Chapter 6 – *Preparation, Storage, and Service Vessels*

This chapter details the results of my analyses of vessels used for preparing, storing, and serving food. These include vessels used for: manipulating, combining, or stirring ingredients before or instead of cooking; storing at a small scale; transporting and presenting food at the table; containing the food of individual diners. The wares discussed in this chapter are categorized either as black gloss, red gloss, or common ware.

This chapter begins with an overview of the three ceramic wares into which preparation, storage, and service vessels are grouped. I then present details of each vessel type, broken down by ware, first for all vessels at Musarna, and then for all the vessels at Populonia. The analysis will begin with the study of serving and table vessels because the samples for these forms are reasonably large and reveal visible and statistically significant trends which can guide the understanding of the preparing and storing vessels, for which the small sample sizes require a degree of extrapolation. Similar statistical analyses have been used as those in the previous chapter on cooking vessels; however, the study of blackening from fire does not apply in this case.

6.1. Ceramic Wares

6.1.1. Black gloss

Black gloss ware was widely produced in Italy from about the 4th century into the 1st century BCE.[720] It is identifiable by its buff-to-pink, well-levigated clay coated with black slip. The slip often has a high sheen; the vessels were possibly created originally to serve as a less-expensive alternative to bronze and silver vessels. The quality of black gloss vessels – the fineness of the clay, the thickness of the slip, how evenly it is applied, its sintering and sheen – varies widely depending on the production location. Particularly high-quality

[720] This pottery is also called *vernice nera* or black glaze; however, modern English language publications increasingly refer to it as "black gloss" in recognition of its surface sheen being due not to glaze, but to a fine layer of slip made with the same clay as the ceramic body.

examples were produced around the Bay of Naples (called Campana A production, and Cales ware) and near Rome (called *petites estampilles*) and new production centers are continually being identified.[721] Black gloss forms are what we might call "table wares." They appear most commonly as bowls or plates with variants also of cups and stemmed chalices, jugs, and small jars, perhaps for cosmetics.

6.1.2. Red gloss

Red gloss ware for the purposes of this study includes two types of ceramic. The first is traditional *terra sigillata*, a ware which originated in central Italy in the middle of the 1st century BCE. It has a pink paste, a thick red slip, and typically has a mold-made and applied decoration. Like black gloss, it is used to make bowls and plates. The second vessel type classed as red gloss in this study is a ware with red slip which seems to have been a transitional vessel type between black gloss and red gloss and was likely produced by black gloss workshops in the 1st century BCE. The transitional nature of this material is suggested by the similarity in the red gloss vessels' form to black gloss vessels and by the use of similar (and in some instances identical) decorative stamps on both black gloss and these red gloss vessels.[722] These appear only in the sample from Musarna.

6.1.3. Common ware

The third ware examined in this chapter is common ware, a generic term referring to vessels used for preparing and serving food but which do not have contact with the cooking fire. In the Italian literature, this category is *ceramica comune da mensa, da dispensa*, and *per la preparazione*: all terms which denote vessels made from clay that can range in coarseness and which have good mechanical shock resistance. These vessels

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[721] The literature on black gloss is vast and increasingly controversial both in its typology and its chronology. Highlights include Lamboglia 1952; Morel 1969; Morel 1981; Cibecchini and Principal 2004; Ferrandes 2006; Stanco 2009a; Stanco 2009b; Di Giuseppe 2012.

[722] These are "C" stamps which are attested at Bolsena and the Palatine, but have not been further reported or studied elsewhere (Jolivet and Tassaux 1995, 69 n. 133, page 76 n. 172). These vessels are distinctly *not* the same as the problematically-identified "*vernice rossa*." The various vessels to which this name has been applied is outlined by Enrico Stanco (Stanco 2009a, 91–97).

typically appear in calcareous fabrics in Italy in the Republic.[723] I use the term common ware to refer to a broad set of ceramic fabrics. These are generally locally-produced and the clays have been sourced to the hills of Latium, according to x-ray fluorescence and petrological analyses.[724] One commonly-identified fabric which appears often in this ware group is called *impasto chiaro sabbioso*, defined by a yellow-green clay with black volcanic inclusions used to make large basins and mortaria as well as closed-form jugs.[725] Forms which appear in common ware include jugs, bowls and mortaria, pentole and ollae, and small containers and tubes likely for perfumes or cosmetics.

6.2. Musarna

6.2.1. Black gloss ware

At Musarna, black gloss ware appears mostly as bowls and plates, with small ollae and a single specimen each of a jug and a cup (Table 59).[726]

Table 59. Black gloss forms at Musarna according to rim fragment

Period	olla	jug	bowl	plate	cup
1	3	0	0	1	0
2	1	1	36	9	1
4	1	0	19	8	0
5	0	0	30	13	0
6	0	0	1	0	0
8	0	0	18	66	0
Total	*5*	*1*	*104*	*97*	*1*

6.2.1.1. Bowls and Plates

Morphology

In black gloss studies, it has been generally noted that the aesthetic of black gloss vessels changes over time from curved forms to more angular forms; however, changes in functional form and size are not typically discussed.[727] The exception to this is the pioneering , but still unique, study by Michel Bats in 1988, described in chapter 1. He first

[723] Olcese 2003, 22–23; Bertoldi 2011.
[724] Olcese 2003, 45–59.
[725] This ware has already been discussed in chapter 3. Olcese 2003, 34–36; Merlo 2005.
[726] For explanation of these formal distinctions, see chapter 3.
[727] Morel 1981, 524–528.

noted changing forms and their function in black gloss assemblages from Olbia in Provence and Cosa in the 2nd century BCE.[728] In examining the vessel forms from Musarna, several patterns emerge. The dataset from Musarna has 104 black gloss bowl rims and whole profiles.[729] This represents an MNV of 101 and 20.64 EVEs. There were 97 rim and whole profile fragments of plates recovered. These represent 88 MNV and 14.2 EVEs. Overall, bowls at Musarna are significantly smaller in diameter than plates. The bowls have a mean rim diameter of 14.7 cm and median diameter of 14 cm; whereas the plates have a mean rim diameter of 20.64 cm and a median diameter of 19 cm.[730] This makes sense when we consider the well-known forms of black gloss: small, deep, individual-portion bowls, and though some plates for individual portions were produced, plates tend to be wider for laying out of flat-foodstuffs. In examining the distribution of these forms over time at Musarna, there is a significant increase in plates relative to bowls in Period 8 (150-50 BCE) (Figure 103).[731] This trend corresponds with black gloss forms in the Iberian Peninsula of the same period. Jordi Principal notes the change at nine sites in Iberia from bowls in the 3rd century to wide shallow bowl/plates at the end of the 2nd century BCE. For Principal, this suggests that people began eating semi-solid foods out of bowls like porridge or stews and then started eating solids like meat and fish which were served on open flat forms.[732]

Table 60. Black gloss bowls in rim and whole vessels

Period	Frequency	Percent	Mean (cm)	Median (cm)
2	36	34.6	13.86	13
4	19	18.3	16	16
5	30	28.8	14.37	15
6	1	1	19	19
8	18	17.3	14.72	15
Total	*104*	*100*	*14.70*	*14*

[728] Bats 1988, 71–75. While the dating of the black gloss ware and the deposits of Cosa has recently been adjusted, this does not affect Bats' general observations. Scott 2008.
[729] 94 of these are rims and 9 are whole profiles.
[730] t=7.468 ($p<0.01$)
[731] There are various ways to demonstrate this statistically. One is the comparison of the proportion of bowls in black gloss from Period 4 or 5 with Period 8, which decreases from 61.3% or 69.8% to 20.9% of the black gloss sample: Period 4 to Period 8, χ^2=17.17 ($p<0.01$), Period 5 to Period 8, χ^2=29.26, ($p<0.01$). We can also compare the proportion of black gloss plates from Period 4 or Period 5 to Period 8, which increases from 25.8% or 30.2% to 76.7%: Period 4 to Period 8, χ^2=25.44 ($p<0.01$), Period 5 to Period 8, χ^2=26.13 ($p<0.01$).
[732] Principal 2006, 51.

Table 61. Black gloss plates as rims and whole vessels at Musarna

Period	Frequency	Percent	Mean (cm)	Median (cm)
1	1	1	20	20
2	9	9.3	17	17
4	8	8.2	18.13	18
5	13	13.4	21.62	19
8	66	68	21.26	19
Total	*97*	*100*	*20.64*	*19*

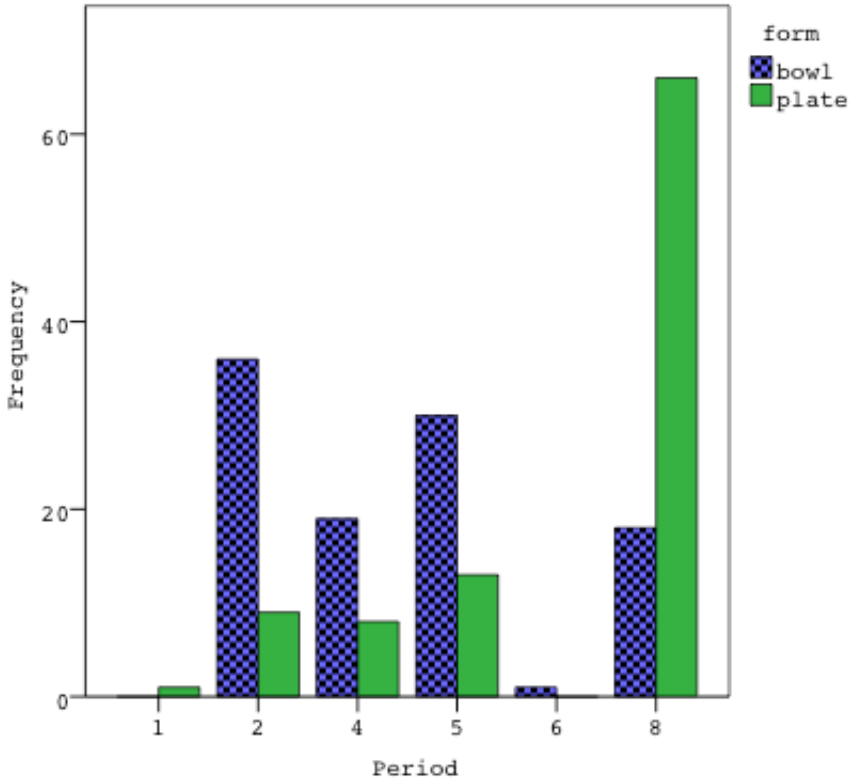

Figure 103. Numbers of black gloss bowls and plates compared

Focusing on bowls specifically, the sample size is large enough to reveal that after Period 2, by about 200 BCE, rim diameters had increased significantly and then remained constant over the remaining periods (Figure 104).[733]

There are major temporal changes in the angle of the rim of these bowls. Between Period 2 and Period 4 there is a significant decrease in the rim angle; in Period 2 the mean

[733] Between Period 2 and Period 4 χ^2=9.80 ($p<0.01$), and Period 5 χ^2=7.89 ($p<0.01$), and Period 8 χ^2=3.88 ($p<0.05$).

and median are 73.24˚ and 70˚, and by Period 4 the mean and median are 59.72˚ and 65˚.[734] This means that Period 2 rims tend away from the outwardly horizontal towards the vertical or even incurved.[735] There is also a significant difference between Period 2 and Period 5, where again, Period 2 vessels are more vertical and Period 5 more open (Figure 105).[736]

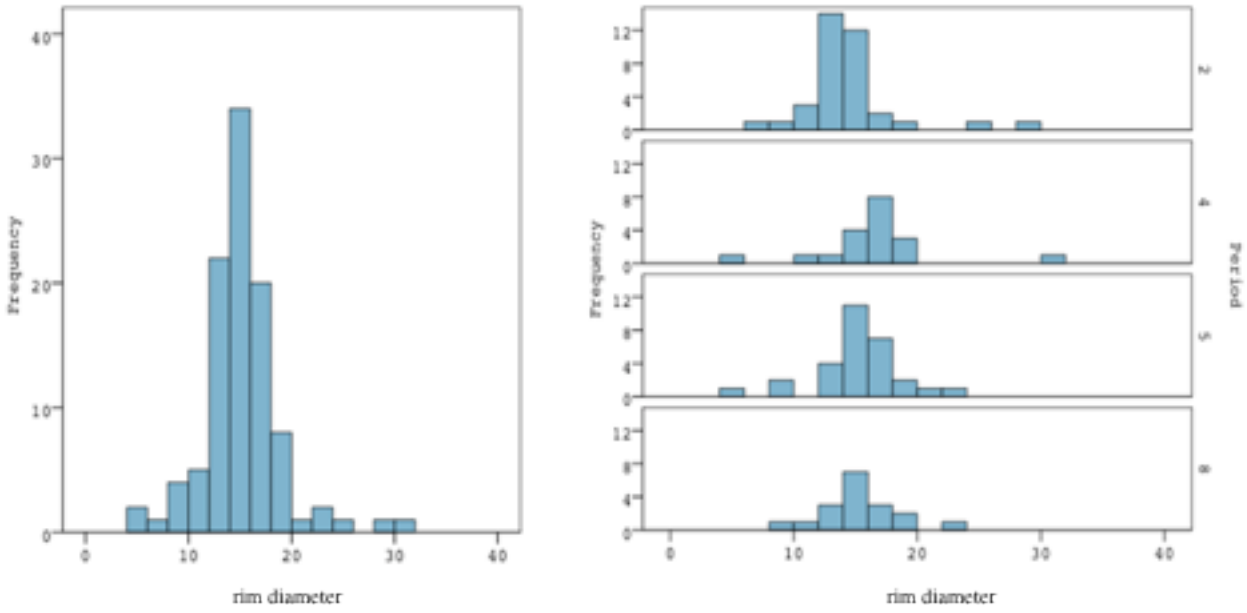

Figure 104. a) Diameter of all black gloss bowl rims; b) Diameters of bowls divided by period

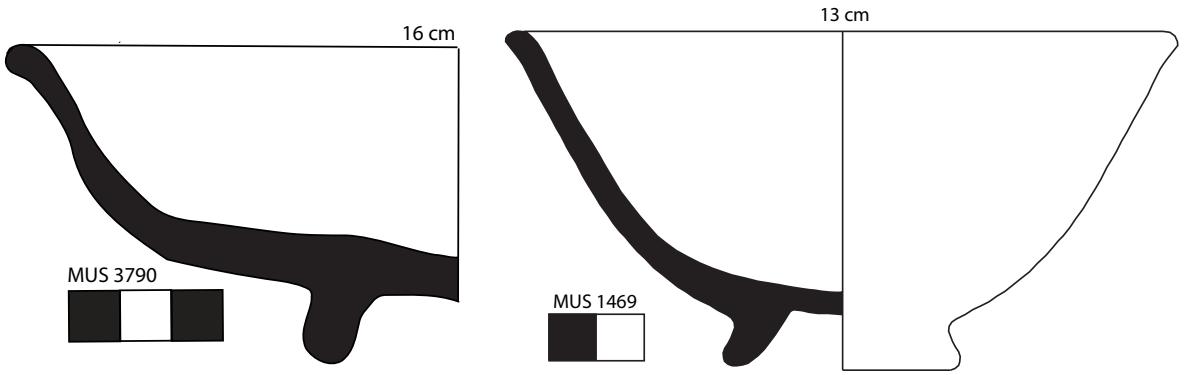

Figure 105. Black gloss bowl forms from Musarna (MUS 3790, MUS 1469)

This change in the size of bowls contrasts the scenario for plates at Musarna. The distribution of plate diameters is quite broad and, as noted above, they appear only in low

[734] χ^2=4.86 ($p<0.05$)
[735] The angle of an incurved rim, like Morel (1981) form 2783, is about 105˚.
[736] χ^2=11.9 ($p<0.01$)

numbers prior to Period 8 (Figure 106, Figure 107). There is not, therefore, a discernible change in rim diameter over time.

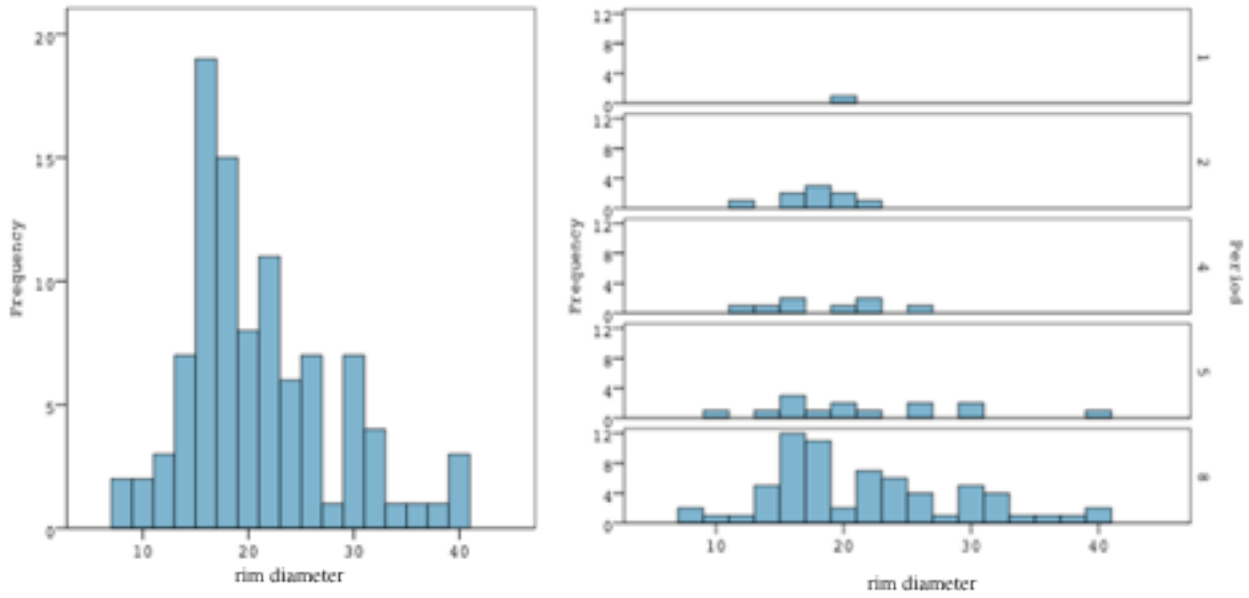

Figure 106. a) Diameters of all black gloss plate rims; b) Diameters divided by period

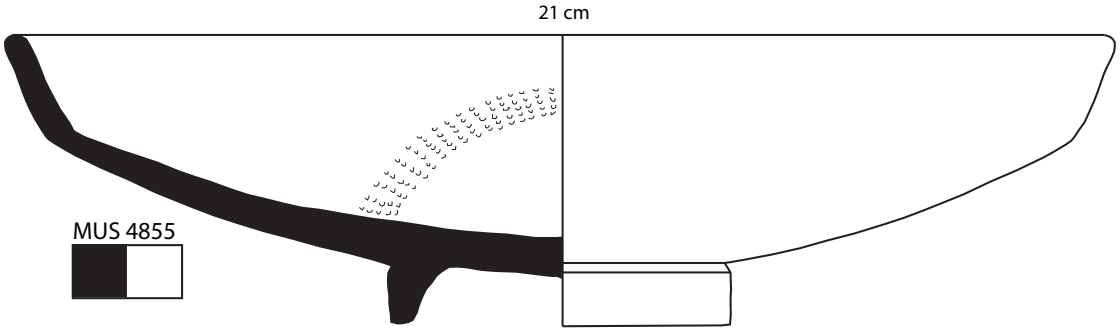

Figure 107. Black gloss plate form from Musarna (MUS 4855)

Alteration

When we turn to the alteration of black gloss vessels at Musarna, the focus is on abrasion, rather than fire damage, since fire was not a factor in their use. This study reveals that the composition of the particular black gloss production seems to be an important factor in the vessel's susceptibility to abrasion as well as the visibility of abrasion. At Musarna, the majority of the black gloss vessels were likely made locally. The fabric is beige to buff color (Munsell "light yellowish brown" 10YR 6/4); the slip is generally of good quality, but roughly-finished on the underside of the vessel, often containing drips as well

as the potter's finger prints (Figure 108).[737] These vessels show scratches relatively easily, whether cutting right through the slip or decompressing the slip. This is in contrast to the situation found at Populonia, discussed later in the chapter.

Figure 108. Black gloss bowl and plate with hand prints and dripping slip (MUS 2715, MUS 4938)

Before the consideration of use-alteration on black gloss, it is important to note the condition of this pottery at Musarna. Ninety-two percent of the bowl fragments at Musarna have fractures which have been coded as "sharp" and the other 8% are "slightly rounded" suggesting minimal post-depositional movement. Furthermore, only 30% of these fragments have any mineral encrustation on them and for 66% of these fragments, more than 80% of the surface of the sherd is visible. The condition of the plates is similar: 33% of plate fragments show mineral crust and 73% even of these have more than 80% of their surface visible. These vessels, therefore, seem to be excellent candidates for alteration analysis.

Sixty-nine percent of the black gloss bowls at Musarna have interior abrasion of some kind, 75% on their exterior, and 58% have both interior and exterior abrasion (Table 62). Of the plates, 81% have abrasion on their interiors, 73% have it on their exterior, and 62% have both (Table 63).

[737] This is similar to the character of the black gloss at Bolsena, a site of similar chronology near Musarna (Jolivet and Tassaux 1995, 65). For a classification of Musarna's black gloss fabrics, see the dissertation of Letitia Marchesson (2004). On the methods of slipping black gloss see Stanco 2009a, 25; Di Giuseppe 2012.

Table 62. Location of abrasion on black gloss bowls

Location of abrasion	Count (int)	Count (ext)
Abrasion on base	10	9
Abrasion on wall	19	18
Abrasion on rim	62	69

Table 63. Location of abrasion on black gloss plates

Location of abrasion	Count (int)	Count (ext)
Abrasion on base	5	7
Abrasion on wall	29	33
Abrasion on rim	72	60

The high frequency of exterior abrasion bears further analysis. It can often be attributed to indirect or unintentional abrasion, such as from the storage of vessels.[738] Dorothy Griffiths' examination of 18th century lead-glazed pottery attributed wear on the base and exterior side of her teacups and plates to the ways that they were stacked and leaned in storage.[739] At Musarna, nearly all of the bowls and plates which have their whole profiles preserved as well as the bases of bowls and plates have exterior base abrasion on the edge of their foot rings (Figure 109).[740]

Figure 109. Wear on edge of foot ring of a black gloss vessel at 20x magnification (MUS 1467)

[738] Schiffer and Skibo 1989, 112. Among the Kalinga people, see Skibo 1992, 112–113. This is discussed further in chapter 3, Methodology. See also Vuković 2009, 31.
[739] Griffiths 1978, 73–74.
[740] Nine out 10 bowls with exterior base abrasion are abraded on the edge of their foot ring. Seven out of 9 whole plates are abraded on their foot ring.

The major difference between abrasion on bowls and plates is the direction of the interior abrasion. In bowl forms, the large majority of the abrasion runs concentrically (parallel to the wheel marks of the vessel). This is the case on both the interior base floor of the vessel, when it is preserved, and the interior walls of bowls (Table 64).[741]

Table 64. Location and direction of interior abrasion on bowls

Direction	Whole vessels			Rims		
	base	**wall**	**rim**	**base**	**wall**	**rim**
Concentric	6	3	5	2	13	54
Radial	1	1	0	1	1	0
Chordal	0	1	0	0	4	6
Total with abrasion[742]	*7*	*5*	*5*	*3*	*13*	*56*

Ridges from wheel marks that are on the interior surface often have slip that is worn off. More commonly, the slip is worn in concentric lines along the interior wall (Figure 110). In one case from Musarna, the central interior slip has been totally removed in a patch (Figure 111). These marks are reminiscent of what Dorothy Griffiths interpreted as stirring marks when studying 18th century teacups: evidence for repetitive movement.[743]

[741] The presence of concentric interior abrasion on whole vessels does not show a strong relationship with any of the locations using a χ^2 test likely because the sample sizes are so low. For the rim fragments, concentric interior abrasion is highly correlated with the interior wall (χ^2=11.844, $p<0.01$) and the interior rim (χ^2=4.362, $p<0.05$).

[742] These row numbers do not always add up to the "total with abrasion" number because some fragments have two types of abrasion.

[743] Griffiths 1978, 71, 75. See methodology chapter for a discussion of this work.

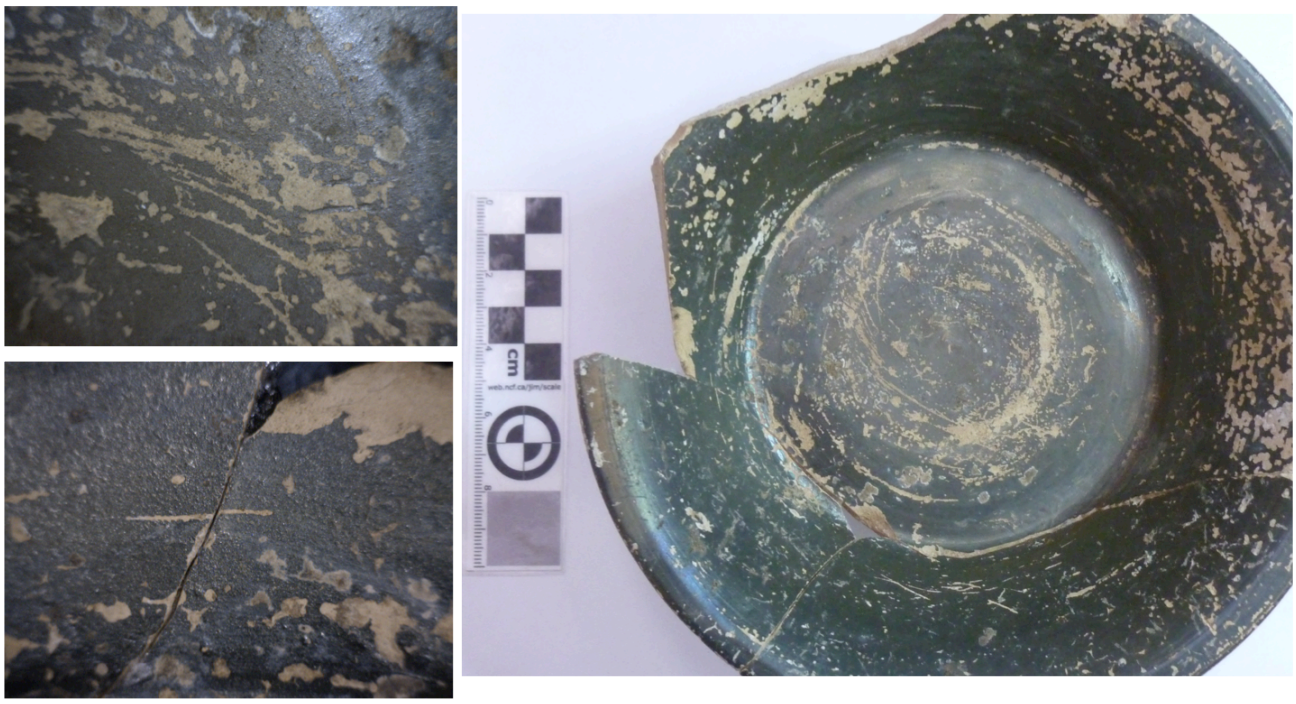

Figure 110. Black gloss bowl with concentric abrasion on interior base and walls, with details at 20x magnification (MUS 4647)

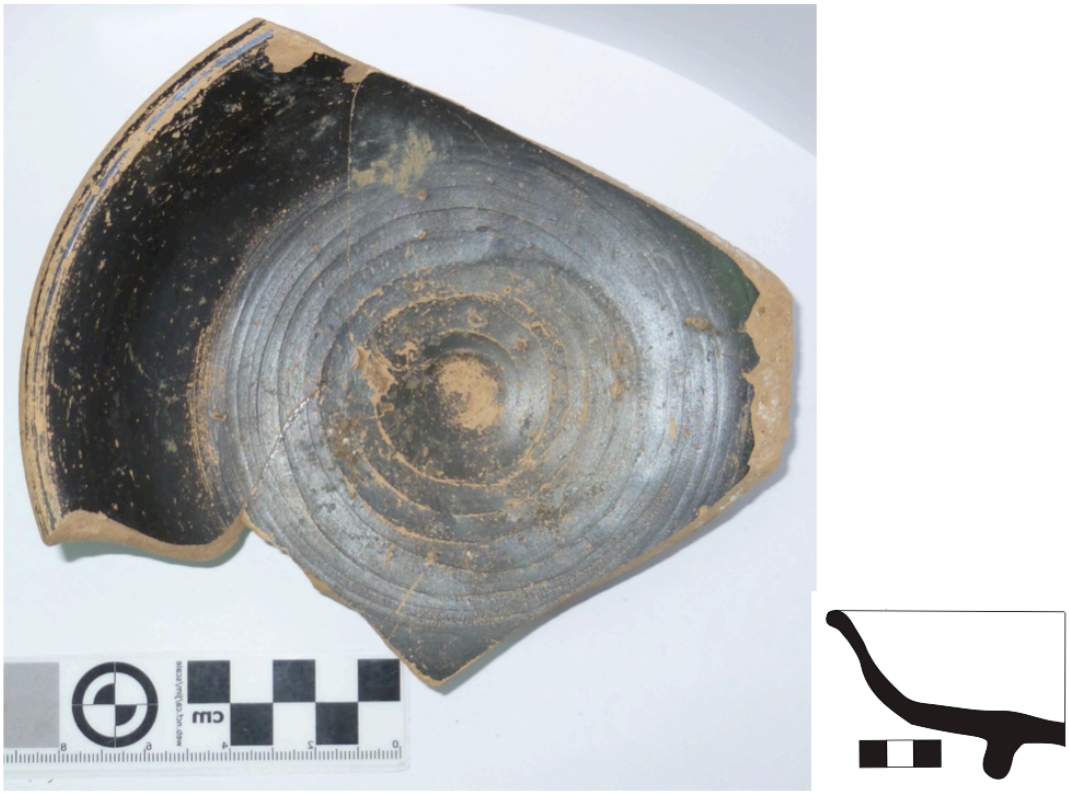

Figure 111. Black gloss bowl with concentric interior abrasion and worn central floor (MUS 3790)

The wear patterns on bowls from Musarna are also reminiscent of those observed on terra sigillata bowls found in England. Edward Biddulph notes that bowls of the straight-walled Dragendorff 33 tend to have a circle of wear along their interior carination at the base of the vessel wall as well as some abrasion of their central stamp (Figure 112). Alternatively, the Dragendorff 27, which has a more curved profile, tends to be heavily worn in the interior center of its base floor (Figure 113).[744] Biddulph suggests that the circle patterns on Dragendorff 33 come from stirring wine perhaps in the form of *mulsum*, a mixture of warm honey and wine: "Over time, the stirring lifted the surface slip and exposed the pink fabric underneath."[745] Conversely, Biddulph contends that the removal of the central slip on Dragendorff 27 bowls, "instead suggested an abrasive action, such as grinding herbs or spices with a pestle, or eating yoghurt-like food with a metal spoon."[746] Both of these suggestions are reasonable; however, one wonders what he is specifically imagining about the "lifting" of slip as a result of daily stirring, if it is not from abrasive contact with a stirring utensil.[747] Biddulph experimented with two replica vessels which

Figure 112. Dragendorff 33 with interior abrasion from Heybridge, Essex (Biddulph 2008, fig. 1)

[744] Biddulph 2008, 92. These are anecdotal observations based on an unknown sample size.
[745] Biddulph 2008, 93
[746] Biddulph 2008, 93.
[747] Could this be from acidic properties of the wine? See Vuković 2009

Figure 113. Dragendorff 27 with interior abrasion from Heybridge, Essex (Biddulph 2008, fig. 2)

reproduce Dragendorff 33 and 27 forms and slip. After two years of daily stirring in the Dragendorff 33 vessel, he did not yield any stirring damage; however, a demonstration of stirring with food coloring produced a stain on the interior of the vessel identical to the circular wear pattern he observed in archaeological examples. For the Dragendorff 27 vessel, Biddulph used a metal spoon to eat yoghurt out of the vessel and "gradually" produced wear on the edges of the central stamp. Biddulph also used a marble pestle to grind peppercorn and coriander seeds in the vessel. The curved wall of the bowl meant that the pestle pushed the seeds up, but they always rolled back into the center of the vessel and quickly wore the central stamp and slip.[748]

Biddulph's empirical exercises are extremely valuable and suggestive as demonstrations of the possible uses for terra sigillata and the ways in which form is connected to wear. They do not, however, ultimately reflect the duration of use and other realistic use factors involved in producing interior vessel abrasion. Firstly, his experimental vessels were made by an English potter who uses industrial "ready-prepared clay" to make replicas for museums.[749] This modern clay from an unreported source cannot necessarily be compared to hand-sourced manually-levigated clay from Italy or France, as would have

[748] Biddulph 2008, 96.
[749] Biddulph 2008, 93.

been used for these Roman vessels.[750] While the forming and slipping techniques were closely-representative of potting practices in the Roman world, the vessels were fired in an electric kiln, instead of a kiln supplied by organic fuel. This means that even if the temperature was controlled to be similar to a Roman kiln, the heating and cooling of the kiln is potentially more consistent and uniform than with an ancient kiln. We have already noted the importance of material quality in the durability and visibility of abrasion as suggested by the black gloss material. Secondly, the study of early Neolithic pottery in Serbia as well as ethnoarchaeological research suggests that the chemical composition of the liquid contained in the vessel has an important affect on abrasion potential. Acidic liquids, like fermenting beer, will eat away at the microstructures of the clay surface, possibly making alteration from abrasion more likely.[751] Nevertheless, Biddulph demonstrated that repetitive behaviors do produce traceable patterns of alteration.

Returning to the Musarna black gloss, when we examine the relationship between the vessel size and form and the presence of abrasion, logistic regression analysis demonstrates that diameter is positively correlated with interior rim abrasion and negatively correlated with base interior abrasion. That is, as the rim diameter increases by 1 cm, the likelihood of having interior rim abrasion increases by 17.4%.[752] And as the diameter of the vessel decreases by 1 cm, the likelihood of its base showing any kind of interior floor abrasion increases by 22.2%.[753] This correlation between size and interior abrasion is only statistically significant when looking at the entire sample of black gloss bowls at Musarna, not in any one period.[754] This may suggest that small bowls were being used in such a way that a utensil abraded their interior base floor; whereas larger bowls were more likely to be rubbed on their rim by a utensil. The only instance in which the rim angle of bowls is correlated with abrasion is in the case of the interior wall, and it is a very slight correlation. As the angle of the bowls' rim decreases (and the bowl becomes more

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[750] Ettlinger 1990, 64.
[751] Arthur 2002, 339; Vuković 2009, 31.
[752] Expβ=1.174 ($p<0.05$). When I select for this calculation only the sherds which were coded as having "sharp" fracture edges, the correlation is nearly identical: Expβ=1.173 ($p<0.05$).
[753] Expβ=0.778 ($p<0.05$). When I isolate only the sherds which were coded as having "sharp" fracture edges, the correlation is nearly identical: Expβ=0.752 ($p<0.01$).
[754] Rim size is positively correlated with interior rim abrasion to a close to statistically significant degree in Period 8: Expβ=1.991 ($p=0.077$).

open) the likelihood of abrasion on the interior wall increases by 3%.[755] Such low odds of increased abrasion may not be attributable to a major difference in the use of bowl forms; however, the numbers are at least suggestive that bowls of different forms succumbing to abrasion in different ways.

On plates of black gloss from Musarna, interior abrasion is dominated by chordal and radial scratches everywhere except on the rim of the vessel (Table 65). On the interior wall and interior base of plates, these are often relatively long, continuous linear streaks of abrasion running chordally or radially relative to the wheel marks of the vessel.[756] They range in length from 1 cm to 6 cm. These are visible as either cuts through the slip that reveal the fabric beneath, or as less-destructive linear depressions of the slipped surface (Figure 114 - Figure 117).

Table 65. Location and direction of interior abrasion on plates

Direction	**Whole vessels**			**Rims**		
	base	**wall**	**rim**	**base**	**wall**	**rim**
Concentric	0	0	1	1	20	63
Radial	3	2	4	0	2	3
Chordal	2	0	1	0	6	1
Total with abrasion[757]	*4*	*2*	*6*	*0*	*27*	*65*

[755] Expβ=0.973 (p=0.049)

[756] I label the interior of the vessel above the foot the "base", and the interior of the vessel between the foot and the carination of the rim, the "wall."

[757] These row numbers do not always add up to the "total with abrasion" number because some fragments have two types of abrasion.

Figure 114. Black gloss plate with interior abrasion (MUS 4632)

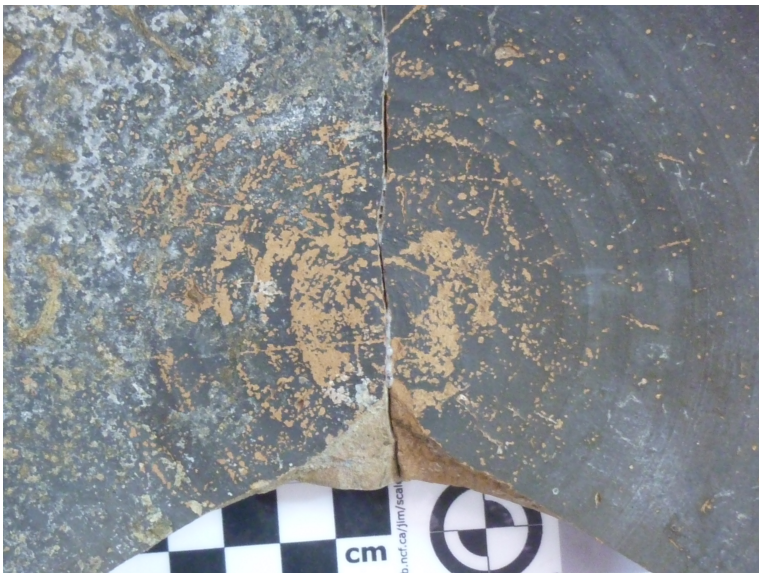

Figure 115. Close-up of internal abrasion on black gloss plate (MUS 4632)

Figure 116. Black gloss plate with interior abrasion, with image at 20x magnification (MUS 4976)

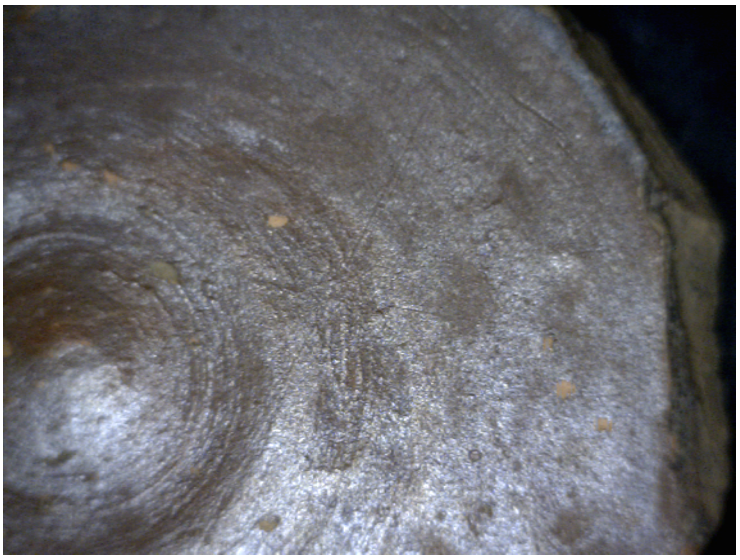

Figure 117. Black gloss base with 3 cm long diagonal cuts which decompress the slip at 20x magnification (MUS 1459)

6.2.1.2. Black gloss bases

Eighty-two base fragments, usually with their complete diameter preserved, have been recovered from Musarna (Table 66). Based on the preserved wall angle, wall width,

slip, interior stamp style, and foot style, I have sorted the base fragments into forms (Figure 118). I have also created an "unknown BG" category for fragments which are clearly a bowl or a plate (and not a closed form) but whose preservation precludes being able to distinguish between them.

