	0	0%
dI/dC	11	1.375	3%
C	0	0	0%
dC	0	0	0%
dP2	28	14	34%
dP3	44	22	54%
dP4	53	26.5	65%
P1	0	0	0%
P2	13	6.5	16%
P3	34	17	42%
P4	43	21.5	53%
P	0	0	0%
M1+M2	163	40.75	100%
M3	52	26	64%
M	9	1.5	4%
P/M	0	0	0%

UPPER	MNE	MAU	%MAU
dP2	16	8	20%
dP3	23	11.5	28%
dP4	19	9.5	23%
P1	0	0	0%
P2	4	2	5%
P3	4	2	5%
P4	9	4.5	11%
P	8	1.33	3%
M1+M2	91	22.75	56%
M3	39	19.5	48%
M	4	0.67	2%
P/M	0	0	0%

Early max MAU 40.75

ELEMENT

	MNE	MAU	%MAU
Zygomaticus	7	3.5	9%
Horncores	27	5.5	13%
Atlas	6	6	15%
Axis	2	2	5%
Scapula	8	4	10%
Humerus (p)	2	1	2%
Humerus (d)	20	10	25%
Radius (p)	11	5.5	13%
Radius (d)	11	5.5	13%
Ulna	14	7	17%
3rd Carpal	1	0.5	1%
Metacarpal (d)	22	11	27%
Pelvis	15	7.5	18%
Femur (p)	3	1.5	4%
Femur (d)	4	2	5%
Tibia (p)	3	1.5	4%
Tibia (d)	32	16	39%
Astragalus	11	5.5	13%
Calcaneum	13	6.5	16%
Scafocubois	2	1	2%
Metatarsal (d)	17.5	8.75	21%
Metapodial (d)	5	1.25	3%
Metapodial total	44.5	11.125	27%
Phalanx I	39	39	4.875
Phalanx II	14	1.75	4%
Phalanx III	10	1.25	3%

Table 4.5.4 Sheep/goat skeletal element distribution – other archaeological

Unfused epiphyses excluded. cf. table 3.6.1 for MAU calculations.

Other archaeological phases

TEETH

LOWER	MNE	MAU	%MAU
I1	0	0	0%
I2	0	0	0%
I3	3	1.5	3%
I	13	1.625	3%
dI1	0	0	0%
dI2	0	0	0%
dI3	0	0	0%
dI/dC	4	0.5	1%
C	0	0	0%
dC	0	0	0%
dP2	50	25	44%
dP3	74	37	66%
dP4	100	50	89%
P1	0	0	0%
P2	21	10.5	19%
P3	40	20	36%
P4	49	24.5	44%
P	0	0	0%
M1+M2	225	56.25	100%
M3	56	28	50%
M	3	0.50	1%
P/M	0	0	0%

UPPER	MNE	MAU	%MAU
dP2	23	11.5	20%
dP3	44	22	39%
dP4	48	24	43%
P1	0	0	0%
P2	15	7.5	13%
P3	24	12	21%
P4	23	11.5	20%
P	16	2.67	5%
M1+M2	130	32.5	58%
M3	48	24	43%
M	3	0.50	1%
P/M	0	0	0%

Other archaeological max MAU 56.25

ELEMENT

	MNE	MAU	%MAU
Zygomaticus	27	13.5	24%
Horncores	21	10.5	19%
Atlas	9	9	16%
Axis	0	0	0%
Scapula	34	17	30%
Humerus (p)	10	5	9%
Humerus (d)	50	25	44%
Radius (p)	25	12.5	22%
Radius (d)	25	12.5	22%
Ulna	33	16.5	29%
3rd Carpal	0	0	0%
Metacarpal (d)	28.5	14.25	25%
Pelvis	30	15	27%
Femur (p)	18	9	16%
Femur (d)	17	8.5	15%
Tibia (p)	17	8.5	15%
Tibia (d)	51	25.5	45%
Astragalus	23	11.5	20%
Calcaneum	20	10	18%
Scafocubois	6	3	5%
Metatarsal (d)	43.5	21.75	39%
Metapodial (d)	11	2.75	5%
Metapodial total	83	20.75	37%
Phalanx I	55	6.875	12%
Phalanx II	23	2.875	5%
Phalanx III	4	0.5	1%

Table 4.5.5 Sheep/goat left vs. right body part distribution

Probability (p) calculated using a chi squared test (x^2). Probability provided when $n > 50$.

	Observed			Expected		x^2	p
	Left	Right	Total	Left	Right		
Cranium	23	23	46				
Scapula	29	31	60	30	30	0.0667	0.7963
Humerus (p)	9	8	17				
Humerus (d)	70	47	117	58.5	58.5	4.5214	0.0335
Radius (p)	26	31	57	28.5	28.5	0.4386	0.5078
Ulna	28	33	61	30.5	30.5	0.4098	0.5221
Radius (d)	31	29	60	30	30	0.0667	0.7963
Metacarpal	31	33	64	32	32	0.0625	0.8026
Pelvis	30	35	65	32.5	32.5	0.3846	0.5351
Femur (p)	17	26	43				
Femur (d)	13	22	35				
Tibia (p)	19	14	33				
Tibia (d)	51	63	114	57	57	1.2632	0.2611
Astragalus	23	25	48				
Calcaneum	27	32	59	29.5	29.5	0.4237	0.5151

Table 4.5.6 Sheep/goat bones with butchery marks
Percentages given when sample size ≥ 25.

	Cut	Chop	Cut and chop	Saw	Butch total		NCSP	% butch
	n	n	n	n	n		n	%
Horncore	2	20	5	6	33		73	45%
Zygomaticus	0	0	0	0	0		47	0%
Atlas	2	0	0	0	2		26	8%
Axis	0	0	0	0	0		2	
Scapula	14	7	0	0	21		61	34%
Huermus (p)	1	0	0	0	1		17	
Humerus (d)	20	3	1	0	24		117	21%
Radius (p)	10	0	0	0	10		58	17%
Ulna	2	0	0	0	2		61	3%
Radius (d)	1	1	0	0	2		61	3%
Carpal 3	0	0	0	0	0		1	
Metacarpal	8	1	0	0	9		88	10%
Pelvis	5	0	0	0	5		67	7%
Femur (p)	5	0	0	0	5		44	11%
Femur (d)	2	0	0	0	2		35	6%
Tibia (p)	2	0	0	0	2		33	6%
Tibia (d)	5	4	1	0	10		118	8%
Astragalus	3	1	0	0	4		49	8%
Calcaneum	0	1	0	0	1		59	2%
Cuboid	3	0	0	0	3		17	
Metatarsal	7	0	0	0	7		103	7%
Phalanx I	12	0	0	0	12		149	8%
Phalanx II	0	0	0	0	0		47	0%
Phalanx III	0	0	0	0	0		18	
Grand Total	104	38	7	6	155		3141	12%
%	67%	25%	5%	4%				

Table 4.5.7 Sheep/goat bones with butchery marks by context type
Percentages given when sample size ≥ 25.

