Findings from the Preliminary Analysis of Faunal Remains at Ancient Eleon

by

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B.A, Anthropology, University of Victoria, 2012

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Abstract

A relatively small, but well-preserved, assemblage of faunal remains centered around an apparent refuse heap in the southwest quadrant of Eleon has been analyzed to determine the relative representation of domesticated and wild taxa, as well as mortality profiles for sheep and goats. Although the total number of identified specimens is low, at 1059 fragments, several patterns have emerged in the data that warrant further analysis. The representation of deer among these remains is higher than at other sites on the Greek mainland. Lower utility elements such as metapodials and tibiae are better represented than meatier portions of the skeleton, suggesting that entire carcasses were being processed onsite. Mortality profiles developed from sheep and goat mandibles indicate distinct management strategies for each species, with a high number of very young and juvenile goats, compared with many more mature sheep. Overall, the faunal remains from this deposit suggest a varied economy in the post-palatial period, exploiting a wide range of species for both primary and secondary animal products. Further faunal analysis at Eleon is warranted to allow for comparisons across time periods and between locations at the site.

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Acknowledgments

I would like to thank my long-suffering supervisors, Yin Lam and Brendan Burke, who showed me endless patience.

I would also like to thank the sheep and goats of ancient Eleon, who showed me their teeth.

Dedication

To my wife.

Chapter 1 - Introduction

1.1. Context

The archaeological site of ancient Eleon is located in present-day Arma in eastern Boeotia, Greece. Excavations at the site have recovered material ranging in date from the Neolithic to the Byzantine time periods, with substantial Late Bronze Age and Classical components. This thesis examines faunal material from Eleon associated with a substantial structure dating to the Late Helladic IIIC period (roughly 1200-1170 BC), a time immediately following the destruction of the large Mycenaean palatial sites scattered throughout the Greek mainland. Eleon was not a palatial site, but may have served as a “satellite” to the nearby palace at Thebes due to its strategic location along a fertile valley corridor between the palace and the Euboean gulf. It is unclear how much autonomy was enjoyed by these smaller settlements, but preserved administrative records suggest that the palaces exerted considerable influence on certain areas of the regional economy (Killen 2008). One area of particular concern to the administration was sheep herding, as palaces collected large quantities of wool that were made into textiles in palatial workshops (Halstead 2003). The aim of this thesis is to examine patterns of animal exploitation at Eleon during this transitional time period, with a focus on determining whether sheep and goats were being raised for primary products (those requiring the death of the animal for harvest, i.e. meat or bone) or secondary products (i.e., milk or wool).

Many secondary Mycenaean sites appear to have weathered the palatial destruction with minimal disturbance, particularly those that were farther from their respective palatial centres (Foxhall 1995). Recent zooarchaeological work at Lefkandi, less than 30km from Eleon on the island of Euboea, suggests that the animal economy was largely unaffected by the fall of palatial centres

(Mulhall 2016), and elite burials containing both local and traded prestige goods continued through LH IIIC and the subsequent Early Iron Age at that site (Popham et al. 1982). Other comparable studies are rare, as faunal reports are relatively uncommon in Bronze Age Greek archaeology, and many of the theoretical and methodological bases of the existing corpus has recently come under intense scrutiny (Halstead 1996; Greenfield 2005; MacKinnon 2007). Additional faunal analyses from smaller Late Helladic settlements using contemporary methodologies are needed in order to examine local and regional patterns of animal exploitation. The LH IIIC faunal material from Eleon allows for the expansion of our knowledge of the relationships between Mycenaean settlements in general, as well as within the territory of the nearby Mycenaean palace at Thebes.

1.2. Research Questions and Hypotheses

This thesis analyses the faunal remains excavated from trenches in the southwest portion of Eleon, which includes a substantial deposit of fill that appears to have been used during the LH IIIC period to convert the remains of a substantial earlier structure into a terrace wall. All sheep and goat mandibles from this assemblage were separated for tooth wear analysis, and were treated as a separate sample. This sample was also supplemented by the addition of sheep and goat mandibles recovered from contemporaneous deposits in the northwest quadrant of the site. The data were analyzed to determine what species were present (and in what abundance), which skeletal elements were best represented, and the age at which sheep and goats were slaughtered. This allows for comparisons to other contemporaneous sites, and inferences about the economic and herding strategies employed at LHIIIC Eleon.

Faunal remains were quantified using NISP (Number of Identified Specimens, a raw count of each identified specimen by species) and MNE (Minimum Number of Elements, which calculates the smallest number of individual bones that could have produced the recovered fragments). Although there are many inherent issues with relying on NISP for quantification (Reitz and Wing 2008), it remains the standard for Greek sites, and thus is used here to interpret the relative abundance of species present.

A consistent pattern of species representation is noted at the majority of sites on the Greek mainland from the Late Neolithic onward (Halstead 1996), which I hypothesized would also be reflected by the Eleon material. First, sheep and goat remains were expected to make up the majority of the assemblage. Cattle and pigs were expected at similar ratios to one another, much lower than sheep and goat. Wild species are typically found in small numbers in Bronze Age Greek assemblages, thus deer were expected to make up a small fraction of the Eleon fauna. Smaller wild game, including fish, was not expected to contribute greatly for several reasons. First, the material was not screened, introducing a bias toward larger bone fragments. Second, the site is situated roughly 25km from the Euboean Gulf, making fishing unlikely as a major subsistence or economic activity.

The sheep and goat remains provide the best opportunity to explore questions about the LH IIIC economy. Recent advancements in identification methods (e.g., Zeder and Lapham 2010; Zeder and Pilaar 2010) have allowed sheep and goats to be differentiated in zooarchaeological assemblages with much greater accuracy. The sheep and goat mandibles were aged based on tooth wear (Grant 1982; Payne 1973) and analysed using survivorship curves (Greenfield and Fowler 2003) and ternary diagrams (Weaver et al. 2011). Sheep were expected to outnumber goats at Eleon, which would suggest a herding structure that specializes in producing one or more secondary products (Sasson 2010) rather than a generalized strategy.

A bias toward older adult individuals was predicted for the sheep mandibles, which would indicate wool production (Payne 1973; Grant 1982). This would be consistent with LH IIIC spindle whorls recovered in the northwest area of the site (MacDonald 2017) and would indicate herding practices similar to those recorded in palatial Linear B records from the earlier LHIIIB period (Halstead 2003). Goat mortality profiles were expected to differ significantly from sheep, conforming to models of either meat or milk production, with more infant and juvenile individuals represented.

Finally, element distribution was analysed to examine the likely activities that contributed to the accumulation of the assemblage. An element distribution biased toward "lower utility" bones that are associated with body parts of lower food value (Binford 1978) would suggest that the assemblage around the LH IIIC structure represents butchery, while "higher utility" elements may indicate refuse from meals or communal feasts (Halstead 2003).

1.3. Thesis Structure

This thesis is divided into six chapters: (1) Introduction, (2) Literature review, (3) Methods, (4) Results and Discussion, and (5) Conclusion.

Chapter 2 is divided into three sub-sections. Section 2.1 briefly reviews the chronology of the Greek Bronze Age, discusses the different ways that the Mycenaean economy has been modelled, and provides an overview of the literature surrounding Mycenaean Linear B tablets. Section 2.2 outlines the ways that researchers have attempted to model the exploitation of secondary products (i.e., products that can be harvested from animals without killing them). Section 2.3 reviews published faunal analyses from mainland Greek sites.

Chapter 3 describes the methods used for analysis of the assemblage. Section 3.1 outlines recovery and recording, quantification, aggregation, and measurement of the entire assemblage. Section 3.2 summarises how the sheep and goat mandibles were identified to species, aged, and compared to models of meat, milk, and wool production.

Chapter 4 combines the results of my analysis and a discussion of their context and implications within the broader context of mainland Greek Late Bronze Age and Early Iron Age sites, with a focus on comparisons to the material from Lefkandi in light of the strong parallels between the two sites (Van Damme 2017a). Results are presented by species, outlining the relative abundance of each species, the representation of different skeletal elements, notable individual specimens, and age-at-death data when it is discernable from the remains.

Chapter 5 presents a summary of the above chapters. The research hypotheses outlined above are each examined, and Eleon is placed within the context of similar sites. Finally, future avenues of research for expanding our understanding of post-palatial Greek settlements are suggested.

Chapter 2 - Literature Review

2.1. Introduction

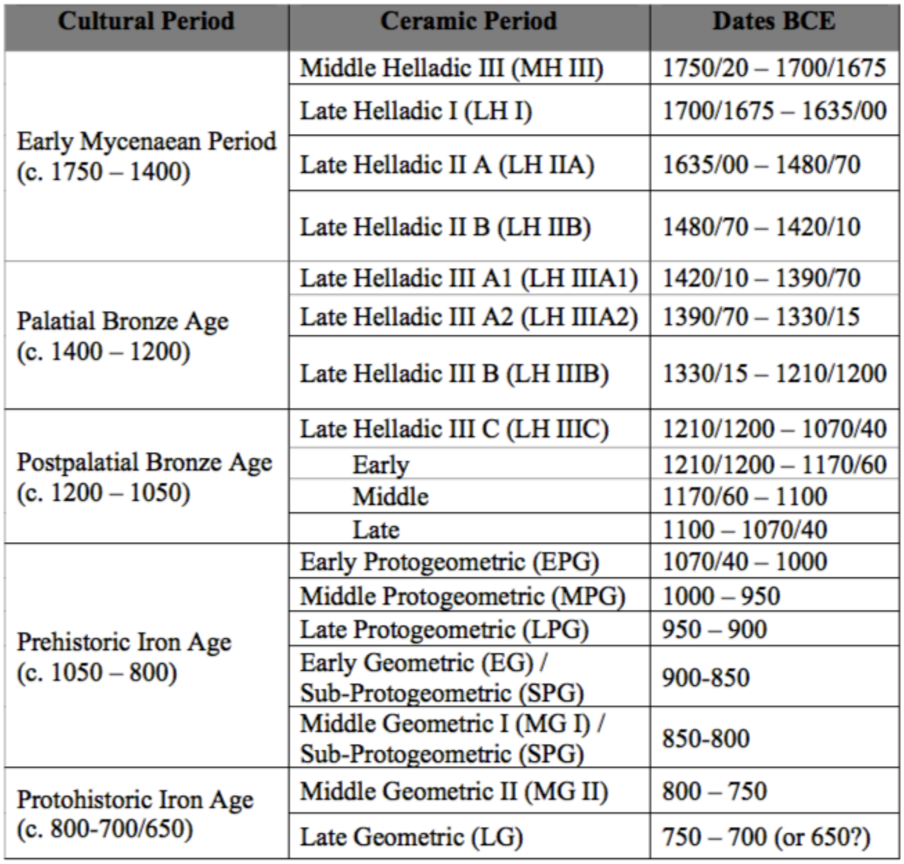
In order to interpret the faunal material from Eleon, it is necessary to review the cultural context of the region during the Bronze Age and Early Iron Age, the theoretical basis of my analysis, and the published body of faunal reports in the region. The sources that are included in this review include published site reports, secondary sources discussing the Greek Bronze Age, analyses of Linear B texts, and unpublished dissertations.