Table 66. Forms represented by black gloss bases from Musarna

Form	Frequency	Percent
olla	2	2.4
jug	11	13.4
bowl	12	14.6
plate	11	13.4
unknown BG	46	51.6
Total	82	100.0

If we examine together the bowls, plates, and unknown BG (n=69), 57% have interior abrasion, 83% have exterior abrasion, and 46% have both, revealing not enough overlap to demonstrate a strong relationship between interior and exterior abrasion. On the interior base, 16 of 38 examples are concentric abrasion, 10 of 38 are chordal, and 8 of 38 are radial and 10 of these have both, demonstrating a strong likelihood of having two directions of abrasion on the vessel interior.[758] All exterior base abrasion is concentric, consistent with the other vessels from Musarna, which are worn on the their base foot.

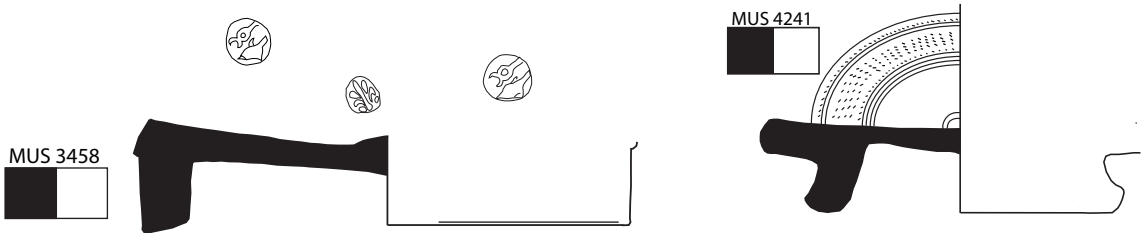

Figure 118. Black gloss plate base fragments

When only bases of bowls are considered (n=12), 50% have interior abrasion, 92% have exterior abrasion, and 50% have both. Four out of six examples of interior abrasion are concentric.[759]

When just bases of plates are selected (n=11), 82% have interior abrasion, 64% have exterior abrasion, and 55% have both. On the base interior, three out of nine

[758] $\chi^2=9$ ($p<0.01$)
[759] χ^2 cannot be calculated for this in SPSS because there are no non-base examples selected.

examples are concentric scratches, four out of nine are chordal, and three out of nine are radial (Figure 119). This is consistent with the types of scratches noted on fragments of rims and whole vessels of black gloss plates at Musarna further suggesting a relationship between plates and cut lines.

Figure 119. Internal abrasion on plate base fragment (MUS 5080)

6.2.2. Discussion

The rims, whole vessels, and bases of black gloss bowls and plates demonstrate clear temporal trends in use. Bowls increase in diameter after 200 BCE and subsequently increase in rim angle through the 2nd century. Throughout their use at Musarna, their abrasion is consistently oriented concentrically, suggesting repeated stirring. In some cases their central base interior is worn. This suggests that bowls were often used in conjunction with utensils that scooped or stirred beverages or loose liquidy foods.

In clear contrast, plates are always present at Musarna, but take over the black gloss assemblage after the middle of the 2nd century BCE, in Period 8. These plates generally have larger rim diameters than the bowls. Abrasion patterns on plates are dominated by straight scratches, either radial or chordal. These marks suggest that people were cutting on their black gloss plates. Similar scratches have also been noted, but not published, on black gloss

plates from Iberia, and on eastern sigillata red gloss plates in the Eastern Mediterranean.[760] Such anecdotal observations of knife marks have never before been supported by a large sample.

There is little information about Roman knife use; for example, there is one reference in Juvenal to a bone-handled, rather than ivory-handled, knife as a sign of poverty at the dinner table.[761] Though knives were found in Pompeii, they have been recovered or published from few other sites in Italy, likely because the metal blade was recycled and re-purposed. A. Dosi and F. Schnell explain that knives would have been used infrequently in the triclinium because the reclining position would have made it inconvenient to cut food; they suggest that knife use was more common at lower-status sit-down meals at *tabernae*.[762] Since we do not know the specific use context of the black gloss plates, we cannot speculate about the presence or absence of utensil marks being associated with body position or the status of the meal. The status of black gloss generally when compared to metal vessels is not known.[763] While it is reasonable to assume that black gloss was of lower prestige value than metal, just how widespread metal vessels would have been in the houses of a town like Musarna is unknown.[764] It is important to note that a change in use or prestige of black gloss plates over the history of Republican Musarna is not supported by the examination of abrasion. There is no significant difference in the type or amount of interior abrasion between the different periods under study.[765]

The change from stirring and scooping in a bowl to cutting on a plate has clear implications for food change. If we look at the range of sizes of bowls in Period 8 (or

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[760] Similar linear scratches on black gloss from Iberia have been reported to me by Jordi Principal (personal communication, 15 June 2012). Similar linear abrasion on red gloss vessels from the Eastern Mediterranean have been mentioned to me by John Lund and Kathleen Slane (personal communication, 28 September 2012)

[761] Juvenal, *Satires* 11, 131.

[762] Dosi and Schnell also suggest that this is the reason that more knives have not been excavated in triclinia, ignoring the uncountable problems of discard versus use contexts. Dosi and Schnell 1986, 67–68. For Pompeian knives see Stefani 2005.

[763] Bats (1988, 76) and Principal (2006, 49) both discuss this in the western provinces suggesting that in the 2nd century BCE, metal became the serving vessel of choice for the wealthy while black gloss was "democratized" for the middle-classes. Roman Roth takes black gloss as the ware of "non-elites" because of the probable use of metal by the wealthy (Roth 2007a, 5–6).

[764] For discussions of the difficulty of determining pottery use versus metal and glass use, see Morel 1979; Vickers and Gill 1994; Lund 2005; Hudson 2010.

[765] This is the case both when the common incidental rim abrasion is included and when the abrasion on the interior wall and base is isolated.

earlier) compared to plates in Period 8, bowls are much more narrowly spread from about 8 cm to 22 cm. The abundance of plates range in size from 7 cm to 41 cm, with many more examples larger than 18 cm. These data point to a move from individual stewy proportions to large platters of potentially drier foods as an indication of communal sharing of foods and an increased importance of displaying food. Instead of scooping food from a cooking pot (possibly an olla) or a large common ware vessel into smaller vessels, by the mid-2nd century BCE, there was more of an interest in laying out food visibly on large flat vessels.

6.2.3. Red gloss ware

There are only 34 fragments of this transitional ware from Musarna. They appear only in Period 5 (200-100 BCE) and Period 8 (150-100 BCE); and their rarity is in keeping with the fact that *terra sigillata* as a ceramic type only begins being produced in Italy in the middle of the 1st century BCE (Table 67). The majority of these vessels are plates.

Table 67. Red gloss vessels at Musarna.

Period	Frequency	Percent
5	18	52.9
8	16	47.1
Total	*34*	*100.0*

6.2.3.1. Plates

Red gloss plates (n=20) range in diameter from 10 cm to 38 cm (Figure 120, Figure 121). Although there are a few very large examples from Period 8, neither mean diameters nor the distribution of diameters change significantly from Period 5 to Period 8, nor do wall thickness or the angle of their rims.

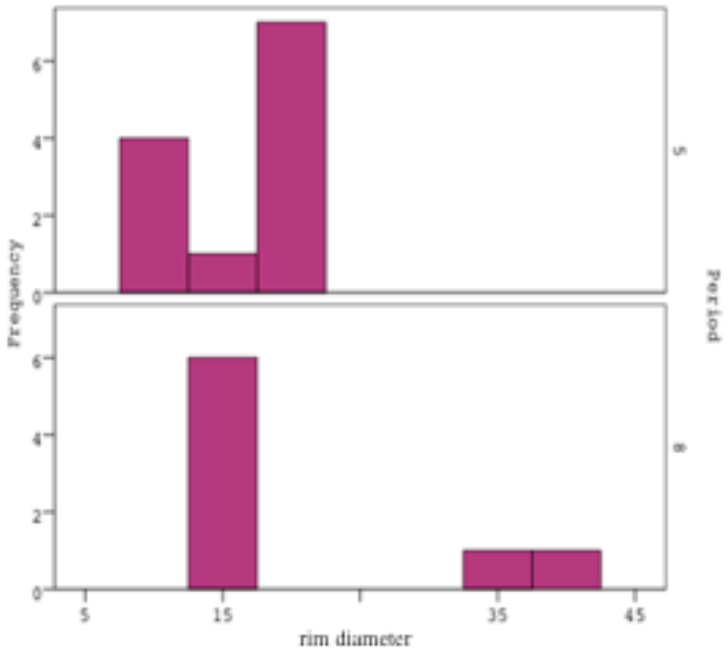

Figure 120. Diameters of red gloss plates by period

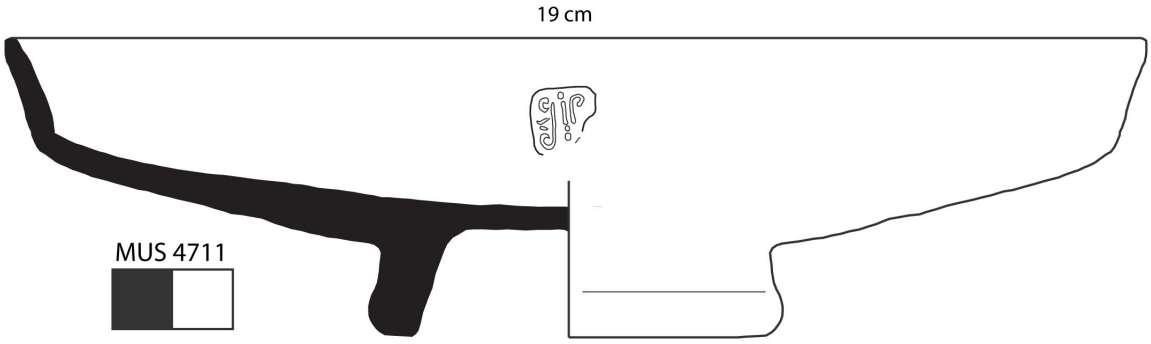

Figure 121. Red gloss plate form (MUS 4711)

Ninety-five percent of these red gloss plates have abrasion on their interior, 65% have exterior abrasion, and 60% have both (Table 68).[766]

Table 68. Location of abrasion on red gloss plates

Location of abrasion	Count (int)	Count (ext)
Abrasion on base	2	2
Abrasion on wall	11	5
Abrasion on rim	13	10

[766] Like black gloss vessels, these vessels seem to have undergone relatively little post-depositional disturbance. With 19 out of 20 of them being coded as having "sharp" edges and only 22% of them having any mineral encrustation (in all cases covering less than 20% of the fragment surface).

The direction of abrasion on these plates is mostly concentric. All of the abrasion on the interior rim and wall is concentric, with a few overlapping chordal scratches. On the interior base, one scratch is chordal and the other concentric.

6.2.3.2. Bowls

Thirteen red gloss bowls were recovered at Musarna. These are all represented by rim fragments. Mean diameter does not change from Period 5 and 8, with a mean and median from both periods of about 16 cm (Figure 122, Figure 123).

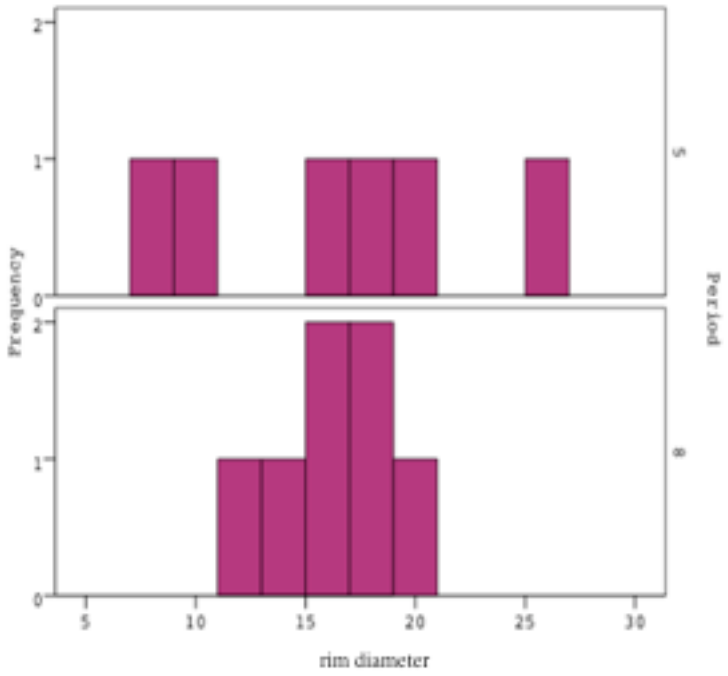

Figure 122. Diameters of red gloss bowls by period

These fragments are not in good condition. Six out of 13 (46%) have “slightly rounded” edges, though only two have any calcium encrustation. When we isolate only the sherds characterized as having “sharp” edges, there are only three examples with abrasion: all patches of slip removed on the exterior rim.

Figure 123. Very worn red gloss bowl fragment (MUS 5467)

6.2.4. Common ware

At Musarna, common ware appears in six distinct forms: pentola, olla, jug, bowl, cup, and *unguentarium*, a small spindle-like form likely for scented oils or cosmetics (Table 69). The following analysis and results will focus on the most frequently-represented forms associated with foodways.

Table 69. Common ware forms at Musarna

Form	Frequency	Percent
pentola	3	3.7
olla	35	42.7
jug	18	22.0
bowl/mortarium	19	23.2
cup	2	2.4
thymaterion	5	6.1
Total	*82*	*100.0*

6.2.4.1. Bowls/Mortaria

Morphology

These vessels are unevenly distributed in the periods of interest at Musarna. Far

more were recovered in the first three periods than in Period 8 (Table 70). There are 18 rim fragments and one fragment with its whole profile preserved (Figure 124).[767] These vessels range widely in rim diameter from 9 cm to 52 cm (Figure 125).

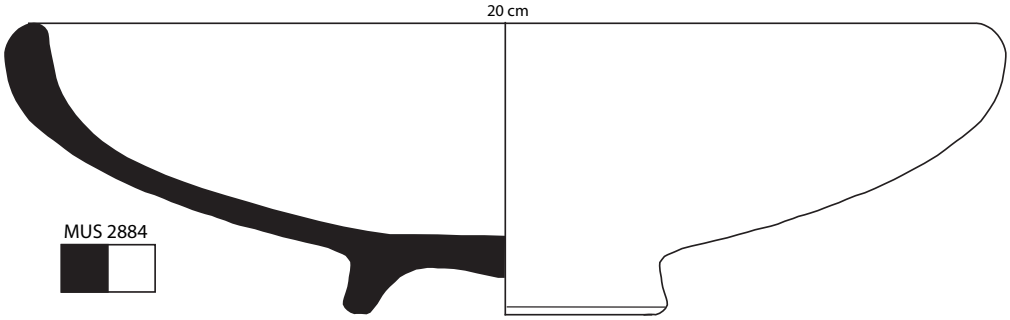

Figure 124. Common ware bowl at Musarna (MUS 2884)

Table 70. Common ware bowls from Musarna

Period	Frequency	Percent	Mean (cm)	Median (cm)
2	11	57.9	25.09	20
4	2	10.5	20	20
5	5	26.3	12.4	12
8	1	5.3	25	25
Total	*19*	*100.0*	*21.26*	*16*

[767] These represent 3.85 EVEs.

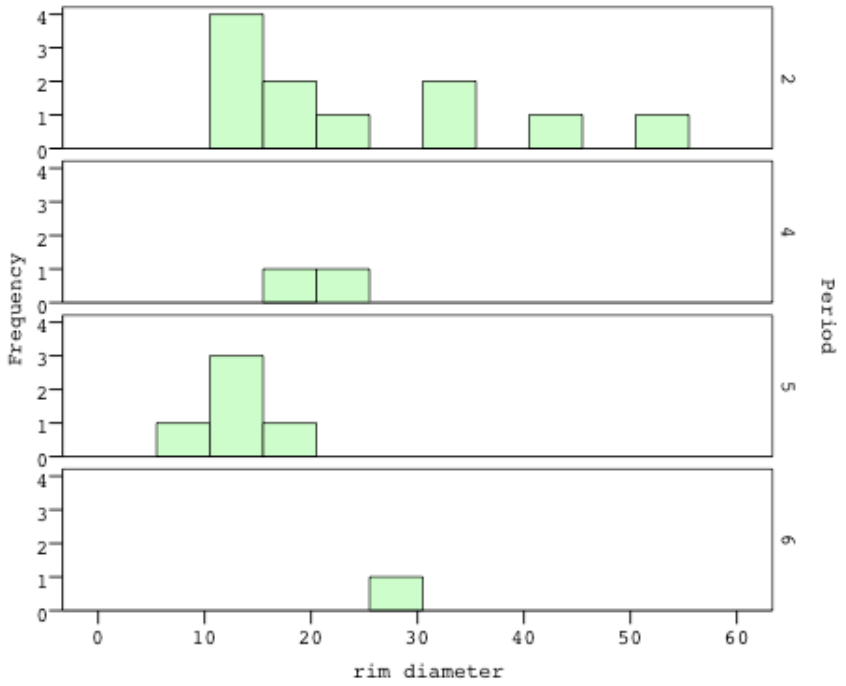

Figure 125. Common ware bowls from Musarna by period

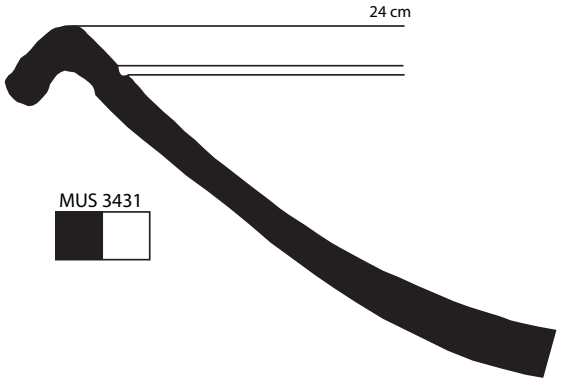

Figure 126. Common ware bowl form at Musarna (MUS 3431)

Between Period 2 and Period 5 there is a minor change in rim diameter. Period 2 has a higher mean rank;[768] therefore its diameter is distributed towards the higher end (10.27) in comparison to Period 5 (4.60) to a statistically significant degree.[769] There are two outliers in these diameter measurements. These are MUS 850 and MUS 3388, which according to their diameters, wall thicknesses, and wide-rimmed form, are clearly mortaria

[768] A "mean rank" is part of a Kruskal-Wallis calculation. It is the product of ranking all of the values, summing them, and dividing them by the number of values. See Appendix 2.
[769] $\chi^2=4.9$ ($p<0.05$)

or large basins (Figure 127). When I remove these two outliers, there is still a significant difference between the diameters of Period 2 and Period 5 bowls.[770]

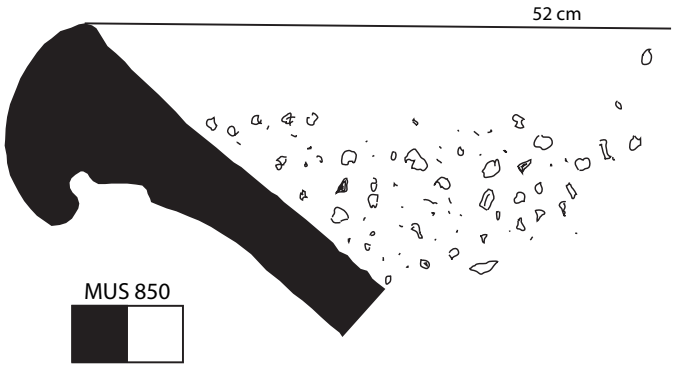

Figure 127. Mortarium fragment (MUS 850)

The thickness of the bowl walls is distributed nearly identically to the diameter.[771] This is connected to the fact that the two mortaria in this sample both have a thicker wall than the rest of the bowls. There is not, however a significant difference in the wall thickness of the bowls in any period with the mortaria included or excluded from the calculation.

Finally, the distribution of the rim angle in each period is almost identical. While Period 2 has the widest spread of angles (ranging from 30˚ to 110˚), it is well-matched by Period 5's range of angles.

Alteration

Several factors affect the observation and recording of abrasion on common ware. Visibility on the ceramic surface is a major limitation. The yellow-buff surface of common wares is typically the same color as the interior paste; therefore, scratches and patches of abrasion can be more difficult to distinguish than on ceramics of a darker color or with more distinction between surface and internal color. This may lead to an under-reporting of abrasion on this ware type.

Post-depositional factors do not appearn to have affected this particular sample of bowls, as they have very little mineral encrustation. Only one fragment has any mineral

[770] χ^2=3.76 (p=0.053)
[771] Pearson correlation, r=0.820

crust on its exterior.[772] A total of 79% of bowls have edges classed as "sharp" and 21% are "slightly rounded." There is also no difference between the periods in the degree of damage. All periods are equally well-preserved.

Thirty-seven percent of these bowls have interior abrasion, 47% have abrasion on their exterior and 26% have both (Table 71).

Table 71. Location of abrasion on common ware bowls

Location of abrasion	Count (int)	Count (ext)
Abrasion on base	1	1
Abrasion on wall	5	6
Abrasion on rim	1	2

The only two locations with a statistically significant relationship are rim exterior and wall interior which overlap on two occasions.[773] There are few statistically significant relationships between the location of abrasion and the direction of abrasion. This may be because the number of fragments with abrasion is too low. It is worth noting the variation in interior wall abrasion: one in five shows concentric scratching, one in five shows radial scratching, and three in five have large patches of removed surface (25 cm^2 or more). Two of the bowls with interior patching are the mortaria which are pedestalled around their interior grit. The third is a similar form and size as a mortarium (35 cm wide, 30˚ opening) but does not have added grit on its interior. Its interior surface is sufficiently worn to show the interior inclusions protruding from its surface.[774] Its fabric places it clearly within the class of bowls often identified as *impasto chiaro sabbioso*. This fabric is used for mortaria or basins, which are identical to mortaria, but do not have interior grit (Figure 128).

[772] And even then, it is only 15% covered.
[773] χ^2=6.259 (p=0.12)
[774] The notes from the database read: "all cracked with inclusions bursting out of the surface."

Figure 128. Pedestalling visible on mortarium surface at 20x magnification (MUS 850)

There is a correlation between rim diameter and abrasion on the interior wall only when the mortaria and large basin described above are included in the calculation. As the rim diameter increases by 1 cm, the likelihood of interior wall abrasion increases by 15%.[775] This statistic neatly confirms that large bowls, which in this case are gritted mortaria, were used as mortars.

Otherwise, there is no significant difference in the proportion of vessels with abrasion on them in different periods. Each period has about half of its fragments abraded in some way.

6.2.4.2. Ollae

Morphology

There are 35 rim fragments from common ware ollae in my sample from Musarna (Table 72).[776] These are very consistent in rim diameter over time, ranging in each period from approximately 7 cm to 15 cm (Figure 129). Like common ware bowls, common ware ollae are hardly represented in the later periods, that is, after the late 2nd century BCE. As we have seen, the same form in *ceramica comune da fuoco* remains in this later period.

[775] Expβ=1.154 ($p<0.05$)
[776] These represent 6.53 EVEs.

Table 72. Common ware ollae from Musarna

Period	Frequency	Percent	Mean (cm)	Median (cm)
2	13	37.1	11	11
4	7	20.0	10.14	10
5	13	37.1	10.15	10
6	1	2.9	11	11
8	1	2.9	8	8
Total	*35*	*100.0*	*10.43*	*10*

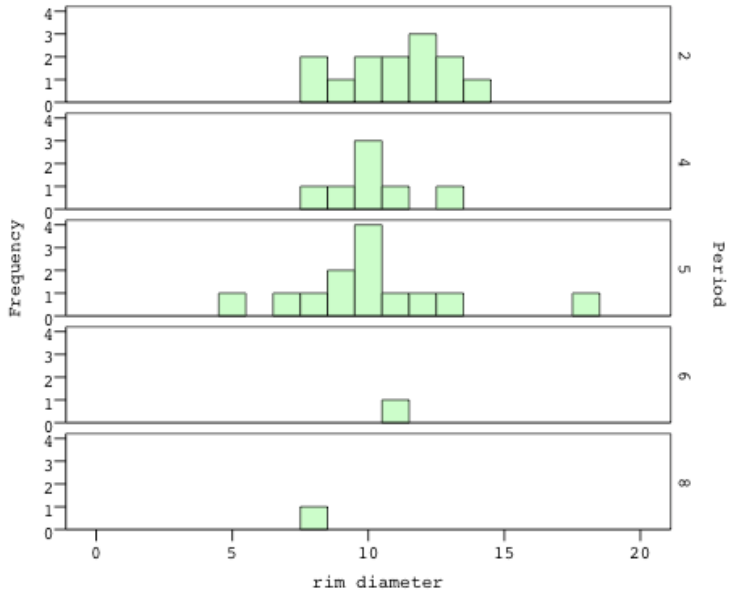

Figure 129. Common ware ollae from Musarna by period

Wall thickness of these ollae varies significantly over time. "Upper thickness," that is, just below the lip of the rim decreases from Period 2 to Period 5. In Period 2, the wall thickness clusters around 6 mm, but in Period 5, it clusters around 4 mm.[777] It is not obvious that this 2 mm of difference, though a significant trend, would have any real effect on the functionality of these preparation or storage vessels (Figure 130).

There is no significant temporal difference in the angle of opening of these ollae. All have a large range of rim angles between 25˚ and 90˚, with each period clustering between 60˚ and 70˚.

[777] χ^2=5.607 (p=0.018)

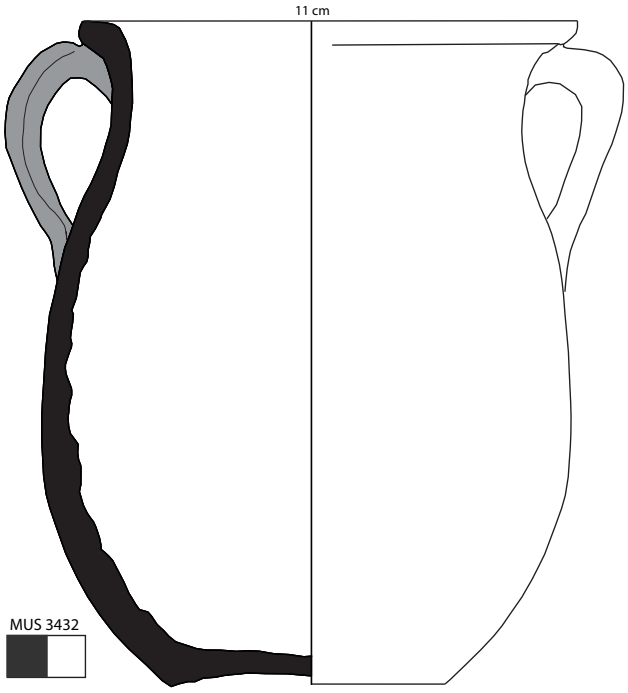

Figure 130. Two-handled olla in common ware (MUS 3432)

Alteration

Twenty percent of these vessels have some mineral accretion, but all are 50% or more visible. Edges of 71% are coded as "sharp," and the rest are "slightly rounded."

Assessing the periods separately, fragments from Period 2 have proportionally more mineral encrustation but otherwise, all periods are similar in terms of edge rounding.

Thirty-one percent of the olla fragments have some type of interior abrasion, 26% have exterior abrasion, and 11% have both (Table 73).

Table 73. Location of abrasion on common ware ollae

Location of abrasion	Count (int)	Count (ext)
Abrasion on base	0	2
Abrasion on wall	2	4
Abrasion on rim	10	4

Although there is no strong relationship between any two locations of abrasion, there are some notable (though not statistically significant) trends in the direction of abrasion on these ollae. Half of the abrasion on rim interiors is concentric, two examples are chordal, two radial, and one a 6 cm^2 patch of surface removed (Figure 131). Abrasion in this location may come from accessing the interior contents of the vessel, though when we

compare the frequency of this abrasion to similar abrasion of ollae in *ceramica da fuoco* fabric, it suggests that cooking vessels were more frequently accessed. There is little abrasion on the interior wall and it is evenly divided between a chordal scratch and a large 16 cm^2 patch of abrasion. This suggests that the interior contents of ollae were not being frequently accessed or mixed – ollae were likely for storage. Otherwise, there is no correlation between vessel size or shape and the presence of abrasion.

Figure 131. Olla with concentric abrasion on interior rim (MUS 3444)

6.2.4.3. Jugs

Morphology

There are 18 jug fragments from Musarna in common ware (Table 74).[778] These are represented by two rims, five rims with handles, and 11 whole or nearly whole vessels with their whole profile preserved. These whole jugs have been reconstructed from up to 50 joining fragments each. They come from the lowest layers of cistern 511 and seem to be the remains of water jugs dropped in the cistern. Their breakage pattern suggests that they were dropped accidently: the rim and handle are preserved whole, while the base is

[778] These represent 16.18 EVEs.

typically in one or two pieces. The vessel wall opposite the handle, however, is smashed into many small fragments (typically 9 cm^2 to 16 cm^2). There are also several examples of complete bases on which at least one side of the jug wall can be reconstructed up to the rim but with no handle present.[779] We can imagine one of Musarna's residents retrieving water from a well with a rope tied around the vessel handle, and as it was being lowered or raised, it may have smashed against the wall with the base dropping into the cistern while the rim and handle were drawn back up and either discarded into the cistern or discarded elsewhere (Figure 132).

Table 74. Common ware jugs from Musarna

Period	Frequency	Percent	Mean (cm)	Median (cm)
2	4	22.2	12.75	12.50
4	8	44.4	9.25	9.50
5	3	16.7	9.67	10
8	3	16.7	7.67	8
Total	*18*	*100.0*	*9.83*	*10*

Figure 132. Nearly whole common ware jugs (MUS 2364, MUS 5755, MUS 4891)

The physical proportions of these jugs vary substantially. Three examples have long narrow necks: two of these have rims of 4 cm and 5 cm in diameter (MUS 4901, and MUS 5758). These are morphological outliers in an otherwise homogeneous set of ovoid jugs

[779] There are 5 of these bases from SU 511003.

(Figure 133). Their heterogeneity in volume comes from the fact that the heights of these ovoid jugs vary greatly.

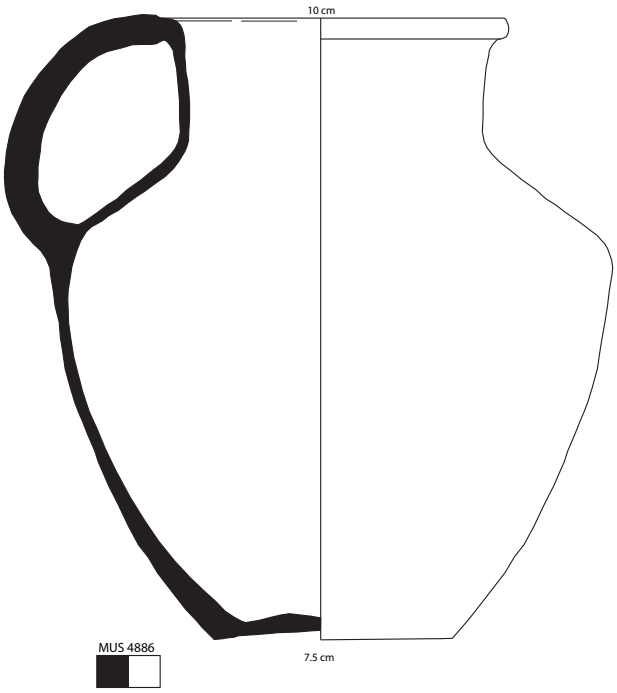

Figure 133. One of the many forms of common ware jug at Musarna (MUS 4886)

The only difference in diameters between periods appears between Period 2 and Period 4 (Figure 134). This is case both when I remove the narrow-necked outlier (MUS 4901) in Period 4 and when it is included. The rim diameters from Period 2 are significantly wider, by more than 2 cm, in comparison to Period 4.[780]

[780] When MUS 4901 is not included, $\chi^2=4.81$ ($p<0.05$)

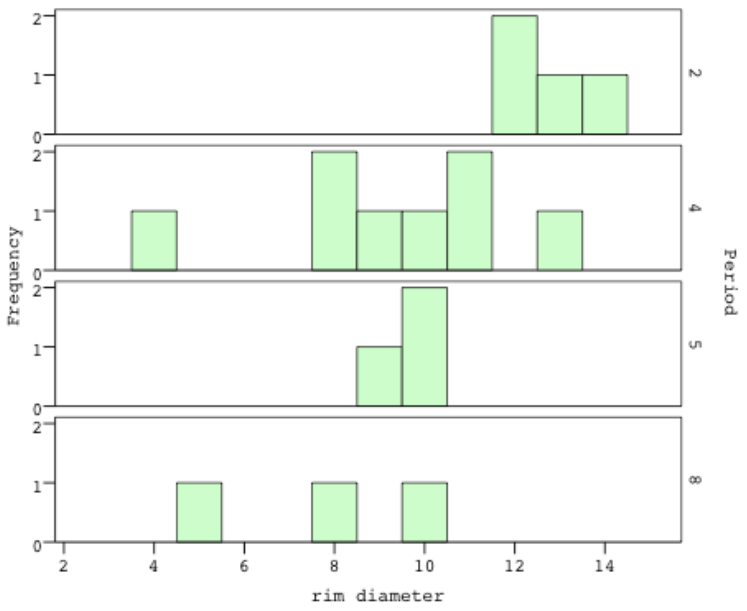

Figure 134. Common ware jugs from Musarna by period

Otherwise, there is no significant difference in the angle or wall thickness of these jugs over time.

Alteration

Only five of the 18 fragments had any mineral encrustation (and all but one are less than 20% covered). The one exception is 75% covered in white calcium crust and is not included in the following discussion. Ninety-four percent of these jugs have "sharp" fractured edges, and 6% (n=1) are "slightly rounded." In general, then, the sherds of common ware jugs are well-preserved and have undergone minimal post-depositional disturbance.

Very little abrasion is evident on these jugs (Table 75). Only 11% have abrasion on their interior; these are two fragments abraded on their rim interior. Sixty-one percent (n=11) have exterior abrasion and 5% (n=1) have both. There are six examples which have no abrasion at all.

Table 75. Location of abrasion on common ware jugs

Location of abrasion	Count (int)	Count (ext)
Abrasion on base	0	8
Abrasion on wall	0	3
Abrasion on rim	2	1

All of the abrasion on jugs is concentric with the exception of three patches of abrasion. On one exterior base, there is a 25 cm^2 abraded patch which seems, like the abrasion on black gloss feet, from everyday dragging.[781] On the exterior wall of two vessels are patches 1 cm^2 and 400cm^2. The latter vessel is MUS 4712, and is perhaps better identified as a hydria or even pyxis than a jug. I have not been able to locate a *comparandum* for this form (Figure 135).[782] Its surface is heavily flaked off around its widest extent, the same location of its main break. I have little explanation for its condition or use except to suggest that it may have come into contact with other vessels or surfaces at its widest extent too many times and eventually broke in half at that weakened point.

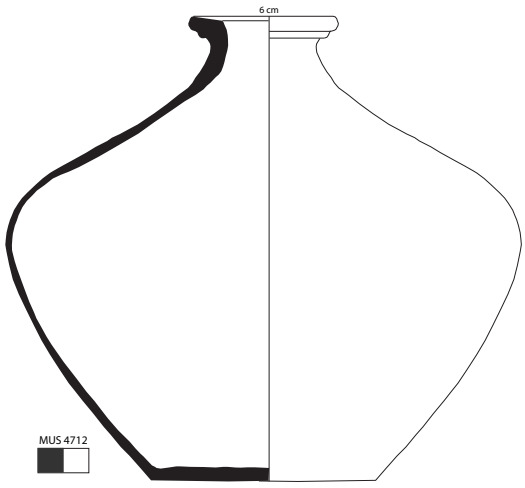

Figure 135. "Jug" with no *comparandum* of unknown function (MUS 4712)

[781] This is MUS 4891.
[782] Its fabric is more ferrous than calcareous, but its form and lack of fire damage caused me to group it with common wares rather than with *ceramica da fuoco.*

6.2.5. Discussion

Though common ware vessels appear in much smaller quantities than other vessel types in every period at Musarna, their scarcity in Period 8 is notable. Only five out of the total 72 common ware fragments were recovered from Period 8. Though we could attribute it to preferential discard practices (i.e. common wares were discarded somewhere else on site in Period 8), the fact that cooking vessels and table vessels were both recovered in substantial quantities suggests that the cistern deposits at Musarna are composed of generally undifferentiated kitchen or household waste. The reason jug numbers are particularly high in the earlier periods of several cisterns is due to their discard being associated with the use of the cistern itself, as has been determined by their breakage patterns. Such a situation does not seem applicable to common ware bowls and ollae.

Before considering the reason for these vessels' scarcity, their purpose or function should be examined. Bowls have an open-form and were likely used for preparing and then mixing ingredients for cooking; however, the appearance of abrasion on their interiors is not substantially more frequent than interior abrasion on common ware ollae. I would expect a closed-form vessel like an olla made in common ware to be used for storage. Vessels used for storage are less likely to have abrasion because they typically store dry contents and may be infrequently accessed and moved.[783] The examination of abrasion patterns on common ware ollae from Musarna supports this assumption, since they have little abrasion on their interior and slightly more on their exterior. Common ware jugs, whose function as water gathering and pouring vessels seems clearer, display similarly low interior abrasion frequencies.

The diminished appearance of common ware bowls and ollae in Period 8 might be explained by an examination of the ceramic assemblage as a whole. In chapter 5, it was shown that pentole and ollae of *ceramica da fuoco* increase in number, range of sizes, and average size in Period 8. The simultaneity of the change in common wares and *ceramica da fuoco* may suggest an alternative use for *ceramica da fuoco* pentole and ollae. This idea is further supported by the results of logistic regression analysis which demonstrate a

[783] Arthur 2002, 340.

negative correlation between later periods and the appearance on blackening on *ceramica da fuoco* ollae and pentole. For ollae, with each later period, exterior blackening is 22.7% less likely,[784] interior blackening is 21.5% less likely,[785] and blackening on the interior or the exterior is 19.3% less likely.[786] The results are weaker for pentole, where with each later period, they are 33% more likely not to be blackened on their interior.[787] Exterior blackening and any kind of blackening is not more likely in any particular period. The fact that blackening is less common in later periods may suggest that *ceramica da fuoco* pentole and ollae were not being used exclusively for cooking, but maybe have also served as storage or mixing vessels in Period 8 as a replacement for the common ware vessels. This interpretation points to the value of examining entire assemblages, rather than focusing on either serving or cooking wares.

6.2.6. Musarna conclusions

Black gloss and red gloss vessels are in scale and style appropriate for serving and eating. The examination of black gloss vessels, for which we have much more evidence than red gloss, demonstrates that foodstuffs were scooped from and stirred in bowls. Conversely, abrasion patterns on plates suggest that they were used for eating foods that were cut with a sharp utensil. Plates, which are at all times significantly larger in diameter than bowls, overtake bowls in relative proportion after the middle of the 2nd century BCE. This change in form and size may reflect a change in the presentation of food for consumption. Instead of eating out of individual (smaller) bowls, diners desired flatter vessels, some perhaps individualized and some larger with food displayed openly. These platters could then be shared among diners.

Common wares do not change shape or size substantially over time at Musarna. This may be due to the low numbers in which they appear, making statistically significant results difficult to obtain. There is, however, a noticeable decline in the numbers of common ware jugs, bowls, and ollae. The decline in these vessels and simultaneous

[784] Expβ=0.773 ($p<0.01$)
[785] Expβ=0.795 ($p<0.01$)
[786] Expβ=0.707 ($p=0.013$)
[787] Expβ=0.679 ($p<0.01$)

increase in *ceramica da fuoco* forms may suggest that the function of common ware vessels has been taken over by *ceramica da fuoco* vessels. The precise foods these vessels would have held, either for storage or mixing or preparation, are not easy to discern.

6.3. Populonia

The kind of analyses of each vessel type within the black gloss, red gloss, and common ware categories presented above was also conducted on the vessels recovered at Populonia. The results are described below.