	Pits and postholes				Construction fill			Hearths and forges						Middens and ditches			Store pits	Floors, pavements and destruction debris			
context	b	c	d		e	i		f	g	k	k/l	l		h	o		m	n	p	q	
n butch.	2	8	2	12	36	1	37	0	2	0	0	0	2	43	14	57	0	7	2	3	12
Total	8	59	57	124	310	28	338	2	6	0	2	8	18	569	98	667	20	70	22	56	148
% butch.		14%	4%	10%	12%	4%	11%							8%	14%	9%		10%		5%	8%

Table 4.5.8 Sheep/goat bones with gnawing marks
Percentages given when sample size ≥ 25.

	Horncore	Zygomaticus	Atlas	Axis	Scapula	Huermus (p)	Humerus (d)	Radius (p)	Ulna	Radius (d)	Carpal 3	Metacarpal	Pelvis	Femur (p)	Femur (d)	Tibia (p)	Tibia (d)	Astragalus	Calcaneum	Scafocuboid	Metatarsal	Phalanx I	Phalanx II	Phalanx III	Total
n gnaw.	1	0	0	0	0	0	5	0	1	0	0	0	1	0	0	0	14	4	3	0	1	0	0	0	38
Total	73	47	26	2	61	17	117	58	61	61	1	86	67	44	35	33	118	49	59	17	103	149	47	18	1480
% gnaw.	1%	0%	0%		0%		4%	0%	2%	0%		0%	1%	0%	0%	0%	12%	8%	5%		1%	0%	0%		3%

Table 4.5.9 Sheep/goat bones with gnawing marks by context type
Percentages given when sample size ≥ 25.

	Pits and postholes				Construction fill			Hearths and forges						Middens and ditches			Store pits	Floors, pavements and destruction debris			
context	b	c	d		e	i		f	g	k	k/l	l		h	o		m	n	p	q	
n gnaw.	1	1	0	2	9	0	9	0	0	0	0	0	0	10	5	15	0	0	1	2	3
Total	8	59	57	124	310	28	338	2	6	0	2	8	18	569	98	667	20	70	22	56	148
% gnaw.		2%	0%	2%	3%	0%	3%							2%	5%	2%		0%		4%	2%

Table 4.5.10 Sheep/goat bones with burning marks
Percentages given when sample size ≥ 25.

	Horncore	Zygomaticus	Atlas	Axis	Scapula	Huermus (p)	Humerus (d)	Radius (p)	Ulna	Radius (d)	Carpal 3	Metacarpal	Pelvis	Femur (p)	Femur (d)	Tibia (p)	Tibia (d)	Astragalus	Calcaneum	Scafocuboid	Metatarsal	Phalanx I	Phalanx II	Phalanx III	Total
n burnt	1	0	0	0	1	0	3	1	0	0	0	1	0	1	0	0	2	1	2	0	1	3	2	1	20
Total	73	47	26	2	61	17	117	58	61	61	1	86	67	44	35	33	118	49	59	17	104	149	47	18	1350
% burnt	1%	0%	0%		2%		3%	2%	0%	0%		1%	0%	2%	0%	0%	2%	2%	3%	0%	1%	2%	4%		1%

Table 4.5.11 Sheep/goat bones with burning marks by context type
Percentages given when sample size ≥ 25.

	Pits and postholes				Construction fill			Hearths and forges						Middens and ditches			Store pits	Floors, pavements and destruction debris			
context	b	c	d		e	i		f	g	k	k/l	l		h	o		m	n	p	q	
n burnt	0	1	2	3	6	0	6	0	0	0	0	1	1	9	0	9	1	0	0	3	3
Total	8	59	57	124	310	28	338	2	6	0	2	8	18	569	98	667	20	70	22	56	148
% burnt		2%	4%	2%	2%	0%	2%							2%	0%	1%		0%		5%	2%

Figure 4.5.12 Sexed sheep/goat pelvises by phase

Phase	Male	Female
D		1
E		1
F		1
G		1
U	2	2
Total	2	6

4.6 CATTLE

Figure 4.6.1 Teeth identified to the general taxa cattle/red deer

Phase			
D			1
	Incisor	1	
D-C			1
	Incisor	1	
E			1
	Incisor	1	
U			5
	Incisor	4	
	dI/dC	1	
Total			8

Table 4.6.2 Cattle skeletal element distribution – all archaeological
Unfused epiphyses excluded. cf. table 3.6.1 for MAU calculations.

ALL archaeological phases								
TEETH						ELEMENT		
LOWER	MNE	MAU					MNE	MAU
I1	1	0.5				Zygomaticus	26	13
I2	1	0.5				Horncores	32	16
I3	1	0.5				Atlas	3	3
I	8	1				Axis	1	1
dI1	1	0.5						
dI2	1	0.5				Scapula	13	6.5
dI3	1	0.5				Humerus (p)	0	0
dI/dC	5	0.625				Humerus (d)	8	4
C	1	0.5				Radius (p)	6	3
dC	0	0				Radius (d)	3	1.5
			UPPER	MNE	MAU	Ulna	19	9.5
dP2	7	3.5	dP2	1	0.5	3rd Carpal	10	5
dP3	9	4.5	dP3	14	7	Metacarpal (d)	28.5	14.25
dP4	16	8	dP4	13	6.5			
P1	1	0.5	P1	0	0	Pelvis	7	3.5
P2	9	4.5	P2	7	3.5	Femur (p)	3	1.5
P3	13	6.5	P3	4	2	Femur (d)	4	2
P4	19	9.5	P4	8	4	Tibia (p)	1	0.5
P	5	0.83	P	17	2.83	Tibia (d)	30	15
						Astragalus	27	13.5
M1+M2	98	24.5	M1+M2	70	17.5	Calcaneum	36	18
M3	34	17	M3	12	6	Scafocuboids	20	10
M	13	2.17	M	12	2	Metatarsal (d)	28.5	14.25
P/M	1	0.08	P/M	0	0			
All archaeological max MAU 24.5						Metapodial (d)	12	3
						Metapodial total	69	17.25
						Phalanx I	115	14.375
						Phalanx II	87	10.875
						Phalanx III	62	7.75

Table 4.6.3 Cattle + cattle/red deer skeletal element distribution

Unfused epiphyses excluded. cf. table 3.6.1 for MAU calculations.