Section 2.1 describes the chronology of the Bronze Age in Greece, discussing changes in architecture and material culture. A discussion of the nature of the Mycenaean economy is also included. Section 2.2 outlines attempts to model animal exploitation and the agricultural economy of the Greek Bronze Age. Section 2.3 reviews faunal reports from sites on the Greek mainland.

2.2. Bronze Age Greece

2.2.1. Bronze Age Chronology

As the material being examined dates to the end of the Bronze Age, significant developments through the entirety of the Greek Bronze Age must be reviewed in order to provide context. The Bronze Age on mainland Greece is divided into three periods spanning from 3250 BCE – 1070 BCE, referred to as Early Helladic (EH), Middle Helladic (MH) and Late Helladic (LH). The culture type referred to as “Mycenaean,” named after the palatial site of Mycenae, rose to prominence and disappeared during the Late Helladic, from roughly 1700-1050 BCE. Each time period is further divided into subsections (e.g. LH I, LH II, and LH III), largely differentiated through pottery typologies. The palatial complexes that characterize the Mycenaean culture arose during LHIII throughout mainland Greece, and their destruction marks the end of both the Late Helladic and the Bronze Age in Greece. The periods immediately predating and antedating the Helladic are the Neolithic and the Geometric (Iron Age) periods, respectively. “Geometric” refers to the distinctive pottery of Iron Age Greece, which bears geometric patterns.



Cultural Period	Ceramic Period	Dates BCE
Early Mycenaean Period (c. 1750 – 1400)	Middle Helladic III (MH III)	1750/20 – 1700/1675
	Late Helladic I (LH I)	1700/1675 – 1635/00
	Late Helladic II A (LH IIA)	1635/00 – 1480/70
	Late Helladic II B (LH IIB)	1480/70 – 1420/10
Palatial Bronze Age (c. 1400 – 1200)	Late Helladic III A1 (LH IIIA1)	1420/10 – 1390/70
	Late Helladic III A2 (LH IIIA2)	1390/70 – 1330/15
	Late Helladic III B (LH IIIB)	1330/15 – 1210/1200
Postpalatial Bronze Age (c. 1200 – 1050)	Late Helladic III C (LH IIIC)	1210/1200 – 1070/40
	Early	1210/1200 – 1170/60
	Middle	1170/60 – 1100
	Late	1100 – 1070/40
Prehistoric Iron Age (c. 1050 – 800)	Early Protogeometric (EPG)	1070/40 – 1000
	Middle Protogeometric (MPG)	1000 – 950
	Late Protogeometric (LPG)	950 – 900
	Early Geometric (EG) / Sub-Protogeometric (SPG)	900-850
	Middle Geometric I (MG I) / Sub-Protogeometric (SPG)	850-800
Protohistoric Iron Age (c. 800-700/650)	Middle Geometric II (MG II)	800 – 750
	Late Geometric (LG)	750 – 700 (or 650?)

Figure 2-1 - Middle Helladic to Late Geometric chronology, from Knodell 2017:196.

2.2.2. The Early and Middle Helladic

The Early Helladic (EH) period spanned from roughly 3250 BCE to 2100 BCE, lasting the length of both the Middle and Late Helladic combined (Cavanagh, Mee, and Renard 2016). The Early Helladic, like the Middle and Late Helladic periods, is divided into EH I, II and III.

Many EH I (3250 BCE – 2950 BCE) sites are situated in the same locations as earlier Neolithic settlements, although there is a noted shift toward coastal areas and to areas of lower elevation (Pullen 2008). This may represent a transition from pastoralism to large-scale agriculture. Little is known of EH I architecture, due mainly to a lack of preserved masonry and obscuration by later construction.

The EH II period (2950 BCE – 2250 BCE) is marked by increased population centralization, as settlements situated in regions with fertile but heavy soil requiring the use of oxen for traction grew to dwarf their regional neighbours (Pullen 2008). The most striking change is the appearance of "corridor houses," large multi-storey structures which have been found at Lerna in Argolis, at Akovitia in Messenia, at Kolonna on the island of Aegina, at Thebes, and possibly at Zygouries in Corinth (Wiencke 1989).

The first corridor house found in Greece was the "House of the Tiles," an elaborate two-storied EH II structure uncovered at Lerna in 1952 (Caskey 1955). The House of the Tiles is a large rectangular building roughly 25 metres by 12 metres. A large principal room surrounded by small apartments and corridors makes up the western half of the building. The name of the building is derived from a number of terracotta slabs unearthed in its rooms (Caskey 1955). Two other rooms, accessed from the exterior of the building, contained broken clay sealings that were pressed onto the tops of jars and baskets and stamped with a number of distinctive round seals. Initial examinations of these sealings found few parallels with seals found in Crete and other parts of the Aegean, suggesting that they were not associated with imported goods (Heath 1958). Instead, they may have acted as a record of taxation from individuals in the region surrounding Lerna, which has been interpreted by some as an indication of centralized regional economies (Gejvall 1969; Pullen 2008). Other corridor houses share very similar layouts to the House of the Tiles, although they are less elaborate. Most notably, most other examples have only two rooms on the lower floor, whereas the House of the Tiles and the Weisses Haus at Kolonna had five. These larger corridor houses featured separate entrances for the upper storeys and rear rooms, suggesting that some rooms were reserved for residents while others were public areas. Shaw (1987) suggests that the variation seen in corridor houses reflects the process of their development from long single story EHI structures that featured antechambers and two rear rooms. The lower floors of the more basic corridor houses are laid out like two of these EHI houses built back-to-back. Certain artefact types (i.e., obsidian cores) are also found almost exclusively at sites containing a corridor house (Wiencke 1989), underscoring the connections between these settlements.

The layout of the central large room of corridor houses is reminiscent of the *megaron* found at Mycenaean palaces, and clay sealings and obsidian cores suggest both trade and industry. However, while the economic activities of Mycenaean palaces are revealed through preserved clay tablets, there is no clear indication of the degree or nature of the influence the inhabitants of corridor houses held over surrounding settlements. Most significantly, every known corridor house appears to have been abandoned or destroyed between the late part of EH II and the end of

EH III, and subsequent building phases see them replaced with smaller, less elaborate structures that appear to be modest homes. Some features of corridor houses, particularly balconies extending off of the upper story, do not appear at Mycenaean palaces at all. Shaw (1987) notes that the entirety of the Minoan palatial period passes between the destruction of the mainland corridor houses and the appearance of mainland palaces, suggesting a much more likely influence on Mycenaean architecture.

The transition to the Middle Helladic (2150 BCE – 1600 BCE) is marked by several notable shifts in material culture, including the appearance of apsidal houses (houses with one rounded end), and pottery types including the fine burnished "Minyan ware." Citadel sites, which later served as locations for Mycenaean palaces, experienced particularly rapid growth during MH III (Wright 2008). These locations were typically easily defensible eminences surrounded by productive agricultural land. Burials from the Middle Helladic are a topic of much research. Along with a general trend from individual burials within settlements (and indeed within houses) during MH I toward cemeteries with communal tumuli (burial mounds) and shaft graves found outside settlements in MH II and MH III, lavish grave goods appeared in burials throughout the mainland (Pullen 2008). Shaft graves are of particular interest to pre-Mycenaean research, as they contain the remains of many individuals along with associated status items associated with trade, hunting, and warfare. The appearance of these burials has been interpreted as evidence of the emergence of a powerful class of social elites (Wright 2008). At Kolonna, for example, the Large Building Complex (which was, as its name suggests, a large fortified complex of buildings) was built in MH I/MH II, contemporaneously with the first known shaft graves (Gauss and Spetana 2010). The earliest burials at complex of shaft graves at Mycenae known as Grave Circle B date to MH III (Graziadio 1988). Paired with the destruction of many sites at the end of the Early

Helladic, the MH has often been framed as a period of turmoil during which the foundations for the Mycenaean palatial system were nonetheless laid.

The destruction events in the latter part of the Early Helladic did not occur simultaneously throughout the region. Some mainland Greek sites, including Lerna, Tiryns, Argos, Zygouries, and Tsoungiza, appear to have been partially or entirely destroyed at the end of EH II. Other sites, including Eutresis, Orchomenos, and Kolonna, have destruction horizons dated to EH III. The timing of resettlement at these sites also varied. While many of the sites destroyed during EH II were resettled early in the MH, some sites, such as Lerna, Tyrins, and Asine, were resettled earlier, during EH III (Hofsten 2014). Thebes appears to have been destroyed and abandoned twice: once at the end of EH II and again at the end of EH III.