6.3.1. Black gloss

Black gloss ware appears in a variety of vessel shapes at Populonia (Table 76). There is no significant change in the distribution of these forms over time. In every period there are more bowls than plates (Figure 136). Bowl frequency always comprises between 70% and 77% of black gloss ware vessels in each period plus a few ollae and the so-called ink well form.

Table 76. Black gloss forms from Populonia

Period	Olla	Bowl	Plate	Ink well	Total
5	0	7	3	1	11
7	3	101	29	0	133
9	0	11	4	0	15
Total	*3*	*119*	*36*	*1*	*159*

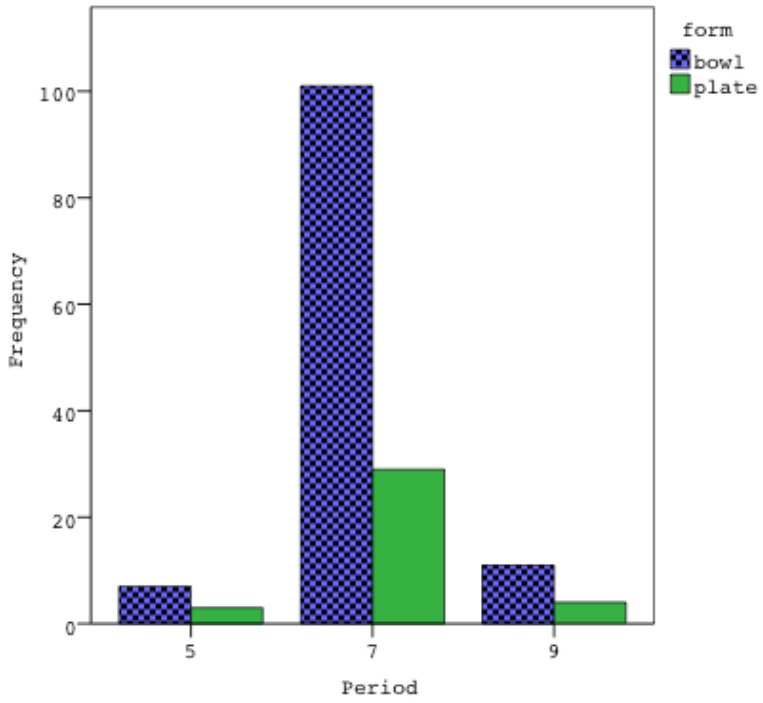

Figure 136. Black gloss bowls and plates from Populonia over time

There are 119 black gloss bowl fragments: 114 rims, and five with their whole profile preserved. These represent 118 MNV and 8.81 EVEs. The bowls range in diameter from 7 cm to 29 cm wide, with a mean of 16.26 cm and a median of 16 cm. There are 36 plate fragments at Populonia. Thirty-three are rim fragments, while an additional three are whole profile fragments. These represent 34 MNV and 3.88 EVEs. They range in diameter from 11 cm to 33 cm, with a mean of 20.40 cm, and a median of 20 cm. Although in general plates are wider than bowls from Populonia, this difference does not quite reach statistical significance.[788]

6.3.1.1. Bowls

Morphology

There is no significant change in rim diameter over time with a broad range of sizes available in every period at Populonia (Table 77, Figure 137). There is no change in wall thickness over time. There is, however, a significant change in the angle of the opening of

[788] *t*=3.97 (p=0.099)

these bowls. The mean and median angle of bowls in Period 5 is 70˚ and 65˚, whereas in Period 7 the mean and median are 59.36˚ and 55˚. This suggests that bowls are getting broader and less likely to have vertical or incurved rims (Figure 138).[789] Between Period 5 and Period 9 there is no significant difference in rim angle, though the mean rank of Period 5 is greater. There is also little change between Period 7 and 9.

Table 77. Black gloss bowls as rims and whole vessels at Populonia

Period	Bowl	Percent	Mean (cm)	Median (cm)
5	7	5.9	15.86	16.47
7	101	84.9	16.26	16.50
9	11	9.2	16.55	16
Total	*119*	*100*	*16.26*	*16*

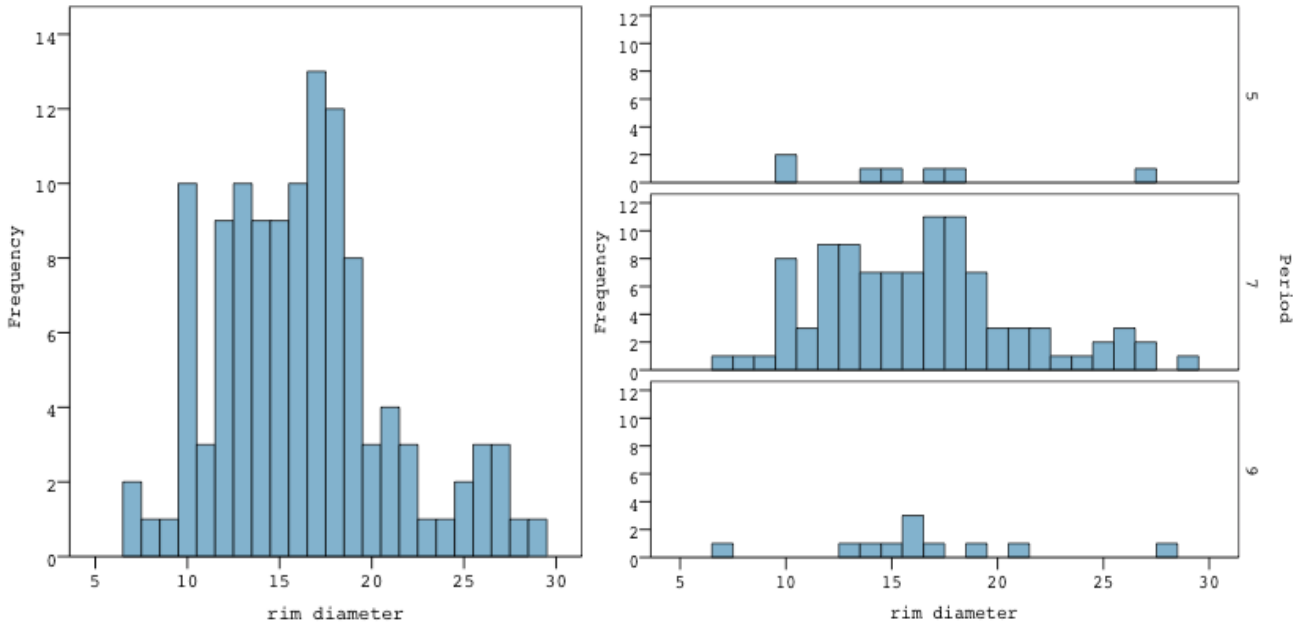

Figure 137. a) Diameters of black gloss bowls from Populonia; b) Diameters by period

[789] χ^2=3.98 (p<0.05)

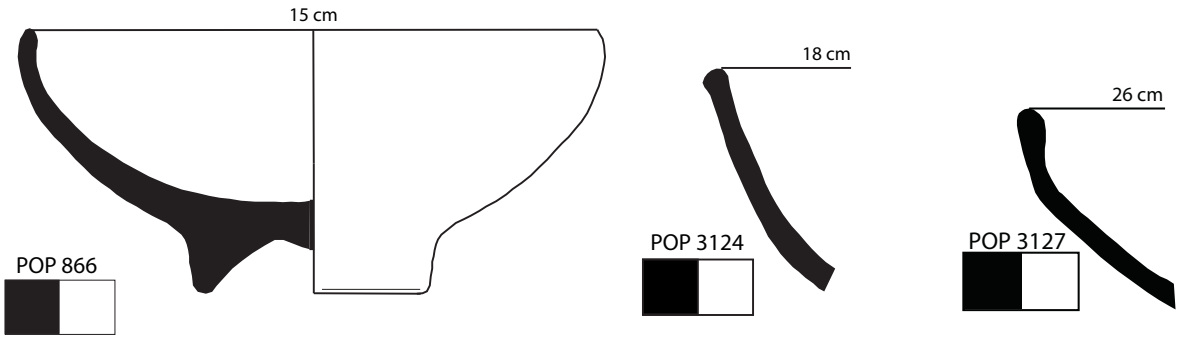

Figure 138. Various black gloss rim forms from Populonia (POP 866, POP 3124, POP 3127)

Alteration

An examination of accretion and attrition of black gloss fragments from Populonia suggests that they have undergone slightly more post-depositional disturbance than sherds from Musarna. Thirty-two percent of bowl fragments have some mineral encrustation, of which 46% have more than 20% of their interior surface covered and 29% have more than 20% of their exterior surface covered. In terms of attrition, 79% of these sherds have been classed as having "sharp" fractures, 19% are "slightly rounded," and 2% are "very eroded." There are proportionally more fragments with crust in Period 5 (71%) compared to Period 7 (27%);[790] however, there is no significant difference in the *amount* of mineral encrustation on sherds from different periods. There is also no difference in the distribution of edge rounding. For the purposes of the following analysis, the fragments which have edges classed as 2 or 3 are excluded, leaving a total of 94 bowls in the sample.

The majority of the black gloss vessels at Populonia seem to be Campana A production.[791] This is a production of black gloss which was made in the Bay of Naples area.[792] Populonia's coastal location meant that the importation of these vessels would not have been difficult. Campana A is a glossy, consistently-sintered black gloss which appears

[790] $\chi^2=6.3$ ($p<0.05$)
[791] Quaratesi 2008. I take seriously Helga Di Giuseppe's warning that it is not possible to determine the provenance of black gloss via "naked-eye" observation because of the fineness of the clay, the firing conditions, and because we are identifying ever more production locations (Di Giuseppe 2012, 4). However, Campana A production has been chemically determined to be a well-defined, homogeneous production. The consistency of the quality and characteristics of Campana A vessels mean that they are the easiest to identify and are perhaps the only production which would be acceptable to identify by eye according to Di Giuseppe.
[792] Mirti and Davit 2001, 31; Stanco 2009a, 30.

to be higher quality than the locally-produced black gloss typical of inland central Italy and Etruria, like that of Musarna. Scratches are therefore more difficult to see because they barely alter the ceramic surface. Most of the scratches observed on black gloss at Populonia compress the slip, rather than cut through it. Despite this difference in abradability, the proportion of black gloss vessels with recorded abrasion at Populonia is similar to Musarna.[793]

Sixty-four percent of Populonia's black gloss bowls have interior abrasion, while 65% have abrasion on their exterior and 43% have both (Table 78). This suggests that there is not a strong connection between the appearance of interior abrasion and exterior abrasion.[794]

Table 78. Location of abrasion on black gloss bowls from Populonia

Location of abrasion	Count (int)	Count (ext)
Abrasion on base	3	2
Abrasion on wall	5	18
Abrasion on rim	56	54

The presence of abrasion on the interior of the base of these bowls has a strong relationship with abrasion on the base exterior.[795] This exterior base abrasion, common on the edge of the foot of these vessels is likely due to daily movement of these vessels on hard surface, as we saw with black gloss at Musarna and Canadian lead-glaze vessels in chapter 3. Interior base abrasion is also associated with abrasion on the exterior wall, and on the interior of the rim.[796] Abrasion on the exterior wall is also associated with abrasion on the interior wall.[797]

The direction of abrasion on bowls from Populonia exhibits several notable trends (Table 79). Abrasion on the base interior has a strong relationship with running

[793] Both sites have about 73% of their sample abraded on the interior or exterior if all sherds are included in the calculation, and 70% of their sample if only sherds with "sharp" fractures are included.
[794] There is a relatively equal number of fragments which have abrasion only on their interior and those that have abrasion only on their exterior.
[795] $\chi^2=14.49$ ($p<0.01$)
[796] Interior base abrasion and exterior wall abrasion, $\chi^2=13.08$ ($p<0.01$). Interior base abrasion and interior rim abrasion, $\chi^2=4.57$ ($p<0.05$)
[797] $\chi^2=12.63$ ($p<0.01$)

concentrically or running radial.[798] Abrasion on the interior rim is associated with concentric scratches.[799] A number of these bowls (n=6) also had 1 cm^2 patches of slip removed from their interior on their wall, base, or rim (Figure 139, Figure 140).

Table 79. Location and direction of interior abrasion on bowls

Direction	Whole vessels			Rims		
	base	wall	rim	base	wall	Rim
Concentric	1	2	0	1	4	52
Radial	1	1	0	0	0	1
Chordal	0	0	0	0	1	1
Total with abrasion[800]	*2*	*2*	*0*	*1*	*5*	*55*

Figure 139. Black gloss bowl with interior slip removed in a patch on base (POP 557)

[798] Concentric, χ^2=13.8 (p<0.01) and radial, χ^2=8.65 (p<0.01)
[799] χ^2=5.87 (p=0.015)
[800] These row numbers do not always add up to the "total with abrasion" number because some fragments have two types of abrasion.

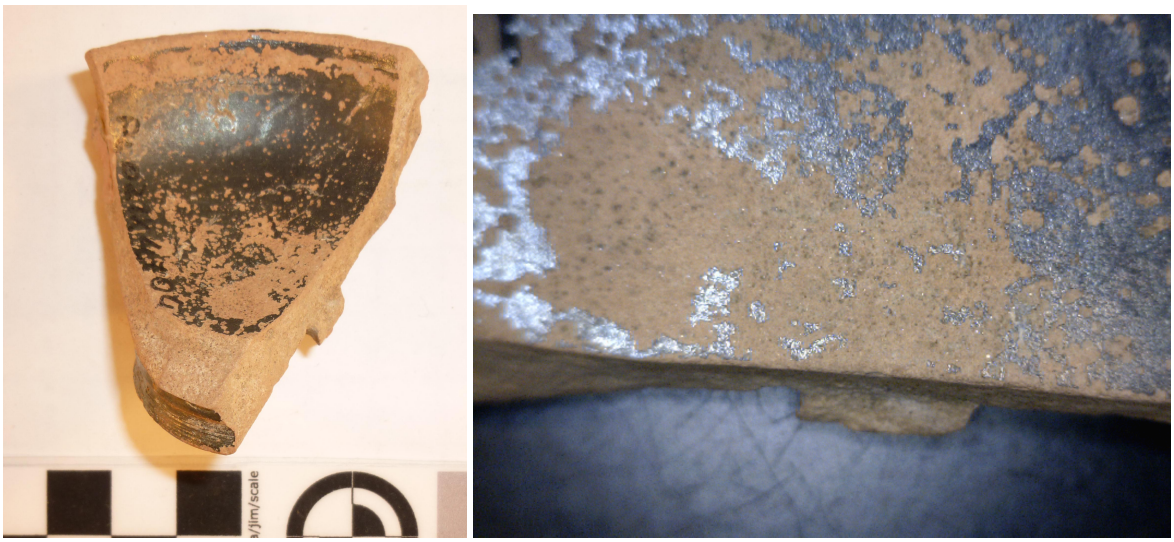

Figure 140. Black gloss bowl with central patch of slip removed, detail at 20x magnification (POP 670)

There is no correlation between the size or shape of these bowls and the appearance of abrasion. There is also no significant difference between the proportions or type of abrasion in different periods. While this could be due to low sample sizes, the proportion of types of abrasion in different periods does appear quite similar. For example, in Period 5 57% of fragments have abrasion on their rim interior, in Period 7 it is 62% and Period 9 it is 64%.

6.3.1.2. Plates

Morphology

There are far more plates in Period 7 than any other period although the numbers overall are very low, so it is not possible to compare diameters, wall thickness, or angle between the periods accurately (Table 76, Figure 141, Figure 142).

Table 80. Black gloss plates as rims and whole vessels at Populonia

Period	Plate	Percent	Mean (cm)	Median (cm)
5	3	8.3	22	22
7	29	80.6	19.79	19
9	4	11.1	20	20.50
Total	*36*	*100*	*20*	*19.50*

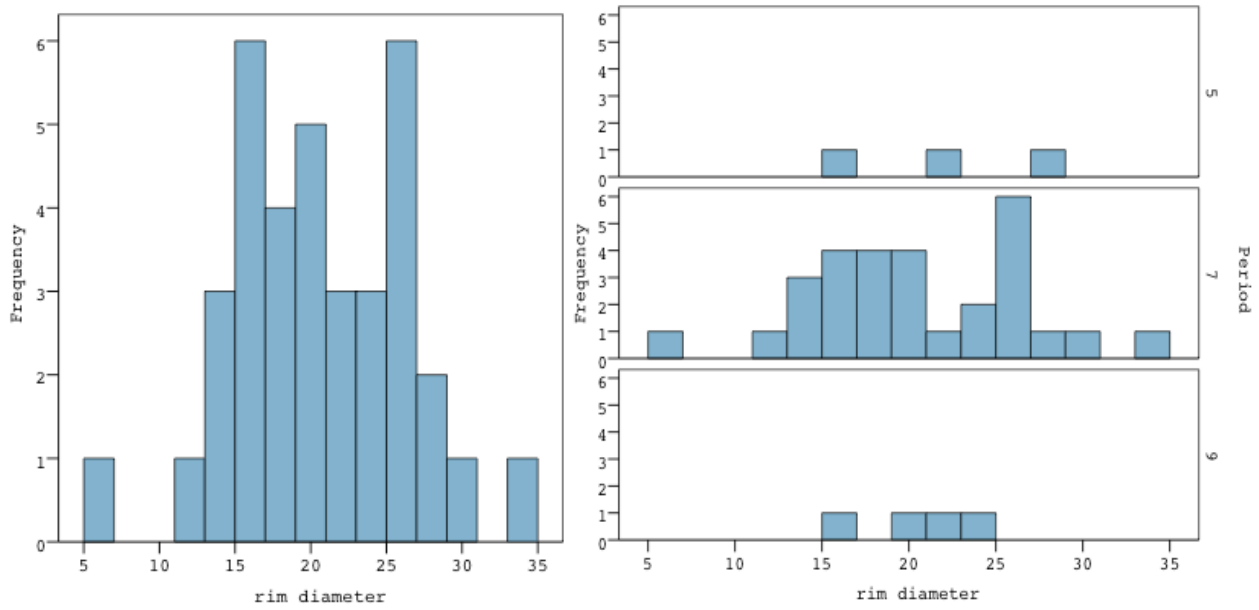

Figure 141. a) Diameters of black gloss plates from Populonia; b) Diameters of plates by period

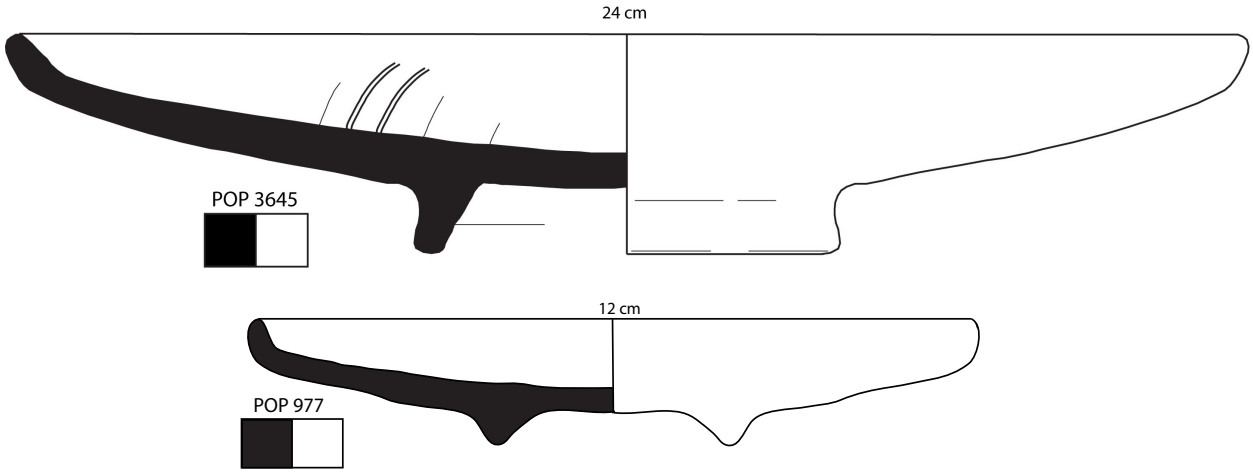

Figure 142. Black gloss plate forms at Populonia (POP 977, POP 3645)

Alteration

Like the black gloss bowls, the plates from Populonia have evidence of post-depositional disturbance which affects our ability to observe traces of use-alteration. Fifty-seven percent of these vessels have crust and 60% of these have 80% of their interior and/or exterior covered in crust. Eighty-one percent of plates have fractures classed as "sharp" and the other 19% are "slightly rounded." There is no discernible difference in the extent or type of post-depositional accretion or attrition in any period. The following analysis includes only sherds with "sharp" edges (n=29).

Eighty-six percent of these plates have abrasion on their interior. Seventy-six percent have abrasion on their exterior and 76% have both (Table 81).[801]

Table 81. Location of abrasion on black gloss plates

Location of abrasion	Count (int)	Count (ext)
Abrasion on base	2	1
Abrasion on wall	7	8
Abrasion on rim	23	16

The appearance of abrasion on the base interior has a strong association with abrasion on the base exterior.[802] The direction of abrasion on plates from Populonia is less consistent than on the plates from Musarna and is less easy to distinguish from the characteristics of bowl abrasion (Table 82). On the rim fragments of plates, abrasion on the rim interior is associated with concentric scratches, since 19 out of 22 examples are concentric.[803] Since most fragments have some wear on their rim edge, concentric rim abrasion here may be related to post-depositional movement. Although I have isolated only sherds with "sharp" fractures, in many cases the black gloss ceramics from Populonia have carinated surfaces worn in places which would not have been from use (for example, stirring or cutting), but suggest water or sedimental damage (Figure 143). This is also suggested by the fact that all exterior rim abrasion is also concentric.[804] Nevertheless, abrasion on the rim interior is also strongly associated with radial scratches.[805] (Figure 143). The final relationship which the data from Populonia reveals is the strong association between interior walls of plates and concentric scratches and interior walls and radial scratches (Figure 144).[806]

Table 82. Location and direction of interior abrasion on black gloss plates

Direction	Whole vessels			Rims		
	base	wall	rim	base	wall	Rim
Concentric	0	1	1	0	3	19
Radial	0	0	0	1	3	2

[801] χ^2=14.58 (p<0.01)
[802] χ^2=13.98 (p<0.01). Interior rim abrasion also has an association with exterior rim abrasionχ^2=4.54 (p<0.05).
[803] χ^2=4.97 (p<0.05)
[804] χ^2=8.89 (p<0.01)
[805] two out of 22 examples are radial. χ^2=6.970 (p<0.01)
[806] Concentric: χ^2=6.008 (p=0.014), Radial, χ^2=2.95 (p=0.05)

Chordal *Total with abrasion*[807]	1 *1*	0 *1*	0 *1*	0 *1*	0 *5*	0 *2*

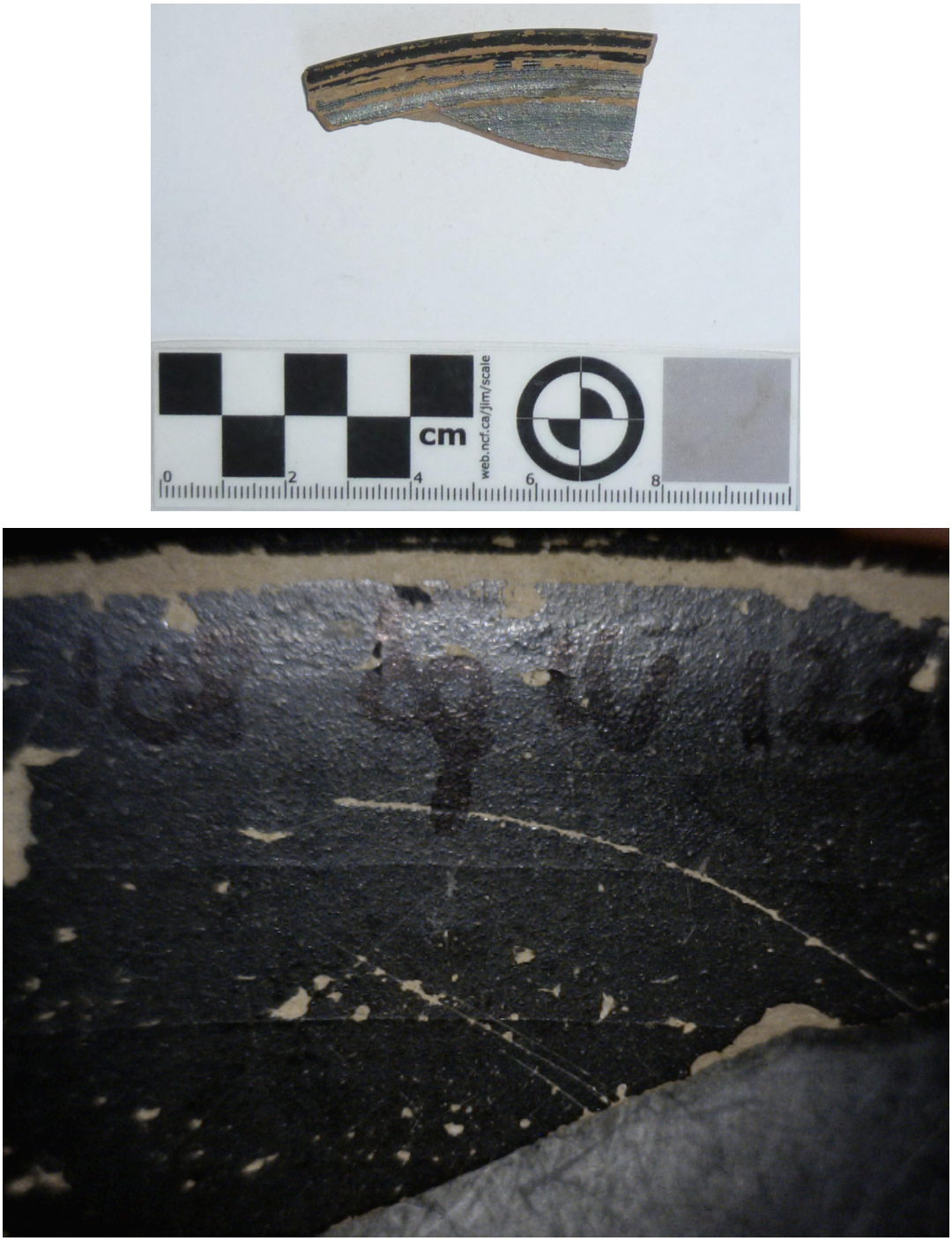

Figure 143. Black gloss with exterior concentric abrasion (above) and detail at 20x magnification of interior chordal and radial abrasion (below) (POP 3557)

[807] These row numbers do not always add up to the "total with abrasion" number because some fragments have two types of abrasion.

Figure 144. Black gloss plate with interior concentric and radial scratches, detail at 20x magnification (POP 3485)

6.3.1.3. Black gloss bases

Fifty-two bases, many with their whole diameter preserved, were recovered in the deposits at Populonia. I sorted these according to their probable form, including an unknown bowl or plate category (Table 83). There is a very narrow range in base diameter, which is typically a ring foot, and no change over time. Therefore, despite changes in rim diameter size, ring feet remained relatively consistent.

Table 83. Black gloss bases from Populonia, divided into forms

Form	Frequency	Percent
jug	1	1.9
bowl	17	32.7
plate	16	30.8
ink well	1	1.9
unknown BG	17	32.7
Total	*52*	*100.0*

With just the bowl, plate, and unknown BG selected, only 63% of these base fragments have fractures classed as "sharp" so I include them in the following analysis. Fifty-five percent of these bases have interior abrasion, 85% have exterior abrasion, and 45% have both. As is to be expected, base exterior abrasion is concentric in 26 out of 29 cases, demonstrating a strong relationship between this location and direction of tool use.[808]

With only the fragments that have been identified as bowls selected (n=17), 65% have interior abrasion, 88% (n=15) have external abrasion, and 53% (n=9) have both. On their base interior, 11 examples have abrasion, three of which are concentric, four are radial, and three of which are patches of removed slip between 1 cm^2 and 3 cm^2 in size (Figure 145).

[808] $\chi^2=29$ ($p<0.01$)

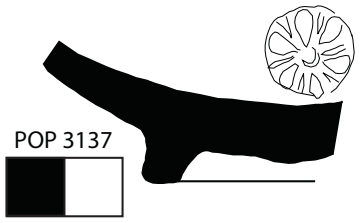

Figure 145. Base fragment of a bowl

With only the fragments identified as plates selected, (n=16), 88% (n=14) have interior abrasion. Two out of 14 of these are concentric, three are radial, four have multiple chordal scratches, and another five have patches of slip removed. None of these figures are high enough to allow for statistical testing and determine a real association between abrasion directions and vessel types.

This alteration analysis demonstrates that abrasion patterns on plates are dominated by radial and chordal scratches, but reveals inconsistency in the alteration of bowls.

6.3.2. Discussion

The black gloss vessels from Populonia have quite different characteristics from those recovered at Musarna. Though the sizes and forms of bowls and plates are similar at both sites (for example, the shift away from bowls with vertical or incurved rims by the middle of the 2nd century BCE), the appearance of these vessels varies significantly. Despite the fact that the period under study at Populonia extends to 50 years after that of Musarna, we never see plates overtake bowls in frequency. Instead, bowls are significantly better represented in every period at Populonia. I have already mentioned the prevalence of Campana A black gloss at Populonia – likely imported as part of Populonia's robust, sea-based trade economy.[809] Campana A would have been available in a variety of bowl or plate forms, so the mere fact that these vessels were imported is unlikely to have been a determinant in household consumers' choice of bowls versus plates.[810] The high proportion

[809] Morel 1985; Gualandi and Rizzitelli 2005 See also chapter 4 on Populonia's history of metal production and chapter 7 on Populonia's potential for a tuna industry.
[810] Stanco 2009a, plates 29–31.

of bowls has implications for eating practices at the site; however, morphological data will need to be considered along with the alteration results.

Although the post-depositional conditions of these vessels complicate the interpretation of abrasion patterns, we can see that there is less of a predominance of concentric abrasion on bowl interiors than is the case with vessels at Musarna. The abrasion which is present on the few plate fragments from Populonia are also not so clearly dominated by chordal and radial lines. If bowls are the dominant vessel for food delivery, it suggests that the residents of Populonia were mostly eating stewed, liquidy foods throughout the period under study; however, mixed patterns of abrasion raises the possibility that bowls were not being used exclusively for stewed, liquid foods. The messiness of the abrasion patterns may suggest multifunctionality or non-ideal use of these bowls and plates.

6.3.3. Common ware

In common ware, the forms at Populonia are very similar to those at Musarna. They are pentole, ollae, tegami, jugs, and bowls (Table 84).

Table 84. Forms in common ware at Populonia

Form	Frequency	Percent
pentola	3	7.5
olla	18	45.0
tegame	1	2.5
jug	5	12.5
bowl	10	22.5
Total	*36*	*90.0*

6.3.3.1. Bowls

Morphology

There are too few examples to confirm the difference in rim diameter of these vessels over time (Table 85, Figure 146).[811] The one example from Period 9 is smaller than all of the examples from Period 7, but the sample size is too small to determine if this

[811] These 10 fragments represent 0.47 EVEs.

difference is significant. Otherwise, the wall thick and rim angle of the example from Period 7 is within the range of those from Period 9 (Figure 147).

Table 85. Common ware bowls from Populonia

Period	Frequency	Percent	Mean (cm)	Median (cm)
7	9	88.9	19.25	18
9	1	11.1	12	12
Total	*10*	*100.0*	*18.44*	*17*

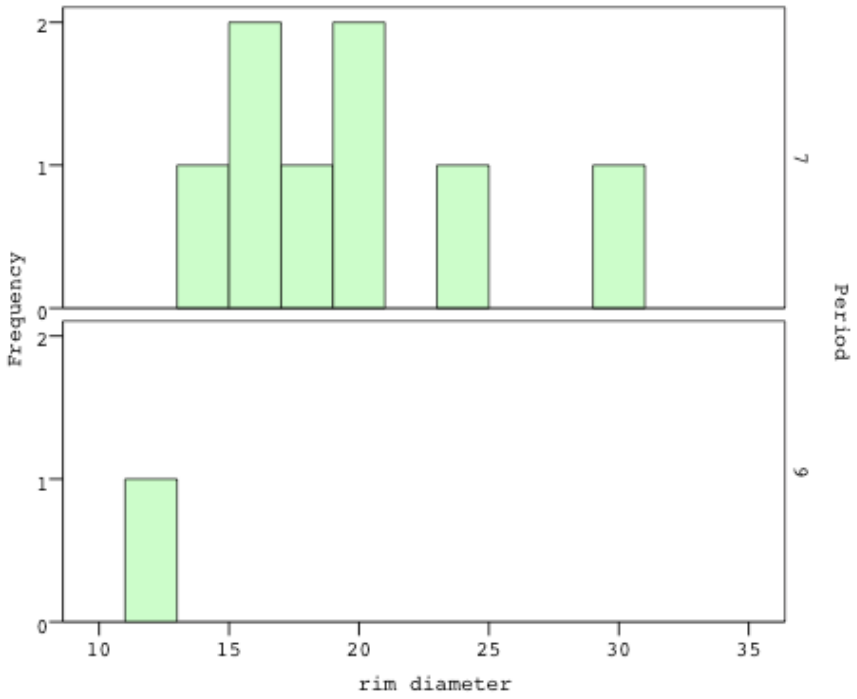

Figure 146. Common ware bowls from Populonia by period

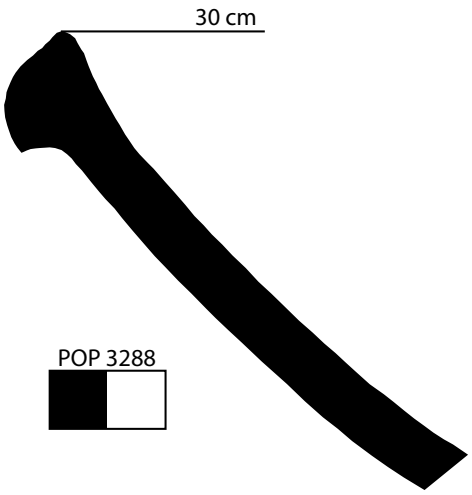

Figure 147. Large bowl form at Populonia (POP 3288)

Alteration

Like the Musarna common ware, the vessels from Populonia have similar problems of visibility of their abrasion. Furthermore, as discussed in Chapter 5, vessels from Populonia are more affected by post-depositional interference which mask and confuse traces of use. Forty-percent (n=4) of these bowls have mineral encrustation, of which two are 20% covered and the other two are 70% and 90% covered in crust. The soil on the promontory of Populonia is clearly calcium-rich.[812] Half of the fragments from Populonia are coded as "sharp" and half are "slightly rounded."

Twenty-two percent of these fragments have interior abrasion, 22% have exterior abrasion and 11% have both.[813] This suggests that the presence of interior abrasion is not connected to the presence of exterior abrasion (Table 86).

Table 86. Location of abrasion on common ware bowls

Location of abrasion	Count (int)	Count (ext)
Abrasion on base	-	-
Abrasion on wall	2	2
Abrasion on rim	1	1

[812] The promontory is largely limestone. See chapter 4.
[813] To maintain the sample size I include both the "sharp" and "slightly rounded" fragments in this calculation.

It is probable that there would be an additional example of interior wall abrasion on POP 3288, which is likely a mortarium (Figure 148). Its interior is likely pedestalled though its interior is 80% covered with mineral crust and not clearly visible. The only relationship between locations of abrasion which has been determined to be statistically significant is between the rim interior and wall exterior.[814] The abrasion on common ware bowls appears mostly as large patches between 9 cm^2 and 81 cm^2 in size.

Figure 148. Common ware bowl with mineral crust on interior (POP 3288)

Otherwise, there is an insufficient sample size to determine other correlations between size or shape and abrasion.

6.3.3.2. Ollae

Morphology

There are 18 rim fragments of the olla form, most from Period 7 (Table 87).[815] This means that there are too few to note anything concrete about temporal change in forms or size. It is, however, notable that all except for one fragment in Period 7 (which is 44 cm

[814] $\chi^2=3.94$ ($p<0.05$)
[815] These represent 2.5 EVEs.

wide) all are between 6 cm and 20 cm and this is the range of the two examples from Period 5 and Period 9 (Figure 149, Figure 149).

Table 87. Common ware ollae from Populonia

Period	Frequency	Percent	Mean (cm)	Median (cm)
5	1	5.6	14	14
7	16	88.9	14.50	13
9	1	5.6	10	10
Total	*18*	*100.0*	*14.22*	*13*

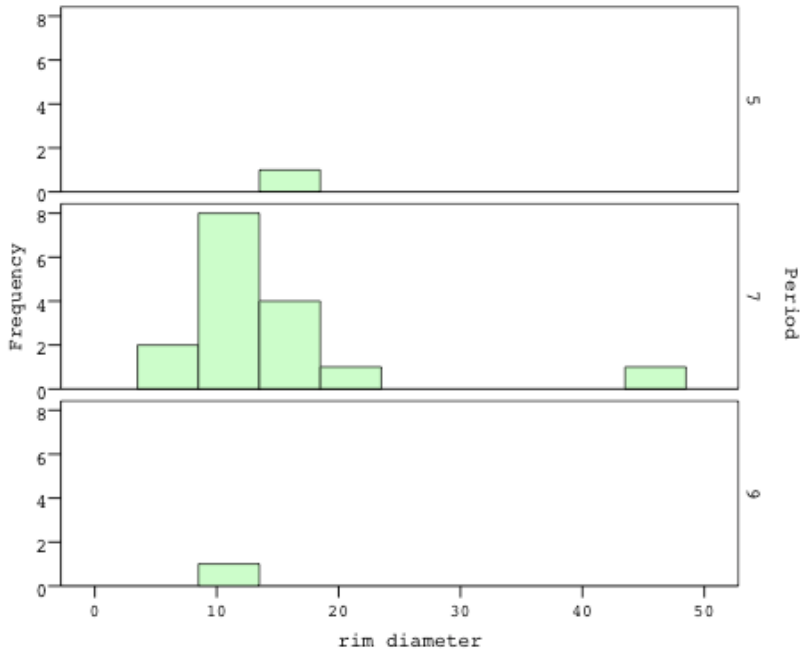

Figure 149. Common ware ollae from Populonia by period

Wall thickness bears out the same pattern as above. One fragment from Period 7 is an outlier (at 19 mm wide). This is the same outlying diameter fragment. Given the size of this fragment, it should probably be considered a closer form to a *dolium*, or large storage container, not an olla.

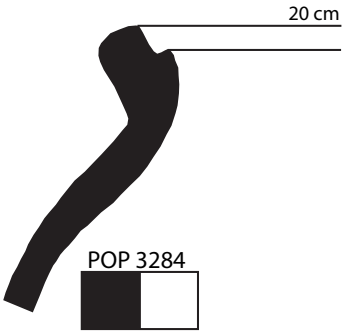

Figure 150. Typical form of common ware olla at Populonia (POP 3284)

Alteration

Like the common ware bowls from Populonia, the ollae suffer from a large amount of mineral encrustation. Thirty-nine percent (n=7) have some encrustation and of these four are over 70% covered and three are covered 60% or less (Figure 151). The potential for observing abrasion, therefore, is low. Fifty-six percent of the ollae are coded as having "sharp" fractures, 33% (n=6) are "slightly rounded," and 6% (n=1) are "rounded."

Figure 151. Common ware olla with a lot of mineral incrustation on the exterior (POP 3630)

Although 33% of these vessels have interior abrasion of some kind, 22% have exterior abrasion and none have both (Table 88).

Table 88. Location of abrasion on common ware ollae

Location of abrasion	Count (int)	Count (ext)
Abrasion on base	-	-
Abrasion on wall	3	1
Abrasion on rim	4	4

There is no strong relationship between any of the locations of abrasion; however, the small number of examples with abrasion precludes a real assessment of this. There are several patches of surface abrasion, particularly on exterior walls (for example, one patch 9 cm^2 on POP 3294) (Figure 152). The other potential trend is the proclivity for interior rim abrasion being concentric, as this is found on two of three examples. This is not always in expected places since there is one example of an olla with lid seating where no abrasion is present.