ALL archaeological phases								
TEETH						ELEMENT		
LOWER	MNE	MAU					MNE	MAU
I1	1	0.5				Zygomaticus	28	14
I2	1	0.5				Horncores	32	16
I3	1	0.5				Atlas	3	3
I	15	1.875				Axis	1	1
dI1	1	0.5						
dI2	1	0.5				Scapula	23	11.5
dI3	1	0.5				Humerus (p)	4	2
dI/dC	6	0.75				Humerus (d)	11	5.5
C	1	0.5				Radius (p)	7	3.5
dC	0	0				Radius (d)	20	10
			UPPER	MNE	MAU	Ulna	3	1.5
dP2	7	3.5	dP2	1	0.5	3rd Carpal	12	6
dP3	9	4.5	dP3	14	7	Metacarpal (d)	29.5	14.75
dP4	16	8	dP4	13	6.5			0
P1	1	0.5	P1	0	0	Pelvis	14	7
P2	9	4.5	P2	7	3.5	Femur (p)	17	8.5
P3	13	6.5	P3	4	2	Femur (d)	8	4
P4	19	9.5	P4	8	4	Tibia (p)	4	2
P	5	0.83	P	17	2.83	Tibia (d)	32	16
						Astragalus	30	15
M1+M2	98	24.5	M1+M2	70	17.5	Calcaneum	37	18.5
M3	34	17	M3	12	6	Scafocubois	23	11.5
M	13	2.17	M	12	2	Metatarsal (d)	29	14.5
P/M	1	0.08	P/M	0	0			
						Metapodial (d)	17.5	4.375
						Metapodial total	76	19
Cattle + cattle/red deer MAU 24.5						PhalanxI	115	14.375
						Phalanx II	86	10.75
						Phalanx III	63	7.875

Table 4.6.4 Cattle skeletal element distribution - Late

Unfused epiphyses excluded. cf. table 3.6.1 for MAU calculations.

LATE - ABCD

TEETH

LOWER	MNE	MAU			
I1	0	0			
I2	0	0			
I3	0	0			
I	2	0.25			
dI1	0	0			
dI2	0	0			
dI3	0	0			
dI/dC	2	0.25			
C	0	0			
dC	0	0			
			UPPER	MNE	MAU
dP2	2	1	dP2	0	0
dP3	3	1.5	dP3	4	2
dP4	9	4.5	dP4	7	3.5
P1	0	0	P1	0	0
P2	4	2	P2	1	0.5
P3	10	5	P3	1	0.5
P4	11	5.5	P4	2	1
P	0	0	P	8	1.33
	0	0			
M1+M2	40	10	M1+M2	26	6.5
M3	16	8	M3	4	2
M	2	0.33	M	6	1
P/M	1	0.08	P/M	0	0

Late max MAU 10

ELEMENT

	MNE	MAU
Zygomaticus	8	4
Horncores	10	5
Atlas	1	0
Axis		
Scapula	4	2
Humerus (p)	0	0
Humerus (d)	3	1.5
Radius (p)	3	1.5
Radius (d)	0	0
Ulna	8	4
3rd Carpal	3	1.5
Metacarpal (d)	16	8
Pelvis	2	1
Femur (p)	2	1
Femur (d)	1	0.5
Tibia (p)	1	0.5
Tibia (d)	13	6.5
Astragalus	12	6
Calcaneum	19	9.5
Scafocubois	7	3.5
Metatarsal (d)	15.5	7.75
Metapodial (d)	7	3.5
Metapodial total	38.5	9.625
PhalanxI	41	5.125
Phalanx II	22	2.75
Phalanx III	17	2.125

Table 4.6.5 Cattle skeletal element distribution - Early

Unfused epiphyses excluded. cf. table 3.6.1 for MAU calculations.

EARLY - DEFGHI

TEETH						ELEMENT		
LOWER	MNE	MAU					MNE	MAU
I1	1	0.5				Zygomaticus	4	2
I2	1	0.5				Horncores	12	6
I3	0	0				Atlas	0	0
I	4	0.5				Axis		
dI1	1	0.5						
dI2	1	0.5				Scapula	4	2
dI3	1	0.5				Humerus (p)	0	0
dI/dC	2	0.25				Humerus (d)	0	0
C	0	0				Radius (p)	2	1
dC	0	0				Radius (d)	1	0.5
			UPPER	MNE	MAU	Ulna	2	1
dP2	3	1.5	dP2	1	0.5	3rd Carpal	2	1
dP3	4	2	dP3	3	1.5	Metacarpal (d)	3	1.5
dP4	4	2	dP4	3	1.5			
P1	1	0.5	P1	0	0	Pelvis	2	1
P2	3	1.5	P2	3	1.5	Femur (p)	0	0
P3	2	1	P3	2	1	Femur (d)	1	0.5
P4	3	1.5	P4	5	2.5	Tibia (p)	0	0
P	3	0.5	P	3	0.5	Tibia (d)	6	3
						Astragalus	9	4.5
M1+M2	32	8	M1+M2	26	6.5	Calcaneum	9	4.5
M3	9	4.5	M3	4	2	Scafocubois	10	5
M	3	0.5	M	1	0.17	Metatarsal (d)	4.5	2.25
P/M	0	0	P/M	0	0			
Early max MAU 8						Metapodial (d)	2	1
						Metapodial total	9.5	2.375
						Phalanx I	30	3.75
						Phalanx II	22	2.75
						Phalanx III	19	2.375

Table 4.6.6 Cattle skeletal element distribution – other archaeological phases
Unfused epiphyses excluded. cf. table 3.6.1 for MAU calculations.

Other archaeological phases								
TEETH						ELEMENT		
LOWER	MNE	MAU					MNE	MAU
I1	0	0				Zygomaticus	13	6.5
I2	0	0				Horncores	10	5
I3	1	0.5				Atlas	2	0
I	2	0.25				Axis		
dI1	0	0						
dI2	0	0				Scapula	4	2
dI3	0	0				Humerus (p)	0	0
dI/dC	1	0.125				Humerus (d)	5	2.5
C	1	0.5				Radius (p)	1	0.5
dC	0	0				Radius (d)	0	0
			UPPER	MNE	MAU	Ulna	9	4.5
dP2	2	1	dP2	0	0	3rd Carpal	3	1.5
dP3	2	1	dP3	7	3.5	Metacarpal (d)	9	4.5
dP4	3	1.5	dP4	3	1.5			
P1	0	0	P1	0	0	Pelvis	3	1.5
P2	2	1	P2	3	1.5	Femur (p)	1	0.5
P3	1	0.5	P3	1	0.5	Femur (d)	2	1
P4	5	2.5	P4	1	0.5	Tibia (p)	0	0
P	2	0.33	P	6	1	Tibia (d)	11	5.5
						Astragalus	6	3
M1+M2	26	6.5	M1+M2	18	4.5	Calcaneum	8	4
M3	9	4.5	M3	4	2	Scafocubois	3	1.5
M	8	1.33	M	5	0.83	Metatarsal (d)	8.5	4.25
P/M	0	0	P/M	0	0			
Other archaeological max MAU 6.5						Metapodial (d)	3	1.5
						Metapodial total	20.5	5.125
						Phalanx I	44	5.5
						Phalanx II	43	5.375
						Phalanx III	26	3.25

Table 4.6.7 Cattle left vs. right body part distribution

	Left	Right	Total
Cranium	15	10	25
Scapula	8	4	12
Humerus (d)	4	3	7
Radius (p)	1	5	6
Ulna	6	13	19
Radius (d)	6	1	7
Femur (p)	2	2	4
Metacarpal	15	10	25
Pelvis	4	2	6
Femur (d)	3	1	4
Tibia (p)	1		1
Tibia (d)	10	22	32
Astragalus	13	14	27
Calcaneum	12	24	36
Metatarsal	14	9	23

Table 4.6.8 Cattle bones with butchery marks

Zero values listed as blanks to improve table readability. Percentages given when sample size ≥ 25.