The destruction of a large number of settlements at the end of the EH, along with the concurrent shifts in material culture and architecture, led to the hypothesis that this period marked "the coming of the Greeks," the invasion of the Greek mainland by people speaking Indo-European languages (Pullen 2008). This coincides with the accepted timeline for the spread of Indo-European languages across Europe during the Middle Bronze Age. This idea was further supported by the decipherment of Linear B and the discovery that it was an ancient form of Greek. Shaft graves were also interpreted as evidence of the introduction of an elite class with burial practices that were distinct from the native population.

The "coming of the Greeks" hypothesis has been hotly debated, and many other explanations for the developments of the Middle Helladic have been advanced. The first issue with the invasion hypothesis is the inconsistent timing of both the EH destruction events and the introduction of

MH artefact and architecture types. For instance, apsidal houses have been argued as an architectural feature brought by the invading population due to similarities to structures found in the Balkans, but possible precursors have been identified in EHII contexts in central Greece (Hofsten 2014). The appearance of "Minyan ware," or Fine Grey Burnished (FGB) pottery, was thought to represent a migration or invasion of people from Anatolia, based partially on similarities to pottery found at Troy (Blegen 1928). As early as 1915, Childe argued that the appearance of Minyan ware predated the grey burnished ware from Troy (Childe 1915). More recently, local precursors to FGB pottery have been identified at Lerna, Pevkakia, Berbati, and Mitrou (Hale 2016). The linguistic evidence provided by Mycenaean Linear B tablets is similarly tenuous, only offering a *terminus ante quem* for the introduction or development of the Greek language some time before the latter half of the Late Helladic.

Alternative explanations for the site abandonments and destructions at the end of the Early Helladic also cast doubt on the "coming of the Greeks" hypothesis. While it is possible that the destruction or abandonment of these settlements was due to related violent conflagrations, it is equally likely that the destructions were unrelated. It has been suggested that the destruction layers represent accidental fires spread from hearths or clearing fires (Weiberg and Lindblom 2014) or possibly even rebuilding to make better use of sunlight (Shaw 1987). Another possible explanation is the migration of populations to other nearby settlements in reaction to regional climate shifts: the abandonment of the Altis at Olympia during EH II may have been in reaction to the flooding of nearby rivers, and Corinth may have been abandoned in a shift to the nearby site of Cheliotomylos (Hofsten 2014). The wide range of dates and scales of the destruction events and rebuilding of sites serve as a reminder that the transitions between EH, MH, and LH are artificial, and should not be treated as stark divisions between vastly different time periods.

As will be discussed below, this approach has more recently been applied to discussions of the apparent collapse of all known Mycenaean palatial sites at the end of LH IIIB, opening new avenues of research.

2.2.3. The Late Helladic

The Late Helladic period (roughly 1700 BCE -1040 BCE) is divided into five subperiods, each spanning roughly 100 years: LH I, LH II, LH IIIA, LH IIIB, and LH IIIC. LH III is divided further than the previous periods because it encompasses the rise and fall of Mycenaean palatial complexes throughout the mainland. Known palatial sites that were built during LH IIIA include Mycenae, Tiryns, Thebes, and Pylos. These centres appear to have reached the peak of their influence during LH IIIB, after which they were destroyed by conflagration events around 1190 BCE. Many settlements, particularly palatial sites, experienced a period of decline during LH IIIC, while others, including Lefkandi (S. Sherratt 2006), Mitrou (Van de Moortel and Zahou 2005) Midea (Walberg 2013), and Eleon continued to thrive.

The largest sites during LH III follow remarkably similar designs despite being dispersed across a wide geographic area. At the heart of the palace was the *megaron*, a large rectangular room with a central hearth surrounded by four columns and likely a throne (Galaty and Parkinson 2007). One side of the *megaron* opened onto a porch, while the other side led to a smaller vestibule. The *megaron* was likely an administrative and symbolic room, in which the *wanax*, or “king,” would meet with supplicants and dignitaries (Shelmerdine et al 2008). The palaces were not, however, simply residences. Workshops, storage rooms, and archives surrounded the *megaron*, indicating the palace’s hand in the organized collection and production of commodities. Palace workshops produced textiles, scented oils, and fine pottery. Beyond the walls of settlements, *tholos* tombs were built into hillsides. These beehive-shaped structures appear to have served as resting places for elites based on the presence of valuable grave goods, including fine pottery, jewellery, and weaponry (Shelmerdine et al 2008).

All palatial sites on the mainland appear to have been destroyed around 1190 BC, an event that is used to mark the boundary between LH IIIB and LH IIIC (Mountjoy 2001). Mycenaean settlements do not show a uniform decline during LH IIIC, however. For example, the site of Lefkandi actually grew in size and population during LH IIIC (Popham et al. 1981; Sherratt 2006). Burials during this period contain prestige items including exotic goods from other regions of the Aegean, suggesting sustained trading between settlements during this period. Sites located far from palatial centres may have fared better during LH IIIC than those closer to the centres (Foxhall 2005), perhaps suggesting a higher degree of independence or self-sufficiency, although continued occupation and rebuilding on a small scale occurred even at palatial sites (Shelmerdine 2008).

2.2.4. Mycenaean Thebes

The nearest Mycenaean palatial site to Eleon is at Thebes, approximately 15km further up the valley corridor to the southwest. Thebes is important to my research because it likely exerted some degree of control over Eleon during LH IIIB. The site sits on a ridge of three hills called the Kadmeia that juts into the Aonian plain, separating it from the more rolling terrain of Parasopia region to the south. It is strategically located at a convergence of natural land routes to northern Greece, western Greece, Attica, and the Peloponnese, as well as the aforementioned valley corridor and other land routes to Boeotia’s eastern coastline (Fossey 1988). This position would have allowed the palace to participate in trade and exert influence over a large area.

The Mycenaean settlement at Thebes nearly covered the Kadmeia and may have been the largest walled citadel site of the period (Fossey 1988). Unlike other palatial sites like Mycenae and Knossos, however, Thebes is buried underneath a substantial modern city, making complete excavation impossible and reducing our knowledge largely to scattered cultural resource management excavations occurring ahead of development (Dakouri-Hild 2001). This has hindered excavations at the site, and shaped the availability of areas of further study.

Portions of a substantial Late Helladic building were first identified at Thebes in 1906 by Greek archaeologist Antonios Keramopoullos. Within this structure, Kermopoullos unearthed luxury items including gold artefacts, fragments of a fresco, and stirrup jars with Linear B inscriptions (Dakouri-Hild 2001). The structure has been nicknamed the “House of Kadmos,” after the mythical founder of Thebes. As the modern city of Thebes has expanded in the latter half of the 20th century, further CRM excavations have unearthed more rooms of the House of Kadmos. Excavators have suggested that rooms A and B of the House of Kadmos represent a *megaron.*

2.2.5. Linear B

Some members of Mycenaean society were literate, writing in a script known as Linear B. Linear B has been found inscribed or painted on artefacts from Late Bronze Age sites throughout mainland Greece, as well as on Crete. The script appears to have been used primarily (or exclusively) by scribes or clerks, and by far the most common objects with Linear B inscriptions are clay tablets recording administrative data such as taxes, feast contributions, and stores of commodities (Duhoux and Davies 2008). These records provide a great deal of information about the social and political organization of Mycenaean states. For instance, the Ma series of tablets from Pylos list taxation of commodities from sixteen districts (Killen 1994), giving an idea of how the territory was divided for administration, the relative distribution of commodities, and which commodities were significant to the administration. Linear B tablets appear to have been short-term records that were preserved because they were inadvertently fired during palace destruction events (Driessen 2008). These tablets are notable to my research because many of them discuss animal husbandry, recording both living animals (in records of flocks and herds) and animals killed for consumption (in records of contributions to feasts).

Linear B was first identified and named by Arthur Evans at Knossos in 1900 (Evans 1963). The name Linear B was coined to differentiate the script from Linear A, an earlier script used on Crete. The Minoan nature of Linear B was first challenged by Blegen's recovery of Linear B tablets from LHIII contexts at Pylos in 1939 (Blegen, Vuilleumier, and Lang 1973). Using slides and transcriptions of the Knossos and Pylos tablets, Michael Ventris, an architect and amateur linguist, deciphered Linear B in 1953 (Ventris and Chadwick 1953), identifying the script as a written form of ancient Greek. Linear B has since been identified at a number of additional sites, including Chania, Mycenae, Tiryns, Midea, and Thebes (Driessen 2008).

Some Linear B tablets offer information about Mycenaean exploitation of domesticates, often recording not only quantities of animals owned or overseen by the palatial administration, but also the purpose for which the animals were raised (Halstead 2003). Sheep are by far the most commonly mentioned animals in Linear B texts, listed both in lists of feast contributions and in inventories of animals administrated or owned by the palace. Tablets from Knossos record 80-100,000 sheep in palace flocks (Killen 1994). Palatially owned flocks were made up primarily of castrated male sheep, called wethers, supplemented by breeding flocks containing ewes (Halstead 1996). Wethers are used for wool production because they grow more wool than ewes while being easier to manage than intact rams, and may produce finer wool (Halstead 1987). It also appears that herders would replace female lambs born to palatial ewes with male lambs from their own flocks, bolstering palatial supplies of wethers. In addition to flock information, some tablets appear to be records of production targets and raw wool allocations for large groups of workers who processed wool into textiles (Killen 1994). This large-scale textile production was likely a major source of wealth for the palaces (Burke 2010).

2.2.6. The Mycenaean Economy

Many of the zooarchaeological studies of assemblages from sites dating to this period are informed by, and derive their research questions from, the Linear B evidence. It is therefore necessary to review the literature pertaining to the nature and structure of the economy (or economies) of which the Linear B tablets were a part.