Otherwise, the sample number of ollae is insufficient to determine other potential correlations between vessel size or shape and alterations.

Figure 152. Common ware olla whose exterior wall has surface abrasion (POP 3294)

6.3.3.3. Jugs

Morphology

Like the other common ware forms from Populonia, there is an insufficient sample of only four fragments to see any change over time (Table 89, Figure 153).[816] Three are rims fragments, and one is a small complete vessel. It is 10.5 cm tall and slipped with matte red color (Figure 154).[817]

Table 89. Common ware jugs at Populonia

Period	Frequency	Percent	Mean (cm)	Median (cm)
7	3	75.0	6.33	4
9	1	25.0	8	8
Total	*4*	*100.0*	*6.75*	*6*

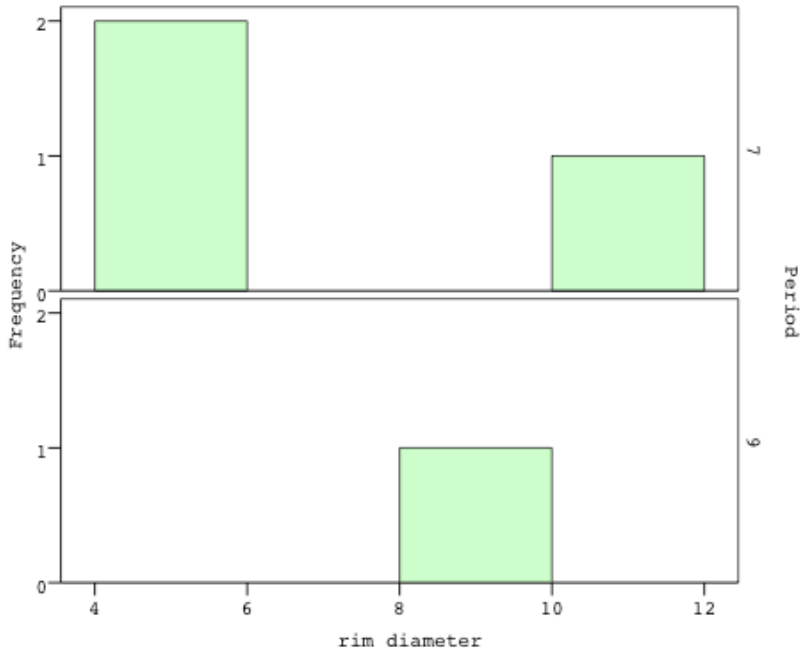

Figure 153. Common ware jugs from Populonia by period.

Despite the low sample numbers, it is notable that the one example from Period 9 (100 BCE to 1 BCE) is in within the size range of the examples from Period 7. This is also the case for wall thickness and rim and body angles.

[816] These represent 0.95 EVEs.

[817] This type of vessel has no precedent in any published material I have found from Populonia or elsewhere. It could be classed perhaps as a local black gloss, but its slip is really not black and its fabric too coarse to reasonably assign to black gloss ware

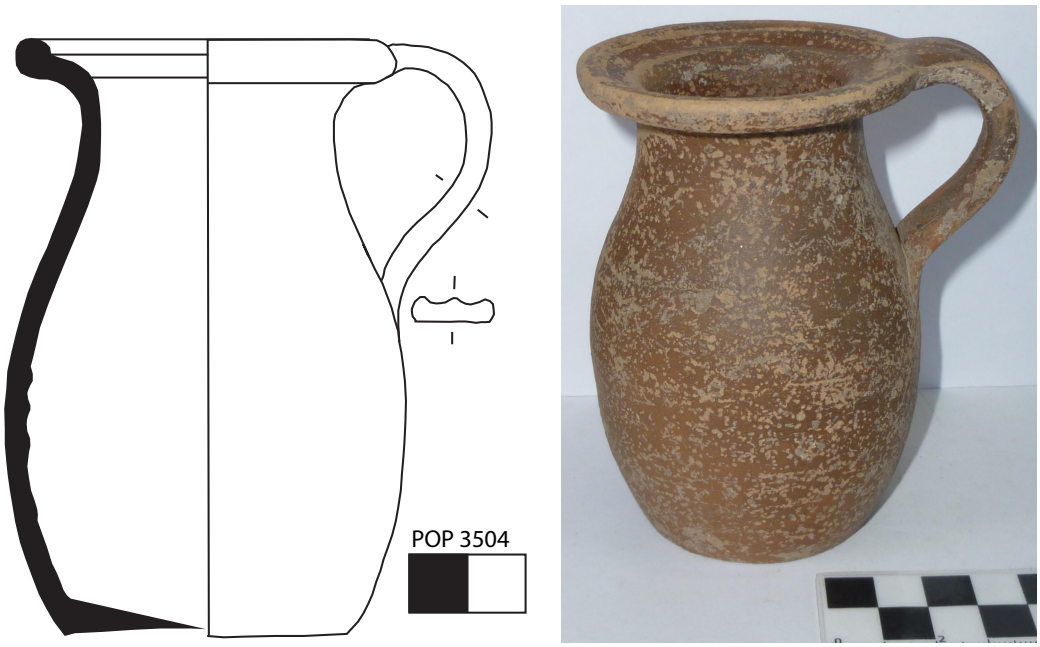

Figure 154. Small common ware jug with red brown slip (POP 3504)

Alteration

Post-deposition disturbance seems to be less of a problem on these fragments than with the other common ware from Populonia. Although three of four have some mineral encrustation, two are less than 20% covered and the other is 90% covered. Furthermore, all of the fragments' fractures have been deemed "sharp."

Only one fragment has any abrasion. It is the whole slipped jug which has concentric abrasion on its exterior rim, wall, and base. The slip makes the abrasion very easy to see. The abrasion seems more associated with post-depositional circumstances than with use since it is on the slightly raised wheel marks and corner edges of the vessel (Figure 154).

6.3.4. Populonia conclusions

A heavy amount of post-depositional disturbance limits our ability to identify and understand abrasion patterns on these preparation, serving, and eating vessels. Common ware especially seems to have an ideal surface on which calcium crust can become lodged. The few common ware vessels at Populonia demonstrate similar characteristics to those at Musarna. Bowls are similar in size to those at Musarna with one example of a mortarium. Ollae are also of a similar size to those at Musarna but their small numbers makes any potential changes over time not discernible. There is more abrasion on the interior of ollae

than on their exteriors; this is surprising, given the fact that they are closed forms, likely used for storage of foodstuffs rather than preparation or cooking. Unfortunately, the result is difficult to conclude as indicating anything about use since the large amount of mineral encrustation present on these vessels means that some amount of abrasion must have gone unobserved.

The black gloss assemblage is dominated by bowls with few plates of slightly larger diameter in every period under study. This points to a preference for, or at least the prevalence of, stewed or liquid-based foods being consumed. The abrasion marks on rim, whole vessel, and base fragments of both bowls and plates at Populonia suggest a messier, not so clear-cut use of bowls and plates at the site. On bowls, concentric abrasion is the most common; however, radial abrasion also has a statistical relationship with the interior of the vessel. On plates, though they appear in low number, there is a notable lack of association between radial and chordal abrasion with the vessel interior, suggesting cutting is less common. This may mean that black gloss bowls and plates at Populonia were not used exclusively for activities which took advantage of their "optimal performance characteristics;" instead there is evidence that its users sometimes cut into bowls and scooped or stirred on plates. This potential flexibility of bowl use at Populonia might help to explain the persistence of bowls when compared to Musarna. Unlike at Musarna, however, the distribution of black gloss vessels does not suggest a change in the presentation of foods or in their sharing – we do not have ceramic evidence to suggest a changing interactions among eaters or between a cook or host and dinners. The specific types of foods that the bowls at Populonia might suggest will be explored further following an analysis of the faunal and botanical record at the site.

6.4. Chapter conclusions

The examination of black gloss bowls and plates, red gloss bowls and plates, and several forms of common ware vessels from Populonia and Musarna has yielded a number of meaningful results pertaining to the foodways of the inhabitants of these sites. At Musarna, there is a clear shift from bowls, which have evidence for "scooping" and "stirring" to plates with evidence for cutting, in the middle of the 2nd century BCE. The change in the relative proportion of these forms together with their abrasion patterns

suggests a change in eating behaviors at this time. This was either a move towards "drier" less liquidy foods which you would lay out on a flat surface rather than needing to contain. At the same time, or perhaps alternately, it also suggests an interest in having foods be more visible, laid out together and presented on a single platter or series of large platters. This result has implications for how we can understand the simultaneous shift in cooking vessels at the site. These possibilities will be further developed following the discussion of faunal and botanical evidence from the period. Common wares at Musarna are relatively uncommon and the results of this analysis are consistent with an assumption of storing and preparing as their primary function. Additionally, I have suggested that their function may have been replaced by *ceramica da fuoco* vessels of similar form (Figure 155, Figure 156).

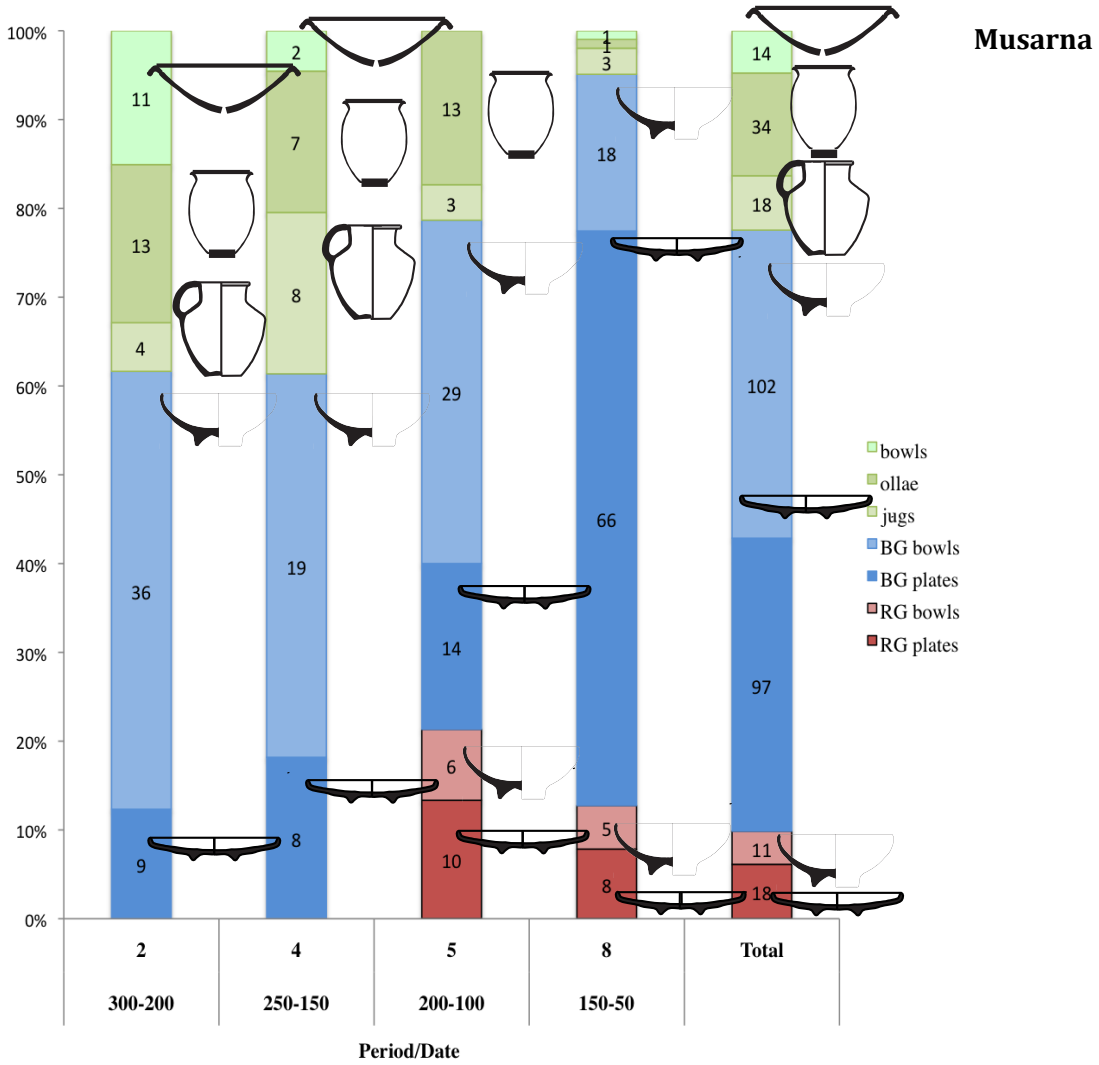

Figure 155. Relative proportions of vessel forms by period at Musarna

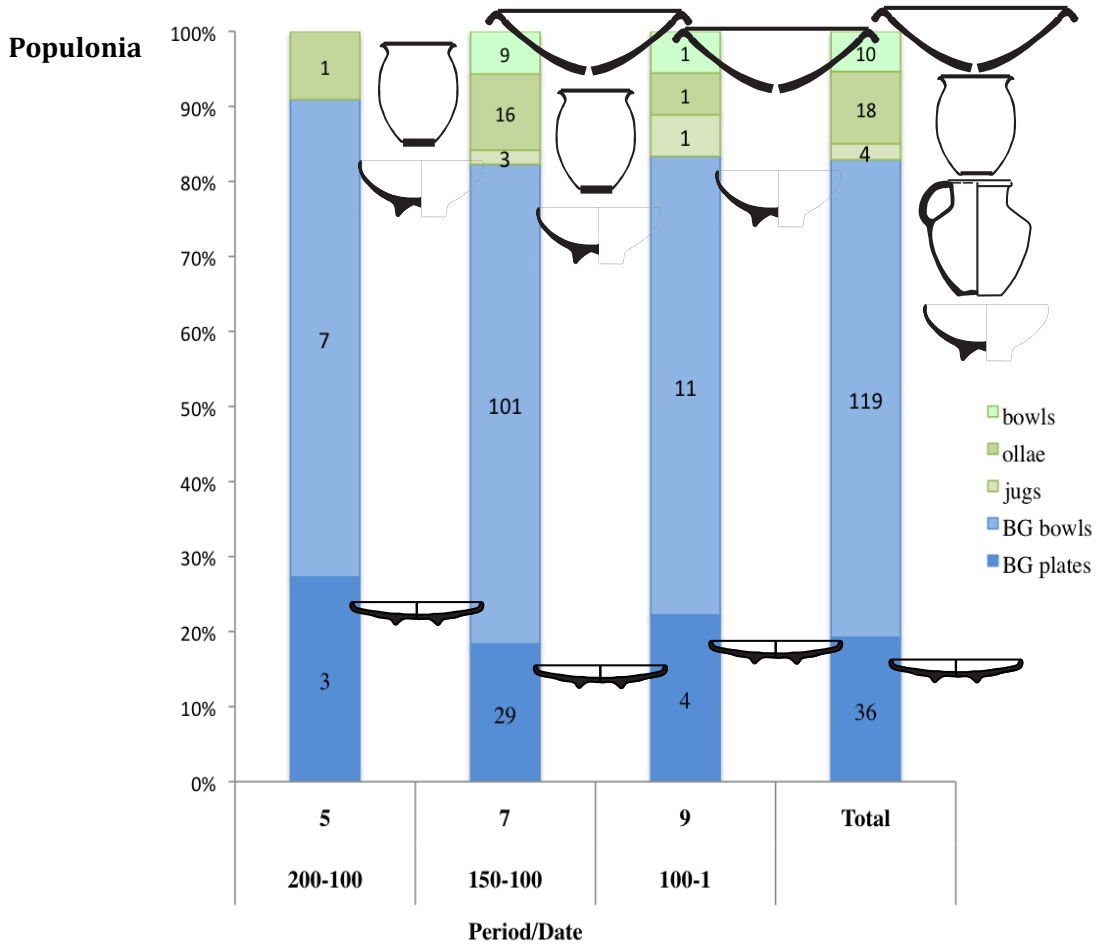

Figure 156. Relative proportions of vessel forms by period at Populonia

The black gloss from Populonia reveals a sustained preference for liquidy foods through the high proportion of black gloss bowls throughout the periods of study. The abrasion patterns on these bowls and the fewer plates recovered from the Populonia deposits do not provide evidence for stirring and scooping the contents of bowls and cutting the contents of plates as clearly as those from Musarna. Since this is the first data set of its kind, there is not another data set to compare with in order to glean a clearer picture of the variability in abrasion patterns and their associated movements. The "kinematics of tool use"[818] for utensils at the eating tables of Populonia are not clear. The messiness of the abrasion patterns on the black gloss from Populonia may, however, indicate that these vessels were sometimes used in ways which did not always "match"

[818] Grace 1996, 215, see Chapter 3.

their form; that is, people could cut in bowls and scoop and stir on plates. At Populonia, the common ware vessels form a relatively consistent portion of the total assemblage through time, though they are represented by very low sample numbers.[819]

The implications of these changes and the persistence in serving vessels' form and use should be addressed with a fuller understanding of the entire ceramic assemblage together with what we know about the plants and animals which formed the basis for the diet. This botanical and faunal element is addressed in the following chapter.

[819] At both Musarna and Populonia evidence for drinking vessels in conspicuously lacking. There is one "cup" form in black gloss at Musarna and three isolated fragments of thin-wall vessels which seem to be cups at Populonia – so few and so small that I have not discussed them in this chapter. At Musarna, an important reason for the lack of drinking vessels may come from the removal of thin-wall fragments for study by another researcher, Julie Léone, in 2011. It might be prudent to understand the smaller bowls from Musarna and Populonia to be for drinking, perhaps those under 10 cm in diameter. Even then, there are only a handful of examples from each site which are that small. Furthermore, the fact that bowls of all sizes at both sites have frequent interior abrasion does not support their use solely for drinking. Glass drinking vessels which have not survived are a possibility, though glass production between the 3rd century and 1st century BCE was minimal and likely particularly costly in the western Mediterranean (Morel 1979, 255).

Chapter 7 – *Environmental Archaeology*

Environmental remains provide direct evidence for food processing, consumption, and discard. Botanical materials in the form of macro- and micro- remains of seeds, chaff, and weeds, reveal the landscape surrounding ancient consumers, the resources they exploited or managed through foraging and farming, and the methods that they used to prepare plant foods. Faunal remains reveal both the species exploited for labor and food as well as the methods of animal husbandry, hunting, slaughtering, and cooking.

In the scholarship of environmental archaeology a strong but mostly unexplained correlation has often been made between the prevalence of certain plant or animal species found at sites and the probable cultural or ethnic identities of the site's inhabitants – such remains may be cited as indications of "Romanization" or "Gallicization" etc.[820] If we wish to draw a connection between organic remains, food choice, and cultural group, we have to explain how exactly these link. Krish Seetah takes steps to explain the connection between conceptual shifts in culture with shifts in the material record:

> If the rationale that perception is linked to functionality is adhered too, then the economically visible shift in use, based on increased numbers of animals seen in urban Romano-British sites, systematic butchery and trade specific implements, should be indicative of a subtle shift in perceptions.[821]

He refers to a "shift in perceptions" about meat preference. These preferences can be guided by taste preferences, economic interests, matters of convenience and accessibility, or a combination of these issues.

The following chapter seeks to use the environmental data from Musarna and Populonia and their nearby sites to complement the ceramic analyses previously discussed. I begin with a brief review of the results of archaeobotanical studies from the regions surrounding Musarna and Populonia as well as Rome and Pompeii. I then examine

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[820] King 1999; King 2001; King 2005; van der Veen 2008; van der Veen et al. 2008.
[821] Seetah 2005, 6.

zooarchaeological methods and the results of synthetic faunal studies which have been undertaken in Roman Italy. The analysis and results of faunal remains from Musarna and Populonia will then be explained. Finally, I conclude by highlighting the most important local taxa at these two sites and considering the implications of their adoption. I argue that while a study of ceramic evidence is the primary research focus of this dissertation, the inclusion of botanical and faunal evidence provides an important additional dimension to the analysis of subsistence practices and foodways.

7.1. Archaeobotany in Italy

Relatively little archaeobotanical research has been undertaken in Roman Italy. Most archaeobotanical studies in Italy focus on the prehistoric period (the Neolithic to the early Iron Age) or the post-Roman period.[822] Roman period studies from Italy center around the Bay of Naples area.[823] In general, relevant publications in Italy are of varying quality and detail; they are often a catalogue of finds for the purposes of palaeoenvironmental reconstruction and are published in small local periodicals and conference proceedings which are not widely circulated.[824] Furthermore, syntheses and interpretations of these results are almost non-existent. The most exemplary archaeobotanical studies in the Roman world come from Roman Britain. There has been a longstanding attempt to recover and publish botanical materials in Britain and Marijke van der Veen and her colleagues have been responsible for efforts to create broad chronological syntheses of these reports.[825] Even with the paucity of material for Italy, we can draw some general conclusions about the availability of different types of plants in the landscape.

In the following section I offer a summary of the archaeobotanical information which has been gleaned from ancient Italy. Archaeobotanical remains are complicated by

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[822] See the compiled bibliography works up to the year 2000 of M. Rottoli (2005a) in addition to simply searching *Dyabola*, the journal *Vegetation History and Archaeobotany* and *Journal of Archaeological Science.*
[823] Robinson 1999; Robinson 2002; Borgongino 2006; Ciaraldi 2007; Fiorentino and Marino 2008; Murphy et al. 2012. I am specifically not including in this list all the charcoal publications (Veal and Thompson 2008; Moser et al. 2012; Veal 2012). The only Roman period study not from the Bay of Naples which I have found is a study of isolated "flower pot" deposits in the gardens of *hortus Luculliani* and the *Villa Hadriana* (Giardini et al. 2006).
[824] More rarely, such information may be buried at the end of excavation reports in material of the rest of site.
[825] van der Veen et al. 2007; van der Veen et al. 2008.

the many challenges of formation processes, preservation, recovery bias, and quantification, as was the case for the other materials in this dissertation.[826] Good studies must take into account these challenges through their research-design and their reporting.[827] Below, I focus on reports produced for sites close to my two study sites; then, I turn briefly to Rome and Pompeii, where work has been undertaken with the most recent methods, in order to gain the fullest picture of our state of knowledge of the processing and consumptions of plants.

7.1.1. Central Italian studies

Carbonized and mineralized remains were recovered from several wells and votive containers, like ceramic ollae, from the monumental complex at Tarquinia.[828] These deposits date from the late 10th century BCE to the 5th century BCE. A large variety of grains, legumes, and some fruit seeds were recovered, which suggest "the diversity in the Etruscan diet;" however, because the deposits are ritualistic in nature, it is not possible to associate these remains with daily consumption or the ease with which these foodstuffs might have been obtained.[829] One notable feature of the Tarquinian assemblage is that it contained almost entirely glume wheats: *triticum monococcum* (einkorn), *triticum diccocum* (emmer), but not other clearly identifiable species of grain.[830] This absence of naked wheat species (*triticum aestivum*, for example) is consistent with the findings of other Bronze and

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[826] Miller and Smart 1984, 15. See also, for example, criticisms which Costantini and Giorgi make of Haelbek's 1960s study of archaeobotanicals of the Esquiline tombs. Costantini and Giorgi 2001, 239.

[827] van der Veen et al. 2007, 185–193; van der Veen 2007, 968–969; van der Veen 2008, 84. Ciaraldi (2007, 47–51) explains of the science behind preservation conditions: waterlogging, mineralization, carbonization. The most recent and exemplary archaeobotanical reports are very explicit in their efforts to collect random samples from across the area excavated, rather than privileging larger deposits or "ritual" deposits (Robinson 1999; Ciaraldi 2007, 54–56; Motta 2011; Murphy et al. 2012). There is, of course, always a problem here with intrasite variability and the difficulty of comparing different types of deposits within the same site. See Motta 2011, 246.

[828] Rottoli 1997, 92; Rottoli 2005b, 114.

[829] This is despite the fact that the excavators maintain that the layers inside the ollae appear disturbed, rather than sealed. Rottoli 2005b, 118

[830] Though according to Table 3, there are a fair number of cereals present which were not able to be further identified. Rottoli 1997, 95.

Iron Age Italian sites.[831] Another important feature of the assemblage is that it contained only items which could be grown locally.

Another site close to Musarna which has had some archaeobotanical study is at Gran Carro at Bolsena.[832] The deposits from which the botanical remains derive are dated from the 12th to the 8th century BCE.[833] Of the 499 macrobotanical remains, over 95% were fruit seeds and nuts from cornelian cherry (*cornus mas*) berries (similar to dogberry), damson plum, sloe (a type of tart plum), grape, acorn, and hazelnut. The concentration of these fruits, and in some cases, the fragmentation patterns of the nuts, suggest that they were systematically collected and processed for consumption.[834] In contrast, there were only a very small number of legumes and cereals. Only four fava bean and four emmer wheat remains were recovered.[835]

I have found no studies that date to later than the 5th century BCE and into the Roman period in the region around Musarna.

Archaeobotanical study has been undertaken at a small scale at Populonia. A study published in 2006 examines a small assemblage of carbonized materials from the structure which lies to the south of the domus of Saggio IV, under study in this dissertation. Referred to as the "Logge," this was a large platform at the height of the acropolis which was surrounded by masonry terrace walls. The botanical sample comes from a two-storied highly decorated portico built into the terrace wall. The portico overlooked the *area sacra* and open market space at the saddle of the acropolis below (Figure 14). The material thus dates to the end of the 2nd or beginning of the 1st century BCE.[836] The majority of the material is carbonized wood, likely from the collapsed upper balcony of the portico. Other

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[831] Rottoli uses a reference in Ovid's *Fasti* (6.169-86) to connect the appearance of emmer to ritual activities at the site comparing it to Sant'Omobono and Haelbek's work at Luni sul Mignone. Rottoli also notes that these materials come from a building burnt by fire, therefore there is less preservation bias and the presence of wheats which did not require parching is possible. Rottoli 1997, 95.
[832] The material was collected in 1974 and, unusually for the time, it was sieved and later floated.
[833] Costantini and Costanini Biasini 1995, 326.
[834] Costantini and Costanini Biasini 1995, 329–330.
[835] Costantini and Costanini Biasini 1995, Table 1.
[836] Di Pasquale and Terzani 2006, 282–285.

than wood, 700 fava beans were recovered which, as the excavators note, Pliny suggests could be crushed and mixed with grain to make bread.[837]

The next-closest site with some Roman-period archaeobotanical study is the farm of San Mario in the countryside west of Volterra, about 70 kilometers north of Populonia. Settlement at this small stone farmhouse seems to have been continuous and relatively stable from the 6th century BCE through to the 5th century CE.[838] Although a more detailed breakdown of the carbonized botanical finds awaits the site's final publication, it is clear that the inhabitants of the site had a relatively unchanged cultivation and food-gathering strategy throughout its history.[839] Grape seeds were found in every strata sampled, and though barley dominates the cereals, the farm inhabitants seem to have practiced polyculture. There was substantial evidence for emmer, bread wheat, and einkorn consumption. This cultivation was combined with a systematic gathering of wild species of nuts and cherries (*cornus mas)*.[840]

Otherwise, archaeobotanical and palaeobotanical work has focused exclusively on the Bronze Age and Medieval period. Bronze Age sites confirm the early presence of great variety in people's diets. Grape pips (though it is often difficult to determine if these are cultivated or wild grapes), hazelnut, and dogberry are common. There is also typically a mix of free-threshing wheats and hulled wheats.[841]

7.1.2. Rome and Pompeii

The city of Rome is not much better-represented in the archaeobotanical literature. The few studies which have been published have focused on the Iron Age. Several have unusually large sample sizes and relatively robust sampling strategies, namely the study of 18,000 items from 82 different samples in the Iron Age settlement on the north slope of the

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[837] Di Pasquale and Terzani 2006, 286. This is Pliny *Natural History* XVIII, 117. Also from Populonia, we have an isolated study of several pollen and root samples from two tombs dating to the 4th to the 2nd centuries BCE in the Grotte Necropolis. Because the aim of this research was palaeoenvironmental reconstruction, the authors focus on tree species identification, rather than on evidence for food or consumption activities. Mariotti Lippi et al. 2009, 338.
[838] Motta et al. 1993, 109.
[839] Terrenato 1998b, 102. Publication in preparation, L. Motta ed., *The Etrusco-Roman farm at Podere San Mario*.
[840] Motta et al. 1993, 113.
[841] Giachi et al. 2010, for example.

Palatine, and 8,000 items from the 6th to 5th century forum and south-west slope of the Palatine.[842] Both studies confirm the importance of glume wheats, specifically einkorn and emmer.[843] Both studies also identified a limited range of legumes and fruits: specifically, bitter vetch, fava beans, common vetch and pea and grape, olive, fig, wild strawberry and prune.[844] The material from the north slope of the Palatine highlights the differing compositions of assemblages in different locations throughout the site over time. In the 8th century all the sample locations contained a high proportion of chaff along with individual grains. This suggests that wheat was being cleaned and prepared for use inside the settlement. At one location, sector 9, by the late 7th to early 6th century, the proportion of chaff compared to grain decreased markedly, potentially suggesting a reorganization of grain processing at the site. Wheat producers were processing the grain at a different location and then bringing it to the settlement to be consumed. This suggests a greater organization of crop production and movement. This data suggests a gradual change in food practices within the city of Rome over three centuries.[845]

From the Vesuvian sites around the Bay of Naples, a series of articles and books have focused both on large-scale multi-phase samplings of buildings as well as individual primary deposits.[846] For example, Mark Robinson's study of the material from the House of Amarantus includes both carbonized and mineralized remains from more than 30 contexts. The material is divided into an "early" group (4th to 3rd century BCE) and a "late" group (2nd to 1st BCE).[847] In the early group, einkorn, emmer, barley, and millet were abundant, as well as clover. The fruits present were pomegranate, grape, fig, walnut, hazelnut, and fava bean and pea were the legumes present. There were also poppy seeds present alone and on

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[842] Costantini and Giorgi 2001, 240; Motta 2011, 247.
[843] Costantini and Giorgi 2001, 241–243; Motta 2002, 73.
[844] Costantini and Giorgi 2001, 244–245; Motta 2002, 73.
[845] Motta 2002, 75–76
[846] Notwithstanding the fact that Marina Ciaraldi calls the amount of archaeobotanical work done in Pompeii in comparison to how well things are preserved "risible." Ciaraldi 2007, 19. The attention paid to environmental remains at Pompeii is likely a result of the unusual preservation of large items (like whole seeds and the famous mineralized bread) as well as a testament to researchers' interest in daily life activities and the domestic sphere in this region. Jashemski 1979; Meyer 1980; Jashemski 1993. See Ciaraldi (2007, 38–43) for a discussion of the importance of this early work.
[847] Robinson 1999, 96

"charred vesicular material" which must be bread.[848] The late group was dominated by fig, hazelnut, walnut, grape, olive and lentil. It also contained barley, millet, and emmer. Everything recovered could have been grown locally; the large numbers of weeds in the assemblages reinforces the likelihood that production and processing occurred in the interior of the property.[849]

Additionally, flora from the House of the Wedding of Hercules and from throughout Insula VI.1 has been studied by several archaeobotanists. A vast sampling strategy of this insula resulted in the recovery of samples from 1,294 contexts from buildings of many different uses. The material (more than 24,000 items) were carbonized or mineralized and date from the 1st century CE, with a few from the 1st century BCE. Though emmer was present in small numbers, free-threshing wheats were more common than hulled wheat. For legumes, there are vetches and lentils, but strangely no fava bean, chickpeas, or peas. Fruits include pomegranate, apple, peach, cherry, blackberry, pine nut, hazelnut, and almond. There seems to be no clear distinction between 1st century BCE deposits, what in Pompeii is the "pre-Roman" or "early Roman" period, and 1st century CE deposits.[850]

7.1.4. Plants in ancient Italy

Emmer and barley in particular dominate Italian archaeobotanical samples, followed (perhaps slightly later in time) by millet and bread wheat. The major difference over time is in the organization of crop processing during the course of the Iron Age and into the Roman period. Processing moved out of the settlement area to some exterior space. Nicholas Purcell suggests, based on literary references to emmer, that the processes for preparing cereals were more important than which cereals were prepared. Preparation was a way of "articulating social separation" that marked new "urban" patterns of consumption. The effects of urbanity can be further considered with the changing patterns of faunal consumption below.

7.2. Faunal study in Roman Italy

[848] Robinson 1999, 97.
[849] Robinson 1999, 99–100.
[850] Murphy et al. 2012.

This section presents an analysis of the faunal remains from Musarna and Populonia and how they can suggest the ways that people from these two locales were acquiring, processing, and consuming their meat. I begin with an overview of the methods of quantification. I then review some of the conclusions already made about the consumption of meat in Roman Italy during the Republican and later periods and the methods for studying these trends. This is followed by a detailed explanation of the data and the observed trends in the data from Musarna and Populonia. Where appropriate, chi-squared tests were performed in order to assess the degree of difference in the quantity of various types of meat over time. Finally, I consider several specific types of meat, including pork, chicken, fish which feature as important contributions to the diet of Musarnans or Populonians.

7.2.1. Quantification

The recovery of archaeological fauna depends on many factors of taphonomy and excavation. In addition to the post-abandonment processes affecting the preservation, condition, and recovery of ceramic materials, carnivore scavengers also affect the taphonomy of bones.[851] If bones do manage to survive, their recovery is dependent on the care that the excavators take in their collection. Systematic sieving was not undertaken at either Musarna or Populonia, though the recovery of small bone fragments and small species from many deposits suggests that extreme care was taken in hand excavating and that in some cases the excavators decided to start sieving select stratigraphic units.[852]

The quantification methods employed by different analysts vary and can have a significant effect on how faunal data is interpreted. As in the quantification of ceramics, it is important to have a standard process to assess fragmentary remains, especially in studies which synthesize reports from multiple sites. The most basic and common method of reporting bone quantity is the "Number of Identifiable Specimens" (NISP) figure. This is the total number of elements of a single taxon which can be identified in the sample without regard to distinguishing features like element, side, or sex of the animal. The NISP figure

[851] Davis 1995, 24–28.
[852] This will be elucidated below. Elisabeth Reitz and Elisabeth Wing (2004, 147–151) explain the substantial biases inherent in this method, but I must work with what I have.

tends to overestimate the number of unique animals represented in the sample since differential fragmentation of bones due to post-depositional processes can skew the data.[853] Furthermore, the NISP figure can be biased towards certain species since different species have varying numbers of diagnostic bones.[854]

Alternately, the "Minimum Number of Individuals" (MNI) figure involves counting all the bone fragments and calculating the number of animals necessary to account for those bones based on side, sex, age, and proportions.[855] This calculation tends to underestimate the number of animals. Furthermore, calculating NISP into MNI counts tends to overestimate rarer species since, for example, you could transform 150 pigs bones (NISP) into a minimum of three pigs (MNI), but the presence of one pigeon leg fragment corresponds to an MNI of one pigeon.[856] Though there are many other methods of quantifying faunal assemblages, NISP and MNI have the most relevance for this dissertation since they are typically used in Italian contexts and were used in the previously published study of the bones of Populonia and Musarna.[857]

While these two methods of quantification are useful for studying the basic presence of animals on site, they are problematic for the consideration of meat as a contribution to the diet. NISP and MNI represent the number of animals recovered; however, the proportion of meat these animals provide varies greatly based on their physical size. This is where the calculation of "meat weight" can be a key element in the faunal study of foodways. Early proponents of measures of meat weight used the weight of the bones recovered at a site to calculate the weight of the live animal. This has proven to be an unsubstantiated calculation since the weight of archaeological bones is quite different than

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[853] MacKinnon 2004, 22–23; Reitz and Wing 2004, 167–168. The fact that different quantities of bones are diagnostic in different taxa is another source of bias in this calculation. Davis 1995, 36. This calculation is also referred to as the Total Number of Fragments (TNF) and similarly in Italian, the Numero Resti (NR) or "number of remains." Hesse and Wapnish 1985, 112–113; Tagliacozzo 2004.

[854] See, for example, the different quantities of foot bones for wolves, pigs, sheep, cattle, and horses. Schmid 1972, 128–129

[855] Hesse and Wapnish 1985, 113–115; Lyman 1994, 43; MacKinnon 2004, 22.

[856] Grayson 1984, 50.

[857] In addition to the many suggestions for quantifying collected by Lyman (1994), Marta Moreno-García, Clive Orton, and James Rackham suggest an alternative for estimating animals which is akin to some statistical measures of ceramics. This method would require the re-study of all the bones in this dissertation and identification of "diagnostic zones" on the fragments. Moreno-García et al. 1996.

the weight of fresh bone, due to a variety of taphonomic factors.[858] It is the relative proportion of meat provided by different animals which is most important and the recognition of this has led to the use of constants for the weight of common animal species. Michael MacKinnon has noted the inconsistency with which meat weights have been chosen and applied in Italian studies, citing seven different weights for cattle, ranging between 192.5 kg and 275 kg. I follow Michael MacKinnon's ratio for meat weight in Roman Italy in which cattle:pigs:sheep/goats have a relationship of 1:4:7.3. This was calculated based on withers heights of live specimens. This means that if an average cow yields 200 kg of meat, a pig yields 50 kg and a sheep or goat 27.5 kg. These weights can be multiplied by the MNI for a given species in a given deposit.[859]

While considering meat weight is a great advance, two limitations of this method should be kept in mind. First, using a defined constant for meat weight calculations ignores size differences that may arise from differences in the specific breed, sex and age of an animal within a species. Breeds of ancient domesticates are increasingly well-understood based on the combined study of literary, artistic, and zooarchaeological evidence.[860] Additionally, animal age and sex can be determined from bone remains; however, the standard meat weight calculation does not incorporate any of these considerations. Second, using MNI to calculate meat weight imagines that a whole animal is being consumed, providing little room for ancient consumers preferring or discarding particular anatomical elements.[861] Both of these shortcomings are tolerable as long as meat weight is understood as a heuristic *estimate of relative proportion* rather than a strict measurement of an absolute amount.

7.2.2. Foodways methodology and its limitations

Depending on the type of information gathered, faunal study can address research questions concerning the environment, animal husbandry, butchering and cooking practices, and consumption. Identification of animal taxa represented in a given deposit is

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[858] Casteel 1978. Meat weight's association with bone weight produced an error of between 28% and 2243%.
[859] Vigne 1991, 25–27; MacKinnon 2004, 189–190
[860] MacKinnon 2001; Kron 2008, 177–180; MacKinnon 2010.
[861] Lyman 1979, 537.

the most basic information for the presence and use of animals. In addition to the three common domesticates in the Roman world (cattle, pigs, and sheep/goats),[862] zooarchaeologists also identify wild and domestic non-mammals (birds, reptiles, fish) as well as wild mammals.[863] Identification of the sex and age of animals at death can also contribute to our understanding of the quality of meat they provided and whether they were being used solely for meat or also for labor or secondary products like wool.[864]

The skeletal elements deposited in specific contexts can also reveal which cuts of meat people prefered and inform on the political economy of distribution and consumption. Primary cuts of meat are represented by the presence of elements from the torso section of the animal and its junction with the upper limbs: the scapula, spine, ribs, pelvis, femur, and humerus. These tend to be the most flavorful and tender pieces of meat. Secondary cuts come from the lower limbs of the animal. Primary and secondary cuts were likely to be the most sought-after and valuable parts of the animal. Tertiary meat cuts come from the animal's extremities, like foot bones. They provide very little, rather tough meat, but may have been used for making broth. Heads also contain meat from the brain, tongue, jowl, and eyes, which can be considered palatable by certain culture groups.[865] Marrow is also an important element of food derived from animal bones. Long bones and horns can be broken to extract marrow from mammals, and in larger animals like cattle, lower limbs also provide marrow.[866] The examination of anatomical parts and their associated cuts of meat need to be combined with a consideration of depositional processes. When the whole skeleton of an animal is not recovered, it means that the rest of it was deposited elsewhere on site or off site.[867] This is a reflection of the depositional choices of the butcher, meat processer, and consumer and may reflect the method of processing the animal or its consumption. So while the cuts of animals found in contexts we might expect to be food debris likely reflect cuts of meat being eaten, we must also consider whether the rest of the

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[862] Sheep and goats are difficult to distinguish unless certain diagnostic skeletal elements are present in the sample. For methods in identifying between goat and sheep according to the various parts of the skeleton, see Boessneck et al. 1964; Prummel and Frisch 1986; Halstead et al. 2002; Zeder and Lapham 2010.
[863] MacKinnon 2004, 215.
[864] Reitz and Wing 2004, 172–178; Cool 2006, 85.
[865] MacKinnon 2004, 26, 196; Barker 1982, 86.
[866] Davis 1995, 27; MacKinnon 2004, 26, 173; Cool 2006, 91.
[867] Or it has been removed by scavenger animals.

animal was not deposited because it was not eaten at all, or not eaten by the same group of individuals and then discarded elsewhere.