	Cut	Chop	Cut and chop	Saw	Butch total		NCSP	% butch
Horncore	3			3	6		32	19%
Zygomaticus					0		26	0%
Atlas		1			1		3	
Axis					0		1	
Scapula	1	3			4		13	
Huermus (p)					0		1	
Humerus (d)	2				2		8	
Radius (p)		1			1		6	
Ulna	4	1	1		6		19	
Radius (d)					0		7	
Carpal 3					0		10	
Metacarpal	8	1			9		28.5	32%
Pelvis	1				1		7	
Femur (p)					0		5	
Femur (d)					0		4	
Tibia (p)					0		1	
Tibia (d)	1	1			2		32	6%
Astragalus		2			2		27	7%
Calcaneum		3			3		36	8%
Cuboid		6			6		20	
Metatarsal	6	2.5	1		9.5		28.5	33%
Phalanx I	2	29			31		119	26%
Phalanx II		1			1		87	1%
Phalanx III					0		62	0%
Grand Total	28	51.5	2	3	84.5		583	14%
%	33%	61%	2%	4%				

Table 4.6.9 Cattle bones with butchery marks by context type

Percentages given when sample size ≥ 25.

	Pits and postholes				Construction fill			Hearths and forges						Middens and ditches			Store pits	Floors, pavements and destruction debris				
context	b	c	d		e	i		f	g	k	k/l	l		h	o		m	n	p	q	
n butch.	2	2	3	7	27	5	32	0	0	1	0	0	1	26	9	35	1	3	3	7	13
Total	7	22	41	70	146	18	164	1	2	1	0	3	7	215	81	296	2	18	17	38	73
% butch.			7%	10%	18%		20%							12%	11%	12%				18%	18%

Table 4.6.10 Cattle bones with gnawing marks

Percentages given when sample size ≥ 25.

	Horncore	Zygomaticus	Atlas	Axis	Scapula	Huermus (p)	Humerus (d)	Radius (p)	Ulna	Radius (d)	Carpal 3	Metacarpal	Pelvis	Femur (p)	Femur (d)	Tibia (p)	Tibia (d)	Astragalus	Calcaneum	Scafocuboid	Metatarsal	Phalanx I	Phalanx II	Phalanx III	Total
n gnaw.						1				1		2					4	2	16		5	5	3	1	40
Total	32	26	3	1	13	1	8	6	19	7	10	28.5	7	5	4	1	32	27	36	20	28.5	119	87	62	521
% gnaw.	0%	0%										7%					13%	7%	44%		18%	4%	3%	2%	8%

Table 4.6.11 Cattle bones with gnawing marks by context type

Percentages given when sample size ≥ 25.

	Pits and postholes				Construction fill			Hearths and forges						Middens and ditches			Store pits	Floors, pavements and destruction debris			
context	b	c	d		e	i		f	g	k	k/l	l		h	o		m	n	p	q	
n gnaw.	2	0	4	6	8	3	11	0	1	0	0	0	1	13	5	18	0	1	0	3	4
Total	7	22	41	70	146	18	164	1	2	0	0	3	6	215	81	296	2	18	17	38	73
% gnaw.			10%	9%	5%		7%							6%	6%	6%				8%	5%

Table 4.6.12 Cattle bones with burning marks

Percentages given when sample size ≥ 25.

	Horncore	Zygomaticus	Atlas	Axis	Scapula	Huermus (p)	Humerus (d)	Radius (p)	Ulna	Radius (d)	Carpal 3	Metacarpal	Pelvis	Femur (p)	Femur (d)	Tibia (p)	Tibia (d)	Astragalus	Calcaneum	Scafocuboid	Metatarsal	Phalanx I	Phalanx II	Phalanx III	Total
n burnt		1							1			1										1	1	1	6
Total	32	26	3	1	13	1	8	6	19	7	10	28.5	7	5	4	1	32	27	36	20	28.5	119	87	62	521
% burnt		4%										4%										1%	1%	2%	1%

Table 4.6.13 Cattle bones with burning marks by context type

Percentages given when sample size ≥ 25.

	Pits and postholes				Construction fill			Hearths and forges						Middens and ditches			Store pits	Floors, pavements and destruction debris			
context	b	c	d		e	i		f	g	k	k/l	l		h	o		m	n	p	q	
n burnt	0	0	1	1	0	0	0	0	0	0	0	0	0	4	0	4	0	0	0	1	1
Total	7	22	41	70	146	18	164	1	2	1	0	3	7	215	81	296	2	18	17	38	73
% burnt	0%	0%	2%	1%	0%		0%							2%	0%	1%				3%	1%

Table 4.6.14 Cattle dP$_4$ and M$_3$ tooth wear stages by period

	Late – ABCD			Early – EFGHI			Other archaeological		
Wear stage	a-h	j-n	Total	a-h	j-n	Total	a-h	j-n	total
dP$_4$	0	6	6	2	2	4	2	0	2
M$_3$	4	7	11	3	2	5	4	0	4

4.7 OTHER DOMESTIC TAXA

Table 4.7.1 Dog bones with butchery, gnawing and burning marks
Percentages given when sample size ≥ 25.

	Zygomaticus	Atlas	Axis	Scapula	Huermus (p)	Humerus (d)	Radius (p)	Ulna	Radius (d)	Metacarpal	Pelvis	Femur (p)	Femur (d)	Tibia (p)	Tibia (d)	Astragalus	Calcaneum	Metatarsal	Metapodial total	Phalanx I	Phalanx II	Phalanx III	Total	%
n. butch.		1		1	1	4		2	1		4		1					1	1				16	18%
n. gnawed															1								1	1%
n. burnt																1	1						2	2%
total bones	1	6	1	6	5	9	1	5	2	3	7	3	2	1	7	2	3	4	12	5	1	1	87	

4.8 WILD TAXA

Table 4.8.1 Red deer skeletal element distribution – all archaeological phases
Unfused epiphyses excluded. cf. table 3.6.1 for MAU calculations.