The Mycenaean economy is often labelled a “command” economy based on the collection and redistribution of goods by the central authority that is the palatial administration. Finley (1957) made the case for such a system shortly after Ventris and Chadwick’s seminal publications of 300 translated Linear B texts, suggesting that Mycenaean palaces were centres of an economic system that “covered the whole of the economy” in “a massive redistributive operation, in which all personnel and all activities, all movements of both persons and goods, so to speak, were administratively fixed" (Finley 1957:135). He saw attempts to find parallels between Mycenaean economic and political organization and that of later Greek periods as problematic, citing a lack of similar top-down central authorities during later periods. Instead, he proposed that the most productive comparisons to be made were with Bronze Age societies of the Near East, whose power was largely rooted in the large-scale production, collection, and distribution of staple goods. Goods were believed to enter palace control and subsequently be redistributed as subsistence, offerings, and payments (Shelmerdine et al 2008).

More recent work has challenged the idea of redistribution as the primary (or sole) driver of the Mycenaean economy. In order to understand this critique, we must first look at the origin of its use in economic and anthropological theory.

Finley's interpretation of the Mycenaean economy drew on the work of the Hungarian economic historian and anthropologist Karl Polanyi (Nakassis et al 2011). Polanyi's influential book, *The Great Transformation* (Polanyi 1944), sought to understand how economies operated through the concepts of reciprocity, redistribution, and market exchange. Polanyi saw reciprocity as operating mainly at the level of the family or kin group. Reciprocal exchanges are not necessarily exchanges in kind – for example, if one is socially obligated to provide food for one's relatives, that person may receive only social recognition or acceptance in exchange. Redistribution occurs at a larger regional or societal scale, pooling resources and reallocating them in a manner that allows for the support of an aristocratic or non-producing segment of the population. Polanyi did not conceptualize redistribution as a top-down economic system, but rather as a type of socially economic activity that can occur within the broader context of large-scale economies. In the context of Mycenaean Greece, however, redistribution was initially used as a model to explain the entire Mycenaean economy.

Finley's (1957) application of redistribution to the Mycenaean economy hinges on the absence of any allusions to other economic activities in the Linear B tablets. He was particularly interested in the lack of any evidence of currency during the palatial period, which, he argued, discounts market exchange. This is curious considering that Finley himself notes the problematic nature of "arguments from silence," asserting that "Documentation in some form surely extended to a far greater range of activity than the existing tablets reveal" (Finley 1957:131). Here, Finley is (perhaps inadvertently) illuminating one of the greatest flaws in text-based examinations of the Mycenaean economy: we are seeing records only of the activities that were of direct importance to the administration of palatial affairs. The economic activity (for instance, coarse pottery production for cookware and household storage) not recorded in the tablets cannot be discounted, as it is necessary to support large-scale production.

Halstead (2007:70) suggests that the mobilization of goods hinted at by the Linear B texts represents "a combination of staple and wealth finance," in which staple commodities were produced near palaces for palatial consumption, while the production of wealth goods depended upon the collection of smaller amounts of bronze, spices, oil, wax, honey, and flax from more outlying areas. Linear B texts from Knossos and Pylos also record subsistence allotments to groups of skilled craftspeople who were apparently "employed" by the palatial administration (Hooker 1980). As discussed above, textile production was similarly structured, with large palatial flocks consisting of tens of thousands of sheep near the centres producing wool while settlements located farther away provided animals to replenish the production flocks (Halstead

2003). This distinction between nearer and farther settlements is consistent with Foxhall's (2005) assertion that settlements located farther from palatial centres were much less affected by the LH IIIB destruction event – they were much less integrated into or dependent upon the palatial economy.

A picture thus begins to emerge of multiple nested economies operating within the sphere of Mycenaean polities. The palace was concerned with the production of prestige items, while "autonomous systems of production and exchange" operated throughout the territories they oversaw (Parkinson 2007:87). This is reflected, for example, in the pottery and stone tool industries surrounding Pylos. Chemical analysis of pottery from the Pylos Regional Archaeological Project shows that fine wares came from a single site (presumably one or more of the workshops found at the palace) while coarse ware production was decentralized, occurring at many workshops throughout the region (Galaty 2007). Obsidian blade production, on the other hand, is centred around the settlement at Romanou, a coastal site at the base of the ridge on which the palatial site sits (Parkinson 2007). Obsidian blades were found at sites throughout the 250 km^2 survey area, suggesting they were important commodities. Neither of these industries was recorded in Linear B records, demonstrating how vital sectors of the Mycenaean economy operated outside of the sphere of palatial influence.

In light of these multiple economies, we can begin to understand the importance of faunal analyses at non-palatial sites to the study of Mycenaean Greece. Forty-one tablets from Pylos, called the "Cn" set, recorded a census of pigs, sheep, and goats in nine territories (Hooker 1980). These records included the names of the individuals who herded the animals and the names of the owners of the animals as well – the first set of names is in the dative case (*x* sheep given to *person "a"*) while the second set is in the genitive case, implying ownership. Palatially owned oxen are also documented, indicating state investment in draft animals which may have been used to produce staples near the palaces (McInerney 2010, Foxhall 1995). What is not clear is the use of domesticates outside of this system. Additional investigations into domesticate use at smaller Mycenaean settlements, which will help us to conceptualize the non-palatial sphere of the Late Helladic economy, are required. How was this economic activity shaped by the larger political contexts of the state? Can we see the enactment of palatial livestock interests at a site-to-site level?

2.2.7. Late Helladic Eleon

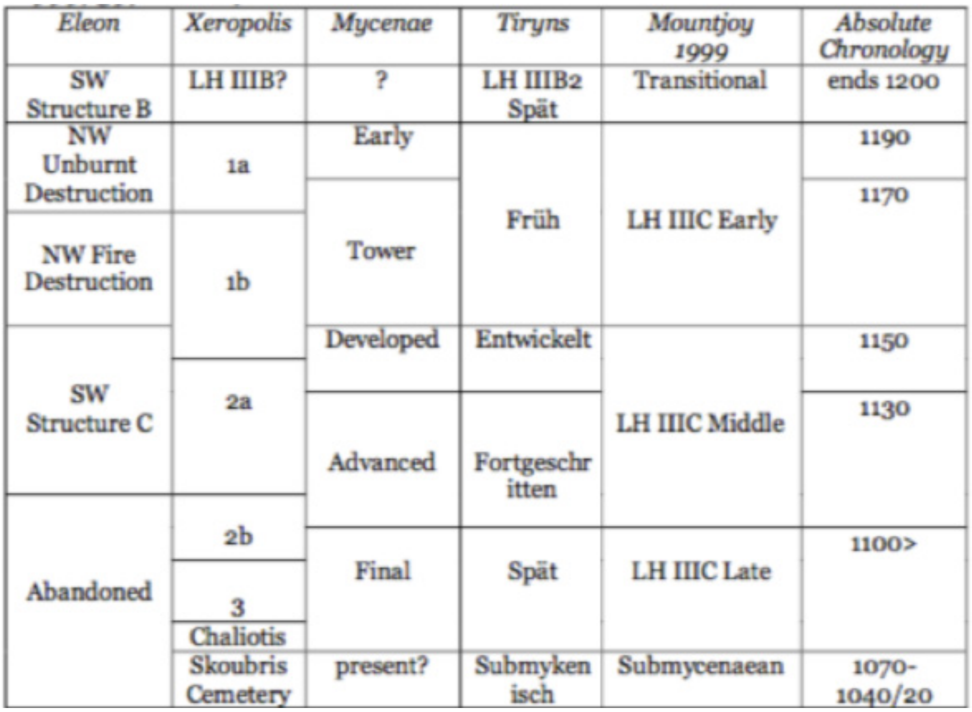
The site of ancient Eleon is ideal for examining regional post-palatial networks due to the nature of its LHIIIC components, the connection of these structures to earlier Middle Helladic building phases, and the strong parallels between Eleon and other Eastern Boeotian and Euboean sites. Ancient Eleon is situated atop an acropolis overlooking the Theban plain. The acropolis at Eleon would have served as a natural fortification, with sheer slopes on the south, north, and west sides, and a more gradual approach on the east side. Archaeological components have been identified dating from the Middle Helladic, LH IIIB, LH IIIC, Classical, and Archaic periods. During the palatial period, Eleon appears to have been a secondary centre to the palace at Thebes, appearing in Linear B inscriptions as *E-re-o-ni* (Palaima 2011). One Linear B tablet from Thebes, Ft 140, lists a number of place names followed by ideograms for grain and olives (or olive oil) and quantities. This may have been a record of either taxation or of the growing capacity of the land, but it is clear that the palace was in some way involved in, or concerned with, agriculture at Eleon (Van Damme 2017b).

The most prominent architectural feature at Eleon is a large Archaic polygonal masonry wall standing on the east side of the acropolis. The wall remains imposing to the present day, with some sections standing as high as 5m tall. Excavations have revealed a series of earthen ramps leading through this wall to a threshold. The polygonal was built atop the foundations of an earlier Mycenaean Cyclopean wall, and the threshold abuts a MH/LHI tomb complex called the Blue Stone Structure on its north side, underscoring the many phases of rebuilding evident at the site (Burke et al. 2014).

Despite the Linear B records of LHIIIB Eleon, relatively few secure palatial period contexts have been excavated from the site to date. Some deposits dating to LHIIIA2-LHIIIB1 were identified in the northwest portion of the site, but they are almost entirely obscured by later construction. The later postpalatial construction, identified as the Northwest Complex, represented one or more LHIIIC households, with several two-story sections, industrial and domestic areas, and a large partially roofed room accessed via a ramp with a 3m wide gate. One of the most significant aspects of the Northwest Complex is the use of architectural features more typical of the palatial period, including a central hearth surrounded by post bases, and ceramic roof tiles (Van Damme 2017b). A burnt layer attests to the conflagration and collapse of the Northwest Complex near the end of LHIIIC Early. Ceramics from this destruction layer show remarkable similarity to material from Lefkandi, and allow for relative dating between the sites. Stylistic similarities with Lefkandi include a motif of 3 decorative bands on the shoulders of closed vessels arranged as thick-thin-thick, and a branch-like decoration found on one vessel. The most significant similarity is a type of dipper jug that has only previously been found at Lefkandi. Despite the overall similarities between the Northwest Complex and Lefkandi ceramics, the lack of motifs that appeared shortly before the Lefkandi destruction suggests a slightly earlier date for the Northwest Complex destruction (Van Damme 2017a).