An increased scholarly interest in the technology of animal processing and food preparation and consumption has meant that there is a growing body of research on human modification of bones.[868] The examination of surface discoloration, butchery marks, and fragment size can all reveal details of meat processing. Several experiments have sought to define the physical characteristics of cooked bone and to determine if we can use these characteristics to determine the temperature reached in the fire or the extent of boiling (in particular, the length of time).[869] The results are mixed. While typically boiled bones are yellowed, this alteration can just as easily as come from the effects of burial.[870] Measuring the physio-chemical changes of animal bones (collagen content, protein, nitrogen content) suggests that there are not measurable differences in bones which have been boiled for lengths of time which are typical for cooking (three to nine hours). Instead physical changes are only discernable in extended or repeated boiling (for 27 to 81 hours) which may happen far less typically.[871] In the case of roasted or baked bones, the results are clearer. Because the bone is insulated by the meat on it, it does not experience high enough heat to alter its physical condition in a discernible way.[872] There is significant shrinkage in the size of the bone if it is roasted or baked in temperatures exceeding 600˚ Celsius;[873] however, this is hotter than a typical camp fire.[874] Blackening does appear on the exposed ends of bones in definitive streaks of the bone from roasting.[875] Therefore, while these studies suggest that cooking processes do leave traces on bones, further investigation is needed to clarify all of the factors involved in archaeological bones.[876]

A combination of discoloration and fragmentation can help to establish processing and consumption. For example, patches of burning on long bones combined with their

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[868] This focus began as early as Binford's work with Inuit hunters (Binford 1978) and shifted to more experimental and archaeological studies in the 1980s. See for example, Shipman et al. 1984 and Maltby 1985.
[869] Shipman et al. 1984; Nicholson 1993; Pearce and Luff 1994; Alhaique 1997; Roberts et al. 2002.
[870] Pearce and Luff 1994, 54.
[871] Roberts et al. 2002, 489–492.
[872] Roberts et al. 2002, 486 citing Alhaique 1997.
[873] Shipman et al. 1984, fig. 8.
[874] Wood burns in a camp fire at about 400˚C. Shipman et al. 1984, 308.
[875] Russell 1999; MacKinnon 2004, 172–173.
[876] Montón Subías 2002, 11.

consistent fragmentation suggests to Kerry Harris and Yannis Hamilakis that marrow extraction was an important feature of fauna recovered in a deposit from Crete.[877] Furthermore "warped" fractures, that is, fractures that are curved rather than following the linear tissues of the bone can be signs of excessive boiling.[878] The size into which bones have been broken or cut can be an indication of cooking method. Excessive numbers of fragments and standardized lengths of bones suggests "pot-sizing," that is, bones are being portioned to fit inside cooking vessels.[879]

Finally, cut marks left on the surfaces of bones can help us posit the skill of the butcher to consider how and by whom people's meat was being prepared, the butchering utensils being used, and the proportions which were being cooked whole and consumed. There are several types of marks which zooarchaeologists have tried to define; however there is as of yet no standard way to record butchery marks.[880] Some zooarchaeologists document the presence or absence of butchery marks in order to confirm that the animal was killed or processed by humans (as opposed, for example, to animal carnivores); some make anecdotal observations about types of butchery marks; and some use systematic coding to record types and locations of marks. For example, Roel Lauwerier invented an ingenious but highly complex coding system for his study of bones from the Netherlands in the Roman period.[881] The implementation of this system has been quite limited.[882]

In general, skinning marks leave shallow scrapes on bones and are likely to be found on mandibles, around the bottom of horns, and lower leg bones.[883] Chopping or hacking marks occur as a result of jointing, the initial division of the carcass, and are therefore typically found at the ends of bones. These marks tend to be "deep, non-symmetrical 'V'

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[877] Harris and Hamilakis 2008, 164.
[878] Pearce and Luff 1994, 54; MacKinnon 2004, 172.
[879] Snyder and Klippel 2003; Fernández 2008. Depending on the particular formation process of the site, it can be difficult to determine if fragmentation is caused by humans or is post-depositional. Orton 2010.
[880] Noe-Nygaard 1989, 471–474. Some archaeologists have started using scanning electron microscopes to record these cuts at a microscopic level, but this is the exception rather than the rule. Cassoli and Tagliacozzo 1997.
[881] Lauwerier 1988.
[882] It has mostly been undertaken by Dutch zooarchaeologists or those working in the Northern Roman provinces. See for example, Sykes n.d.; De Cupere 2001; Filean 2006; Groot 2008. Jacopo De Grossi Mazzorin and Claudia Minniti recorded butchery marks on the bones from Populonia using Lauwerier's system, but their interpretation of this information has not been published.
[883] Hesse and Wapnish 1985, 57; MacKinnon 2004, 178; Reitz and Wing 2004, 126–127.

shape and lack striations."[884] (fig. 5.7 in Reitz and Wing to then later be compared with Populonia bones?). "Cuts" or "slices" with a knife are thinner more shallow marks incised into the bone which may be the result of later portioning of the animal after cooking.[885] In several cases carnivore gnawing and weathering can alter bones in similar ways to human modifications; therefore, the appropriateness of identifying butchery marks in any given deposit needs to be determined based on the general condition of the bone sample.[886]

The systematic recording and analysis of human modifications is still in many ways in its infancy, much like the recording of alterations on pottery. The following analysis and discussion will attempt to assemble the various disparate pieces of information gleaned from the published and unpublished bones from Musarna and Populonia and neighboring sites in order to draw preliminary conclusions.

7.2.3. Trends in Italy

Despite the difficulties of preservation, taphonomy, and comparable methods of quantification, several substantial studies synthesize zooarchaeological reports across the ancient Mediterranean in order to capture long-term trends. Anthony King's 1999 study uses published reports to observe trends in faunal consumption throughout the Roman world.[887] For Italy he composes a diachronic study and defines his periods as "Greek, Etruscan, and Pre-Roman" (10th-3rd centuries BCE), and "Roman" (after the 3rd century BCE) and divides sites into urban, small town, military, and rural.[888] Sites in Italy in the earliest period have a relative balance between their remains of sheep/goats and cattle (estimated at 40% to 70% and 30% to 60% of the total sample, respectively) with slightly less frequent pig remains (mostly 10% to 30%). In contrast, King notes that in the Roman period, remains from villa and rural sites are skewed towards sheep/goat remains (50% to 90%), with pig remains at 30% to 80%, and cattle comprising only 10% to 30%. Urban

[884] Reitz and Wing 2004, 127–128.
[885] Reitz and Wing 2004, 128–130.
[886] Hesse and Wapnish 1985, 85–87. The identification of patterns in the marks observed can also help distinguish them from taphonomic alteration.
[887] King 1999, 168. The reports he used all had samples of greater than 300 NISP. King cites 300 fragments as the minimal amount from which to take meaningful results.
[888] King's investigation of faunal remains in the rest of the Mediterranean is synchronic (the "Imperial period") rather than diachronic.

sites in the Roman period, on the other hand, lean slightly more towards pig with remains of 40% to 80%, and sheep/goat at 40% to 100% and cattle at 10% to 50%.[889]

Regional variation in fauna consumption existed across the Italian peninsula. Specifically, in the Late Republican to Early Imperial period, there is a marked dominance of pig remains in west central Italy, in comparison to northern or southern Italy. King observes that in the former Magna Graecia, sheep/goat forms the highest proportion of the sample, whereas in the North, there is a slightly higher percentage of cattle remains, but still a preponderance of sheep/goat rather than pig.[890] Sheep/goats and some cattle would have found appropriate grazing land in the mountains of the North. Yet despite the fact that sheep/goat would also have had an excellent grazing habitat in the hills of central Italy, they are not represented prominently in King's figures. He attributes the low quantity of cattle and sheep/goats in central Italy in the Roman period to increased agricultural production in the plains and valleys. Any cleared land was farmed and Roman Italians did not have the available open grazing land needed to support the quantity of cattle and sheep/goats required to sustain significant meat consumption.[891] This is in agreement with Michael MacKinnon's compilation of evidence for Roman pigs. He observes that rearing and feeding them in forests and stalls was the preferred method for the two major breeds of pig.[892]

In light of these observations, King declares that the fundamentally Roman meat diet focused on pork because of what must have been regional conditions, but also what became "cultural preference."[893] In support of this idea regarding the desirability of pork, King compares his own observations of the contexts of faunal remains at the villa in the ager Cosanus, Settefinestre, from excavations acknowledged as the first large-scale scientific excavation in Italy. One of its research aims was to consider the "slave mode of production." King observes that in the "high status" areas, pig remains were found in higher

[889] King 1999, fig. 2, Appendix Table A.
[890] King 1999, 169 and fig. 1.
[891] King 1999, 171.
[892] MacKinnon 2001, 649.
[893] King 1999, 171.

numbers than in areas of "low status" where slaves would potentially have lived.[894] Though this is an interesting observation, it warrants further critical investigation.

A final important comment on King and others' work on faunal remains and change over time is the lack of quantitative rigor of the studies. King only uses NISP figures and observes and reports changes in proportion of various species without examining whether those changes are in fact statistically significant.[895]

Michael MacKinnon's 2004 book on meat production and consumption in Roman Italy is similarly a synthesis of published reports divided by site type and period.[896] The study is intended to answer the call Anthony King makes for "comprehensive regional comparative analyses" by concentrating solely on Italy and integrating ancient textual evidence with trends in taxa, cuts of meat, and human modification. MacKinnon divides sites into towns which are *municipia*, towns which are not designated as *municipia*, "rural" sites, and "special" sites which include funerary and votive deposits. He also subdivides the Italian peninsula into northern, central, and southern regions in order to capture broad geographical differences. His chronological divisions are fairly rough given that he must work with the periodization of multiple sites. He groups the Republican Period (as 500 to 50 BCE), the Imperial Period (as 50 BCE to 300 CE) and the Late Antique Period (as 300 to 500 CE).[897]

MacKinnon demonstrates that when we consider meat weight along with faunal study, the amount of cattle meat increases substantially compared to pigs and sheep/goats: "cattle account for more than one third of the total domestic mammalian meat consumed" and in northern Italy, beef forms a significant part of the diet at all times.[898] This is followed by central and southern Italy where beef is slightly less dominant. Although by meat weight cattle account for half of total meat at sites in northern Italy, its lowest representation is in the Imperial Period when pig and sheep/goat are more prominent, but still account for a minority of the meat diet. In southern Italy, cattle and sheep/goats steadily decline through

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[894] King 1999, 169.
[895] Noting proportional differences without recourse to statistical testing is unfortunately the norm for zooarchaeological reports.
[896] MacKinnon personally examined the material from 3 out of 97 sites in his database. MacKinnon 2004, 32.
[897] MacKinnon 2004, 31–36.
[898] MacKinnon 2004, 190–193.

to Late Antiquity while pig increases. Cattle and sheep/goats "contribute progressively less" over time in Central Italy while pig increases, accounting for "on average, about half the domestic mammalian meat consumed in Imperial times in central Italy – among its largest values for the whole country."[899]

Wild animals are a very small part of Roman diet: at 76% of the sites which had wild animal remains, they made up 10% or less of the meat. Minor trends in the data suggest more wild animals were consumed at rural sites and slightly more wild animals consumed in the Republican period.[900]

In terms of anatomical elements, primary and secondary cuts are the least represented at every site, but are more common in towns than at rural or special sites. When grouped by period, there is variation in the prominence of each animal's element over time and within regions. For cattle, there is a general increase in secondary cuts and head pieces over time. Northern Italy has the most heads, primary cuts, and secondary cuts. In contrast, southern Italy has proportionally more extremities and the lowest proportion of heads and primary cuts. For sheep/goat, there is much more fluctuation over MacKinnon's three periods and only the head fragments steadily increase over time. Southern Italy has proportionally the most secondary cuts. Central Italian sites have the highest proportion of primary parts and the lowest proportion of extremities. For pork cuts, over time there is an increase in head fragments and primary cuts. Primary pork cuts account for proportionally more meat in northern and central Italy in comparison to the South where extremities are more common.[901]

Thus, MacKinnon's data confirm an increased, though not as dominant, amount of pork being consumed in Italy, though when this change occurred within the broad Republican period he defines (500-50 BCE) is unclear. This trend is important to keep in mind in the examination of bones from Musarna and Populonia below. I will consider further the cultural and environmental implications for pork following that section. MacKinnon's data also seem to indicate a richer diet in central and northern Italian sites when compared to the south, and also perhaps that people in urban sites were eating more

[899] MacKinnon 2004, 215.
[900] MacKinnon 2004, 190.
[901] MacKinnon 2004, 199–204.

choice cuts of animals than in rural areas where whole carcasses were utilized. This general trend may reveal the process of dividing and distributing meat in dense settlement areas and suggest that butchery was taking place outside of many settlements. Such a conclusion would help explain disproportionate amounts of different cuts of meat in deposits in Roman contexts. This possibility will be considered further below.

7.3. Fauna from Musarna

Antonio Tagliacozzo's publication of the fauna from the cisterns of the Hellenistic baths is the only published faunal material from Musarna to-date, as the site is still in the midst of study and publication.[902] The baths contained 4,000 fragments of bone. Of these, 20% (n=800) were identifiable by species. The majority of the materials from the baths were recovered in cisterns and sewers, much like the archaeological artifacts from the rest of the site.[903]

In aid of my research, Tagliacozzo's colleagues at the Museo Nazionale Preistorico Etnografico "Luigi Pigorini" in Rome, Beatriz Pino Urìa and Monica Gala, undertook a preliminary taxonomic study of fauna from three of the cisterns whose ceramics feature in this dissertation.[904] I was also fortunate to have Michael MacKinnon come to my lab in Rome in July 2012 to conduct an extensive study of the age, size, and human modification of the bones from two further cisterns of interest (511 and 635).

In total, 2,024 fragments of animal bones, teeth, and shells were collected from these five cisterns. Forty-one percent of these fragments were identifiable by species (NISP=827) and the other 59% were identifiable simply as coming from "large" "medium" or "small" animals. These account for a minimum number of 156 animals.

Less than 5% of the total sample bore traces of carnivore gnawing, weathering, erosion, mineral leaching, or sun exposure, suggesting rapid incorporation into archaeological deposits. Furthermore, the generally excellent preservation of bones in these deposits (with a relatively large proportion of identifiable specimens and evidence for many juvenile animals) attests to minimal post-depositional disturbance. The condition

[902] Tagliacozzo 1990; Tagliacozzo 2004.
[903] See chapter 4.
[904] Gala 2012; Pino Urìa 2012.

of material recovered from cistern 511 and 635 is similar, with bones from 511 bearing slightly more frequent "darker, humic staining." This mirrors the preservation conditions of the ceramics from these features, discussed in chapter 5 and 6, and supports my contention that the alterations the pots bear are attributable to use rather than post-depositional disturbance. Indeed, McKinnon argues that the fauna inform on "general patterns of animal use in the diet and economy of people in the area during each of the periods under consideration for each cistern, as opposed to these being largely and artificially a factor of post-depositional and taphonomic forces."[905] This independently confirms my impression that these deposits are of general eating debris, rather than the result of unusual circumstances.

In the following faunal study I have included data from the cistern fills from the baths, which are similar in period to the periods under study from cisterns 511 and 635, in order to increase the sample size.[906] From the baths I have included cistern C12, C3, and C11 in Period 4 and cisterns C12 and C20 in Period 8.[907] These contained 480 fragments (NISP) and a minimum of 89 individual animals (MNI).

In the following discussion I focus on animals recovered from Musarna that were commonly consumed as food. This means that I have discounted the remains of dogs, cats, two garden snails, and the remains from one each of a frog, owl, donkey, weasel and vole, none of which were typically consumed in the Roman world (Table 90).[908]

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[905] MacKinnon 2012, 2–3.

[906] The MNI is too low from cisterns 511 and 635 to support statistical testing. The decision to combine material from multiple cisterns is validated by the observation of the zooarchaeologists that the material seems to be from general meal and meat processing debris, and is not obviously area-specific (Tagliacozzo 2004, 314–315; MacKinnon 2012, 7).

[907] Tagliacozzo 2004, 293–296, 305–310. Cisterns C12 and C20 are both determined to span into the "first decades of the 1st century CE;" however, they fit closely enough in Period 8, that I have included them.

[908] While it might be hasty to assume that none of these animals were being consumed, their low individual amounts suggest that they were not a normal inclusion in the Musarnan diet. The dog and cat bones had no signs of butchering (MacKinnon 2012, 4). We have no evidence for owls among game birds in Latin literature (Kron 2008, 193–203), and nothing to suggest that rodents were being eaten.

Table 90. NISP and MNI figures for edible animals at Musarna

	Period 1		Period 3		Period 4		Period 5		Period 8	
	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI
Cattle	1	1	1	1	10	6	28	3	19	8
Sheep/goat	1	1	4	1	49	14	151	9	128	17
Pig	2	1	6	1	27	14	115	6	175	29
Chicken	0	0	0	0	14	3	55	4	38	15
Other bird	0	0	0	0	1	1	1	1	7	5
Fish	0	0	0	0	1	1	1	1	1	1
Total	*4*	*3*	*11*	*3*	*102*	*39*	*351*	*24*	*368*	*75*

7.3.1. Taxonomic data

Several overall trends are evident in the fauna from Musarna. The three common mammalian domesticates predominate, followed by domestic chicken (*gallus gallus*) and other birds which were potentially consumed, such as pigeon or doves (or other birds of the passerine family).[909] No edible wild animals were present in the deposits examined and fish remains are extremely scarce.[910] The poor representation of fish is not surprising, given the lack of accessible lakes and ponds in the area, coupled with what may have been higher costs of acquiring fish when domestic mammals and fowl were more readily available.[911] The scarcity of fish bones does not seem connected to recovery biases given the occurrence of small chicken bones, and bones of rodents and amphibians.[912] Also notable is the complete lack of mollusk shells. This is likely not a result of preservation or recovery since mollusk shells preserve very well in comparison the bones of vertebrate mammals.[913] The nearby site of Tarquinia has as at least 46 mollusk shells recovered from its Bronze Age to Republican layers.[914]

When we examine the graph of NISP at Musarna, a pattern emerges of steadily increasing pork consumption, decreasing sheep/goat, and relatively consistent cattle and

[909] For a comprehensive list of birds species consumed by according to Greek and Roman textual sources and zooarchaeological evidence, see Kron 2008, 193–203.
[910] The only exception is a red fox represented by 8 fragments in C11 from Period 4 in the bath house. Although such remains are attested in hunt scenes in Roman wall paintings, they are not mentioned as food in Latin literature and it is unclear if foxes were ever consumed. Kron 2008, 190.
[911] MacKinnon 2012, 3–4.
[912] Non-edible species present included 2 dogs and 2 cats, one of which was a kitten who likely fell into the well, a vole, a weasel, 2 land snails, a frog or toad, and one tooth from a donkey.
[913] Reitz and Wing 2004, 203
[914] Bedini 1997, 108.

chicken consumption, though chicken only appears in Period 4, beginning in the middle of the third century (Figure 157). The appearance of chicken in Period 4 is difficult to consider meaningful, however, when we note how small the sample sizes are from Period 1 and 3 (NISP=4 and 11). These sample sizes preclude Period 1 and Period 3's inclusion in the following statistical analyses, though the distribution of their few fragments should be kept in mind. The NISP for edible animals in Period 4, 5, and 8 is 629. While Period 5 contains 233 of these fragments, it is worth noting that it is an interim overlapping period created because of the nature of the stratigraphy in different cisterns. Period 4 ranges from 250 to 150 BCE, Period 5 from 200 to 100 BCE, and Period 8 from 150 to 50 BCE. This means that, notwithstanding slight depositional differences, the faunal remains from Period 5 should be somewhat reflective of both Period 4 and Period 8. At the same time, the inclusion of Period 5 in the following calculations can somewhat confuse the discussion because of its chronological overlap and the fact that it creates a third column of data from which to calculate change within the chi-squared test. Its inclusion potentially masks the differences present over the course of the 2nd century BCE. For both of these reasons, the following calculations will focus on the differences between Period 4 and Period 8, while reporting when there are major discrepancies between these results and results when Period 5 is included in the calculation.

When the NISP figures are subjected to statistical testing, we see a significant change in the presence of sheep/goat between Period 4 and Period 8. Sheep/goat bones make up 51.1% of the sample in Period 4 and 35.5% of the sample in Period 8.[915] Simultaneously, pig bones jump from 25% of the sample in Period 4 to 46.7% in Period 8, which is also statistically significant.[916] Here, then, is a confirmation of King's observations about pig increase and sheep/goat decrease over time. Meanwhile, cattle bones at Musarna remain steady at about 5%[917] and chicken bones at about 13% in each period (Figure 157).[918]

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[915] $\chi^2=7.18$ ($p<0.01$)
[916] $\chi^2=13.7$ ($p<0.01$)
[917] When Period 5 is included in this chi square calculation, there is a significant change because cattle make up 12% of the bones in Period 5. This is $\chi^2=10$, $p<0.01$.
[918] This is also the case when I combine all of the bird species together. They are consistently about 13% of the sample.

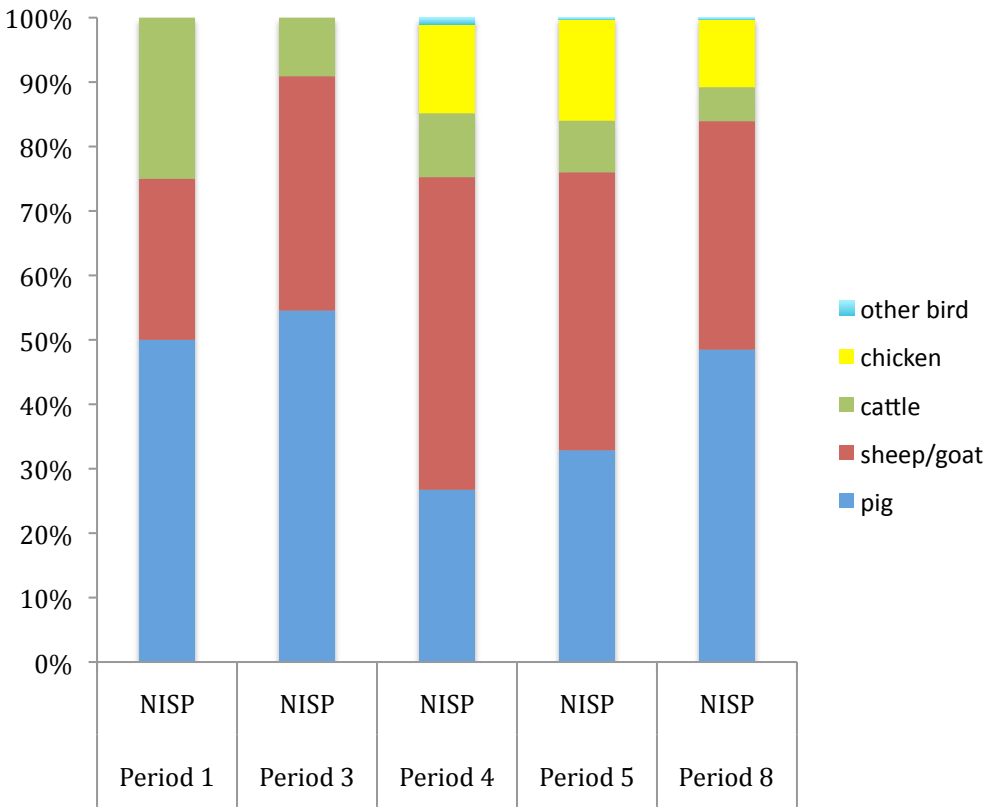

Figure 157. Relative proportions of NISP from Musarna

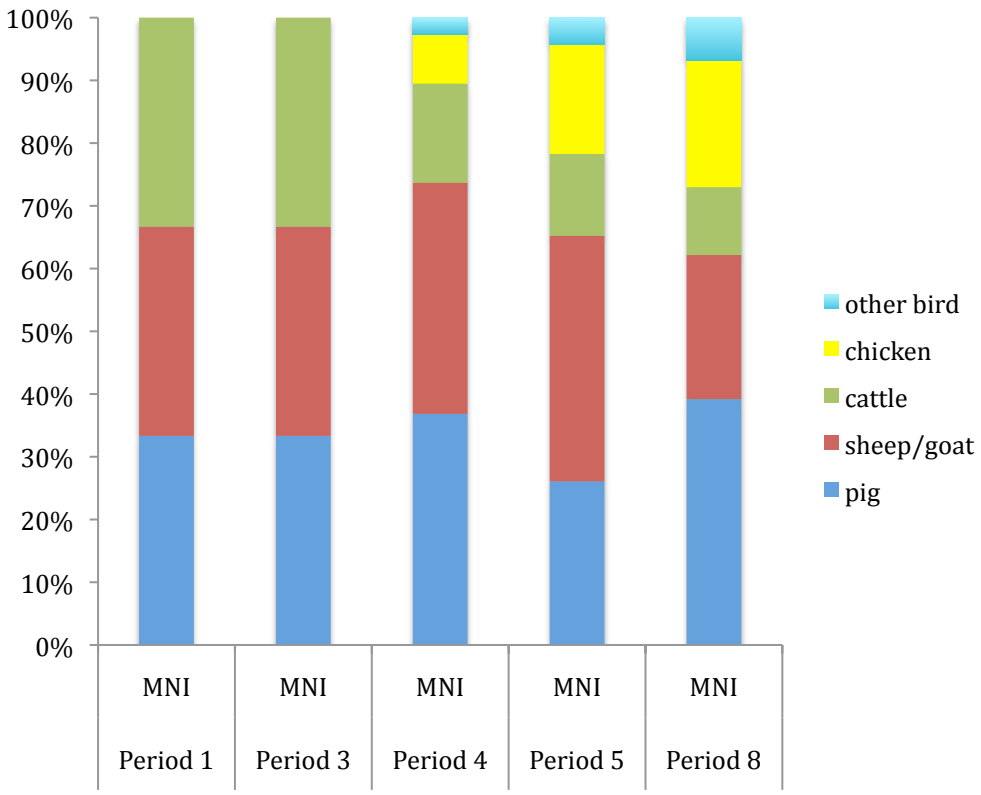

Figure 158. Relative proportion of MNI from Musarna

The bone fragments of edible animals in Period 4 and Period 8 represent a minimum of 113 animals (Figure 158). Using MNI to determine the change in the use of animals over time produces quite different results from the NISP. Though we saw a significant change in NISP of sheep/goat, in MNI values the proportion of sheep/goat in the sample goes from 35.9% in Period 4 to 23% in Period 8 – a suggestive, but not statistically significant difference (at the 0.05 level).[919] Similarly, the proportion of pig barely increases from 35.9% to 39.2%. The proportion of cattle decreases notably, though not significantly, from 15.4% to 10.8%. The biggest change occurs in the number of chickens which increase from 7.7% of the sample in Period 4 to 20.3% in Period 8.[920] When we include pigeons and passerine birds together with chicken, birds go from being 10.3% of the sample to 25.7%.[921]

[919] χ^2=2.14 (p=0.143)
[920] χ^2=3.017 (p=0.082)
[921] χ^2=3.746 (p=0.053)

The inhabitants of Musarna seem to be slaughtering slightly fewer cattle and sheep/goats in favor of slightly more pigs and birds, specifically chickens, in Period 8. Though we can see this as a developing trend, it cannot be confirmed as statistically significant, that is, a difference likely reflecting real patterns in a parent assemblage, rather than being an artifact of the vagaries of sampling.

When the MNI figures are used to calculate the meat weight of these animals, the proportion that each animal contributes to the meat diet becomes even clearer. The graph representing MNI makes it appear that cattle, forming only 15% to 10% of recovered bones, is a very small proportion of the sample in comparison to pig bones, for example. The graph representing meat weight, however, reveals that cattle contribute more than 50% of the meat in every period except Period 8, when it decreases to 45.1% (Figure 159). The differences are similarly dramatic for the other animals. Chicken, which here is given a value of 2 kg per animal, begins to take over the MNI graph in Period 4 to 8;[922] whereas, the meat weight graph demonstrates that though their numbers increase their percentage of the overall diet is paltry. When we apply chi-squared tests to meat weight proportions in order to understand whether there are significant changes between the periods in question, the meat weight figures yield more definitive results than the MNI figures (Table 91).[923] The differences between the proportion of each domestic mammal and chickens change significantly between Period 4 and Period 8.[924] Cattle decrease from providing 52.4% of the meat weight to 45.1%.[925] Sheep/goat decreases from 16.8% to 13.2%.[926] Pig increases from 30.6% of the total meat weight to 40.9%.[927] These pork weight calculations are slightly overestimated since there are a minimum of three fetal pigs in Periods 4 and 8.

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[922] Geoffrey Kron suggests based on size studies throughout the Roman Empire that through breeding Roman hens cluster "in the middle range of modern breeds at about 2 kg, significantly heavier than the hens of 1 to 1.5 kg occasionally found on Celtic sites" (Kron 2008, 180). Measurement of the chicken bones at Musarna accord with average ranges for other domestic fowl from ancient Italy (MacKinnon 2012, 5).

[923] This might be because of very large base numbers. Their extremely high chi square figures (much higher than the critical value needed to confirm significance) may be a confirmation of the pattern which emerges, but fails to be significant in the MNI figures. However, the exponential increase here means that adjustments to the assigned meat weight per animal will dramatically affect proportions of meat contribution.

[924] I calculated the difference between Period 4, 5, and 8 together, which were significant with every animal, but here I only report the results of the comparison between Period 4 and Period 8 figures.

[925] $\chi^2=29.53$ ($p<0.01$)

[926] $\chi^2=14.68$ ($p<0.01$)

[927] $\chi^2=63.72$ ($p<0.01$)

Nevertheless the measurements of pig bones from Musarna demonstrate that at least among adults, there is a general homogeneity of breed.[928] Chicken increases from 0.04% of the meat weight to 0.14%.[929]

Table 91. Meat weight of domestic animals at Musarna

	Period 1	**Period 3**	**Period 4**	**Period 5**	**Period 8**
	kg	kg	kg	kg	kg
Cattle	200	200	1200	600	1600
Sheep/goat	27.5	27.5	385	247.5	467.5
Pig	50	50	700	300	1450
Chicken	0	0	6	8	30
Other bird	0	0	1	1	5

[928] MacKinnon 2012, 6.
[929] χ^2=7.74 ($p<0.01$)

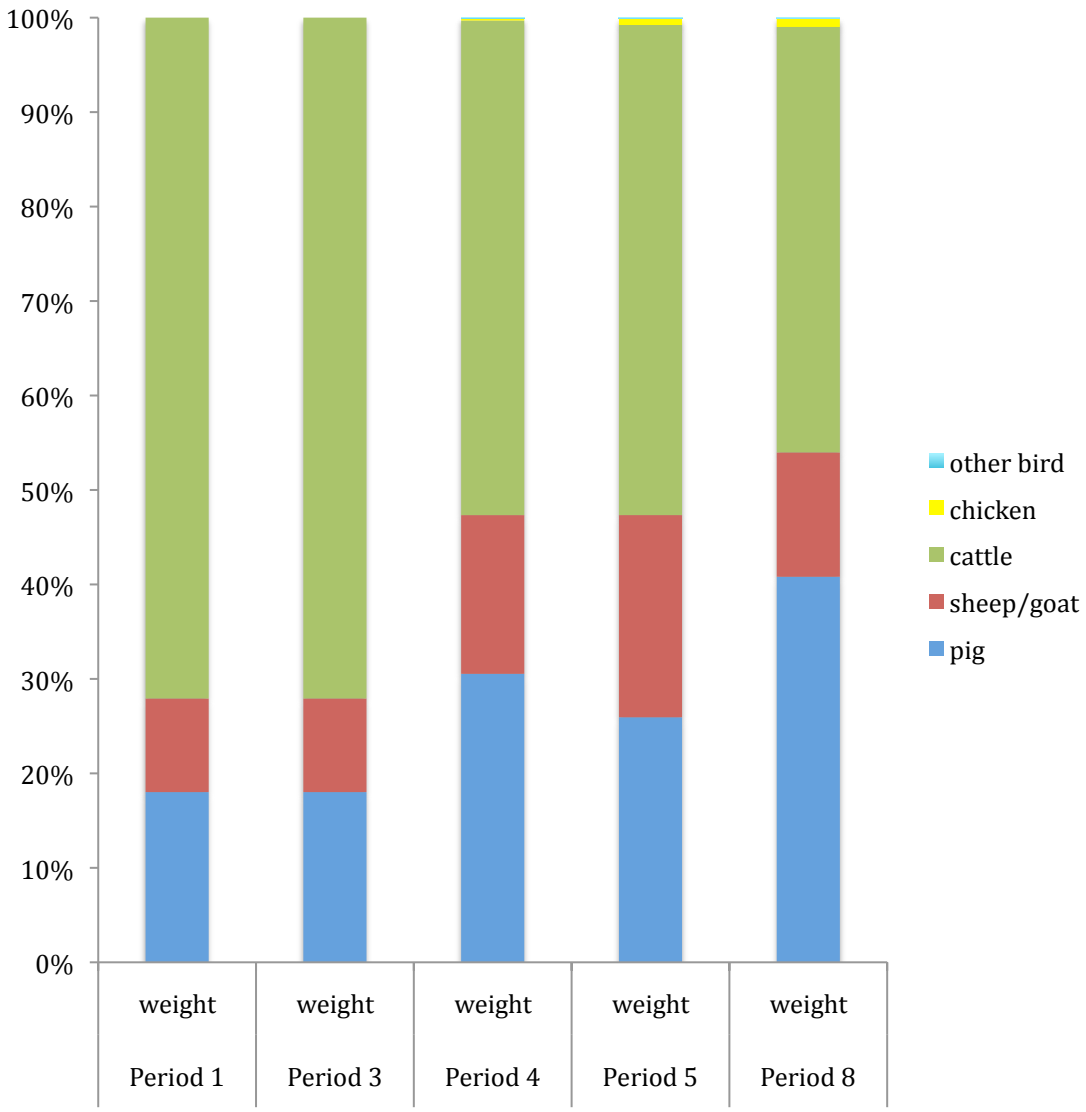

Figure 159. Relative proportion of meat weight for Musarna

These meat weight figures demonstrate that while pig contributed substantially more to the diet in Musarna by Period 8 and increased in importance over time, cattle were still the most important source of meat among residents who deposited their debris in the sampled cisterns.

7.3.2. Condition and modification

i. Age

Animal bones are aged according to the fusion of elements at the end of leg bones, cranial fragments, the eruption of teeth, and general size and skeletal wear.[930] Depending on the skeletal elements present, therefore, it is not always possible to determine the age of animals. Although the sample size of aged individuals according to MNI is too low to make comparisons between periods, we can make some general observations about age distributions for certain species. There is a high frequency of younger individuals in both the sheep/goats and pigs at Musarna. MNI counts from cisterns 511 and 635 yield at least two sub-adult sheep/goats (less than 2 years of age).[931] From the baths, there were about eight individuals under one year of age, and four sub-adults. Younger representatives also comprise the MNI sample for pigs, with two fetal pigs, one or two juvenile pigs (that is, under six months of age), and at least two sub-adults from cisterns 511 and 635. Meanwhile, the baths contained one juvenile pig, five pigs less than one year old, and four sub-adults.[932] Younger pigs are fairly common in faunal samples from Roman sites and increasing frequencies of very-young and fetal pigs tends to suggest a more elite diet, since the pigs are being killed before reaching their maximum meat-bearing size. A similar argument should correspond to a high frequency of young sheep/goats in a faunal sample since these animals are often raised to exploit their secondary products before they are slaughtered for food.[933]

This result is actually in contrast to the situation at nearby Tarquinia, where pigs and sheep/goats under one year of age form only a small proportion of the sample (under 30% and under 25% in each period, respectively), though they both increase slightly in proportion from the 11th century BCE into the 2nd century BCE.[934] For cattle from Musarna, the large majority seem to have reached adulthood (three or four years of age), though the determination of their age at death through tooth wear was not undertaken. This is similar to cattle from Tarquinia, who were almost all older than two years of age and more frequently older than 4 years of age.[935] This points to the use of cattle as draft animals or

[930] Reitz and Wing 2004, 70–743
[931] One of these is a young lamb.
[932] Tagliacozzo 2004, 318, fig. 250 and fig. 251; MacKinnon 2012, 5.
[933] MacKinnon 2012, 5
[934] Bedini 1997, 112, 115.
[935] Bedini 1997, 118.

for milk production and suggests that cattle were not raised for beef consumption initially. These data contribute to our understanding of beef consumption at Musarna: though the quantity figures reveal that beef was the major source of meat, the age of the cattle may suggest that eating beef was an opportunistic and beneficial method of disposing of cattle, but not necessarily a primary purpose for keeping them.

ii. Anatomical Parts

The most frequent anatomical part, and therefore cut of meat, of the three most common mammalian domesticates and chicken at Musarna is the head fragment. In each period, head fragments constitute 30% to 40% of the sample. This is followed in frequency by primary cuts, which make up about 24% of the sample in every period, then by secondary cuts at about 20% of the sample, and tertiary cuts at about 17% of the sample. When we examine the change over time in the proportion of cuts of meat of these animals, there is no significant difference between periods. The picture is quite different, however, when we isolate which cuts were being eaten in different species.

For cattle, which constitute only 85 fragments of the entirety of the material under study, there is a significant decrease in primary cuts (from 57.1% to 20.6%) between Period 4 and Period 8.[936] The proportion of secondary cuts over this time remains relatively stable between 14% and 11%. Tertiary cuts increase from 19% to 44% in Period 8, creating a statistically significant change.[937] This shift in prominence to tertiary cuts may be attributable to a local hide industry, since lower limbs can be the debris from skinning. It may also suggest an increase in beef-based broths in Period 8.

For sheep/goats, which total 348 fragments, there is much more consistency in the proportion of available cuts over time. The primary cuts range between 16% and 24% of the sheep/goat remains. The secondary cuts are tightly bounded between 18.3% and 18.5%, and the head fragments between 37% and 46%. The tertiary cuts show the largest and most significant change, but in a somewhat unclear manner. In Period 4, they constitute 28.4% of the sheep/goat remains. In Period 5, the overlapping period, they drop to 11%, and in Period 8, they rise again to 20.9% of the sample. Though when we compare

[936] $\chi^2=7.67$ ($p<0.01$)
[937] $\chi^2=3.6$ ($p=0.057$)

Period 4, 5, and 8, there is a significant difference,[938] when we discount Period 5 the difference is no longer significant. This diversity of the Period 5 sample may reflect an intra-site variability which is otherwise undetectable.