ALL archaeological phases								
TEETH						ELEMENT		
LOWER	MNE	MAU					MNE	MAU
I1	0	0				Zygomaticus	0	0
I2	0	0				Horncores	27	13.5
I3	1	0.5				Atlas	1	1
I	0	0				Axis	0	0
dI1	0	0						
dI2	0	0				Scapula	10	5
dI3	0	0				Humerus (p)	0	0
dI/dC	0	0				Humerus (d)	3	1.5
C	0	0				Radius (p)	5	2.5
dC	0	0				Radius (d)	7	3.5
			UPPER	MNE	MAU	Ulna	4	2
dP2	0	0	dP2	0	0	3rd Carpal	2	1
dP3	0	0	dP3	0	0	Metacarpal (d)	17.5	8.75
dP4	0	0	dP4	1	0.5			
P1	0	0	P1	0	0	Pelvis	7	3.5
P2	1	0.5	P2	2	1	Femur (p)	1	0.5
P3	5	2.5	P3	4	2	Femur (d)	0	0
P4	6	3	P4	6	3	Tibia (p)	0	0
P	1	0.17	P	2	0.33	Tibia (d)	23	11.5
						Astragalus	12	6
M1+M2	16	4	M1+M2	10	2.5	Calcaneum	34	17
M3	9	4.5	M3	6	3	Scafocuboid	18	9
M	1	0.17	M	9	1.5	Metatarsal (d)	16	8
P/M	0	0	P/M	0	0			
All archaeological max MAU 17						Metapodial (d)	4.5	1.125
						Metapodial total	38	9.5
						Phalanx I	26	3.25
						Phalanx II	22	2.75
						Phalanx III	5	0.625

Table 4.8.2 Red deer bones with butchery, gnawing, and burning marks

	Antler	Atlas	Axis	Scapula	Huermus (p)	Humerus (d)	Radius (p)	Ulna	Radius (d)	3rd Carpal	Metacarpal	Pelvis	Femur (p)	Femur (d)	Tibia (p)	Tibia (d)	Astragalus	Calcaneum	Scafocuboid	Metatarsal	Metapodial total	Phalanx I	Phalanx II	Phalanx III	Total	%
n butch.	13	1		6			1		2		3.5	2	1			1	4	8	8	3.5	7.5	12			74	26%
n. gnaw									1		0	1				1		12	1	0	0.5	1	1		19	7%
n. burnt	1										1					1		1	1	0	1				6	2%
total bones	27	1		10		3	5	4	7	2	18	7	1			23	12	34	18	16	40	26	22	5	281	

Table 4.12.1 Human remains identified at Forcello

P = proximal. D = distal. Age category established using Schaefer et al. (2009). Ind. = possible individual. Context descriptions provided by excavators. Adult remains italicized.

Element	Side	Fusion		Age	Notes	Ind.	Phase	Context	Context	Description
		P	D						type	(provided by excavators)
TI	L	UD		LESS THAN 1 YEAR			U	292	h	scarichi nel canale tra le case in R18 e R17
TI	L	UD	UD	0-1 MONTH	PROB SAME IND	A	F	476	q	livello di crollo per incendio case in R18 di fase F
TI	R	UD	UD	0-1 MONTH	PROB SAME IND	A	F	476	q	livello di crollo per incendio case in R18 di fase F
FI	R	UD	UD	0-1 MONTH	PROB SAME IND	A	F	476	q	livello di crollo per incendio case in R18 di fase F
FI	L	UD	UD	0-1 MONTH	PROB SAME IND	A	F	476	q	livello di crollo per incendio case in R18 di fase F
HU	L		UD	FEOTAL 34 WEEKS	PROB SAME IND	B	X	499	r	strato limo sabbioso in R17 (documentazione lacunosa)
FE	R		UD	FEOTAL 34-36 WEEKS	PROB SAME IND	B	X	499	r	strato limo sabbioso in R17 (documentazione lacunosa)
HU	R	UD	UD	C. 36 WEEKS			M	682	a	riempimento di taglio di età moderna es 357
FE	L	UD	UD	C. 40 WEEKS			E	693	g	riempimento fornacetta es 363 di fase E
SC	L	UD		C. 40 WEEKS			X	844	b	riempimento di grande buca di scarico es 432 in R18
TI	L	UD	UD	C. 40 WEEKS			X	844	b	riempimento di grande buca di scarico es 432 in R18
TI	R		UD	LESS THAN 1 YEAR			X	844	b	riempimento di grande buca di scarico es 432 in R18
FE	L	UD	UD	C. 40 WEEKS			X	844	b	riempimento di grande buca di scarico es 432 in R18
HU	L	UD	UD	C. 40 WEEKS	PROB SAME IND	J	X	844	b	riempimento di grande buca di scarico es 432 in R18
HU	R	UD	UD	C. 40 WEEKS	PROB SAME IND	J	X	844	b	riempimento di grande buca di scarico es 432 in R18
PE	L	UD		C. 40 WEEKS			X	844	b	riempimento di grande buca di scarico es 432 in R18
TI	L	UD	UD	C. 40 WEEKS			X	844	b	riempimento di grande buca di scarico es 432 in R18
FE	R	UD		LESS THAN 1 YEAR	STRANGE ROUND CAVITY IN PROX END - POSS CYST		X	844	b	riempimento di grande buca di scarico es 432 in R18
TI	L	UD		LESS THAN 1 YEAR			X	844	b	riempimento di grande buca di scarico es 432 in R18
TI	R	UD	UD	C. 40 WEEKS			X	844	b	riempimento di grande buca di scarico es 432 in R18
FE	L	UD	UD	0 - 1 MONTH			X	844	b	riempimento di grande buca di scarico es 432 in R18
TI	R	UD	UD	C. 40 WEEKS			X	844	b	riempimento di grande buca di scarico es 432 in R18
HU	L	UD	UD	40 - 2 WEEKS	PROB SAME IND	K	X	844	b	riempimento di grande buca di scarico es 432 in R18
CLAVICLE	L			C. 40 WEEKS			X	844	b	riempimento di grande buca di scarico es 432 in R18
RA	L	UD	UD		PROB SAME IND	K	≤B	845	e	livello limoso di riporto, di fase C o B
HU	L	UD	UD	40 - 2 WEEKS			U	846	e	livello di argilla compatta di riporto di fase C o B
UL	R	UD	UD	40 - 2 WEEKS			U	847	h	riempimento canale es 438 di fasi recenti (B o C)
FE	L	UD	UD	40 - 2 WEEKS			X	848	u	NO DATA FROM EX
FE	R	UD	UD	40 - 2 WEEKS			X	849	u	NO DATA FROM EX
TI	R	UD		LESS THAN 1 YEAR			U	850	h	riempimento canale es 438 di fasi recenti (B o C)
PE	R			C. 40-2 WEEKS	ILLIUM - UNUSUAL POSTERIOR FLARE? SOMEWHAT MORE BENDY THAN OTHERS		U	876	h	scarichi tra le case nei settori R18 e R17, metà VI - inizi IV sec AC
SC	L	UD		UNDER 1 YEAR			U	876	h	scarichi tra le case nei settori R18 e R17, metà VI - inizi IV sec AC
CLAVICLE	L						U	876	h	scarichi tra le case nei settori R18 e R17, metà VI - inizi IV sec AC
RIBS	L				3		U	876	h	scarichi tra le case nei settori R18 e R17, metà VI - inizi IV sec AC