The most significant palatial period component at Eleon comes from a building called Structure A in the southwest, but it is once again obscured by later building phases. The destruction layer of Structure A contains fine pottery with features similar to Cypriot vessels, as well as a carved bone head with inlaid eyes that shows Syrian influence. Structure B was built on the remains of Structure A immediately after its destruction. The only room that has been excavated from this structure was large, measuring 8.05m x 5.05m, and contained a diverse array of ceramics dating to LH IIIC Early 1 (Van Damme 2017b). After a brief occupation that may have lasted only one generation, Structure B was filled and replaced with a terrace wall. The bulk of the faunal material analyzed in this thesis originates from this fill. Van Damme (2017b) identified a large number of ceramic vessels in this fill that suggest communal eating and drinking, including pictorial kraters, deep bowls, and kalathoi, as well as coarser cooking wares. Two ceramic bull figurines, ring vases, and stirrup jars were also recovered from this fill, suggesting that ritual activity may have been taking place. This fill is contemporaneous with the Northwest Complex. Fragments of walls surrounding this area indicate that it may have been a courtyard between other as-yet unexcavated LH IIIC households.

Figure 2-2 - Aerial view of Eleon modified from Van Damme 2017b. The fill containing the bulk of the faunal material is indicated in red.



Eleon	*Xeropolis*	*Mycenae*	*Tiryns*	*Mountjoy 1999*	*Absolute Chronology*
SW Structure B	LH IIIB?	?	LH IIIB2 Spät	Transitional	ends 1200
NW Unburnt Destruction	1a	Early	Früh	LH IIIC Early	1190
		Tower			1170
NW Fire Destruction	1b				
SW Structure C		Developed	Entwickelt	LH IIIC Middle	1150
	2a	Advanced	Fortgeschritten		1130
Abandoned	2b				
	3	Final	Spät	LH IIIC Late	1100>
	Chaliotis				
	Skoubris Cemetery	present?	Submykenisch	Submycenaean	1070-1040/20

Table 2-1 - Table from Van Damme 2017b:17 showing the chronology of the Late Helladic occupation layers at Eleon compared with contemporaneous deposits from Xeropolis (Lefkandi), Mycenae, and Tiryns. Column 5, showing time periods, is adapted from Mountjoy (1999).

Van Damme (2017b:349) suggests that Eleon provides “an ideal case study in the aftermath” of the Mycenaean palatial collapse. The tomb structure, which predates the palatial period, suggests that the site may have been “the seat of one or more prominent local families, who perhaps even established a hereditary chiefdom at (Eleon).” These elites may have continued to preside over the sectors of the local economy that were not under the control of Thebes during the palatial period. After the collapse of Thebes, Structure B continued to be occupied for up to 50 years before it was destroyed and rebuilt. Meanwhile, new construction showing typical palatial features was taking place in the Northwest Complex. Van Damme suggests that the proximity of this new construction to the Blue Stone Structure was intended to solidify the complex’s connection to Eleon’s prepalatial power structure. This continuity is significant in that it mirrors developments at Lefkandi, which includes significant post-palatial building phases, while being located much closer to the palatial centre. Combined with the strong ceramic parallels between the two sites, this suggests a region-wide network of cultural and economic connections that existed outside of the sphere of palatial influence. Knodell (2017) addressed these types of connections in the area surrounding the Euboean Gulf through the lens of network theory, suggesting a decentralized network of "small worlds" geographically linked by gulf. According to Knodell, the more centralized network of the palatial period was inherently unstable precisely because it was dependant on a small number of influential sites. Weak, but perhaps influential, ties to regions further afield, including throughout the Mediterranean, are attested by imported grave goods excavated from elaborate elite tombs built during the Early Iron Age at Lefkandi. Eleon is therefore uniquely poised between the overlapping networks represented by Thebes and the Euboean Gulf, both physically and culturally.

The strong ties between Eleon and Lefkandi are noteworthy in part because it is unclear to which degree Euboea was under the influence of the palace at Thebes. Palaima (2011) notes only very limited references to the sites of "*Karustos"* and "*Amarynthos"* in the Theban Linear B texts, none of which record the large-scale taxation that would be expected from satellite settlements. These references are on nodules with impressed seals rather than tablets. Each nodule has three inscribed sides, but there is still a space limitation on nodules that is not present on full tablets. Perhaps because of this lack of space, the place names are presented without syntax, making it unclear whether they are intended to be in the dative-locative case, which would simply locate the activity, or whether the settlement was *in charge* of the activity. The activities themselves are rather small-scale. For example, nodule Wu 58 reads "pig finishing work of *qe-ri-jo* (a personal name)," followed be the caseless "*Amarynthos*" (Palaima 2011). It should be noted, however, that Linear B records in general were relatively limited in the scope of activities they recorded, and the absence of certain activities in the corpus of recovered texts does not necessarily indicate that they were not taking place.

The parallels between Eleon and Lefkandi extend to the available faunal material as well. Mulhall's (2016) PhD dissertation is among the most thorough faunal reports from any site on the Greek mainland, and focuses on the LHIIC/SubMycenaean and EIA components of the site. Mulhall examines the postpalatial economy through changes in species composition and mortality profiles through this transitional timer period. Comparisons between the faunal material from Eleon and Lefkandi, and to a lesser extent the less thoroughly published faunal assemblage from Oropos, are integral to furthering our understanding of the Euboean Gulf network that appears to have extended further inland than expected.

2.3. Modeling Animal Exploitation

2.3.1. The Secondary Products Revolution

Many of the zooarchaeological studies from Neolithic and Bronze Age sites in Greece and nearby regions focus on Sherratt's (1983, 1986) concept of the Secondary Products Revolution (2PR). Sherratt proposed that during the later Neolithic, peoples in western Eurasia began to exploit their domesticated animals for "secondary products," that is, those products that can be used without killing the animal. The most obvious of these are wool and milk, but many other secondary products can be collected from living animals. These include manure, lanolin, horsehair, shed horns and antlers, and in some instances blood. Services or tasks performed by domesticated animals are also considered to be secondary products. Pack animals move goods much more efficiently than humans, while riding horses and camels allows people to travel rapidly over large distances. Additionally, grazing and browsing animals can also be used to clear land. In contrast, primary products are collected from dead animals. This includes edibles such as meat, organs, marrow, fat, and blood, as well as many raw materials like bone, horn, antler, hides, teeth, sinew, tallow, oils and tendons. Nearly every part of a carcass may have uses as a primary product, often in ways that are not immediately apparent – for instance, brain tissue is used to tan hides and furs. Sherratt proposed that the 2PR was instrumental in the centralization and intensification of agriculture that was seen in many regions during the Late Neolithic period. Many researchers embraced Sherratt's ideas and began to apply these concepts in Europe, the Near East, and Asia in order to identify the origins and spread of secondary products exploitation. While criticisms have been levelled at the model in recent years, it is significant to my study because it has provided the theoretical basis for much of the zooarchaeological work in the eastern

Mediterranean and has been a primary motivator of improved methods for ageing animal remains.

Sherratt suggested that the development of secondary products-driven economies began as a “mosaic” of new practices, largely developed in the Near East during the fourth millennium BC as early farming moved into new environments, particularly open plains capable of supporting large numbers of livestock (Sherratt 1983). This “mosaic” of innovations was said to work in concert, with the adoption of each practice supporting the others. Ploughing allowed for the cultivation of land at a much faster pace, and in previously unfeasible locations. In mountainous Greece, where arable lowland areas are scarce, the introduction of ox-pulled ploughs would have allowed for greatly intensified food production necessary during the shift toward larger population centres that is observed in the transition from the Final Neolithic to the Early Helladic (Pullen 2008). While Sherratt suggests that dairying dated to the Neolithic period, he posited that its large-scale adoption developed alongside this agricultural intensification, using fallow fields to feed milk herds. The use of both cattle and sheep for milk produces a greater yield of calories relative to feed than rearing for meat. It also maintains a stock of animals that can be slaughtered as an emergency food source in times of drought or famine. Grazing cows and sheep may also increase the yield of fallow plots, with cattle eliminating larger weed and brush growth and sheep grazing closer to the ground on the ends of harvested crops and fallen grains (Halstead 1981). In contrast to dairying, rearing sheep for wool uses the same newly cleared land, but greatly reduces the amount of food produced by the herd. Large-scale wool textile production, which required oversight by regional power centres, was instead a major source of wealth during the Bronze Age, further reinforcing the centralized intensified economy (Halstead 2003).

Greenfield (2014) suggests three “phases” of the application of the 2PR model to zooarchaeological research: the age of innocence during the 1980’s, the golden age (the 1990’s and early 2000’s), and the age of disillusionment (from the early 2000’s to the present). These somewhat dramatic terms reflect the prevailing attitudes toward the model as enthusiasm grew alongside improving recovery, identification, and sampling methods, followed by a critical backlash at the turn of the 21st century. It should be noted that Greenfield has been a leading figure in studies based on the 2PR model, and is credited as author or co-author in many studies that apply the model or discuss the theory behind its application. Of particular importance is his study of the origins of milk and wool production in the central Balkans (Greenfield 1988), in which he challenged the practice of relying on artefactual and pictographic evidence for identifying the origin and spread of secondary products exploitation, and suggested archaeologists instead turn their attention to faunal remains.