Pig fragments total 293 and present a different pattern from the other taxa. The primary cuts constitute a relatively consistent proportion of pig cuts over time. Between Period 4 and Period 8, they range from 23% to 21.4%. Similarly, secondary cuts range from 19.7% to 15.9%. The tertiary cuts instead, change significantly and go from 16.4% in Period 4 to 7.6% in Period 8.[939] The head fragments, conversely, increase over time, making up 41% of the fragments in Period 4 and 55.2% of the fragments in Period 8.[940]

The relatively even balance in proportion between the various cuts in sheep/goat and pig suggests that whole animals were processed and consumed locally and that all waste products were being disposed in the same place. Large frequencies for ribs and long bone fragments in the unidentified "medium-sized" animal group from cisterns 511 and 635 further suggest that remains from the central part of sheep/goats and pigs can be added to the parts of being consumed and discarded.[941]

There is a problem with the calculation of head fragments since they are based on both teeth and bones from the cranium and jaw. A similar problem exists for tertiary fragments, since there are many more bones in the feet than in the other subsections of the body. This means that both head and tertiary cuts may be over-represented.[942] The increase in head fragments over time for cattle, sheep/goats, and pigs may be an early example of a trend already noted in mammalian remains in Italy. From the Republic into Late Antiquity, there is a general increase in heads and secondary cuts over time.[943]

I cannot include the chicken bone fragments from the Hellenistic baths in this discussion since anatomical parts are only enumerated for the three mammalian

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[938] χ^2=8.345 (p=0.015)
[939] χ^2=3.64 (p=0.056)
[940] χ^2=3.46 (p=0.063), though not technically at the level of 0.05 significance, this seems to be a trend worth noticing.
[941] MacKinnon 2012, 5.
[942] MacKinnon 2004, 198.
[943] MacKinnon 2004, 200.

domesticates.[944] The remaining 65 chicken bone fragments from cisterns 511 and 635 have very stable numbers of fragments of different cuts from Period 4 to Period 8.

iii. Human Modification

The analysis of the human modification of bones from Musarna is centered on the bones from cistern 511 and 635, since I have the recorded raw data from their examination. The bones from the bath house are reported on anecdotally in their publication, and therefore will be referred to only for comparison in this section. Twenty-five percent of the bone fragments from the Musarna cisterns have discernible butchery marks on them, which MacKinnon in his report classed as either "chops" likely from a cleaver or "knife" cuts. An additional 4.2% have spiral fractures which may indicate boiling and marrow extraction. In general, chopping marks are most common, followed by knife marks, and spiral fractures. The remains in this sample suggest that the use of these different techniques of butchering were fairly consistent across time at Musarna.

For cattle, chop marks are evidence of jointing at the ends of the femur, humerus, and scapula, as well as appearing on cranial fragments, the base of horns, and vertebrae at the base of the head clearly indicating the removal of the animal's brain.[945] In Period 4, which total only seven NISP, chop marks are found on three fragments (42.9%), whereas in Period 8 (NISP=10) chop marks are on four fragments (28.6%). This is fairly consistent with the marks attributable to a cleaver on cattle from Republican Italy.[946] Knife marks, which appear as shallower, finer striations on the bone's surface, are visible on cattle bones only once in Period 8.

On sheep/goat bones, chop marks are also mostly found at the ends of long bones, for example, from the separation of the femur from the pelvis, and also in great frequency on foot bones and along the spine. In Period 4, which has 47 total sheep/goat fragments, chop marks appear on 25.5%, and in Period 8, with 108 bones, chop marks appear on 19.4%. On sheep/goat fragments, knife marks are visible 4.3% of the time in Period 4, and

[944] The text for cistern C12 which had 75 *gallus gallus* fragments explains that the majority of these fragments were long bones. Tagliacozzo 312.
[945] De Cupere 2001, 161–162.
[946] MacKinnon 2004, Table 47.

5.6% of the time in Period 8. They are frequently found on the scapula and result from the action of slicing meat off of the back and shoulder of the animal.

Figure 160. Sheep/goat scapula chopped in two areas, with cut marks showing attempted chops

On pig bones in Period 4, chop marks appear on 34.8% of the 23 fragments, and similarly in Period 8, on 37.3% of 142 fragments. In Period 4 these marks are not consistently placed. They appear on proximal and distal ends of radii, on a few ankle bones, and on sporadic jaw fragments. In Period 8 three consistent locations of chop marks are the distal end of the humerus (in order to separate it from the lower limb), on cranium fragments (likely to extract the brain tissue) and on the pelvis in 14 cases (to divide it into smaller pieces). The similarity of the occurrence of chop marks on pigs in Period 8 may suggest an increased professionalism or at least systematization of meat preparation. Finally, of the unidentified mammal bones, the majority of the ribs of medium-sized animals had been chopped and snapped, likely dividing the rib into thirds, for ease of cooking and eating.[947]

On chicken bones, finally, there are only chop marks in Period 8, appearing on 2 of 37 bones (5.4%). Pig and chicken bones have low numbers of knife cuts with only one example from the kneecap of an adult pig in Period 8.

[947] For similar chopping of ribs at Sagalassos, see De Cupere 2001, 163 and 164.

Spiral fractures appear on only a small number of the total sample of bones from Musarna. Cattle and sheep/goat bones both have very low proportions of spiral fractures across time; however, spiral fractures in pig bones decrease from 8.7% (two out of 21 fragments) in Period 4 to 0.7% in Period 8 (one out of 142 fragments).[948]

The appearance of discoloration on bone fragments from Musarna is rare, and is isolated in most cases to unidentifiable specimens. Out of the 289 total rib fragments from medium-sized mammals, more than 20 in Period 8 have charred or burnt patches in black or brown. In several instances, this discoloration appears in a clean stripe on the end or central section of the bone, clearly indicating where meat was covering the bone and protecting it from charring over the fire. A sheep/goat calcaneus from Period 5 and a mandible from Period 8 are also charred. Though evidence for discoloration is rare, its consistency particularly in the case of ribs reminds us of the possibility for roasting as a method of meat preparation which cannot be seen through the ceramic evidence.

The faunal remains from Musarna demonstrate a reliance on domesticated animals with an increasing interest in pork, especially of a young age, and chicken over time while beef remained an important source of meat. The cattle bone remains suggest that older animals were consumed and the increase in extremities over other parts in the later period may suggest a shift in the types of food in which beef was used.

7.4. Fauna from Populonia

At Populonia, the fauna from several of the contexts from saggio IX whose ceramics I have studied were published by Jacopo De Grossi Mazzorin and Claudia Minniti in 2008.[949] Additionally, there are also several interesting investigations of fish consumption and tuna production in the city.[950] Both of these focus on one small deposit adjacent to saggio IV where there was a complete amphora with tuna fish remains preserved inside and fish bones surrounding it. These serve as important reminders of the typically poor-preservation and low-recovery rate of fish bones from other excavations. Populonia also

[948] $\chi^2=7.08$ ($p<0.01$)
[949] De Grossi Mazzorin and Minniti 2008.
[950] De Grossi Mazzorin 2006; Battafarano and De Grossi Mazzorin 2008.

has an excellent but brief faunal study focused on material from a nearby temple from the 3rd century BCE.[951]

It has already been observed that the ceramic deposits in saggio IV and saggio IX were quite different from each other. This holds true for the faunal material as well. In the deposits of saggio IV, there were not more than 15 identifiable bone fragments recovered and approximately 25 other fragments which were not identifiable. The taxa represented are present in the deposits of saggio IX (mammalian domesticates, mollusks). While it is of interest to note that many of the bone fragments from saggio IV, including tibias of a pig and sheep/goat, were burnt black, the extremely small number of bones recovered from this deposit does not render their inclusion in this discussion worthwhile.[952]

From the domus in saggio IX, 1,321 bone fragments were recovered of which 55% (NISP=721) were able to be identified at the taxonomic level.[953] These were relatively large fragments with minimal post-depositional weathering or gnawing.[954] From the three attività whose ceramics were examined in this dissertation, 73, 79, and 84, there were a total of 411 NISP. This represents a minimum of 89 individuals (MNI) which are relatively evenly divided between Period 7 and Period 9 (Table 92). This faunal data has been provided to me by Jacopo De Grossi Mazzorin for my analysis. I am therefore able to make reference to his published report and discuss specifically the faunal remains from the rest of saggio IX.

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951 De Grossi Mazzorin 1985.
952 One to eight bone and shell fragments were present in SU 12278, 12286, 12295, 12302, 12307, 12310, and 12344.
953 De Grossi Mazzorin and Minniti 2008, 198.
954 Only one fragment, a pig astragal from attività 79, had evidence of gnawing reported.

Table 92. NISP and MNI of all fauna at Populonia

	Period 7		Period 9	
	NISP	MNI	NISP	MNI
Cattle	24	4	19	3
Sheep/goat	93	6	44	4
Pig	110	10	44	5
Chicken	6	1	2	2
Other bird	0	0	1	1
Mollusk	21	22	21	21
Rabbit	5	1	1	1
Wild boar	1	1	4	1
Dog	3	2	3	1
Fish	5	1	0	0
Cervus elaphus	2	1	2	1
Total	*270*	*49*	*141*	*40*

7.4.1. Taxonomic Data

The relatively large numbers of mollusks and wild animals are immediately apparent in the above table. Wild animals make up about 5% of the total NISP assemblage from saggio IX. There is evidence for two wild boars, four deer (both red deer and roe deer remains were recovered) and there are six rabbit fragments amounting to at least six rabbits. Though the presence of wild animals is notable, especially given their absence from the faunal assemblage at Musarna, their presence in this sample suggests that they did not contribute a large amount to the meat diet at Populonia.[955]

Turning to the domesticated species, if we first consider the NISP figure, the proportion of cattle, sheep/goat, and chicken bones in each period is relatively consistent at about 10%, 32%, and 2%, respectively (Figure 161).[956] There is a close to significant decrease in the number of pig bones. In Period 7, pig bones make up 41.2% of the sample of edible animals. In Period 9, in contrast, the proportion of pig has decreased to 31.9% of the

[955] The 3rd century deposit from the area sacra at Populonia was also less than 5% wild animals fragments (De Grossi Mazzorin 1985, 156).

[956] This calculation includes all the fauna attested in these deposits except dog, which was probably not contributing to the human inhabitants' diet.

sample.[957] Also in Period 9, the proportion of mollusks has increased significantly in the sample from 7.9% in Period 7 to 15.2%.[958]

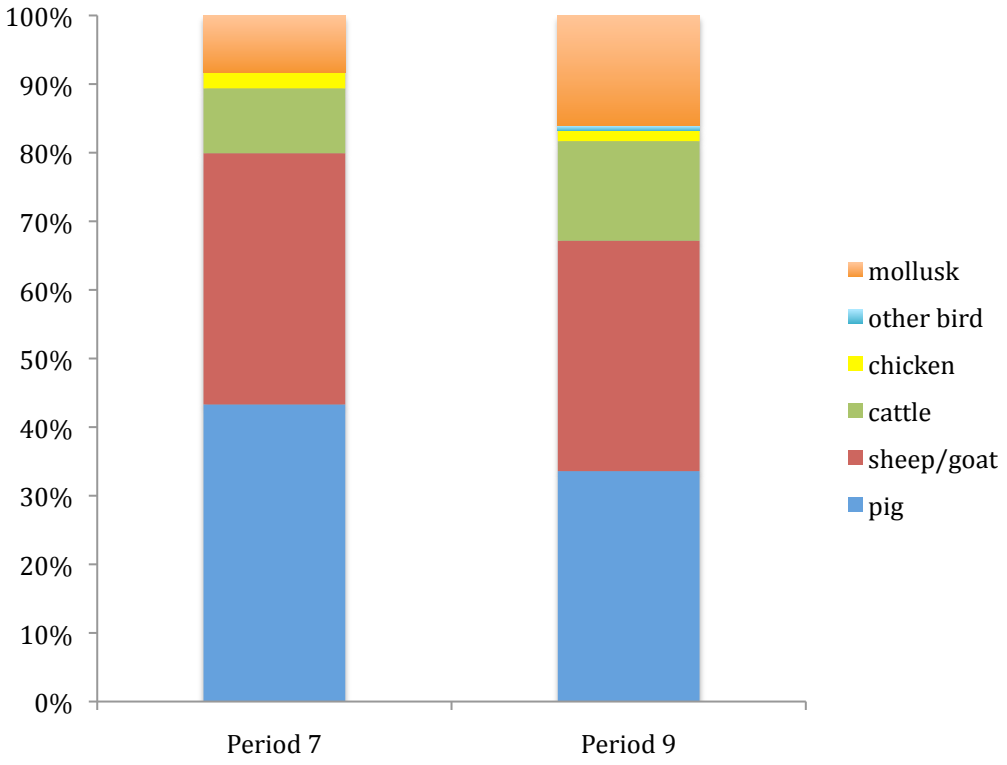

Figure 161. Relative proportion of NISP of domestic animals from Populonia

[957] χ^2=3.349 (p=0.067)
[958] χ^2=5.291 (p<0.05)

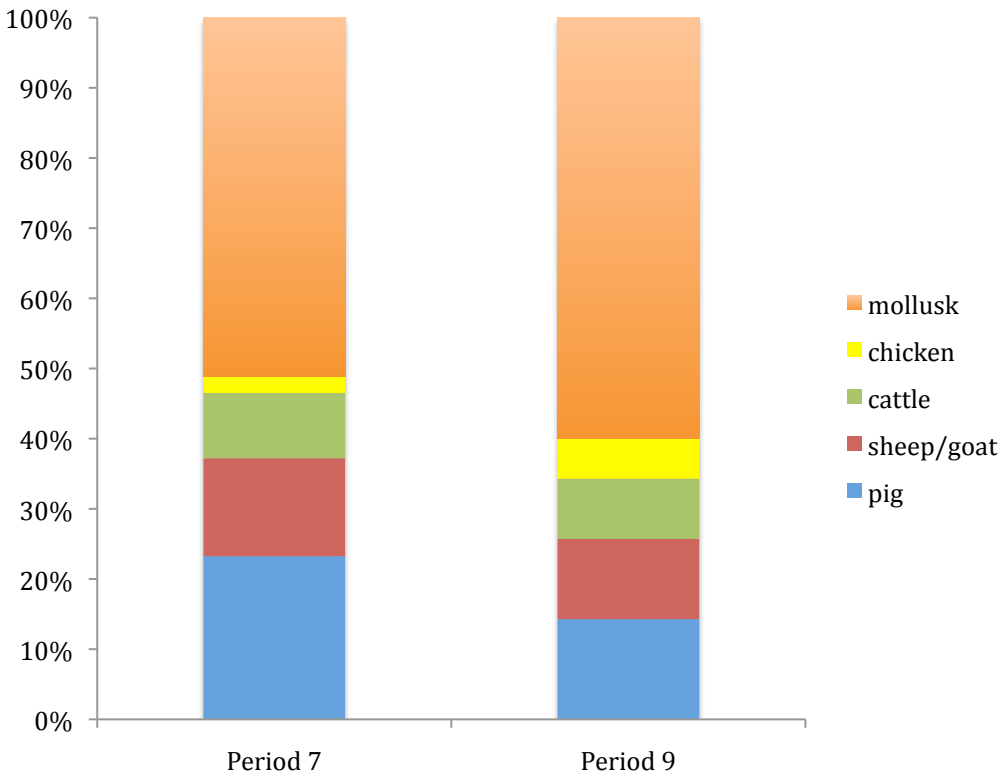

Figure 162. Relative proportion of MNI of domestic animals from Populonia

Recognizing that there are quite small samples sizes when we calculate the MNI for each period, I attempted to do a chi-squared test to ascertain if there is a significant difference in proportion of individual animals of any one species (Figure 162). Considering the proportion of cattle in Period 7 compared to Period 9, it is evident that there is a very consistent quantity, varying between 8.5% and 7.7% when all the edible species (MNI=86) are included, or 19% and 21.4% when only domesticates are included. Similarly, sheep/goat numbers are stable at 12.8% in Period 7 and 10.3% in Period 9, or consistently at 28.6% of the sample when we include only the domesticated animals. Though the minimum number of pigs changes more dramatically (from 47.6% to 35.7% with all edible animals, and 21.3% to 12.8% with only domesticates), this is still not a statistically significant change. The chicken numbers double from one to two, but this is also not significant. Finally, mollusks are similarly common in both periods representing 46.8% of the sample in Period 7 and 53.8% in Period 9.

An examination of meat weight of the main edible species produces a different picture (Figure 163). For cattle, there is a statistically significant increase in its presence on

site from 54.5% to 62.2% of the meat weight.[959] If I isolate the proportion of sheep/goat, it contributes a very consistent amount (about 11.3%) in both Period 7 and Period 9. Pig decreases between Period 7 and Period 9, moving from 34% to 25.9%.[960] Meanwhile, chicken's contribution in terms of meat weight, despite doubling between the two periods, remains well below 1% for both.

Table 93. Meat weight of domestic animals at Populonia

	Period 7	**Period 9**
	kg	kg
Cattle	800	600
Sheep/goat	165	110
Pig	500	250
Chicken	2	4

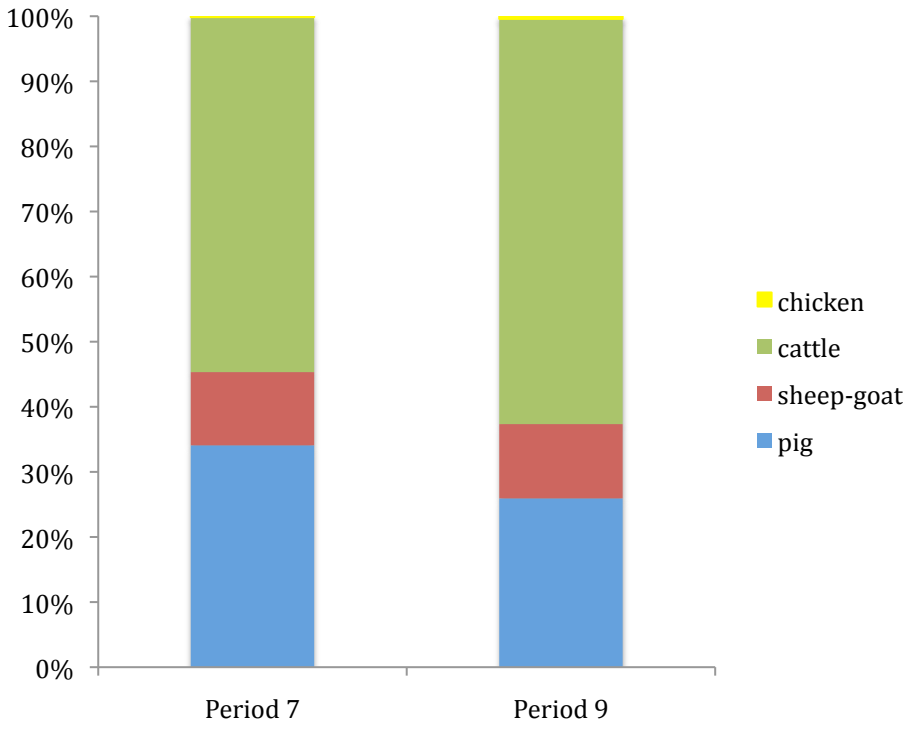

Figure 163. Relative proportion of meat weight of domestic animals at Populonia

The NISP, MNI, and meat weight figures from Populonia all suggest a very different picture from that at Musarna. Between Period 7 (150-100 BCE) and Period 9 (100-1 BCE),

[959] χ^2=11.90 (p<0.01)
[960] χ^2=12.09 (p<0.01)

there is a general consistency in the proportion of all the domesticated animals, with a potentially significant decrease in the proportion of pig and an increase in the proportion of cattle. Nevertheless, meat weight calculations suggest that cattle constituted more than half of all the domestic meat consumed at Populonia throughout the Republican period. Meanwhile pig meat contributed less than one-third of the diet of domestic animals. Of course, these proportions fail to consider how fish may have contributed to the diet. Given the high frequency of mollusks and the few fish bones recovered, it is likely that fish was an important local resource.

7.4.2. Condition and modification

i. Age

The faunal assemblage from saggio IX at Populonia contains a large proportion of cattle under two or three years of age. This relatively young age suggests that cattle were primarily being raised for beef consumption, rather than being kept long-term for secondary products, like milk products, or for labor. The majority of the sheep/goats, similarly, are between two and three years of age with three examples of teeth from animals under one year of age, demonstrating the consumption of lambs or kids. Similar to Musarna, a high proportion of the pigs from Populonia (about 50%) were under one year of age.[961] There is little to distinguish age prevalence between Period 7 and Period 9 at Populonia.

ii. Anatomical Parts

There are several notable trends for changing preferences for cuts of animals over time. In total, 334 bone fragments from cattle, sheep/goats, pigs, and chickens can be analyzed here. Considering all of these animal species together, there is a notable drop in the proportion of primary cuts between Period 7 and Period 9, going from 29.8% to 20.8%.[962] Both secondary and tertiary cuts overall stay consistent around 23% in both periods. Fragments of head bones increase dramatically constituting 22.8% of the total in

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[961] De Grossi Mazzorin and Minniti 2008, 206. These calculations are done by assessing the age of individual bone fragments, rather than the age of individuals.

[962] χ^2=3.02 (p=0.082), while not statistically significant to the standard p=0.05 level, this does appear to be an important trend.

Period 7, but 36.8% in Period 9.[963] These trends are somewhat reflective of the changes visible with each species.

Though cattle cuts emulate the slight decrease in primary cuts, marked stability in secondary and tertiary cuts, and increase in head fragments, none of these changes are large enough to be statistically significant.[964] In contrast, for sheep/goats primary cuts decrease from 30.1% of the total in Period 7 to 15.9% in Period 9; however, this is not quite statistically significant. Secondary cuts stay consistent at 28% and 27.3%. Tertiary cuts are also relatively consistent, constituting 19.4% in Period 7 and 15.9% in Period 9. Head fragments of sheep/goats increase dramatically in Period 9 to 40.9% of the sample from 22.6% in Period 7.[965] For pigs, there is little difference in the proportion of primary, secondary, and tertiary cuts, while head fragments increase from 25.7% to 38.6%, but this is not a statistically significant change. For chicken fragments, the numbers are too low to reveal meaningful changes in cuts of meat over time.

iii. Human Modification

Twenty-five individual bones (6%) from saggio IX have discernible traces of butchery. This was most prevalent on pig and sheep/goat bones, with far fewer examples from cattle (n=4). The sample size is insufficient to determine if there is a real change in the type or frequency of these marks over time, but we can make some general observations. For cattle, three out of four of the fragments have chop marks in at the end of the bone, suggesting the marks were made in the process of jointing. There is one example of what is classed as a "cut" rather than a "chop", likely synonymous to MacKinnon's "knife" mark, on a scapula, likely to slice meat off, as we saw at Musarna.

For sheep/goats, there is slightly more evidence for chopping in Period 7 (n=6), compared to Period 9 (n=2), but this is not statistically significant. Unusually, the long bones which have chop marks, femur, humerus, and several radii, are all chopped in their central section, rather than at either end of the bone.[966] This may suggest portioning for

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[963] $\chi^2=7.14$ ($p<0.01$)
[964] This was noted as well in De Grossi Mazzorin and Minniti 2008, 201.
[965] $\chi^2=3.28$ ($p=0.07$). Again, while this is not statistically significant according to the 0.05 standard, a p value of 0.075 approaches significance and is worth noting.
[966] This is Lauwerier's 21, 11, and 19. De Cupere 2001, Appendix 7.

cooking and consumption of major bones. Interpreting these marks as failed attempts at "pot-sizing" is tempting for a ceramicist; however, the distances between chop marks were not recorded for comparison with ceramic vessels, rendering any such interpretations far too speculative.

Pig bones, conversely, show relatively more evidence of chopping (7% of a large sample, 11/154 bones) and marks tend to be at the ends of bones (femur, radius, scapula, ulna, tibia) clearly during the jointing of the animal (Figure 164). There are only two traces of shallow cutting, both in Period 7, and both at ends of large bones (pelvis, and femur) suggesting, again, probably jointing. No modifications, butchery or burning, were recorded on chicken bones.

Figure 164. Pig ulna and tibia with chop marks near their ends (De Grossi Mazzorin and Minniti 2008, fig. 3 and fig. 4)

Regarding evidence of burning or other discoloration, the only traces which were recorded from the Populonia material are on sheep/goat and pig bones. Only four sheep/goat bones from Period 7, two head fragments, a femur and a foot bone, show contact with fire. This totals only 3% of the sheep/goat bones recovered. Five percent of pig bones, four in each period, have traces of burning. These include a range of body parts

such as scapula, femur, humerus and foot bones. The scarcity of burning marks may suggest that meat was not being roasted over a fire often, but rather was commonly cooked in vessels as stew or pan-fried or sautéed.

While the sample size of bones displaying modification is small and makes any conclusions challenging, the bones from Populonia begin to suggest a consistency of animal processing and preparation.

7.5. Meat and Preference

At Musarna, we have a seen a clear shift in the taxa being discarded and therefore presumably consumed. If we take meat weight as a corollary of meat consumption, in Period 4 (250 to 150 BCE), cattle dominate the sample, followed by pig, sheep/goat, with chicken contributing in a small way starting in this period. By Period 8 (150 to 50 BCE), cattle meat has significantly decreased, but still contributes 45% of the meat, pig has increased to 40%, and sheep/goat has further decreased to less than a quarter of all meat. In both periods a high frequency of bones came from young pigs and sheep/goats, suggesting that they were raised specifically for consumption. In terms of cuts of meat, all three domesticates show relatively consistent cuts of meat used between Period 4 and 8. Notable changes include increases in tertiary cattle cuts and pig head fragments. Butchery marks are consistent with relatively large-scale, professional processing, particularly by Period 8, with evidence of frequent cleaver use.

At Populonia, the results are quite different. Despite a smaller sample size, it seems clear again that cattle and pigs dominate the sample over sheep/goats; however, cattle increases into Period 9 (100 to 1 BCE) to constitute more than 60% of the meat diet. Pig, conversely, decreases to a mere 26% of the meat. The age of all three taxa suggest a rather select diet, since the animals are being slaughtered to maximize the tenderness of their meat rather the quantity of meat they would provide upon reaching their full size. The cuts of meat represented by the bone fragments suggest that whole animals were being consumed and by Period 9 there is a marked increase in head fragments from all animals. Butchery marks are also consistent over time but differ from Musarna in the traces on sheep/goat remains, which are chopped with a cleaver beyond basic jointing.

It is worth now considering the reasons and implications for the most prominent animals present at Musarna and Populonia.

7.5.1. Pork for dinner

Pork is typically described as the defining Roman foodstuff and "the choicest of all the domestic meats consumed," having more Latin names than any other animal.[967] In literature, it certainly had prominence in the Republican period. Varro remarks rhetorically, "who of our people runs a farm without keeping pigs?"[968] Pork is also the meat most frequently referenced in Plautus.[969] The value of pork as an appropriate meat with which to impress dinner guests is alluded to frequently in Plautus, as discussed in Chapter 2. This is also suggested by comments Pliny makes about sumptuary legislation. He remarks that pigs provide the most variety of all meats, having "almost 55 flavors, whereas all other meats have one each." This meant that sumptuary laws always tried to check pig consumption by prohibiting, "hog's paunches, sweetbreads, testicles, matrix and cheeks for banquets."[970] Writing three centuries after Plautus, it is not clear to which sumptuary laws Pliny was referring. There were a series of sumptuary laws passed over the course of the 2nd and 1st centuries BCE which Pliny alludes to elsewhere in his text; therefore, this pig comment may also be referring to a distant past. The repeated passing of sumptuary laws addressing similar conspicuous consumption of food and displays of luxury further intimates Romans' appreciation of these foods. In Ovid's *Fasti,* the goddess Carna is said to enjoy the festive foods of emmer and pork. She rejects, on the other hand, fish and foreign birds.[971] It is also important to note that pig featured as the preferred sacrificial offering in many Roman rituals.[972]

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[967] MacKinnon 2001, 649; Purcell 2003, 340.
[968] Varro *de Re Rustica* 2.4.3.
[969] Banducci 2011, 199.
[970] *Hinc cenosoriarum legum paginae, interdictaque cenis abdominal, glandia, testiculi, vulvae, sincipita verrina* Pliny *NH* 8, VIII, 209.
[971] Ovid, *Fasti* 6.169-86.
[972] Corbier 1989; Kavaja 1998; Donahue 2003; De Grossi Mazzorin and Mascione 2010.

In the work of Anthony King, pork is used as a marker of "Romanization" or Roman presence throughout the Roman provinces.[973] King suggests that a "pork rich diet" began as a Roman preference in the Late Republic in Italy and then was exported by the Roman military throughout the provinces affecting the composition of local meat consumption in different ways in different regions.[974] As discussed above, data from Musarna indicate that while pig bones increase in quantity, MNI increases in quantity, and the meat weight increases substantially, pig is still only a maximum of 40% of the total meat. At Populonia, conversely, pig numbers universally decrease over time. The label of "pork rich" therefore should to be qualified.

The ease of King's move between quantitative dominance (with NISP) and cultural preference seems understandable yet problematic. If we consider the Musarna data further and acknowledge that an increase in the number of pigs slaughtered (even if pork meat does not completely overshadow beef) equates to an increased preference for pork, the question arises, why pork? One reason for choosing pigs over grazing animals during the course of the Republican period in central Italy may simply be environmental pragmatism. Rather than grazing on large plots of land or requiring transhumance, pigs can live side by side with humans and feed on scraps of discarded food from human eating activities and small amounts of fodder. Outside the city, they can stay in small forest plots eating acorns.[975] Central Italy in the 2nd century is an important context for this change. The Gracchan land reforms of 133 and 122 BCE called for the redistribution of the *ager publicus* away from larger estates to individual farmers. These were just two of the most controversial of the land reforms of the 2nd century and both their motivation and their impact on the landscape has been the subject of debate.[976] Despite the uncertainties in the details of the historical record, the archaeological record attests to a shift towards

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[973] King 1984; King 1999; King 2001.
[974] King 2001.
[975] MacKinnon 2004, 152.
[976] J. S. Richardson (1980) provides a useful summary of the problem. David Gargola (1997, 2008) provides a recent perspective on Appian's intentions and biases as an author of the Gracchan episode in *Civil Wars*. Saskia Roselaar (2008) provides a middling view that the reforms affected regions of Italy to differing extents. It is not clear, for example, if the Gracchi's plan for redistribution allowed farmers to continue to use *ager publicus* as grazing land (Tipps 1989).

intensifying agricultural production from the 3rd and into the 2nd century BCE.[977] A combination of increased agricultural production, division of the land surrounding the city, and increasing urban density, or at least, increased interest in city living, may simply make pigs a better meat option for the residents of Rome. The same logic would extend to the urbanism of the later Republic in central Italy. Unfortunately, most Latin texts address pig rearing in rural locales and there is little mention of pigs in urban spaces.[978] In Plautus' *Captivi*, pigs feed on grain at an urban bakery, and Horace mentions a muddy sow running through the streets of Rome.[979]

It follows that recipes for creative pork processing and curing were invented, a penchant for pork gradually established in Italy, and was then exported to the provinces during the Imperial period as a cultural preference to be indulged without regard to local environments.

7.5.2. Chicken for dinner

The focus on the three mammalian domesticates which dominate most faunal assemblages has meant that chicken remains have been largely ignored in faunal studies. Chicken remains are rarely brought into comparison with the mammalian domesticate; nor have they been included in the discussion of changing meat preferences due to environmental or cultural shifts.

The chicken remains from Musarna suggest that domestic fowl figured as a locally-produced, supplemental meat. This is supported by the fact that chickens are represented by all parts of the skeleton; there is evidence for both sexes and a high ratio of juvenile chicks. Chickens were raised on a relatively large scale where younger individuals could be culled easily without jeopardizing the vitality of the flock. They could be "exploited for poultry meat, feathers, and eggs as demanded."[980]

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[977] Morel 1989, 495–498; Terrenato 2001a, 21–22.
[978] See for example, Columella Book 7.
[979] Plautus *Captivi*. 807-8; Horace *Epistles*, 2.2.72-75.
[980] MacKinnon 2012, 5, 8

From as early as the Etruscan period, eggs feature as important, perhaps symbolic, features of the meal.[981] Chickens appear as good omens in Augustan art, and as luxury food items along with suckling pigs in late Roman wall paintings.[982] Stories of sacred chickens and their auspicious eating in *tripadium solistimum* before battles are important and amusing features of military narratives.[983]

The earliest evidence for the domesticated chicken in Italy comes from Tarquinia, where chicken bones appear in a 6th century BCE context. The chicken, originally a Southeast Asian domesticate, was introduced to Italy probably from India via Asia Minor in the 6th century BCE. Interestingly, chicken bones appear in the 6th to 5th century contexts at Tarquinia, but not in the 3rd to 2nd century contexts.[984] At Populonia, chicken appears in 3rd century contexts from the temple.[985]

An important trend visible in the Musarna data is that the increase in chicken coincided with the increase in pig consumption. This same trend has been noted by Mark Maltby in the study of domestic chicken remains at sites in Roman Britain. Chicken remains (as NISP) were most numerous at urban sites, followed by military and villa sites. They were lowest at small nucleated settlements and rural sites. Their quantity correlated with the proportion of pig present at each site.[986] Maltby remarks that there are "indications that on some sites the view that chicken was a 'useful supplement to the diet' may greatly underestimate the frequency of its consumption."[987] There has not as of yet been a similar synthesis for domestic fowl consumption in Roman Italy. The problems of creating such a synthesis stem from recovery and sieving practices, as well as taphonomic issues.[988] It is

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[981] Million 1926, 447; Small 1994. See Lowrance (1939) on eggs at Roman dinners especially in reference to Horace's remark, "*ab ovo ad mala*." (*Satire*, 1.3,6).
[982] Ryberg 1955, 60; Dunbabin 2003b, 446, 450.
[983] Livy X.40; Cicero *de Natura Deorum*, 2.7.
[984] Bedini 1997, 109. The chicken's domestication was first posited to have taken place in India by Frederick Zeuner (1963) and has been generally supported by subsequent genetic testing. See for example, Kanginakudru et al. 2008.
[985] De Grossi Mazzorin 1985, 150–151.
[986] Maltby 1997, 411–413.
[987] Maltby 1997, 413.
[988] Maltby 1997, 404–405.

additionally all too common that non-mammalian animals were infrequently reported in faunal reports of earlier decades and not well-quantified.[989]

If the increase in pig consumption in the Roman period can be attributed partially to an increase in urban density and loss of grazing land, an increase in chicken consumption follows the same logic. Chickens can be kept in small enclosed areas and can feed off of small amounts of unprocessed grain, grass, and scraps, and they reproduce relatively quickly and easily.[990] The actual status of chicken as a food is not clear. Our one suggestive reference comes from the 1st century CE, again, from Pliny the Elder's discussion of birds. He recalls that sumptuary laws from the 2nd century BCE made provisions against the fattening and consumption of fowl. The Lex Fannia, passed under Gaius Fannius Strabo, limited the expenditure of patrician dinner parties during the annual Ludi Megalenses festival. Various facets of the law are described by several Latin authors, but Pliny is the only one who records the tenet that people could not serve more than one chicken at a dinner, and it must not have been fattened. He also states that this same provision was adopted by the sumptuary laws which came in the decades after the Lex Fannia.[991] This scenario represents chicken, especially when it is fattened, as a luxury food which formed part of an elite dinner display. It is not clear how much this same value would have applied to chickens outside of the city of Rome, and particularly when they were not fattened.[992]

The Musarna chickens and to a lesser extent the few chicken bones from Populonia suggest the beginning of a shift in chicken consumption to form a larger proportion of the meat diet.

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[989] For sites in Iron Age or Roman Italy, I have found chicken bones reported at Sant'Omobono (Ioppolo 1972), Bolsena (Tagliacozzo 1995), Monteporziano (De Grossi Mazzorin 1987), Tarquinia (Bedini 1997), Volterra (Sorrentino 2003), Pievina (MacKinnon 2009), and Casa Nuove (MacKinnon Forthcoming).

[990] Chickens have a 21 day incubation period. Columella, writing in the 1st century CE, gives very specific advice about the placement of chicken coops in a yard. They should face east and be close to the kitchen, since smoke is beneficial for fowl. Columella book 8, 3.

[991] *ne quid volucrum poneretur praeter unam gallinam quae non esset altilis* (Pliny, *NH* 10.71). Despite the uniqueness of Pliny's chicken statement, this limitation falls well within the tenets of the law outlined by Aulus Gellius and Macrobius. For the symbolic value of the Lex Fannia, see Rosivach 2006.

[992] Eugenia Salza Prina Ricotti (1987, 97) suggests that in the Roman Republic, Romans were against eating chicken, raising them only for eggs. This seems counter to both the literary and the zooarchaeological evidence presented here.

7.5.3. Fish for dinner

Though only five fish bones were recovered from saggio IX, the large quantity of mollusk shells (n=42), and the already known tuna industry suggests the importance of seafood procurement and consumption at Populonia.[993] This makes sense given Populonia's coastal location. Saltwater seafood was a close and easy resource for the inhabitants of the town. In the 3rd century BCE assemblage of fauna from area sacra of the acropolis, 66 out of 168 MNI of animals were sea creatures, 59 of which were mollusks, and 6 small fish.[994] A large marine mosaic installed in the building complex on the platform of the "Logge" on Populonia's acropolis further suggests the local importance of fish. Dated to the end of the 2nd or beginning of the 1st century BCE, the mosaic depicts more than a dozen different species of sea creatures in great anatomical detail (Figure 165).[995]

By the first century CE, Strabo noted that Populonia was an important source of tuna.[996] The late Roman and medieval layers in saggio IV at Populonia reveal thousands of fish bones of at least 31 different species as well as several amphorae full of the remains of 60 tuna fish, probably as *salsamenta*, salted or pickled fish.[997]

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[993] De Grossi Mazzorin 2006.
[994] De Grossi Mazzorin 1985, 152 and table 1.
[995] The similarities which this mosaic bears to examples in Pompeii and Palestrina led Paul Meyboom to attribute it to Alexandrian precedents. (Meyboom 1977). This interpretation has generally been accepted (Shepherd 1999, 126–128; Mascione 2005, 136).
[996] Strabo V.2.6.
[997] De Grossi Mazzorin 2006, 263–264; Battafarano and De Grossi Mazzorin 2008, Table 1.

Figure 165. The marine mosaic from the "Logge" of Populonia, now in the Museo Archeologico del Territorio di Populonia, in Piombino (Semplici 2008, 116)

The importance of fish in the diet of the Romans in the form of fish sauces, whether *garum, allec,* or *liquamen*, has been popularly emphasized and studied from the perspective of experimental archaeology.[998] The variable status of fish as a luxury or base item has already been alluded to.[999] Textual sources from the Republican period tend to portray fish as a luxury item, provided that it is sourced from a certain place and prepared in a certain way, as we saw in the writings of Ennius and Lucilius in chapter 2. Indeed even Varro, who is more descriptive than prescriptive, has one of the characters in his *de Re Rustica* explain how much better fish raised in saltwater were compared to fish raised in freshwater.[1000]

When we recall the ceramic evidence from Populonia and also recognize the potential for a significant degree of seafood consumption, it is interesting to consider the famous traditional fish stew of Livorno, cacciucco. Livorno is 79 kilometers north along the

[998] Curtis 1979; Curtis 1991; Grainger 2006.
[999] See Chapter 2.
[1000] Varro, *de Re Rustica*, 3.3.9-10.

Tyrrhenian coast from Populonia.[1001] Cacciucco is a stew of heterogeneous fish, crustaceans, and shellfish. Depending on the cookbook, it can include potentially eel, dogfish, rockfish, mullet, goby fish, bottom-dwellers, angler, croaker, octopus, squid, shrimp, and crab, as well as mussels, clams, and oysters (Figure 166).[1002] The stew is traditionally served on crusted bread. Some current chefs in Livorno claim that cacciucco has "Etruscan origins" and was invented by fishermen to make use of the smaller less profitable fish they caught.[1003] One proud hometown chronicler, Gastone Razzaguta, dates the invention of *cacciucco* in Livorno between the time when its mythical founder, Hercules Labrone, finished carving the topography of the town and when Jesus' apostle, Peter, preached to the townsfolk.[1004] Though there was a port at Livorno in Cicero's day, the town itself was not founded and fortified until the 11th century.[1005] Another version of the stew's origin explains how a medieval statute from the city of Pisa banned the use of oil for frying food for the tower guards at Livorno. As a solution to this, the guards developed cacciucco as a way to make fish flavorful and still be able to use their oil without frying.[1006]

Figure 166. Cacciucco from Livorno in the 21st century CE (*www.cacciucco.com* home page image)

[1001] This is 79 km driving on the highway which is likely farther than the distance by sea due to the curvature of the coastline.
[1002] This list is according to Nencioli 1964, 22; Parenti 1986a, 84; Riley 2007, 84; however, www.cacciucco.com says that mullet and shrimp are not appropriate for cacciucco.
[1003] Grant 2008, 260.
[1004] Razzaguta 1958, 17.
[1005] Cicero, *ad Quintum Fratrem.* II, 6.
[1006] The re-telling of this tale is somewhat convoluted in Parenti 1986b, 226.