Table 4.12.1 continued

Element	Side	Fusion		Age	Notes	Ind.	Phase	Context	Context	Description
		P	D						type	(provided by excavators)
RIBS	R				3		U	876	h	scarichi tra le case nei settori R18 e R17, metà VI - inizi IV sec AC
HU	R	UD	UD	40-2 WEEKS	PROB SAME IND	G	U	876	h	scarichi tra le case nei settori R18 e R17, metà VI - inizi IV sec AC
UL	R	UD		C. 40 WEEKS	PROB SAME IND	G	U	876	h	scarichi tra le case nei settori R18 e R17, metà VI - inizi IV sec AC
FE	L	UD	UD	40-2 WEEKS	PROB SAME IND	G	U	876	h	scarichi tra le case nei settori R18 e R17, metà VI - inizi IV sec AC
FE	R	UD	UD	40-2 WEEKS	PROB SAME IND	G	U	876	h	scarichi tra le case nei settori R18 e R17, metà VI - inizi IV sec AC
TI	L	UD	UD	C. 40 WEEKS	PROB SAME IND	G	U	876	h	scarichi tra le case nei settori R18 e R17, metà VI - inizi IV sec AC
TI	R	UD	UD	C. 40 WEEKS	PROB SAME IND	G	U	876	h	scarichi tra le case nei settori R18 e R17, metà VI - inizi IV sec AC
FI	L	UD	UD	C. 40 WEEKS	PROB SAME IND	G	U	876	h	scarichi tra le case nei settori R18 e R17, metà VI - inizi IV sec AC
HU	L	UD					U	876	h	scarichi tra le case nei settori R18 e R17, metà VI - inizi IV sec AC
RA	L				PROB SAME IND	H	U	876	h	scarichi tra le case nei settori R18 e R17, metà VI - inizi IV sec AC
RA	R				PROB SAME IND	H	U	876	h	scarichi tra le case nei settori R18 e R17, metà VI - inizi IV sec AC
FE	L	UD	UD	C. 40 WEEKS	PROB SAME IND	I	U	876	h	scarichi tra le case nei settori R18 e R17, metà VI - inizi IV sec AC
FE	R	UD	UD	C. 40 WEEKS	PROB SAME IND	I	U	876	h	scarichi tra le case nei settori R18 e R17, metà VI - inizi IV sec AC
TI	L	UD	UD	C. 40 WEEKS	PROB SAME IND	I	U	876	h	scarichi tra le case nei settori R18 e R17, metà VI - inizi IV sec AC
TI	R	UD	UD	C. 40 WEEKS	PROB SAME IND	I	U	876	h	scarichi tra le case nei settori R18 e R17, metà VI - inizi IV sec AC
TI	L	UD		LESS THAN 1 YEAR			D-C	921	e	strato limo-sabbioso
TI	R		UD	LESS THAN 1 YEAR			D-C	921	e	strato limo-sabbioso
TI	L	UD	UD	38-40 WEEKS			D	1012	c	riempimento di buca di palo es 516 in R18
PE	L	UD		C. 40-2 WEEKS	ILLIUM		B-A	1095	e	strato che copriva il crollo della casa di fase C-D in R 19, riferibile alla fase B
HU	L		UD	38-40 WEEKS			D-C	1784	o	strato, livello di riporto o di accrescimento di fase C-D
FE	R		UD	C. 38-40 WEEKS			D-C	1784	o	strato, livello di riporto o di accrescimento di fase C-D
UL	R	UD	UD	C. 40 WEEKS +			D-C	1784	o	strato, livello di riporto o di accrescimento di fase C-D
RA	R		UD	LESS THAN 1 YEAR			D-C	1784	o	strato, livello di riporto o di accrescimento di fase C-D
PE	R	UD		C. 40 WEEKS	ILLIUM		D-C	1784	o	strato, livello di riporto o di accrescimento di fase C-D
FE	R	UD	UD	C. 40 WEEKS			E	1855	o	strato, livello di riporto o di accrescimento di fase E
HU	L	UD	UD	NEONATAL			E	1893	e	livello di limo di fase E in settore R19 (uguagliabile a 1910)
PE	L	UD		C. 40 WEEKS	ILLIUM		E	1969	e	strato di riporto di fase E
FE	R	UD		LESS THAN 1 YEAR			D-C	2216	c	riempimento di buca di palo 2217 anteriore a fase B
TI	R		UD	LESS THAN 1 YEAR			D-C	2216	c	riempimento di buca di palo 2217 anteriore a fase B
TI	R	UD		LESS THAN 1 YEAR			D-C	2216	c	riempimento di buca di palo 2217 anteriore a fase B
TI	L	UD	UD	C. 40 WEEKS	PROB SAME IND	C	X	2262	u	NO DATA FROM EX
TI	R	UD	UD	C. 40 WEEKS	PROB SAME IND	C	X	2262	u	NO DATA FROM EX
PE	R	UD		38-40 WEEKS	ILLIUM		D-C	2267	h	area di scarichi, riempimento di grosso canale di scarico ES 2273
MT	*L*		*F*	*ADULT*	*II OR III*		*E*	*2474*	*d*	*riempimento di grande buca circolare es 2475, fase E*
P1	*L*	*F*		*ADULT*	*II OR III*		*E*	*2474*	*d*	*riempimento di grande buca circolare es 2475, fase E*
FE	R	UD		LESS THAN 1 YEAR			D-C	2527	h	area di scarichi, strato limo-sabbioso di fase C-D
MCII	*R*		*F*	*OVER 14 YEARS*			*C*	*2560*	*e*	*livelletto appartiene allo stesso episodio di us 2561*