2.3.2. Payne’s Models

Payne’s (1973) hypothetical harvest profiles for sheep and goats, developed from consultations with Turkish sheep and goat herders, have been used in studies of the 2PR since the 1980’s, and have had a great influence on research questions and methodologies. Payne outlined optimal herd management strategies for meat, wool and milk production. When a particular animal is slaughtered is said to be dependent on “the relative value placed on the different products, on the characteristics of the stock, and on a range of environmental factors” (Payne 1973:281). Despite the fact that Payne addressed only sheep and goat management, his profiles have been used for cattle and pigs as well.

Before Payne's proposed herding strategies are laid out below, it should be noted that he offers almost no citations or references to back up his assertions. This makes their application extremely problematic; however, they must still be outlined here because their use is widespread. It should also be noted that, as in many zooarchaeological reports, no difference between sheep and goats is noted in Payne's kill-off patterns. This fails to address differences in growth and development, feeding behaviours, and potential uses of the species (for instance, goats are not kept to make textiles as often as sheep).

According to Payne, for meat production, male sheep and goats are slaughtered just before they reach the point of development when the ratio of meat yield to feed input begins to fall. This period occurs between the ages of 18 and 30 months. Females are allowed to live longer, particularly in adverse conditions when the flock may need to be replenished, or in particularly favourable conditions, when an increase in flock size is sustainable.

For milk production, male and female lambs that aren't destined to join the breeding flock are killed as soon as they are not needed for their mother to continue lactating. This pattern could change considerably depending upon the breed in question, however. For example, Greenfield (2005) notes that more "primitive" or "unimproved" breeds of cattle will not lactate without a calf present, but that selective breeding of many breeds has eliminated this requirement. The timing of this breeding development is not known. Adult males are kept in sufficient numbers for breeding (this number is not defined, however), while females are slaughtered once they are no longer able to yield an economical amount of milk.

The kill-off pattern that has received the most attention in Mycenaean contexts is that for wool production. Wool flocks are comprised largely of adult animals, and breeding is aimed at maintaining or increasing the number of wool-producing adults. Males that aren't used for breeding stock are castrated. These castrated animals, called wethers, are valued because they produce both finer and more plentiful wool. Linear B tablets form Knossos record that the majority of palatial wool flocks were made up of wethers, with a much smaller contingent of ewes and yearlings, presumably for breeding (Halstead 2003; Mancz 1989).

2.3.3. The Survival Subsistence Model

In recent years, there has been a critical backlash toward Payne's models, leading to alternative interpretations of mortality data. Halstead (1998) levelled three main critiques against Payne's models. First, the models do not account for biological differences between ancient and modern breeds of livestock. Most notably, these early breeds may not have produced milk if infants were slaughtered young, as suggested by Payne. Second, the models assume that people were highly specializing herds for production of only one product at a time, whereas more generalized and mixed strategies appear to be much more common in historic contexts. Third, and most importantly, Halstead notes that faunal assemblages are influenced by many factors that can mimic these models, including the selective deposition of young and old animals in different locations or carnivore ravaging and the chemical or physical wear of smaller, more delicate elements.

Sasson (2010) proposed that the root of these issues lies in the implicit assumption that Bronze Age and Iron Age pastoralists and herders were operating within a "market economy." According to Sasson, market economies are driven by the goal of maximizing profit, and individuals or communities within such a system focus on producing as much of the most profitable commodity (e.g., meat, milk, or wool) as possible from their livestock. Sasson suggests that this thinking imposes modern Western economics onto ancient peoples, and views smaller settlements as sustainable only through the lens of a larger, regional economy. Highly specialized herds carry more risk than generalized herds, in that they may focus on the most profitable demographic makeup rather than the most stable. For example, a large wool flock may maintain only a small breeding population of females.

As an alternative, Sasson proposes a "survival subsistence strategy," in which the scarcity or abundance of natural resources (i.e., water, pasture land, or wild grazing resources) is the primary driver of economic decisions in ancient societies. Each community is viewed as operating a self-sufficient economy whose goal is to ensure the sustainability of herds, families, and the community itself, rather than profit. Regional trade is incidental, and trade goods (i.e., meat, hides, or secondary products) are generated as by-products of local subsistence herding.

Sasson (2010) and Sasson and Greenfield (2014) posited that this strategy was used in the highly centralized Bronze Age Levant, which operated in a similar manner to the Mycenaean textile economy. Central administrations dictated the management of many flocks spread out between the smaller settlements of the region in order to maximize wool production. Based on this model, Sasson and Greenfield suggested that zooarchaeological studies should focus on identifying the degree of specialization across time periods at multiple sites within a given region using mortality profiles. Several lines of evidence are proposed that would support his survival subsistence model. First, herds would have to be relatively small, below the maximum carrying capacity of the environment. Instead, herds would be sustainable on the resources available during the least productive years or seasons in regional weather cycles. Second, roughly equal ratios of sheep to goats (between roughly 50% and 65% sheep) indicate an emphasis on herd sustainability rather than specialized production. Third, the mortality profiles within these herds should show that roughly equal numbers of sub-adults and mature animals were culled, while maintaining a stable population of breeding adult females. Infants and juvenile deaths are regarded as the result of natural mortality.

Although Sasson and Greenfield's work is critical of the application of models like Payne's, it could be argued that they are effectively rebranding these models rather than offering alternatives. The identification of more specialized flocks relies upon the same age-at-death data and generates similar mortality curves, but Sasson conveniently discounts juvenile specimens in order to fit the models to his theory. While the ratio of sheep to goats was not addressed in Payne's original models (most likely due to the lack of reliable methods for differentiating the species), Sasson's assertion that it can be used as a proxy for specialization seems to disregard the fact that sheep and goats could both be raised simultaneously for different products (for instance, sheep for wool and goats for milk) while exploiting different food sources within the same landscape (as goats are browsers and sheep are grazers). In this sense, equal numbers of sheep and goats could indicate *more* specialization.

While the survival subsistence model is as problematic as the models it critiques, Sasson makes a valid argument that local economic forces and decisions must be understood both in the context of wider regional economies and as self-sufficient units. This is highly relevant to the case of

Eleon and the nearby sites of Oropos and Lefkandi, where the local economy appears to have weathered the LH IIIB/LH IIIC transition.

Despite the potential issues with examinations of secondary products exploitation, the application of these ideas in my work is nonetheless important because it allows for comparisons with the multitude of other studies that have also done so. Specifically, Payne’s (1973) mortality profiles are still used today as a standard against which to compare mortality data, and mortality results are plotted against these models for visual comparison. A standard against which to compare data is therefore necessary, although we must acknowledge its faults.

2.4. Greek Faunal Analyses

2.4.1. Introduction

In order to better understand animal use in Mycenaean states, we must first review the context of domesticated animal use in the region. While much of the work concerning Mycenaean faunal remains focuses on ritual feasting and sacrifice (e.g., Chenal-Velarde and Studer 2003; Dabney, Halstead, and Thomas 2004; Hamilakis and Konsolaki 2004; Isaakidou et al. 2002), studies of subsistence and domesticate exploitation at several other Greek sites provide a basis for comparison to Eleon. These sites include Lerna, Midea, Eleusis, Oropos, Nichoria, Lefkandi, and Megalo Nisi Galanis. It should be noted that Megalo Nisi Galanis is an outlier because it is primarily a Neolithic site; however, its faunal material provides a good comparison for studying exploitation patterns from domesticates using ternary diagrams (explained below).

In his review of the published Greek zooarchaeological literature, Mulhall (2016) notes a dearth of reports. In total, he compiled published faunal reports from 29 Greek sites with components that could be firmly dated from LH IIIC to the Late Geometric (1200BC to 700BC). 9 of these reports were from sites on Crete, and 3 were from sites elsewhere in the Aegean. Of the remaining 17, 7 are from cemetery and sanctuary contexts, which generally have small sample sizes, often under 100 fragments. I have chosen to focus my review on settlement sites on the Greek mainland, in order to avoid issues of comparing Mycenaean and Minoan contexts.

2.4.2. Lefkandi

Mulhall's (Mulhall 2016) doctoral research from the site of Lefkandi on Euboeia provides the closest comparison to my work at Eleon, in terms of the faunal material being examined, the research aims, and the theoretical underpinnings of his research. Mulhall examines faunal remains from Lefkandi in order to attempt to model the socio-economy of Greek sites across the LHIII to EIA transition while taking into account recent developments in zooarchaeological methodology. To accomplish this, Mulhall focuses on remains across these time periods, applying many of the same methods that I have employed in my own research. Mulhall's use of Payne (1973) and Grant's (1982) systems for recording sheep/goat tooth wear and Weaver et al.'s (2011) likelihood-based statistical modelling tool for creating ternary diagrams from these data are of particular interest, as this allows direct comparisons between the sheep and goat mandible data from Eleon and those of a nearby, contemporaneous site.

The site of Lefkandi has two main areas – a settlement, and a complex of cemeteries. The settlement, known as Xeropolis, sits on a long hill that juts into the Euboean gulf, and appears to have been occupied from the EH through to the Geometric period. The cemetery complex lies roughly 450m northwest of Xeropolis, and dates to the Geometric (Early Iron Age) period. A separate tomb complex dates to the MH. While Mulhall is mainly interested in the LH IIIC and Geometric periods, the faunal material he examined also includes small samples from the Early and Middle Helladic. This material was excavated during two separate projects, one between 1964 and 1970, and another between 2003 and 2008. The 1964-1970 excavations took place in the "Main Excavation" area of the site, which lies near the centre of Xeropolis. The 2000's excavations opened a further 500 square metres of trenches, also centred on the settlement portion of the site. The inclusion of material from both projects allows for comparison between excavation methodologies – like the assemblage from Eleon, the 1960's material was largely hand-collected, with small samples dry-sieved (although it is unclear how these samples were selected). In contrast, the recent excavations at Lefkandi dry sieved all material, with smaller samples wet-screened. The context of the Lefkandi faunal material is also similar to the material from Eleon in that it was recovered from contexts in and around large stone structures, including at least one two-storey structure.