The close connection which Razzaguta makes between Livorno and fish stew, however mythical, reflects a very real local seriousness about this cuisine.[1007] Every town on the Tyrrhenian coast has its own special recipe for the stew which is likely part of the reason for the confusion of which fish or spices exactly belong in cacciucco; however, Livorno claims ownership of the name and the archetypal version.[1008] One source on Tuscan cooking, unattested elsewhere, describes cacciucco is served in a "*grossa scodella di coccio, gialla con disegni marroni di antica origine, che i pescatori usano esclusivamente per questa pietanza regale*" "in a large bowl, yellow with brown designs of ancient origin, which fishermen use exclusively for this regal meal."[1009] Such yellow with brown painted designs suggest a style of pottery decoration from the medieval period; however, the apparent association between a vessel type and the stew suggests the recipe's distinct status. It seems likely that fish stew, with pieces and types of fish of varying size and texture was consumed at Populonia. This may explain the preponderance of black gloss bowls at the site.

The faunal remains from Musarna and Populonia provide a focused examination of shifting consumption patterns in the Republican period. Furthermore, the three meat preferences highlighted above reveal the intersection between environmental determinism and taste – two factors of foodways which are difficult to disentangle. The results presented here demonstrate that regional factors played an important role in cooking practices in this period.

[1007] See Razzaguta's other book on Livorno's history and culture entitled *Cacciucchesca* (1951) as well as the several websites attesting to the stew's importance as Livorno's product: www.cacciucco.com and the Associazione Cacciucco Livorno's www.cacciucco.org.
[1008] Nencioli 1964, 21; Riley 2007, 84. The origin of the name suggests a Turkish connection, since *küçük* means tiny in Turkish.
[1009] Parenti 1986a, 87.

Chapter 8 - *Conclusions*

The stated aim of this dissertation has been use the study of foodways in Republican Italy as a lens into the changing and developing identities of the period. This chapter serves to synthesize the data presented in the preceding three chapters and bring them into dialogue with my broader research questions. I separately consider Musarna and Populonia since their materials present clear differences which need to be addressed. For each site I will synthesize the whole assemblage of ceramics together with the faunal and limited botanical data to generate a holistic and coherent view of foodways. This synthesis proceeds chronologically combining the nine original periods used in my analysis into broader time spans. I then consider the broader context of the towns in order to draw a comparison between the foodways and non-foodways evidence. Finally, I explore the ways in which these two case studies contribute to scholarly perspectives of "Romanization" on the Italian peninsula and in the Roman world.

Before plunging back in to the archaeological materials, it is prudent to first frame the discussion by re-visiting the concepts of culture, food, and daily behavior covered in chapters 1, 2, and 3. Tamar Hodos defines culture's links with practice, explaining:

> "Culture encompasses the social production and reproduction of meaning. It represents a coherent system of values, norms, and habits that, through repetition, engender a sense of unified belonging, individually and collectively, over time. Paradoxically, within its own system, culture serves as its own agent for change while maintaining its continuity and perpetuity."
>
> – "Local and Global Perspectives in the Study of Social and Cultural Identities" (2010)[1010]

Without intending to be, this quotation sounds similar to an idea expressed in Mary Douglas' groundbreaking discussion of eating and dining in America:

> "The meaning of a meal is found in a system of repeated analogies. Each meal carries something of the meaning of the other meals; each meal is a

[1010] Hodos 2010, 3.

structured social event which structures others in its own image."
– "Deciphering a Meal" (1972)[1011]

Both scholars emphasize the importance of habit and repetition in the creation of meaning. Foodways reverberate; repetitive actions comprise and reinforce the identities individuals hold. Foodways begin in the domestic realm and reflect daily activities and habitual behaviors. The remains of every day commensal activities, as well as large public feasts, hold important social meanings.[1012] In the ancient Italian context, the meal is somewhere in between the large scale public feast and the daily repast: there were occasions for eating among only the members of the household and there were occasions for hosting a guest or being a guest. These were opportunities not only for physical nourishment, but for creating and maintaining social bonds within a household, exercising patron-client relationships, and discussing political matters which had consequences in the public sphere.[1013]

In chapter 2, the examination of foodways in Latin literary sources from the Republican period brought the links between food and identity in Italy to the fore. We saw how in this period Latin literature was emerging and playing a key role in crafting Roman ideals – a national literature articulating the behaviors and knowledge base of "real" Romans. Some of this writing was based on Greek precedents – fishy poems and comedic plots; however, new geographies, new jokes, and new genres created distance from these Greek models and made Roman literature its own. This literary collection of culinary ideals serves as backdrop for the material remains which are the focus of this project. Clearly in many places in early Roman literature, as it was written by Italian immigrants, food served as something to be judged and critiqued as a marker of status, culture, and knowledge.

8.1. Musarna

[1011] Douglas 1972, 69.
[1012] Donahue 2003; Day and Wilson 2004, 45.
[1013] D'Arms 1984; D'Arms 1990. I refrain from calling the domestic realm the "private realm" because the public/private distinction does not hold clearly in the ancient Roman context (a problem also expressed by D'Arms 1990, 308). If the "Roman's house was his forum" (Hales 2003, 1) commensal activities could be the parade: the opportunity to express and promote oneself under the eye of both superiors and inferiors.

Middle 3rd century – Middle 2nd century

The ceramics and faunal remains recovered at Musarna underwent several changes over the Republican period. In the 3rd century BCE and into the early 2nd century, pentole, ollae, and jugs made of *ceramica comune da fuoco* were produced in a relatively limited range of sizes. They showed relatively consistent patterns of blackening and abrasion which suggest standard methods of cooking and use. Ollae, the most clearly-discernible form, seem to have sat directly in charcoal on a flat stove and were frequently lidded. Abrasion patterns on their interior also suggest that larger ollae were more frequently stirred than smaller vessels in the sample. This suggests that foods prepared in larger quantity required more frequent stirring or access. This might be attributed to a grain staple, like *puls*, made of emmer wheat, which was a prevalent central Italian grain in this period. Also in the 3rd century, internal red slip ware tegami seem to have been used in two different sizes; both elevated over the fuel source on some form of cooking stand. They would have been used for frying or sautéing meats or vegetables. The meats of this period consumed at Musarna were dominated by primary cuts of beef, followed by head fragments of ovicaprid and pig. While these may not have been affordable to everyone in town, the fact that all cuts of these animals are present in the deposits may suggest that different statuses of people had access to some portion of the animal. Cuts of meat which were less-desirable to eat roasted or sautéed would have been appropriate for stews, and boiling for long periods of time.

Pentole, ollae, and bowls of common ware were relatively prevalent in the 3rd century to early 2nd century. The open forms were likely used for food preparation; the mortaria, with their worn interiors, were likely used to crush plants to prepare spices, tenderize meat, and wash legumes and vegetables. Ollae, as closed forms, were used for food storage. Stored foods would have included grains and legumes and perhaps also fruits like grape and hazelnuts. In serving vessels, black gloss bowls in a limited range of sizes were most common in this period. They tended to have vertical to incurved rims, resulting in a lot of restriction to their opening, becoming nearly closed-form. By the beginning of the 2nd century, bowls had increased in diameter as well as having a more open rim angle compared to their 3rd century counterparts. Bowls were supplemented by a few plates of typically slightly larger diameter. Bowls at Musarna show a prevalence of stirring and

scooping marks on their interior, confirming what their form suggests: that they contained liquid foodstuffs. This may have included grain-based liquids like porridge or specifically *puls*, or meat or vegetable-centric stews.

Middle 2nd century – Middle 1st century

By the middle of the 2nd century, the pentole and ollae made of *ceramica comune da fuoco* increased in overall size as well as in variety of sizes when compared with earlier periods. Ollae especially show a progressive increase in average diameter in each period following Period 2 (300 BCE-200 BCE). Despite the changing size, these vessels continued to show standard traces of alteration similar to the vessels in the previous periods. Proportionally fewer of these ollae have blackening, suggesting that they may not have all come into contact with fire. Simultaneously, another deep open-formed vessel, a pentola in internal red slip ware, also appears in this assemblage. Its exterior base tends not to have blackening, suggesting it too sat within a cooking fire or charcoal. Internal red slip tegami also remain prevalent after the middle of the 2nd century. They are consistent over time both in having two relatively distinct size groups and in showing strong evidence of being elevated over a fire, most likely for frying or sautéing flat foodstuffs.

By this time, pork had increased substantially as a proportion of total meat consumed, though still forming only 40% of the estimated meat weight among beef, pork, ovicaprid, and chicken. These pigs were eaten when they were less than two years of age and head fragments dominate, followed by primary cuts. The pork consumed was therefore quite high in quality. Chicken also appears in the faunal record in this period. This is reminiscent of trends in Roman Britain which note that pork and chicken tend to increase simultaneously. Chicken may have been incorporated into stews in ollae, pan-fried, or roasted.

Common ware pentole and ollae both decrease dramatically in number after the middle of the 2nd century and into the first century BCE (Period 8). Given the greater variety of ollae of *ceramica da fuoco* and their less frequent blackening in Period 8, it is possible that some of the tasks previously accomplished by common ware vessels were now being done with *ceramica da fuoco* vessels of the same form. Such an occurrence is important to recognize, since ceramicists often group classes of ceramics as if ancient users

understood their differences as we do (whether based on color or fabric) and as if their function could not have been carried out by several different vessels with similar physical characteristics. As in the previous decades, these storage vessels would have stored dry goods like grain and legumes, and perhaps pickled and preserved items like fruits.

With regard to serving vessels, bowls had already increased in size by the beginning of the 2nd century and stayed consistent in size through to the middle of the 1st century. A major difference in the serving vessel assemblage is the increased prevalence of plates beginning in the middle of the 2nd century. Eating more often from plates may suggest a change in the type of food being consumed. Recall Jordi Principal's suggestion that black gloss plates in Iberia probably meant a prevalence of "solid" or drier foods like strips of meat or vegetables, rather than stews. It is the case that a subset of the cooking ware assemblage at Musarna in this period enables the preparation of "solid" foods – internal red slip tegami are ideal for this purpose. Nevertheless, when we recall that *ceramica da fuoco* ollae have actually increased in size overall by this period, the preference for "solid" or "dry" foods is not, in fact, evident. If the quantity of "dry" food that Musarnans are making in tegami remains constant, but potentially larger volumes of stewed or boiled foods are being prepared, it is not clear what reasons there were for plates to take over the black gloss assemblage. If more and larger ollae reflect more stewed and boiled food, we would expect there to be an increase in bowls at Musarna in which to serve this food. Therefore, there is not a clear correspondence between the cooking vessels and the serving or table vessels in this instance.

An alternative possibility for the prevalence of plates which was raised in chapter 6 is an interest in displaying food and also sharing it among multiple diners. The plates at Musarna are on average significantly larger than bowls, and have a maximum diameter (multiple examples at 40 cm) which is much larger than bowls (largest example at 30 cm). Perhaps stewed and "solid" foods were distributed on these platters and plates as a mechanism of display or in order to pair "solid" foods with associated sauces and stews for dipping and combining. By analogy, we can imagine a platter in an Ethiopian restaurant with discrete piles of different types of stews and dips all to be sampled collectively. This is

in contrast to bowls in Asian cuisine where a heterogeneous mixture of foods is piled on top of each other.[1014] While both of these contemporary examples have many features which were not present in ancient Italy (e.g. *injera*, the spongy Ethiopian dipping bread, and chop-sticks), their differing emphasis on presentation and communal eating is the same as might plausibly be imagined for Musarnan vessels.

Foodways in their local context

The stability in cooking methods, but shift in cooking and serving vessels by the middle of the 2nd century BCE at Musarna return us to an idea touched upon in chapter 5: that of hosting. Larger amounts of food being cooked for larger groups of individuals suggest a change in social structure or social practice. An emphasis on communal serving of well-displayed foods suggests an interest in presentation. *Hospitium* was a bond between two elite men from different communities who pledged to provide hospitality to each other. *Hospitium* is just one example of the opportunities for social interaction between Italians and Romans and among Italians themselves before the Social War.[1015] Elite banqueting seems to have been an important social practice in central Italy long before the Roman period;[1016] however, the connection of an Etruscan elite to a new political power, the increase in urbanism, and the likely increase in wealth and resources, meant that there were more people with whom to negotiate – a more dense and complex network of contacts with whom to maintain good relations. An increase in hosting activity need not have affected only the elite. The emergence of a commercial class, people who were well-off but who still needed to work for their living, carved a new place in the social hierarchy.[1017] This is reminiscent of Martial's 1st century CE epigram of playing client to a man who is client to someone else:

[1014] For example, bibimbap from Korea, pad thai from Thailand.
[1015] Patterson 2006, 140–147; Patterson 2012, 218–224.
[1016] Small 1994; Zaccaria Ruggiu 2003.
[1017] Mayer 2012. Recall too that the first votive inscriptions from independent men and women not stating their affiliations or ancestral history appear in the late 3rd century to 2nd century and the first freedman votive inscriptions begin in the second half of the 3rd century in Rome (Panciera 1989, 911–912). Such epigraphic examples indicate increased disposable income and an increased interest among these classes in participating in community activities.

> *Capto tuam, pudet heu, sed capto, Maxime, cenam, tu captas aliam: iam sumus ergo pares, mane salutatum venio, tu diceris isse ante salutatum: iam sumus ergo pares, sum comes ipse tuus tumidique anteambulo regis, tu comes alterius: iam sumus ergo pares. esse sat est servum, iam nolo vicarius esse. qui rex est, regem, Maxime, non habeat.*[1018]
>
> I fish for your invitation to dinner, I am ashamed, Maximus, yet I fish for it. You fish for another man's invitation; so now we are a pair. In the morning I attend your *salutatio*. You, they tell me, have gone before to another to give your salutations; so now we are a pair. In person I am your attendant, and the follower of a haughty lord. You are the attendant of another; so now we are a pair. To be a slave is enough: I no longer wish to be a slave's slave. He who is a lord, Maximus, should not have his own lord.

Martial's complaint about being "a slave's slave" reveals that at least by Martial's time in Rome society was not divided into "elite" and "poor" anymore, but that there was a multi-level hierarchy of aristocrats, bourgeoisie, merchants, traders, and upstarts, all aspiring to participate in a world of patrons and clients.

The change in vessel forms, then, may reveal a change in social environment which precipitated a transformation of food consumption behaviors. The gradual changes in the faunal record are also potentially attributable to local environmental factors – in this case with regards to shifting land usage and increasing urban living.

Given the conclusions garnered from the foodways data, it is useful to return to the other, non-food, evidence in the town to consider more fully the implications of these interpretations. The on-going study and publication of the site yields several insights from the public sphere. Excavations have revealed that the 2nd century BCE saw a phase of amplified construction activity – with the monumentalization of the so-called "market" area and the first phases of the construction of the tetra-style *domus*. In the middle of the century, a bath house was also constructed in the place of a small temple of the 3rd century BCE.[1019] The bath house was a three-roomed structure (*apodyterium, laconicum, caldarium*) and bore a unique inscription in the floor of its *caldarium*. It names two Etruscan men, Luvce Hulchnies, son of Alve and Vel Alethnas, son of Alve, who were acting as private

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[1018] Martial, *Epigrammata* 2.18.

[1019] The closure of this temple may have been a result of the *senatus consultum* regarding the ending of Bacchic rites (Broise and Jolivet 2004, 329).

donors, *euergetes*, or as public officials organizing the construction of the building. Members of the Alethna family are attested 26 times on sarcophagi and cippi from Musarna and Tarquinia; it was clearly a family of influence in the area.[1020] Henri Boise and Vincent Jolivet draw a contrast between the presence of an Etruscan inscription and the bath building's design, which demonstrates a "hellenized koine" of bathing architecture and the beginning of "Roman-style" bathing with heated pools. Multi-room "Roman-style" bathing seems to have developed at least as early as the 3rd century BCE throughout the western Mediterranean.[1021] This bathing *koine* at Musarna suggests that the locals were part of a larger network of "Hellenistic" behaviors, evidence of the increased ties between towns in the Mediterranean by at least the middle of the 2nd century BCE. Yet, the inscription naming elite Etruscans may echo what Broise and Jolivet see as a potential "Etruscan revival" – a streak of conservatism or ancestral pride – in the middle of the 2nd century in the region of Tarquinia and Musarna.[1022] The baths, then, are a public display of the tension between traditional Etruscan identity and Mediterranean behaviors resulting from Rome's increasingly-wide political network.[1023]

Musarna experienced simultaneous changes in multiple spheres. The materials from the cisterns examined in this dissertation are only a subset of the data in the town, yet the significant trends in their changes reveal a shift in commensal behaviors. This shift perhaps reflects similar impulses and tensions as those suggested by the bath house: the participation of individuals in a vaster, more complex and inter-connected world.

8.2. Populonia

[1020] There are also a few attestations of the name at Clusium, Perusia, and Volsini (see Rix 1991, vol.1, pages 65–66). In one instance from Musarna, an individual from the Alethna family is called a *zilx,* an Etruscan magistrate of some kind (In Rix 1991 AT 1.121, CIE 5832).

[1021] The earliest evidence for multi-room bathing with heated pools is found in Sicily. Trümper 2009; Trümper 2010, 542, 548–549.

[1022] Broise and Jolivet 2004, 334–336; Bouet 2003, 350.

[1023] The attribution of a stronger Mediterranean network resulting from Rome's political and military exercises of the 3rd and 2nd centuries BCE appears to reflect a form of ancient "globalization." While this is an anachronistic term given that it refers to the "globe" and suggests concepts of modern nation-states and mass-media, the "globalization" model can be useful for the Roman Mediterranean in thinking about shrinking distances and dissolving political barriers. For the criticism of this model and an argument for its applications, see Witcher 2000, especially the definitions on page 215.

The ceramics and faunal remains from Populonia show changes over the Republican period, but in a very different way from Musarna. The periods under study and the degree of temporal resolution possible at Populonia is quite different than for Musarna. We have very little resolution from the first half of the 2nd century BCE (since Period 5 captures the whole century: 200-100 BCE) and the periods with the most material recovered are Period 7 (150-50) and Period 9 (100-1). This gives a different tenor to the data, since at Musarna we see the majority of our changes happening in the middle of the 2nd century, but at Populonia, the grouping of the stratigraphy obliges considering this entire century as a whole, and we may be missing mid-century changes which then blur with changes in the material from the early 2nd century or late 2nd century. Unfortunately, lacunae and uncertainty such as this are the nature of archaeology and are unavoidable in this instance. One major benefit of the deposits from Populonia arises in how well-represented Period 9 is, unlike at Musarna. The material from Populonia seems to extend late into the 1st century BCE.

Early 2nd – Late 2nd century

If we sift through the foodways evidence at Populonia by period, we see that in the early 2nd century BCE, ollae, tegami, and jugs made of *ceramica da fuoco* and tegami of internal red slip ware appear in a range of sizes in small numbers. Their use is relatively standard with ollae likely set in charcoal and all the tegami elevated above a cooking fire. We have only one example of an olla of common ware from this period, giving little sense of the overall picture of storage vessels. Black gloss in this period appears mainly as bowls which have relatively vertical or incurved rims.

Middle 2nd century – Beginning of 1st century

By the middle of the 2nd century BCE, the dramatic increase in fragments demonstrates that pentole, ollae, and tegami were all widely used and available in a relatively broad range of sizes. Pentole appear in this period and show significant evidence for abrasion on their interior rims correlated with their size. This may be for similar reasons as those we considered for ollae at Musarna. Foodstuffs cooked in larger vessels, and therefore likely larger quantity, seem to have called for more frequent or more

vigorous stirring which left visible scratches. It is certainly possible that a porridge which required stirring was cooked in pentole at Populonia. The rims of ollae have become 20˚ more vertical than in the previous period; however, this probably did not alter their usability a great deal. Internal red slip tegami seem to be distributed into two size groups similarly to those at Musarna. They show consistent evidence for cooking elevated over a fire. They were likely used for sautéing or frying meat or vegetables.

Common wares in this period appear as bowls in a variety of sizes including large basin or mortaria. Similarly, ollae in common ware were also used likely as storage vessels for dry goods, like fava beans, or perhaps for preserves. Black gloss ware by the middle of the 2nd century is still dominated by bowls. Interior abrasion on these bowls shows a high proportion of radial abrasion which may be evidence of eating something other than "semi-solid" foods from them. When we look at the few black gloss plates from Populonia, the evidence of abrasion patterns is also not clear. Plates have a large amount of concentric abrasion and linear abrasion patterns do not dominate like they do on plates from Musarna. The faunal data from this period at Populonia is rich and suggests a varied diet consisting mostly of beef, followed by pork, and ovicaprid, and supplemented by chicken and game animals. Prime cuts of all three mammalian domesticates are common – especially for sheep-goats. It is difficult to gain an accurate picture of the consumption of fish on site because of the difficulties inherent in the preservation and recovery of fish bones; however, the large number of shells suggests that substantial efforts were being made to acquire seafood.

1st century

By the beginning of the 1st century BCE there are few changes in form. *Ceramica da fuoco* ollae, pentole, and tegami are similar in form and size to the previous periods. They show the same patterns of blackening and abrasion. It is also worth noting the change in opacity levels on the interior of ollae from the previous periods. The darkening of blackening may suggest more frequent or long-term use or poorer cooking skill since interior blackening results from charring of foodstuffs. Common ware vessels are still poorly-represented in number and therefore difficult to consider properly. In serving and table vessels, bowls continue to dominate the black gloss assemblage to a statistically

significant degree. Though the same muddled abrasion results exist here, the persistence of bowls as a form strongly suggests the common consumption of semi-solid foods, rather than "drier" foods. When we consider how the black gloss assemblage had changed by this time at Musarna, the consistency of the assemblage at Populonia is notable. The potential for fish soup, which I explained in chapter 7, is an attractive explanation. The fish evidence at Populonia remains elusive; however, the presence of a fish soup tradition on the Tyrrhenian coast is suggestive of fish's local importance.[1024] One might even imagine that the varied abrasion patterns on bowls from Populonia betray evidence of shell fish consumption: scraping shells along the bottom of a bowl, pinching the meat out of its shell with a utensil.

Finally, the domestic faunal remains suggest a relatively static and possibly diminishing proportion of pork within the meat part of the diet at Populonia in the 1st century BCE, depending upon interpretation of the faunal quantification data. Conversely, beef numbers increase, but the remains favor tertiary cuts suggesting either that the data has been skewed by a lot of hide-production debris or that lower-quality meat cuts were being used. This may imply the preparation of broth for soup or as a stock flavoring for porridge or stew dishes.

Foodways in their local context

Ceramic and faunal evidence from Populonia gives several clear indications of what and how people in the town were eating but does not suggest that there was a major change in these habits through the 2nd or 1st centuries BCE. While the relative proportions of faunal remains shift slightly reflecting changing preferences or changing access to certain animals, the consistency of the cooking amounts and eating behaviors is striking when compared with the dramatic changes we see in Musarna. The historical context of Populonia can aid in the fuller understanding of the implications of this consistency.

[1024] Traditions of fish soup are of course not limited to the Tyrrhenian Sea. *Brodetto* is fish soup in the northern Adriatic region just as *bouillabaisse* is from the southern coast of France. *Cioppino* is an Italian-American version of Italian fish soups. *Cacciucco* currently has the most emphatic claims of tradition and antiquity. This, however, may simply be a result of good publicity by the likes of Gastone Razzaguta: "*Cacciucchesca. Perchè sì strano titolo? Perchè sono Livornese*." (Razzaguta 1951, 13)

There is a tendency in the prolific publications of the city to refer to features at Populonia as coming from the period of "*romanizzazione*" which is an alternative term for the 3rd and 2nd centuries BCE, with little explication of what "Romanization" looks like or implies at the site. The decoration of the "Logge" complex includes first style wall paintings and a detailed marine mosaic which have both been compared to other sites in Italy of the 2nd century and 1st centuries BCE. The similarities of this decoration to houses in Pompeii and Delos and to architecture in central Italy has led to the suggestion that specialized craftspeople from the eastern Mediterranean travelled to Populonia to produce this work.[1025] Populonia seems to have been linked into a network of Italian, and indeed Mediterranean-wide, style.

Another possible indication of the inhabitants of Populonia's cultural loyalties can be found in epigraphic evidence. Following Populonia's entrée into the Roman political sphere some time in the 3rd century BCE, a mix of Latin and Etruscan inscriptions were used on site.[1026] Graffiti on black gloss vessels from the Hellenistic tombs at San Cerbone attest to the use of Etruscan script by funeral participants in the 2nd century BCE.[1027] The most recently discovered example of Etruscan in a more permanent and public context is a dedicatory inscription to a female goddess. Written in well-carved Etruscan letters, seven lines of it are preserved on a triangular slab of marble and preliminary examinations suggest that it dates to the late 2nd century BCE.[1028] The marble fragment was built into the back of temple C on the acropolis during its renovation in the later Roman period. The presence of a high-quality Etruscan inscription on fine stone demonstrates a continued public appreciation for some aspect of Etruscan identity; however, detailed study of the inscription is needed to better understand both its dedicant and the context of the dedication.[1029]

[1025] Cinzia Mascione suggests that these craftspeople were "mediated through" Rome and thus, this serves as an example of "Romanization" (Mascione 2005, 137–138). Rome's intervention here is not convincing.
[1026] CIL 11^1, 2605-2615, and CIL 11^2, 7245-7248. There are several graffiti on black gloss vessels suggesting a presence of individuals of Greek origins, see Manacorda 2006 and Maggiani 1992, fig. 16.
[1027] Maggiani 1992, 179–188.
[1028] Gualandi and Manacorda 2011.
[1029] Enrico Benelli is planning on publishing the inscription in *Studi Etruschi: Rivista di Epigrafia Etrusca* (personal communication, Enrico Benelli, 11 June 2012).

The apparent consistency in Populonians' food behaviors may reflect the status of the city. It had a long and rich local history demonstrated to its inhabitants daily by necropoleis all over its surrounding landscape;[1030] it had had centuries of commercial trade because of its iron resources, and it was well-connected to a plentiful local source of food (the sea) regardless of its residents' ability to maintain farm pastures or attract shepherds to market. The lack of real change in foodways at the site may reflect a lack of need to alter domestic behaviors in order to participate in the Roman cultural sphere, or indeed, a resistance to such forms of participation.

8.3. Foodways on the "Romanization" of Italy

The contribution of foodways to the study of Republican Italy becomes more apparent when we observe that the archaeological examination of identity formation and expression in this period has, until this study, largely been limited to the public realm: the examination of civic space, town planning, landscape, architecture, and epigraphy.[1031] This skew towards public representations of identity may reflect a general bias in archaeology as a discipline. Public processes, and therefore predominantly elite men's processes, have been credited with affecting and reflecting culture and social change. The domestic realm (especially the more mundane aspects of it, like kitchen activity) was a domain run by women and slaves, and has been undervalued in its potential to reveal larger societal characteristics.[1032] Yet, the evidence for changing food behaviors that I have described above suggests that this type of information can serve to support and to add nuance to conclusions drawn from the public sphere.

My foodways-based analysis support the view that change in Roman Italy was heterogeneous and regionally specific. Local histories and needs of different settlements

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[1030] The Iron Age tumuli tombs at Podere San Cerbone and along the Via del Ferro were probably covered by slag by the 4th century BCE in time for tombs from the 3rd century to be buried on top. Some of the earlier tombs have evidence for looting in antiquity, suggesting their presence was remembered. The "house" tombs at Podere del Casone were in use in the 3rd century, and up the hill the chamber tombs of the Grotte necropolis, at Piano delle Granate, and Buche delle Fate were in use into the 2nd and 1st centuries BCE (Romualdi 1992, 11, 199–200; Semplici 2008, 83, 90–91).

[1031] We might call these "idealist," "historicist," and "Marxist" datasets. Terrenato 2001b.

[1032] Bray 2003, 5–6; Diane Gifford-Gonzales (1993) makes the case for this gender bias in the study of bone modification by zooarchaeologists.

played an important role in how each reacted to a change of political status with the coming of Rome. Some scholars might use "Romanization" as a catch-all term for such change after Roman conquest; however, it seems more accurate to characterize these changes as a kind of intensification or complexification of Italy.[1033] Rather than understanding the changes that occurred within towns in Italy as derivative of, or based on emulation of behaviors of people in Rome, the changes seem to be attributable to choices made by individuals about whether and how to participate in a larger network, and also to landscape changes and local situations. The differences between Musarna and Populonia illustrate this variability rather than being evidence of one town being more "romanized" than the other. This less rigid, more inclusive perspective allows us to abandon the stale dichotomy of "Romans versus natives" and to understand a more complex and multi-dimensional reality.[1034]

Such a framework can be compatible with traditional scholarly views of Rome's relationship with Italy as seen through the historical record. Emilio Gabba, for example, highlights the transformation of the relationship between Rome and its allies in the 2nd century: The elite of Rome realized that their city was no longer a hegemonic city-state among many cities in central Italy, but a world power in the Mediterranean basin.[1035] Gabba imagines the integration of Italians following their military cooperation in the wars of the 3rd century and the centralization and re-organization of political power in Rome over the course of the 2nd century.[1036] In contrast, other recent scholars have questioned the extent to which the army facilitated integration and personal cooperation between Italians and Romans, since by the early 1st century the Italian allies were mobilizing for war against Rome.[1037] The reality may in fact lay somewhere in between with some groups actively participating in a new Italian peninsula under Rome and some maintaining traditional domestic behaviors.

[1033] In his examination of cultural change in Gaul in the Roman empire, Woolf describes how the entrance of Gauls into the Roman sphere resulted not only in their entrance into a complex society, but the increased "complexification of Roman society itself." Woolf 1997, 345.
[1034] Woolf 1997; Terrenato 2005, 67.
[1035] Gabba 1990, 267. See also the emphasis P.A. Brunt places on the 2nd century (Brunt 1988).
[1036] Gabba 1990, 268–270.
[1037] Pfeilschifter 2007; Patterson 2012; Rosenstein 2012.

The study of foodways through rigorous quantitative methods presented in this dissertation supports the argument for variability at a domestic level among inhabitants of Italy in their reactions to Roman rule. It has allowed us to move indoors from public spaces. We have turned the light on to reveal both some of the realities of daily life, as well as the gradual shift in these behaviors following Roman political dominance.

8.4. Directions for future research

The limitations of this project also suggest some avenues for future research. The problem of intra-site variation has not been tackled in this dataset. The examination of a broader dataset which cuts across more types of deposits and more areas of a single site would help to confirm that changes in ceramic form and alteration truly reflect use rather than sampling bias. More importantly, I have not been able to fully engage with the effects of status as a factor in both food access and in cultural expression.[1038] While I believe that status and culture are intertwined in the Roman context, it would be interesting to examine how foodways might reveal how people of different statuses, occupations, and backgrounds experienced Roman political dominance.

Finally, the extension of this research into the imperial period in Italy would facilitate a discussion about changing foodways with the socio-political structure of Empire and the stronger ties of Italy to the rest of the Mediterranean and beyond. Such a chronological expansion would also welcome the inclusion of visual evidence. In addition to the vibrant wall paintings of the Vesuvian area, mosaics, sarcophagi and other stone reliefs have the potential to contribute details regarding foods consumed, methods of preparation, as well as the varying symbolic meanings of foods. This type of evidence is largely lacking for the middle and late Republic.[1039]

Though this dissertation has concentrated on foodways as a way to examine identity, from a purely methodological perspective this project demonstrates that alteration analysis contributes significantly to the study of the everyday use of Roman pottery. Through the study of fire damage on cooking wares, we can narrow down the

[1038] For a discussion of the entanglement of different types of identities, see Lucy 2005, 100.
[1039] See, for example, the visual evidence brought to bear in Zimmer 1982; Dosi and Schnell 1986; Ministero per i beni culturali e ambientali. 1987; Cianferoni 2005; Grimaldi Bernardi 2005; Stefani 2005.

range of ways different vessel forms were in contact with cooking fuel (and in some cases determine whether this fuel was charcoal or raw wood, or an alternate fuel source). The discussion of utensil marks on black gloss vessels also has the potential to contribute to questions about the cost and prestige value of these goods themselves and as an alternative to metal. Such information cannot be garnered from the study of vessel form alone. These insights suggest that the study of use-alteration should be more consistently applied to other datasets. Refining our understanding of ceramic use would allow future research questions to be framed in terms of domestic technology, and the use-life and circulation of Roman ceramics.

Appendices

Appendix 1 – *Rim diameter and volume*

Vessel rim is used as a proxy for the non-specific concept of "vessel size" or more specifically vessel "volume" in a number of ceramic publications.[1040] In this dissertation, I use rim diameter as a proxy for vessel size after having determined the strong correlation between the two. This was accomplished by calculating the volume using a method I developed which is similar to the "summed cylinder"[1041] and "stacked beveled-walled cylinders"[1042] using conical frustum solids (cones with their tips cut off) to estimate the volume of the main elements of the vessel (Figure 167, Equation 1).

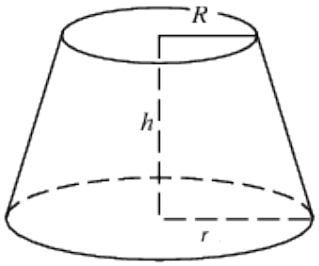

Figure 167. Frustum diagram

$$V = \frac{\pi h}{3}\left(R^2 + Rr + r^2\right)$$

Equation 1. Standard frustum volume equation

Olla volume

Olla volumes were estimated based on the profile drawings of vessels that were either "whole" or were preserved beyond their maximum diameter (Figure 168). From among my ollae I was able to measure the profiles of 30 qualifying vessels. As a first experiment, for each vessel which was not "whole," (not having a wall segment preserved all the way from rim-to-base) I assumed a base radius (the bottom "r_3" in figure 2) as equal

[1040] Wilson and Rodning 2002
[1041] Rice 2005, 221–222.
[1042] Senior and Birnie 1995.

to 60%[1043] of the rim radius (the "R_1" at the top of figure 2). Then, given the curvature of the preserved wall, I estimated the height "h_3" that the lower frustum would have to have, in order for the sidewall reach the base "r_3".

This approach necessarily incorporates some margin of error since I have included assumptions about standardized olla proportions in the calculation.

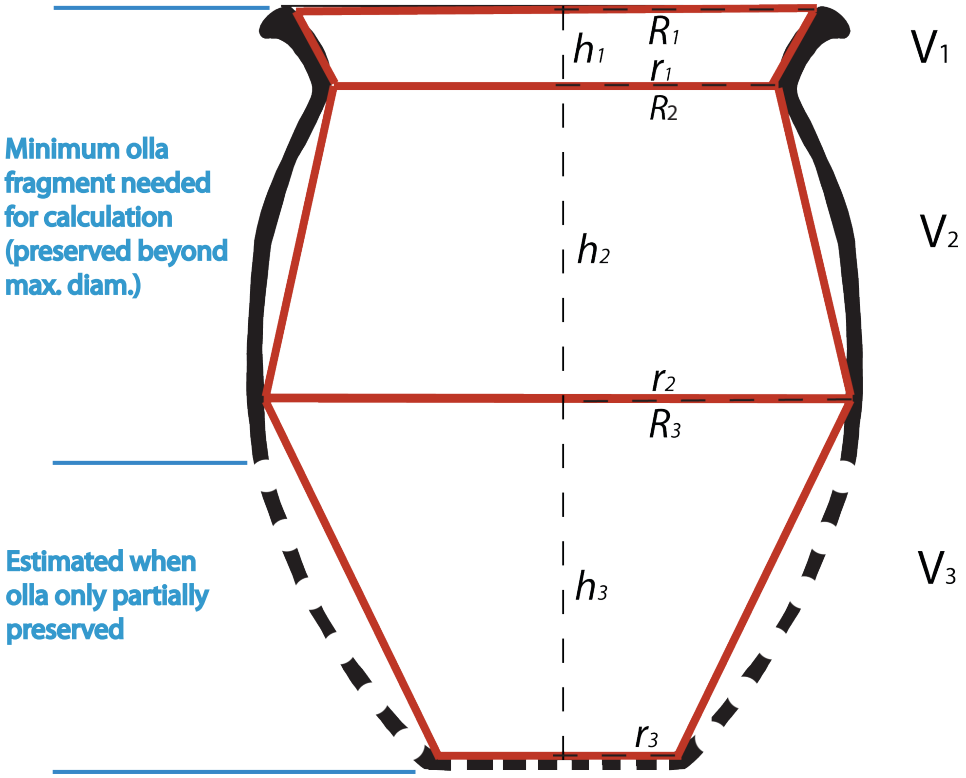

Figure 168. Olla showing the location of three frusta

Equation 2. Equation for the volume of an olla (including present and extrapolated bases)

$$total\ volume = V_1 + V_2 + V_3$$

A Pearson Correlation test to determine the significance of the correlation between measured diameter and calculated volume (using this triple-frustum approach) yields a value of 0.914 ($p<0.01$). A correlation value of 1 would be considered perfect correlation, so this result indicates that the body proportions of ollae are in fact very standardized and hence rim diameter can reliably be used as a proxy for volume.

[1043] This 60% is based on my unsystematic observation of olla proportions.

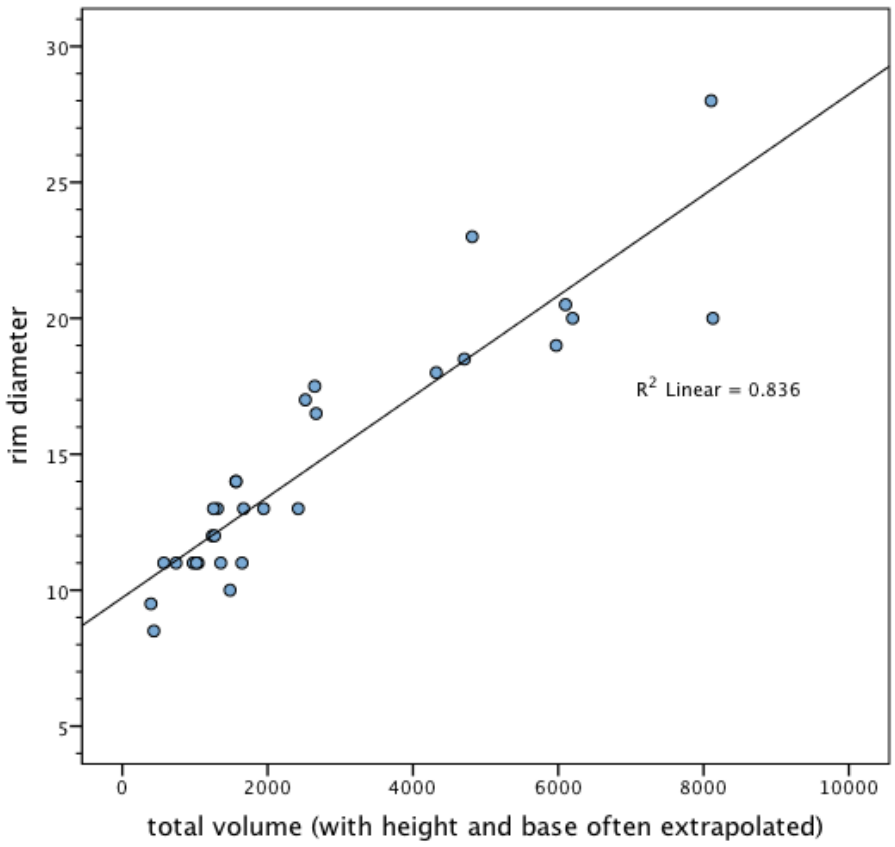

Figure 169. Correlation between rim diameter (cm) and estimated volume (cm^3) with all olla frusta

If we remove the third frustum (V_3) from the calculation in order to avoid the error in my assumption of standardized base size, the correlation between rim diameter and estimated olla volume (Figure 4) is still very high value of 0.898 ($p<0.01$). Moreover, the slope of the line (330.73 cm^3/cm) allows us to understand the ratio of volume to rim diameter as an increase of approximately 331 cm^3 (essentially a third of a liter) per cm of increased rim diameter (for vessels with rim diameters above 10 cm).