Table 4.12.1 continued

Element	Side	Fusion		Age	Notes	Ind.	Phase	Context	Context	Description
		P	D						type	(provided by excavators)
HU	L	UD	UD	C. 40 WEEKS	PROB SAME IND	E	E	2565	h	area di scarichi, strato limo -argilloso di fase E
RA	L		UD		PROB SAME IND	E	E	2565	h	area di scarichi, strato limo -argilloso di fase E
RIBS	L				5; PROB SAME IND	E	E	2565	h	area di scarichi, strato limo -argilloso di fase E
RIBS	R				6 WITH MIN OF 5 (5 HEADS & END); PROB SAME IND	E	E	2565	h	area di scarichi, strato limo -argilloso di fase E
HU	R	UD	UD	C. 40 WEEKS	PROB SAME IND	E	E	2565	h	area di scarichi, strato limo -argilloso di fase E
UL	R	UD			PROB SAME IND	E	E	2565	h	area di scarichi, strato limo -argilloso di fase E
TI	R	UD	UD	0-1 MONTH	PROB SAME IND	E	E	2565	h	area di scarichi, strato limo -argilloso di fase E
FI	R		UD		PROB SAME IND	E	E	2565	h	area di scarichi, strato limo -argilloso di fase E
FE	R	US	UD	0-1 (PROB NEONATAL)			E	2568	h	area di scarichi, strato limoso di fase E
FE	L	UD	UD	C. 40 WEEKS	PROB SAME IND	D	C≤	/430	b	grande fossa di scarico es 430 subito sotto l'agrario
TI	L	UD	UD	C. 40 WEEKS	PROB SAME IND	D	C≤	/430	b	grande fossa di scarico es 430 subito sotto l'agrario
TI	R		UD	LESS THAN 1 YEAR	PROB SAME IND	D	C≤	/430	b	grande fossa di scarico es 430 subito sotto l'agrario
FI	R		UD	LESS THAN 1 YEAR	PROB SAME IND	D	C≤	/430	b	grande fossa di scarico es 430 subito sotto l'agrario
UL	L	UD		LESS THAN 1 YEAR	POSS SAME IND	D	C≤	/430	b	grande fossa di scarico es 430 subito sotto l'agrario
FE	L			LATE FETAL C. 36–40			X	CLEANING	x	cleaning in various parts of trenches or prior to excavation
FE	R	UD	UD	38-40 WEEKS	PROB SAME IND	F	X	CLEANING	x	cleaning in various parts of trenches or prior to excavation
FE	L	UD	UD		PROB SAME IND	F	X	CLEANING	x	cleaning in various parts of trenches or prior to excavation
TI	R		UD				X	CLEANING	x	cleaning in various parts of trenches or prior to excavation
RA	L	UD					X	CLEANING	x	cleaning in various parts of trenches or prior to excavation

CHAPTER FIVE

ANIMALS ON THE EDGE: ZOOARCHAEOLOGY AT FORCELLO IN CONTEXT

Table 5.5.1 Equid measurements from Forcello and other Iron Age/Etruscan sites
* estimate.

Site	Bone	Id	Greatest length (GL)	Distal breadth (Bd)	Smallest breadth of the diaphysis (SD)
Forcello	Metapodial	equid		38.7	
	1st phalanx	equid	77*	43.1	32.3
Pfatten-Vadena	Metacarpal	horse		46.3	
Ficana (zone 3b-c)	Metacarpal	donkey	170	32.5	24*
San Claudio	Metacarpal	horse		41.8	
Veii (acropolis)	Metacarapl	horse		48.8	
Pfatten	Metatarsal	horse		44.6	
Mirandola	Metatarsal	equid (donkey?)	214	33.6	23.4
Pfatten-Vadena	1st phalanx	horse	85	46.4	32.7
	1st phalanx	horse	70.5	48.5	28
Castelrotto	1st phalanx	horse		37.1	26.4
Cerveteri	1st phalanx	equid		37.8	
Santorso	1st phalanx	horse	84.7	45.1	31.3
Monteriggioni	1st phalanx	horse	75.7	44.2	33.8
Veii (acropolis)	1st phalanx	donkey	66.6	33.7	21.7
		n	GL min	GL mean	GL max
Le Brustolade	1st phalanx (fore) 1st phalanx (hind)	34 18	77 74	83.7 79.7	91 87

APPENDIX B | DATABASE STRUCTURE AND FIELD CODES

DATABASE STRUCTURE

Specimens were recorded in one of three spreadsheets contained within the same Excel workbook file. The teeth and jaws are recorded in the TEETH spreadsheet and all other elements, with the exception of ribs and vertebrae, are recorded in the BONES spreadsheet. Ribs and vertebrae are recorded in the RIBS/VERT sheet. In the Teeth and Bones spreadsheets, only one specimen is recorded per row. Moving across the row, any pertinent information for each specimen is then entered into the corresponding column. Non-relevant columns are left blank. After context information, the values for each column are restricted to the field codes below. Sieved material is recorded in separate tables with an analogous structure. Further explanation, including references for measurements and abbreviations, is provided in Chapter 3.

TEETH COLOMN HEADINGS

ID = specimen number
SITE = site of excavation
BOX = box number
YEAR = year of excavation
SETT = sector number
CTX = context
QA = letter of quadrant
Q# = number of quadrant
EL = maxilla or mandible
LJ = loose tooth or jaw
SIDE
TAX = taxon
I1
I2
I3
I (=I/C in ruminants)
dI1
dI2
dI3
dI/dC
C
dC
P1
P2
P2L1
P2Wa
P2Wd
P3
P3L1
P3Wa
P3Wd
P4
P4L (L1 in equids)
P4Wa (W in carnivores)
P4Wd
P
dP2
dP3
dP4
dP4L
dP4W
M1
M1L (L1 in equids) (C in cattle upper tooth)
M1WA (W in caprines and carnivores) (Wa in equids)
M1WP (Wd in equids)
M1hyp
M2
M2L (L1 in equids) (C in cattle upper tooth)
M2WA (W in caprines) (Wa in equids)
M2WP (Wd in equids)
M2hyp
M3
M3L (L1 in equids) (C in cattle upper tooth)
M3WA (W in bovids) (Wa in equids)
M3WC (Wd in equids)
M3hyp
M12
M12WA

M12WP
M12hyp
M
P/M
P1/M3 L (P3/M1 L in felids)
P2/M3 L
P1/P4 L
P2/P4 L
M1/M3 L
H
Comments

BONE COLOMN HEADINGS

ID = specimen number
SITE = site of excavation
BOX = box number
YEAR = year of excavation
SETT = sector number
CTX = context
QA = letter of quadrant
Q# = number of quadrant
PRES = preservation
EL = anatomical element
SIDE
TAX = taxon
FUSP = proximal fusion
FUSD = distal fusion
Butch = butchery
Burn = burning
Gnaw = gnawing
GL = (GLl in astragalus) (GH in equid astragalus) (GLC in humerus) (H in atlas)
Bd = (GB in equid astragalus) (BT in humerus) (BFcr in atlas)
Dd = (Dl in astragalus) (BFd in equid astragalus) (3 in metapodials) (DC in femur) (GD in calcaneum)
HTC = (LmT in equid astragalus) (GLm in astragalus) (6 in metapodials)
LAR
SD = (SC in birds) (SLC in scapula)
Lm = (La in tibiotarsus)
BatF
a
b
1
4
Comments