Mulhall employs 4 quantification methods for the Lefkandi assemblage: NISP for raw counts of recovered elements, MinAU (Minimum Animal Units) and MaxAU (Maximum Animal Units) to record the minimum and maximum possible numbers of pre-defined skeletal portions present (either entire bones or portions thereof), and MNI, which is only calculated for sheep and goat mandibles in order to use Weaver et al.'s ternary diagram program. Mulhall uses animal units instead of MNI because it examines useful or desirable portions of animals rather than entire individuals, which can be argued to account for the way animals are typically divided during butchery.

Mulhall's results are divided by excavation period ("1960's-Combined" and "2000's-rgnl(HC)") and by time period. The 1960's-Combined material is divided into six time periods: L.EHII-E.MHI (Late EHII to Early MHI), MHI-MHII, MHIII-LHII, LHIIIA-LHIIIB, LHIIIC-SMyc (LHIIIC to SubMycenaean), and EPG-LG (Early Protogeometric, referring to the transitional phase after LHIIIC, to Late Geometric). The 2000's material represents only three time periods: LHIIIC-SubMyc, LHIIIC-LG, and EPG-LG. Note that several of these periods overlap, and are more accurately described as denoting the accuracy with which different assemblages could be dated..

The time period that is most directly relevant to the material from Eleon, LHIIIC-SMyc, is also the best represented from both the 1960's excavations and the 2000's excavations, with 4131 fragments and 3027 fragments, respectively.

Taxon percentages for the 1960's assemblage are 17.8% for cattle, 16.7% for pigs/wild boar, 11.1% for deer, 1.8% for dog, and 3.5% for equids (horses, donkeys, asses, and mules). Mulhall is able to differentiate sheep and goats much more accurately than earlier studies, thanks to the methods of Zeder and Pilaar (2010) and Zeder and Lapham (2010). Sheep make up 14.8% of NISP, and goats make up 10.6%. The total for sheep, goat, and sheep/goat is 49%. Percentages for the 2000's assemblage are relatively consistent, with 20.9% cattle, 14.7% pigs/wild boar, 8.1% deer, 1.8% dog, and 3.4% equids. Sheep account for at least 11.2%, goats account for at least 10.9%, and combined ovicaprids make up 51.1%.

Mulhall's age-at-death data, plotted on ternary diagrams using Weaver et al.'s (2011) statistical program, demonstrate no statistically significant differences across time periods for sheep or goats between the LH and EIA, but do show a statistically significant difference between sheep and goat mortality profiles during the LHIIIC-SMyc period. Notably, this difference is only statistically significant using a 90% confidence interval, as the areas surrounding each data point do overlap if a 95% confidence interval is used instead. If we visually compare the points to Greenfield and Fowler's suggested meat, milk, and wool/traction points, the goat data include the meat area, while the sheep data are centred close to the milk area. Sample size for each species is fairly sizable, with an MNI of 49 sheep and 51 goats. It is interesting to note that the sheep data lie far from the wool point, suggesting that sheep were not being raised for wool at post-palatial Lefkandi.

2.4.3. Oropos

Early Iron Age faunal data from Oropos (Trantadilou 2007), approximately 40km southeast of Eleon, provide a good comparative sample to Eleon because they originate from post-palatial contexts identified by the authors as both "habitation" and "industrial" areas (Trantadilou 2007:379). Unfortunately, although extensive raw data tables are presented, the written report is brief and short on methodological details. Tables are presented for each species, with rows of elements and columns for side, modification, degree of fragmentation and NISP. NISP is only listed for fragments of epiphyseal ends of long bones. It appears that differentiation between sheep and goats was based on horn core and long bone morphology, with tables including entries for cranial and postcranial elements, but the number of fragments that were differentiated is remarkably low compared with the total sheep/goat fragments. It is unclear what caused this discrepancy.

Remains were mostly found along the walls of structures, and were largely made up of domesticates. 4488 total fragments were identified, with sheep/goat remains making up the bulk of the assemblage, with an NISP of 3454. 77% of the assemblage was identified as sheep/goat, with roughly even percentages of sheep (1.2%) and goat (1.1%). Cattle were the next most abundant at 7.7%, followed by pigs at 4.2% and equids (likely donkey or wild ass based on size) at 2.4%. 1.8% of fragments were identified as deer, and 0.2% as dog. These numbers are notable for the much heavier bias toward sheep and goat fragments than at other sites, where the spread between ovicaprids and the next most abundant species is typically in the range of 20%, rather than 70%.

MNI for each taxon at Oropos, calculated using the most abundant longbone (accounting for side of the body) for each species, was 9 for sheep/goat, 3 for cattle, 3 for pigs, and 1 for deer. The representation of different skeletal elements was relatively equal, which lead Trantadilou to suggest that domesticated taxa were living and being butchered on site, citing the exclusion of non-limb bones from deer, which Trantadilou posited as representing the transport of meat-rich parts of the carcass from a kill site. It should be noted, however, that both NISP and MNI for deer were too small to draw any firm conclusions.

Mortality profiles at Oropos were developed for domesticates from both epiphyseal fusion (not discussed here) and tooth eruption and wear based on both Payne's (1973) and Grant's (1982) systems. 115 sheep/goat mandible specimens were included in Trantalidou's analysis, divided into the following age classes: 0-2 years (9 specimens), 2-3 years (10 specimens), 3-5 years (23 specimens), 6-10 years (69 specimens), and >10 years (4 specimens). The strong bias toward adult individuals is highly suggestive of secondary products exploitation, although no comparison between sheep and goats is possible, as all of the sheep/goat mandibles are examined together. It would perhaps be fruitful to revisit the Oropos assemblage with the addition of Zeder and Pilaar's (2010) tooth identification method.

2.4.4. Lerna

One of the earliest faunal analyses of a Mycenaean site examined material from excavations at Lerna between 1952 and 1958. Material from these excavations has been used to establish the chronology of much of the Greek Bronze Age, especially the Middle Helladic, Gejvall (1969) conducted the faunal analysis for the Lerna assemblage, which numbered 25,287 fragments, of which 15,621 were identified as vertebrate fragments. These high counts reflect the greatest flaw with Gejvall's report, namely that Gejvall categorizes only 936 fragments (of the total 25,287) as "splinters," and 2 fragments as "unidentifiable," suggesting that all other fragments were placed into a species category. Furthermore, he didn't include size classes or any other category for fragments that were identifiable as terrestrial vertebrates but unidentifiable to species. Identification of an assemblage with this type of accuracy is highly improbable, and suggests that the results should be approached with caution. The reason for the degree of certainty with which Gejvall's data were classified is his use of an early computer for analyzing his data. Fragments were recorded onto punch cards, which limited the number of data points that could be recorded for each fragment.

Two areas that are particularly concerning in Gejvall's results are the differentiation between sheep and goat remains, and the differentiation of wild vs. domesticated pigs and cattle. Gejvall identified sheep and goat remains based on the work of Boessneck et al (1964), noting that these criteria were published halfway through his research, but not specifying how they were applied. Zeder and Lapham's (2010) assessment of the reliability of criteria to differentiate sheep and goat remains drew heavily on Boessneck et al. (1964), as well as the later English translation, and found that they were highly reliable even for unskilled analysts, but the number of fragments that

Gejvall was able to differentiate is nonetheless uncannily high. For instance, the NISP in the "*Ovis et / sive Capra"* category (including sheep, goat, and sheep/goat) is 3,597, of which 225 were identified as sheep and 863 were identified as goat. This means that 43.4% of all sheep and goat remains were identified to species. Considering that Gejvall was classifying the vast majority of fragments to species, meaning that small fragments were likely included in the total number, and that he may have only been applying this methodology to an unknown portion of the total fragments, this number raises some questions. Was Gejvall recording every sheep/goat fragment to species after the publication of Boessneck et al.'s criteria, or were the criteria only used for more complete specimens?

One of Gejvall's primary research questions concerned the timing of the introduction of domesticated pigs and cattle, as well as their relative frequency compared with their wild counterparts. The methods used to differentiate wild and domestic animals were, however, problematic. In fact, Gejvall does not specify what methods were used to differentiate wild from domesticated cattle at all. His methodology for pigs was clearer, but still suspect, using measurements taken from lachrymal bones. This method is still applied today (Reitz and Wing 2008), but has several inherent drawbacks. First, while the morphology of cranial bones is generally a reliable method of differentiating domestic and wild pigs, the bones surrounding the orbit (including the lachrymal) in fact demonstrate the least identifiable difference compared to other portions of the cranium when analyzed using 3D geometric morphometrics (Owen et al. 2014). Second, and more importantly, cranial bones are fragile and are rarely intact in archaeological contexts. Considering the high degree of fragmentation recorded by Gejvall, the likelihood of the lachrymal bone data accurately reflecting the living population is low.

The largest portion of the Lerna assemblage dates to the Lerna V phase, which coincides with the Middle Helladic and was the period of the most intensive occupation of the site. Of a total of 7672 fragments representing this period, 20.4% were identified as coming from domesticated pigs, 13% from sheep/goat, 16.6% from cattle, and 3.4% from red deer. The remaining fragments were identified as wild taxa (e.g., birds, turtles/tortoises, or molluscs). Numbers during Lerna VII (roughly LHI-II) are much lower due to a smaller excavated area and less intensive occupation, with a total of 122 fragments, of which 15.6% are pig, 10.7% are sheep/goat, 9.8% are cattle, and 3.3% are red deer. Reese (2008) revisited the Lerna assemblage, examining 4127 fragments dating to the Late Helladic, for which NISP was 3558 for sheep/goat, 350 for cattle, 189 for pigs, 22 for hare, and 8 for red deer. The calculation of Minimum of Individuals (MNI), based on long bone specimens in this case, indicates the presence of at least 9 sheep/goat, 3 cattle, 3 pigs and 1 deer. All portions of the skeleton were represented, except in the case of the deer, for which only limb bones were found.