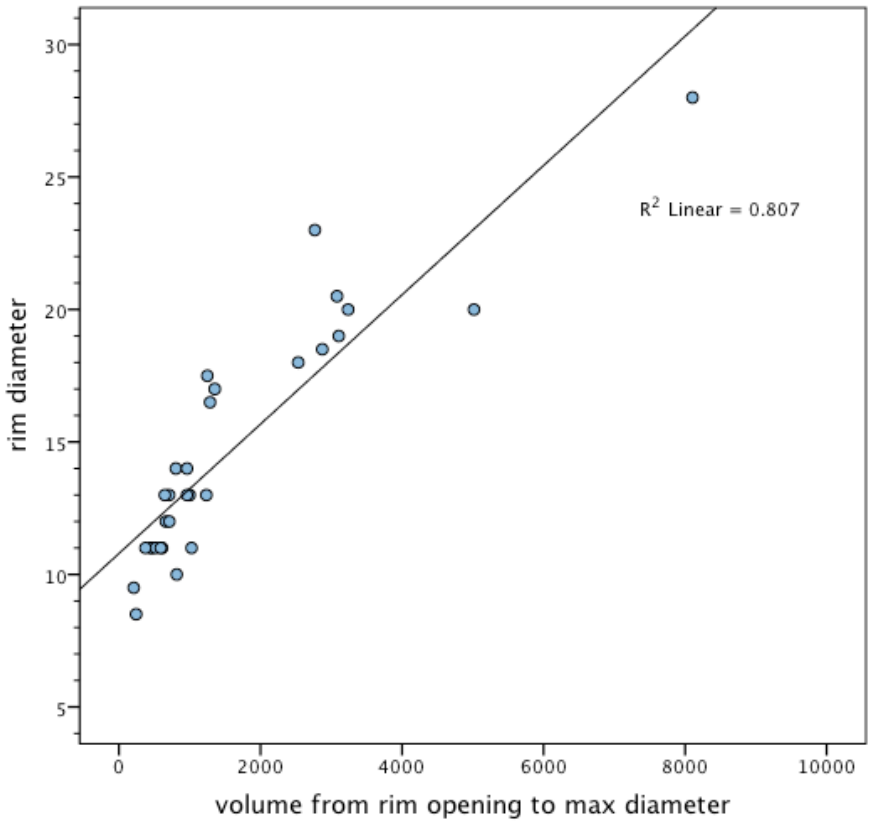

Figure 170. Correlation between rim diameter (cm) and estimated volume (cm^3) with top two frusta (V_1 and V_2)

Tegame volume

I also map a frustum on to a tegame shape in order to estimate its volume and demonstrate the standardization of tegame proportions (Figure 171). The correlation between internal red slip tegame rim diameters and estimated volume using the frustum method is even higher (correlation coefficient of 0.975 ($p<0.01$). Here, however, we have only 6 samples with their whole profile preserved and which are therefore appropriate for this calculation (Figure 172).

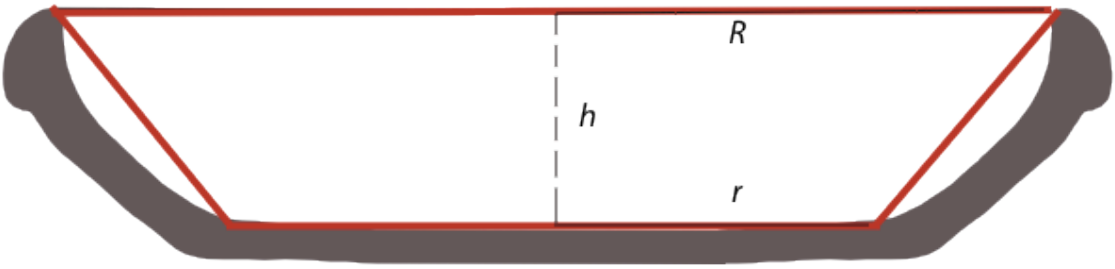

Figure 171. Frustum within a tegame

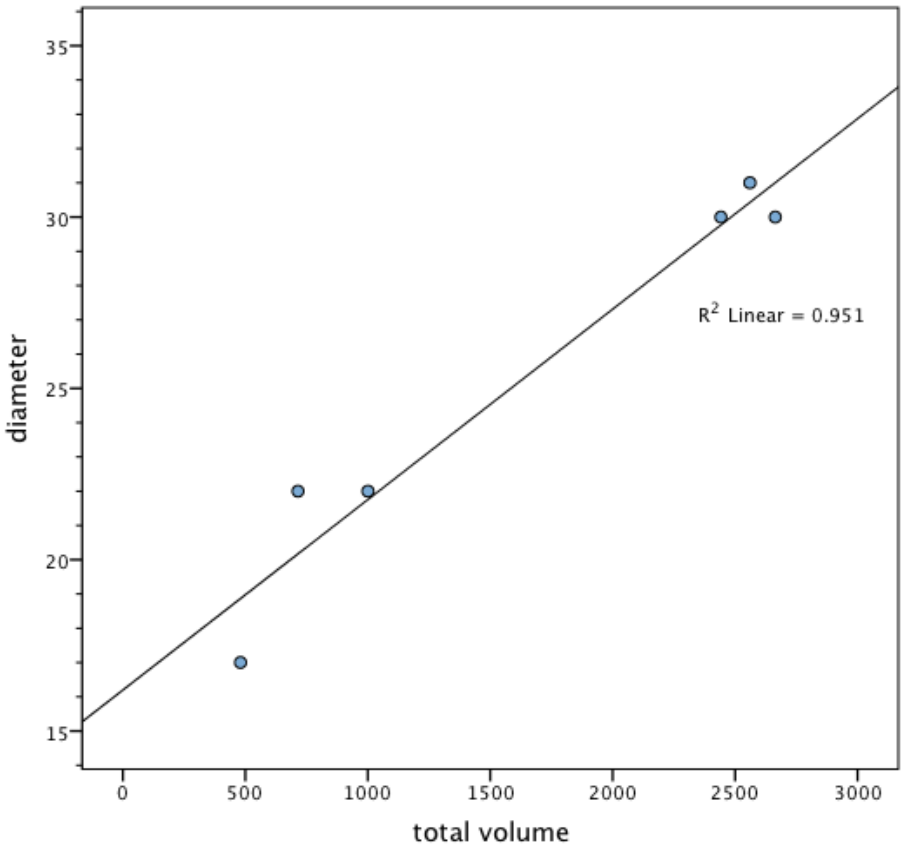

Figure 172. Correlation between rim diameter (cm) and estimated volume (cm^3)

Appendix 2 – *A Note on statistical decisions made in this dissertation*

Tukey alpha or "honestly significant difference" test

I use analysis of variance (ANOVA) to compare average measurements (e.g. diameter, angle) in different periods. I employ a Tukey alpha test to perform pairwise comparisons (that is, each Period compared to every other Period) as part of my ANOVA because it is rigorous enough to have a low risk of either a Type I or Type II Error. Using another popular test like a Fisher's LSD with a Bonferroni Adjustment would mean that I risk both Type I and Type II errors depending on how many sample groups I am comparing. Because I am comparing five sample groups (at Musarna, 5 Periods of time) using a Bonferroni adjustment would mean that if I wanted a 0.05 confidence interval then I would actually need to conduct the test of each pairwise comparison with 0.005 confidence.[1044]

$$q = \frac{\overline{x_{\max}} - \overline{x_{\min}}}{\sqrt{\frac{MS_{error}}{n}}} \qquad \text{where,} \qquad MS_{error} = \frac{\sum_{j=1}^{n} (\overline{x_j} - x_j)^2}{n - k}$$

Equation 3. Tukey alpha equation and associated variables

In equation 1 above:

q is the "studentized range statistic," the figure used to determine statistical significance of the difference

MS_{error} is the mean squared error

x is the value of an element

$\bar{x}$ is the mean of the group of elements

n is the number of elements in the sample groups

[1044] Anderson et al. 1994, 451–459.

j is the index (i.e. the count) of a particular element

k is the number of sample groups

Kruskal-Wallis Test

While an analysis of variance (ANOVA) to compare means of datasets is ideal for my research questions, which relate to changes in sizes and shape over time, this type of test makes certain assumptions about the inherent nature (the parameters) of the inputs. For example, parameters assumed are that the grouped data has a normal distribution and groups of data have a similar spread. Consequently, when I have a non-normal distribution, low similarity, and low sample sizes, I use a non-parametric test, the Kruskal-Wallis test, to examine the distribution of measurements between different groups. The Kruskal-Wallis test puts all the measurements in order from highest to lowest, and then ranks them. It then uses the sum of the ranks, the number of samples in each group, and the number of overall samples to determine the K value, which is reported as a chi-squared value.[1045]

$$K = \frac{12}{n(n+1)}\left(\sum \frac{R_j^2}{n_j}\right) - 3(n+1)$$

Equation 4. Kruskal-Wallis Equation

In equation 2:

K is the figure used to determine the statistical significance of the difference

n is the number of values

j is the index of the particular group in question

R is the sum of the ranks in the j^{th} sample

Logistic Regression analysis

This is a useful tool to understand the correlation between a scaled or numeric variable (like a measured size) and a categorical variable (like the presence or absence of a

[1045] Hamburg 1979, 316–318.

type of alteration). It produces a value, the "odds ratio," to report how likely the categorical variable is to appear as the numeric variable changes by 1 unit. It also produces a significance statistic to help assess whether these odds are significant based on the degrees of freedom in the equation. So in the case of diameter, the odds ratio might be reported as 1.345. This means that when the diameter increases by 1 centimeter, the likelihood of abrasion being present is 1.345 times more likely than when diameter was 1 centimeter smaller. Stated another way, as the diameter increases by 1 centimeter, the likelihood that abrasion will be present increases by 34.5%. If there is a negative correlation between the numerical variable and the categorical variable, the odds ratio will be less than 1. So, if the odds ratio is 0.345, as diameter decreases by 1 centimeter, the likelihood that abrasion will be present increases by 65.5%.

$$\log\left(\frac{\pi_1}{1-\pi_1}\right) = \beta_0 + \beta_1$$

Equation 5. Basic logistic regression equation

In equation 3:

π is the probability of scenario 1

β is the odds

Decision not to Bootstrap

Bootstrapping is a non-parametric approach to dealing with quantitative data. Instead of inferring parameters about the data (e.g. that it has a normal distribution), it repetitively re-samples the data set (commonly 1000 times) to generate a large amount of data from which to make quantitative calculations. In the case of ANOVA of a diameter measurement, for example, bootstrapping would include random sampling with replacement from each "Period" based on the observed values. So bootstrapping does not drastically change the range of values available, but it can be useful for making the sample data stronger by increasing the numbers.

The principal behind bootstrapping is that the observed sample data is a random sample of the parent population, so increasing the sample size will allow you to see more of the same population of data. It is best used to increase the sample size of already medium to large-sized samples of 30-50 examples. There is skepticism around bootstrapping when sampling only 10 to 20 samples.[1046]

Bootstrapping is not used often by social scientists in applied statistics, but is more common in theoretical statistics and model-building. The recent increase in the use of bootstrapping by social scientists is demonstrated by its absence from the statistical software most commonly used by social scientists, SPSS (Statistical Product and Service Solutions, formerly Statistical Package for the Social Sciences). Before the most recent version of the software, it was not possible to bootstrap in SPSS. After some exploratory testing and consultation with Michigan's Center for Statistical Consulting and Research, I chose not to bootstrap the data in this dissertation, preferring instead to use non-parametric tests when specific characteristics of the data could not be assumed (as with the Kruskal-Wallis test, for example) and to acknowledge when collected samples were too small to make meaningful observations.

[1046] Mooney and Duval 1993, 1, 20–21.

Appendix 3 - *Sooting experiments*

Experiment One: Cooking with a wood fire

Dec 16th, 2012
Telluride House, outdoor fire pit, Ann Arbor

Goals:

- Reproduce common sooting patterns observed on pots at Musarna to figure out in what position the pot must be for them to appear. Focus on the possibilities of raw fire producing this soot and these patterns.
- Consider sooting thickness, opacity, and durability. How easy is it to wash off and how much stays after washing?
- Confirm J. Skibo's observations regarding Kalinga pots especially regarding the contention that hot fire on sooted areas causes the pottery to re-oxidize.

Figure 173. Pots used in Experiment One

Materials:

- 2 pots from Paestum gift shop (both wheel-made by a manufacturer in Giffoni Valle Piana, 41 km N of Paestum - clay source unknown)
- 13 planks of red oak (each roughly 30x2x7 cm) from Fingerle Lumber, Ann Arbor
- Rutland magnetic Stove thermometer
- Moisture meter made by General Tools and Instruments (type MMD4E)
- Steel fire pit

– 5 terracotta tiles for fire pit lining
– 5 bricks
– white pine chips and sticks and raffia paper serving as tinder and kindling

Wood moisture:

- Planks 1 – 5: 12%
- 2: 5-10%
- 3: 5-10%
- 4 : 6-9%
- 5 : 7-10%
- 6 : 8-10%
- 7: 7-9%
- 8: 10%
- 9: 6-9%
- 10: 8-10%
- 11: 8-10%
- 12: 9-12%
- 13: not measured because it was used as kindling to start the fire

Methods:

After starting the fire with kindling pine, paper, and a few small pieces of red oak, oak planks were introduced. Once the kindling had burned away leaving just the burning red oak a steel grill was set over the fire and configured with bricks to support a pot for test one.

Figure 174. Fire pit set up for Test 1

<u>Test 1</u>

Tall pot (double handles on one side, closed-form, 3 cm high neck, 2.5YR 6/8 clay) filled with 1 liter of water. It was placed in the centre of the fire approximately 6 cm above the burning wood. The base of the pot was alternately approximately 2 cm from the flames and immersed in licking flames throughout the cooking episode. In the first 15 minutes, the lower half of the pot exterior was lightly sooted all the way around (roughly areas 2 and 3

on my standard opacity scale) and the base of the pot appeared equally heavily sooted. As the wood was consumed, additional wood was added, and this fresh fuel caused flames to lick higher up the sides of the vessel. Several flames reached all the way to the rim of the vessel on the side opposite the handles. These flames left dark soot on the neck of the vessel at the rim in one large 9 cm square patch.

During this experiment, the stove thermometer was placed on aluminium foil on the grill directly adjacent to the base of the pot. Temperatures ranged between 200˚ and 400˚ C. When immersed in the flames rising around the pot, the thermometer exceeded its 500˚ C maximum reading.

Figure 175. Midpoint of Test 1

After 30 minutes, the pot was removed from the fire, photographed and examined. The water inside was not boiling, but was producing copious steam. The base and side walls of the pot below the shoulders were completely covered in thick soot (3-4 on my opacity scale). The rim and neck only on one side of the vessel was blackened with soot where flames had licked it. There was also a V-shaped crack discovered in the base floor which was leaking water. The crack began in the lower wall of the vessel and likely began due to thermal shock when a piece of oak touching it at the midpoint of the experiment. This plank was then moved to a lower position in the fire.

Figure 176. Sooting on pot immediately after Test 1

The pot was left to hang dry for approximately 30 minutes. It was then washed with room temperature tap water to remove any loose soot. While a small amount of black residue washed off the whole pot exterior, the majority of blackening on the pot remained imbedded in the ceramic fabric. The only soot to come off completely was the patch at the neck (though it must be noted that this was over an area of glaze which had spilled out of the interior of the vessel). The body of the vessel below the neck remained very dark (between Munsell GLEY 1 2.5y/1 and 5yr 3/2). Another important observation is that when one edge of the base was briefly in contact with burning wood at one point in the experiment, a patch of lighter vessel color resulted. This color was then covered in soot after the wood was moved and the vessel remained over the fire. When the vessel was later washed, this layer of soot which had accumulated on the vessel edge and covered the light patch was easily removed to reveal the light patch. This suggests that not only is surface treatment of the vessel important to determining whether soot will remain (as in the case of the vessel neck) but also length of exposure to the flame. The rest of the vessel base had been exposed to flame for 30 minutes while this one patch at the base edge had been exposed to flame for less than 20 minutes.

Figure 177. Soot remaining on pot from Test 1 after being washed

Test Two

A short pot (open form, 2 lug handles on opposite sides, glazed on interior) was filled with 1 liter of water. Despite the interior glaze of this vessel, the water permeated through the vessel fabric almost as soon as it had been filled. The exterior of the vessel was wet in a strip around the belly when the experiment began. The vessel was set on 2 spaced-apart bricks on the grill above the fire. Therefore, the vessel's base was 5 centimeters above the grill and approximately 10 cm above the wood for the duration of the experiment. Two pieces of wood were added over the course of the 30 minute experiment to maintain a consistent fire size.

Figure 178. Pot sitting on bricks as supports over fire

Almost immediately, soot began to be deposited on the sides of the vessel where it was not in the "shadow" of the bricks supporting it. During the experiment, the stove thermometer registered 200˚ to 400˚ C on the grill near the flames, and above 500˚ C when it was in the flames. After 30 minutes, the vessel was removed from the fire, photographed and examined. It had not begun to boil and the water was barely steaming. This is likely due to the vessel's permeability (since the glaze was evidently not effective at water-proofing it).[1047] The vessel's base was completely blackened (3 or 4 on the opacity scale) with the exception of a center patch of rough ceramic material where soot did not seem to stick as uniformly as to the rest of the smooth base. On the vessel sides, there was a large swath of soot on both sides of the walls where it was not blocked by the bricks. On one side of the vessel, the soot reached the top of the exterior rim, on the other side, it did not quite reach the rim so that it was noticeable black. This difference is likely due to the differential flames on either side of the vessel. Flame inconsistency was likely caused by the gustiness of the wind.

[1047] See Skibo's observations of nu-a-log pots (1992) and Schiffer's experiment with non-slipped vessels.

Figure 179. Soot on pot immediately after Test 2

After the vessel was cold to the touch (approximately 10 minutes after it was removed from the fire), it was washed with room temperature tap water. A large amount of soot came off easily from the base on the pot leaving only a slightly tinted base (Munsell 5yr 4/4) and a black patch in the centre of the base floor (Munsell GLEY 1 2.5/N). On the side of the vessel which had blackening up to its rim, more black remained on the lower half of the vessel, though not of the slipped rim. At its lightest, it was 7.5yr 2.5/2 and its darkest, it was pure black (GLEY 1 2.5/n). On the side of the vessel which did not have black up to its rim, most of the soot washed off. There was only a faint amount of black visible (5YR 5/4). The blackening of the other side in contrast to this one likely has to do with the intensity and frequency of the flames on the other side. The ease with which the soot was washed off may have to do with the fact that the vessel's exterior surface was wet throughout the test due to the water inside permeating through the fabric.

Figure 180. Soot left on pot from Test 2 after washing

Experiment Two: Cooking with charcoal

March 1, 2013
Telluride House, Ann Arbor, indoor fireplace

Goals:

- Better understand the potential of charcoal to give off and deposit soot on vessel walls.
- See whether charcoal placed in direct contact with pottery will leave it black. This is in specific reference to the blackening patterns observed on Roman ollae and on clibani.

Materials:

- Cowboy Brand 100% Hardwood Charcoal (8.8lb bag from Ace Hardware)
- 1 large flower pot with whole in the bottom from Home and Garden
- 1 smaller ridged flower pot (no hole) from Home and Garden

Figure 181. Two flower pots used for Experiment Two

Methods:

I used a metal chimney lighter to light the charcoal. The bottom of the chimney was stuffed with newspaper and oak leaves.

Test One

For this experiment, I used the large flower pot.

Start of test: I dumped burning charcoal out on to floor of fireplace, spread out and made a hole in which to set the large flower pot. The flower pot was seated open-side up and charcoal was piled around it. The charcoal was burning, but only the backside was smoking or displaying occasion flame.

Ten minutes into test: Fresh charcoal added and the near side starts to burn more vigorously.

Twenty minutes into test: The charcoal on the far side is white-hot.

Twenty-five minutes into test: The charcoal on the near side is white-hot. I mark the height of the charcoal around the edges of the pot with a pencil.

Figure 182. Large flower pot surrounded by white hot flaming charcoal

Thirty minutes into test: Pot is removed from the charcoal.

Results:

There is no sign of blackening below the pencil line (and thus, the height of the charcoal). On the far side of the pot where there was a lot of smoke and high flames, the exterior wall is substantially blackened. On the near side of the pot, where there were small flames, there is light blackening.

Figure 183. Large flower pot is not blackened below where charcoal sat (see pencil line)

This experiment demonstrates that when the charcoal is in direct contact with the vessel walls, they do not get blackened; however, above the line of the charcoal, the vessel walls are blackened if the charcoal is sufficiently flaming.

Test Two

For this experiment, I used the small flower pot.

In place of the large pot, I placed the small pot upside-down to simulate a clibanus. I piled the old charcoal as well as freshly-lit charcoal around and on top of the vessel. It is difficult to cover the pot because the chunks of charcoal keep falling down or rolling away.

Start of test - Pot covered in charcoal and photographed.

Figure 184. Small flower pot is completely covered in flaming charcoal

Five minutes into test: The charcoal flames readily right away because this is already very hot charcoal; the exposed corners of the vessel seem to already show blackening.

Thirty minutes into test: Charcoal pushed off the vessel and vessel is extricated.

Results:
The vessel shows no sign of exterior blackening.
This experiment demonstrates that when the charcoal is in direct contact with the vessel walls, they do not get blackened, despite the intense flaming of the charcoal around the vessel.

Figure 185. Small flower pot after being covered in charcoal

Appendix 4 – *Paestum*

I originally considered Paestum to be the third study site for this dissertation. Poseidonia was founded as a Greek colony on the South Italian coast in about 600 BCE. The city was highly-urbanized. Local Samnites, the Lucanians, took over in 400 BCE, but the extent to which this conquest altered the city is disputed. Mario Torelli explains that the archaeology, especially the sanctuary archaeology, indicates that the citizens of the town remained Hellenic "*sul piano culturale, linguistico, religioso*."[1048] Paestum fell under Roman control in the 270s BCE and was made a colony with Latin rights in 273 BCE.[1049] The city plan was altered and the city's name was changed to Paestum.[1050] There has been a series of modern excavation campaigns within the city walls and in the region. Access to material excavated from inside the city was not possible; however, a University of Michigan-University of Perugia team excavated an extramural sanctuary from 1981-1985, in an area called Santa Venera. The sanctuary was established in the 5th century BCE and parts of it continued to be frequented until at least the 3rd century CE.[1051] The excavators note that un-systematic excavations from the early 20th century "stripped off the surfaces and floors (and most of the materials) of the Hellenistic and Roman phases."[1052] These are the *Vecchi Scavi* completed by P.C. Sestieri and M. Napoli and were never published. The materials from this project are housed in the local Museo Nazionale di Paestum, but no records accompany them. The post-classical pottery from the recent excavations at Santa Venera were never published nor studied. Unfortunately, this material is in very poor condition – very fragmentary and largely non-diagnostic. After completing the data collection at the site, I have determined that the small volume of pottery, despite my best efforts, makes statistical analyses impossible. Furthermore, the detailed study of use-alteration requires

[1048] Torelli 1999, 7.
[1049] Torelli 1999, 8.
[1050] Pedley 1990, 113.
[1051] Pedley 1990, 136-137, 145.
[1052] Pedley and Torelli 1993, 19.

larger, more complete fragments and sherds which can be understood to have undergone a minimal amount of post-depositional disturbance. This is unfortunately not what Santa Venera has yielded.

Thus, I present the basics of ceramic quantification here as a testament of a failed experiment. Using the published Paestum volumes, interim reports, and excavation records, I identified three loci from which to study material. These were the few deposits which were deemed by the excavators to be Lucanian or Roman in date (the 5th century BCE and later) and which seemed to have a minimum amount of post-depositional disturbance because they were sealed or partially-sealed by floors or other features.

Table 94. Ceramic quantities at Paestum

	Sherd count	**Weight**	**Weight/sherd ratio**	**With alteration**
Diagnostic	459	6,237 g	13.59	83 (18%)
Semi-diagnostic	24	262 g	10.91	5 (21%)
Body sherd	1,946	15,816 g	8.13	Unknown
Total	2,429	22,315	**9.19**	~88

Compare the average "sherd size" overall of 9.19 g at Paestum with those calculated for the whole samples at Populonia and Musarna of 28.55 g and 24.74 g, reported in chapter 4. This reveals the extreme fragmentation of this material.

I use one fragment type, rims, to elucidate the problem of a small sample and high fragmentation. When I select all the rims in the sample, the total is 267. This figure and those that follow in the analysis below would be decreased by more than one third were I to select only those whose rims whose circumference is preserved 5% or more.

Table 95. All rim fragments at Paestum

ware	Frequency	Percent
black gloss	73	27.3
common ware	23	8.6
da fuoco	57	19.9
da fuoco or handmade	4	1.5
fineware	42	15.7
handmade	6	2.2
painted common ware	2	.7
painted fineware	64	24.0
Total	*267*	*100.0*

When I examine the condition of these sherds, 59% of them have fracture edges classed as 1 "sharp," 35% are 2 "slightly rounded," and 6% are 3 "highly eroded." These figures suggest that the sherds underwent some amount of post-depositional disturbance. The soil in the area, fortunately, did not deposit much mineral incrustation with only 15% having any evidence of crusty deposits. The average size of the sherds divided into their respective find spots, is given below.

Locus 6609

This deposit has been labelled a *bothros* in the first Paestum publication and was dated to the early 2nd century, likely due to the presence of local "acne" ware, a reddish common ware which has white porous inclusions.[1053]

Table 96. Rim fragments in Locus 6609

Ware	Frequency	Percent
black gloss	17	32.7
Commonware	4	7.7
da fuoco	27	51.9
fineware	2	3.8
painted fineware	2	3.8
Total	*52*	*100.0*

Percentage preserved of rims: mean 7.69% , median 6%

[1053] Pedley et al. 1993, 16.

Surface area of sherds: mean 11.24 cm^2, median 9 cm^2

Locus 10807

This may have been some sort of ritual deposit. It is dated variously in the Paestum publications and reports as 4th to 6th century BCE. It contains a lot of miniature vessels (particularly in black gloss), but many of these are not complete which suggests that they were not, in fact, deposited there in a primary position. The non-fine wares in this deposits are in very poor shape. The sherds are of relatively small dimension with rounded edges and lack diagnosticity suggesting that they are fill shovelled in from elsewhere in a tertiary deposition situation.

Table 97. Rim fragments in Locus 10807

ware	Frequency	Percent
black gloss	45	24.1
commonware	15	8.0
da fuoco	19	10.2
da fuoco or handmade	4	2.1
fineware	38	20.3
handmade	2	1.1
painted commonware	2	1.1
painted fineware	62	33.2
Total	*187*	*100.0*

Percentage preserved of rims: mean, 7.48%, median 5%

Surface area of sherds: mean 5.14 cm^2, median 4 cm^2

Locus 14704-13

There is very little material in this deposit which was identified as a potential "cooking area."[1054]

Table 98. Rim fragments in Locus 14703-14714

ware	Frequency	Percent
black gloss	11	42.3
commonware	4	15.4

[1054] Pedley et al. 1993, 110, 114

da fuoco	5	19.2
fineware	2	7.7
handmade	4	15.4
Total	*26*	*100.0*

Percentage of preserved rim: mean 6%, median 5%

Surface area of sherds: mean 7 cm^2, median 4cm^2

Were I to divide up this material by ware and by form, there would be only a few sherds in each category. The fragmentary nature of the material means that the alteration data is quite skewed. Alteration was difficult to observe. As a result, the database reveals that less than 20% of rim sherds these have alteration (blackening on abrasion) on them.

For the purposes of my dissertation, therefore, it became clear that Paestum is not an appropriate candidate for foodways analysis involving detailed ceramic study.

Regardless of the disappointing state of these materials, I learned quite a bit in Paestum and was welcomed by the people there. The staff of the museum, many of whom lived in the town, were very helpful. Thank you to Marina Cipriani and Giovanni Avagliano, and to Maria Tomasso Granese and Enzo Passarella. Thank you very much to my kind hosts, Giuseppe Desiderio and Modesta Manzo. Finally, thank you to John Pedley for generously providing all of his notes and information on the site.

Appendix 5 - *Diagrams for reference*

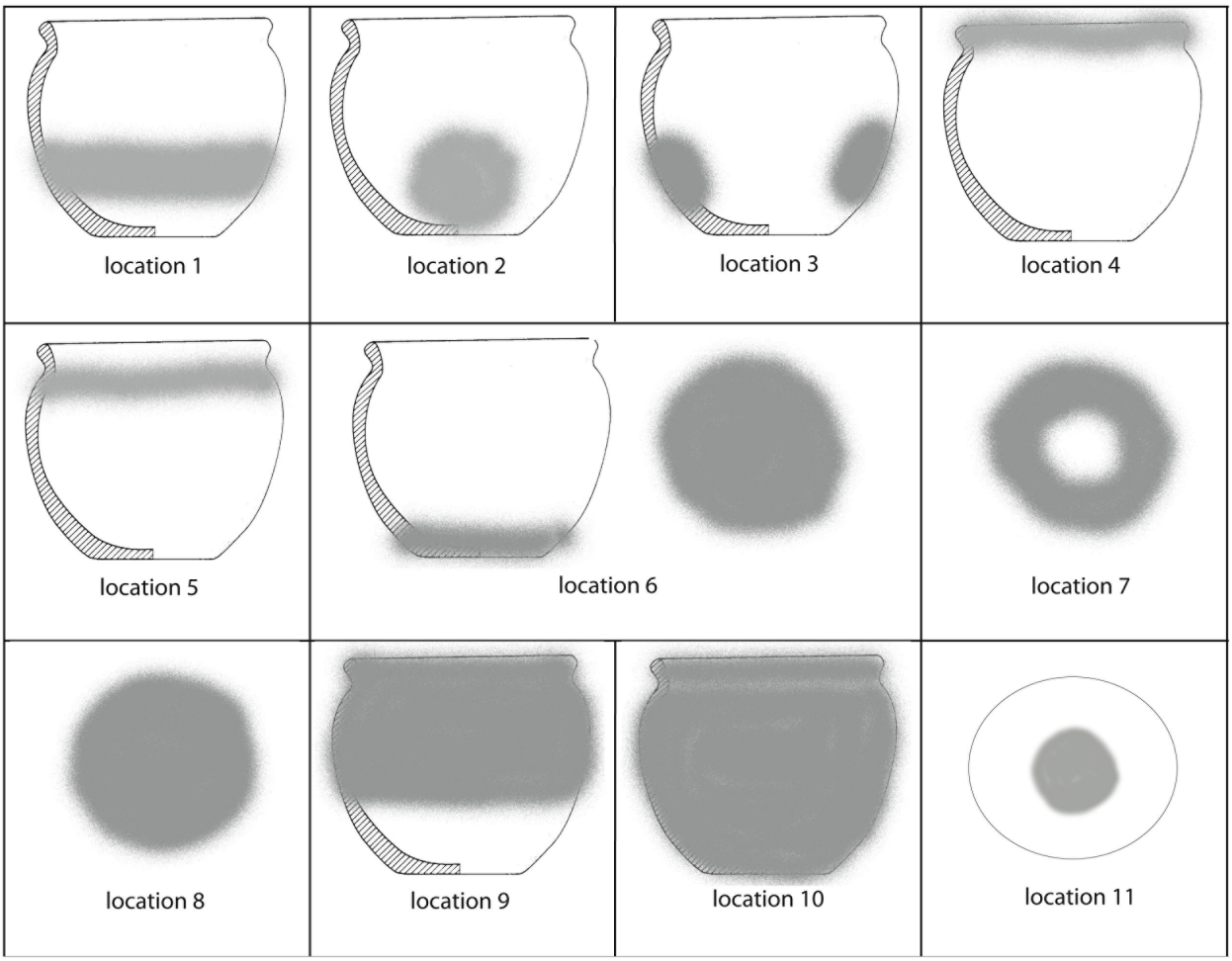

Figure 186. Diagram of blackening locations on ceramics (applicable for vessel interior and exterior)

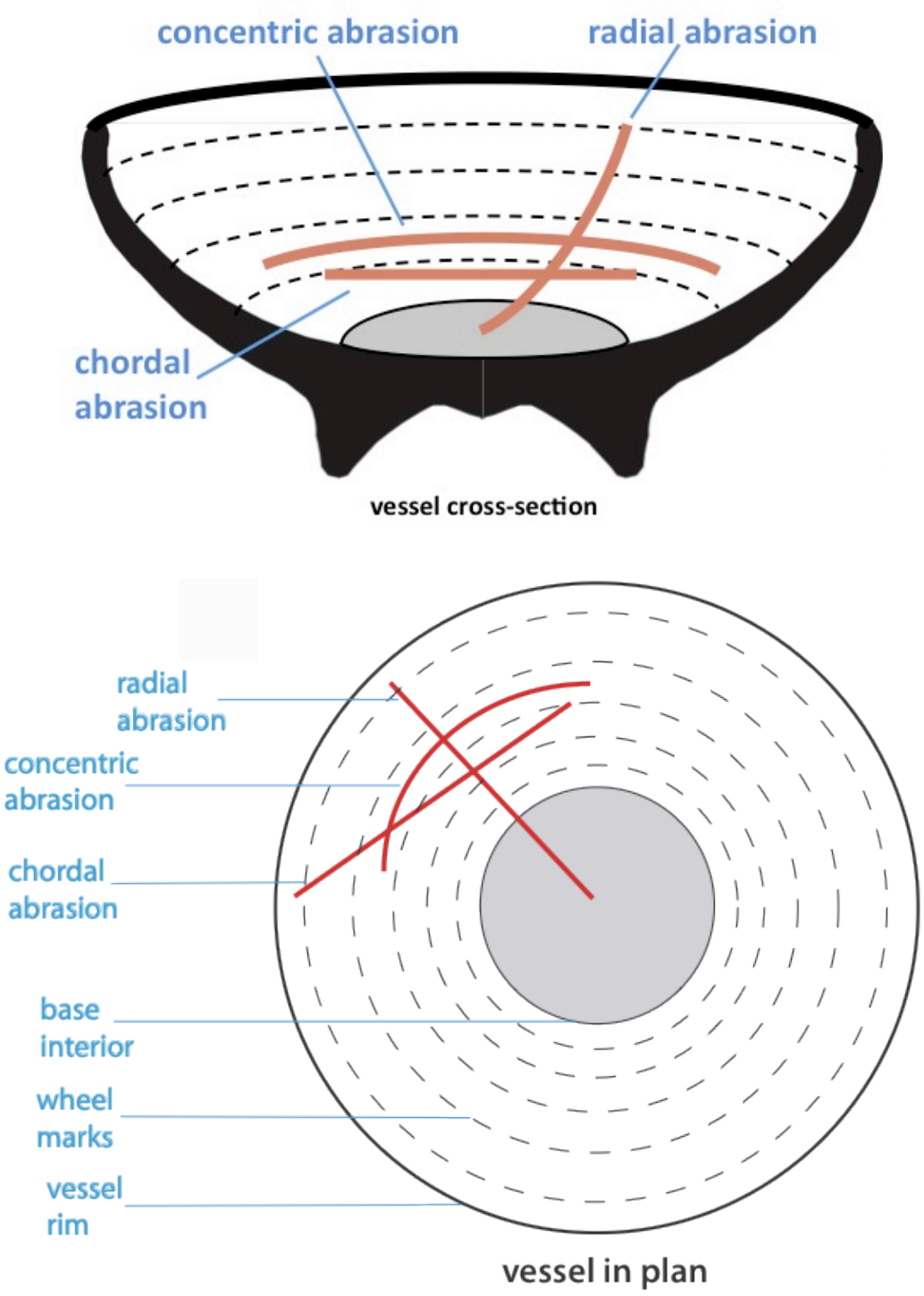

Figure 187. Orientation of linear abrasion

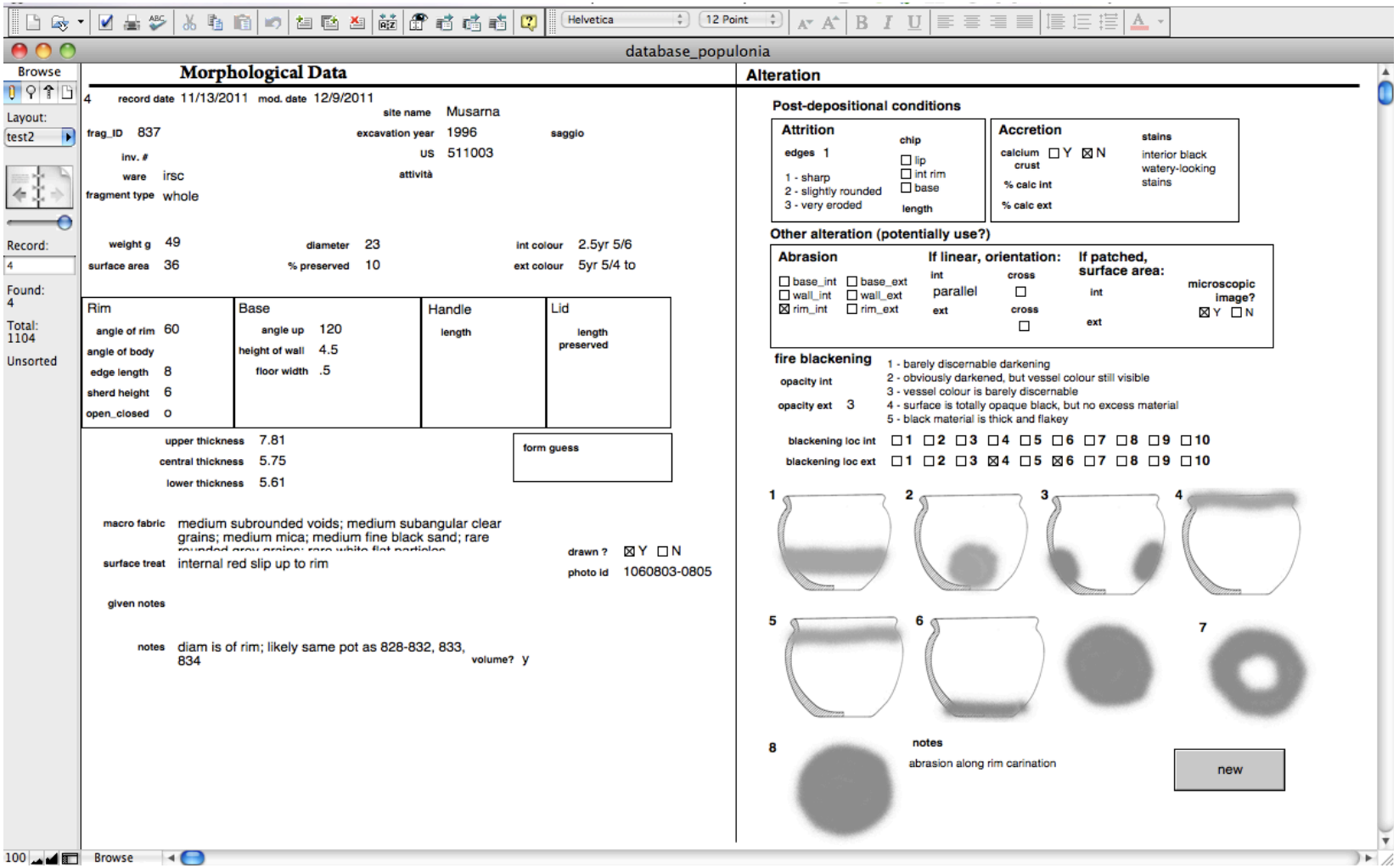

Figure 188. Screen shot of database form – FileMaker Pro 12

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