RIB/VERT COLOMN HEADINGS

ID = specimen number
SITE = site of excavation
BOX = box number
YEAR = year of excavation
SETT = sector number
CTX = context
QA = letter of quadrant
Q# = number of quadrant
Ver L = large vertebrae
Ver M = medium vertebrae
Rib L = large ribs
Rib M = medium ribs
Rib S = small ribs
Comments

DATABASE ENTRY CODES

PRES *Preservation*
A = awful
B = bad
M = medium
G = good
E = excellent

ELEM *Anatomical element*
U = unknown

X = maxilla
N = mandible
CR = cranium (zygomaticus)
AT = atlas
AX = axis
SC1 = scapula (glenoid cavity & neck)
SC2 = scapula (glenoid only)
OTHSC = scapula (neck only)
CO = coracoid (proximal end)
HU = humerus distal
OTHU = humerus proximal
RA = radius distal
OTHRA = radius proximal
UL = ulna
C3 = carpal 3 or 2+3 (capit-trapez – bovids and cervids; capitatum – equids, pig and carnivores)
MC1 = metacarpal (proximal carpometacarpus in birds)
MC2 = 1/2 metacarpal
MCIII = third metacarpal (pigs/carnivores)
MCIV – fourth metacarpal (pigs/carnivores)
PE = pelvis (acetabulum, ischiatic part)
FE = femur distal
OTHFE = femur proximal
TI = tibia distal (tibiotarsus in birds)
OTHTI = tibia proximal
AS = astragalus
CA = calcaneum
SCU = scafocuboid (bovids & cervids) or scafoid (equids) or cuboid (pigs and carnivores)
MT1 = metatarsal (tarsometatarsus in birds)
MT2 = 1/2 metatarsal
MTIII = third metatarsal (pigs/carnivores)
MTIV – fourth metatarsal (pigs/carnivores)
MP1 = metapodial
MP2 = 1/2 metapodial
P1 = phalanx 1
P2 = phalanx 2
P3 = phalanx 3
HC = horncore or antler
OTH = all the others (specify element in comments)

LJ *Loose tooth or jaw*
L = loose tooth
J = jaw (A jaw is defined as a tooth having adjacent to it at least another half tooth/alveolus or an equivalent length of bone.)

HYP *Hypoplasia*
P = present (one line)
PP = present (two or more lines)

TAX *Taxon*
B = Bos
O = Ovis/Capra
OVA = Ovis aries
CAH = Capra hircus
S = Sus
CEE = Cervus elaphus
DAD = Dama dama
CAC = Capreolus capreolus
EQ = Equus
EQC = Equus caballus
EQA = Equus asinus
CAF = Canis familiaris
VUV = Vulpes vulpes
FEC = Felis catus
MUN = Mustela nivalis
MUP= Mustela putorius
MUE = Mustela erminea
MUX = Mustela erminea/nivalis
LE = Lepus
LEE = Lepus europaeus
ORC = Oryctolagus cuniculus
LAG = Lagomorphs
CAS = Castor
RA = Rattus
RAR = Rattus rattus
RAV = Rattus/Arvicola
APO = Apodemus
MUM = Mus musculus
MUS = Mus
SMU = Small Murinae

ART = Arvivola terrestris
CLG = Clethrionomys glareolus
SRO = Small rodent
LRO = Large rodent
ERE = Erinacaeus europaeus
TAL = Talpa
SOA = Sorex araneus
SMI = Small Microtinae
CD = Cervus/Dama
DC = Dama/Capreolus
CB = Cervus/Bos
CV = Canis/Vulpes
OCC = Ovis/Capra/Capreolus
GNP = Gallus/Numida/Phasianus
GP = Gallus/Phasianus
GN = Gallus/Numida
GAG = Gallus gallus
GAL = Galliforme
AA = Anas/Aythya
ANA = Anas
ATH = Aythya
ANS = Anser
CYG = Cygnus
CYO = Cygnus olor
FUL = Fulica atra
FG = Fulica/Gallinula
ANR = Anseriforme
SCR = Scolopax rusticola
PEP = Perdix perdix
PUP = Puffinus puffinus
PHC = Phalacrocorax carbo
ACC = Accipitriforme
BUB = Buteo buteo
MIM = Milvus milvus
FAL = Falco
ACN = Accipiter nisus
PL = Pluvialis
PLA = Pluvialis apricaria
PLS = Pluvialis squatarola
VAV = Vanellus vanellus
GAN = Gallinago gallinago
COL = Columba
TU = Turdus/Sturnus
CO = Corvus
COM = Corvus monedula
COF = Corvus frugilegus/corone
COC = Corvus corax
PIP = Pica pica
GAR = Garrulus glandarius
BTS = Botaurus stellaris
PSF = Passeriformes
CHA = Charafriiforme
GC = Grus/Ciconia
GRU = Grus grus
STR = Strigidae
STV = Sturnus vulgaris
LAR = Larus
NUA = Numenius Arquata
PEL = Pelecanus
ARC = Ardea cinerea
ARD = Ardeidae
AMP = Amphibia
ANU = Anura
RAN = Rana
BUF = Bufo bufo

FUS *Fusion*
F = fused
G = fusing
H = fused/fusing
UD = unfused diaphysis
UE = unfused epiphysis
UX = unfused diaphysis + epiphysis
J = juvenile (for birds)

SPUR *Male chicken spur*
A = absent
P = present
R = reduced
S = scar

BU *Butchery*
P = chopped
T = cut(s)
S = sawn
PT = chopped + cut(s)
SP = sawn + chopped
TS = cut(s) + sawn
"blank" = absent or not recordable

BR *Burning*
S = singed
B = burnt
C = calcined

GN *Gnawing*
C = gnawed by carnivores
D = partially digested
R = gnawed by rodents
CR = gnawed by carnivores and rodents
"blank" = absent or not recordable

TEETH

I1, I2, I3, I, dI1, dI2, dI3, dI, C (other than pig), **dC , P1, P2, P3, P, dP2, dP3, P/M, M**
P = present
"blank" = absent

C *for pig canines*
M = male
F = female
AM = male alveolus
AF = female alveolus
P = present
"blank" = absent

P4, dP4, M1, M2, M3, M12(=M1 or M2)
wear stage
P = present, but wear stage not recordable (or not recorded)
"blank" = absent

Ver L, Ver M, Rib L, Rib M, Rib S
P = present
"blank" = absent