2.4.5. Midea

Reese published a short analysis of the faunal remains recovered during the 1994-1997 excavations at Midea on the Argolid peninsula, on a terraced slope to the north of the citadel's walls. Reese's data are included as an appendix to a volume outlining the results of the 1994-1997 excavations. Each deposit is listed with a total number of fragments and a brief summary of the elements identified for each species at the site. Age-at-death data are also presented in the same way for sheep/goats, cattle, and pigs. Short summaries for each species list MNI as well as listing MNI for each age class of the above major domesticates across time periods. Notably, there is no explanation of the methods used for recovery, identification, or ageing. As such, Reese's results should be approached cautiously. Comparing the raw lists of fragments with age-at-death data, it appears that mortality profiles were developed using a combination of loose tooth wear, tooth wear in mandibles, and longbone fusion, although it is unclear which methods were used. MNI counts are unusually high compared with NISP, possibly due to the fact that MNI appears to have been calculated for each deposit from a given time period (although it is unclear how deposits are defined). All deposits are treated as independent assemblages, leading to possibly inflated MNI counts.

Only 261 fragments from Midea are identified as pre-dating LH IIIB, while 3,091 fragments were dated to LH IIIB, 414 fragments were found in disturbed LH IIIB/LH IIIC layers, and 1,859 fragments were dated to LH IIIC. MNI calculations for the LH IIIB layers indicate the presence of at least 67 sheep/goats (31.6% of total MNI), 71 cattle (33.5%), and 74 pigs (34.9%). MNI decreases for all three taxa during LH IIIC, to 42 (38.5%) for sheep/goats, 36 (33.0%) for cattle, and 31 (28.4%) for pigs. Although the methodology for age estimation was not described, broad age categories are provided for a portion of the sheep/goat remains from LH IIIB and LH IIIC. MNI is calculated separately for specimens that were aged. Eleven of the 17 individuals (64.7%) from LH IIIB were identified as adults over 1.75 years of age, of which 6 (35.3%) were over 2.5 years, while 3 (17.6%) were under 6-8 months. In LH IIIC, 10 of 14 (71.4%) are over 1.75 years old, of which 3 (21.4%) are over 2.5 years, while 2 (14.3%) are under 10 months and 1 (7.1%) is under 6-8 months. The presence of older animals could indicate that these sheep/goat were not being raised for meat, but were being kept alive in order to provide secondary products, namely milk or wool.

2.4.6. Eleusis

The faunal material from Eleusis, a settlement site with material from the Early Helladic to the Roman period located 22km west of Athens, is worth mentioning as it includes a small amount of Late Helladic data. Cosmopoulos et al. (2003) analysed the small assemblage, totalling 1878 fragments (including unidentified fragments) across all time periods, with an interim report published in 2003. It appears that no final report was published, possibly because the material is quite limited. The assemblage in question was recovered from the only well stratified Bronze Age deposits at Eleusis, although its presentation is perhaps of minimal use as there is no mention of the methodology employed for identification or age-at-death calculations. The material is, however, noteworthy for the recovery methods employed, in which all material was dry sieved through 1cm mesh, while a "substantial percentage" (Cosmopoulos et al. 2003:151, undefined by the authors) was also wet sieved and floated. Cosmopoulos et al. identified material from contexts ranging from the Early Helladic to the Roman period, suggesting a great degree of "continuity" from the Bronze Age through Classical times (*ibid.*), with the same range of domestic animals exploited across all time periods. Wild taxa account for only a small portion of the assemblage, and despite Eleusis being a coastal site, almost no fish remains were found. Several explanations for this absence are possible – either fish were not making up a significant portion of the diet at Eleusis (somewhat unlikely), fish were being eaten but their remains were deposited separately from other faunal remains (similarly unlikely), or the screening used at the site was simply too large to recover fish bones. A review of any soil samples that may exist from the site would be beneficial to narrow down these possibilities.

The Late Helladic assemblage from Eleusis is small, with 108 fragments firmly dated to LH I, 19 to LH III, and 105 that could only be dated to some time between LH I and LH III (presented as LHI-LHIII). The LH III material will not be discussed here because of its small sample size. The LH I sample is dominated by sheep and goat at 41.7%. 6.5% of the assemblage could be identified as sheep, and 3.7% as goat. 18.5% of fragments were from cattle, 23.1% were from pigs, and 1.9% were from dogs. The LHI-LHIII material showed an even greater bias toward sheep and goats, with ovicaprid remains making up 69.5% of the assemblage, including 1.9% sheep and 2.9% goat remains. Cattle made up 9.5%, and pigs accounted for 23.8%. No dog remains were identified in this part of the assemblage. It is noteworthy that pigs outnumbered cattle in both time categories, however the remainder of the material demonstrates the typical pattern seen across Bronze Age Greek sites. It is notable, however, that no deer remains were found in any Bronze Age deposits at the site. Only one deer fragment, dating to the Classical period, was identified at Eleusis.

Cosmopoulos et al. do not specify whether their age-at-death data were compiled from tooth wear or from postcranial fusion, making comparison with other studies problematic. Combined with the small sample sizes of aged specimens, I determined that their data should not be considered for my analysis.

2.4.7. Nichoria

Mancz' (1989) doctoral thesis provides a relatively thorough comparison of the Late Helladic and the Early Iron Age faunal material from Nichoria in Messenia, investigating both subsistence and mortality profiles.

Of a total NISP of 453 during LH III, 176 fragments were sheep/goat (only one fragment was identified as goat, and none were identified as sheep), 164 fragments were pig, 96 were cattle, 7 were red deer, 2 were dog and one was equid. Some fragments could be precisely dated within LH III, allowing for a comparison between LH IIIA2 (NISP=290) and LH IIIB (NISP=196), while the remaining fragments were less precisely dated. While the proportion of sheep/goat specimens remained roughly the same between these periods (47.24% vs. 43.37%), the representation of pig remains drops sharply from 33.45% to 20.41% while cattle jumps from 14.83% to 21.43%. When MNI was calculated for these remains, these patterns remained, despite the small sample sizes. The largest difference between NISP and MNI is the drop from 36.36% of total MNI (MNI of 8) for sheep/goats in LH IIIA2 to a 26.67% of total MNI (MNI of 4) in LH IIIB. The transition to the Early Iron Age (NISP=1110) sees a shift toward cattle (NISP=466, MNI=23, 31.51% of total MNI), although sheep and goats remain abundant (NISP=391, MNI=20, 28.57% of total MNI). Pigs occur less frequently, with an NISP of 192 and an MNI of 15 (20.55% of total MNI). Red deer NISP is relatively high during this period, at 41, with an MNI of 5 (6.85% of total MNI).

Mancz developed mortality profiles relying largely on epiphyseal fusion. She is critical of tooth wear analysis, citing differential wear due to diet, but notes that she would have liked to apply Klein and Cruz Uribe's method of calculating age-at-death from tooth wear (Klein and Cruz-Uribe 1983), but it was published after the data had already been recorded. As such, tooth wear analysis was not included, but tooth eruption was used for ageing intact mandibles. Based on the long bone and tooth eruption data, Mancz suggests that sheep and goats were being slaughtered primarily at 20 to 24 months in the Bronze Age, with only 39 of 682 specimens slaughtered before 1 year of age. 26 specimens were identified that had lived 42 months or longer. The Early Iron Age sample was smaller, with only 88 long bone specimens used for ageing. Of these, only 3 fragments could be aged to less than 1 year of age, and 4 to more than 42 months. The remainder were slaughtered between 15 and 36 months. MNI was 1 for both the young and old age categories. The Early Iron Age sample is small enough that mortality profiles are tentative projections at best, but both time periods suggest that the largest number of individuals were being slaughtered between their second and fourth years, suggesting the use of secondary products. The Bronze Age sample would be a good candidate for further research using modern methods for differentiating sheep from goats and tooth wear analysis.

2.4.8. Megalo Nisi Galanis

Although the material at Megalo Nisi Galanis in Macedonia significantly predates the Eleon assemblage, it is notable for the size of the assemblage and for the mortality profiles developed for pigs, sheep/goats, and cattle across different time periods by Greenfield and Fowler (2003). Compared with earlier studies (e.g., Mancz 1989, above), the percentage of sheep and goats that were identified definitively is much higher, most likely due to improved methods for identification. Unfortunately, however, Greenfield and Fowler present only their results, with no real explaination of their methodology.

The assemblage numbered 52,796, of which 5988 could be identified to taxon. The Final Neolithic (FN) and Final Neolithic-Early Bronze Age transition (FN-EBA) periods produced the bulk of the material, with 27,417 and 20,184 fragments, respectively. The Early Bronze Age sample is simply too small to provide any useful information, with only 26 fragments identified.

2,768 of the FN fragments could be identified to species, the majority of which (1517 fragments, or 54.8%) were sheep (NISP=453, or 16.4%), goat (NISP=114, or 4.1%), or indeterminate sheep/goat (NISP=950, or 34.3%). Cattle were the second most abundant, at 443 fragments (16%), followed by pig at 403 fragments (14.6%), and dog at 106 fragments (3.8%). Wild taxa were rare, with only 60 red deer fragments, or 2.2%. The FN-EBA material shows a similar pattern, with sheep/goat making up 41.1% of the 917 fragments identified to species. In the small sample of specimens that could be identified to species, sheep once again seemed more abundant than goat, with an NISP of 95 (10.4%) versus an NISP of 18 (2%); indeterminate sheep/goat made up 28.8% of the total with 264 fragments. The relative proportions of cattle (15.6%), pig (15.5%), and dog (3.1%) changed very little, although red deer rose to 6% (NISP=55). Greenfield and Fowler plotted mortality profiles for sheep/goat, cattle, and pig from Megalo Nisi Galanis on ternary diagrams. The mortality profile for pigs was used as a control, as pigs are generally exploited for primary products (meat, hide, or bones). The results for sheep/goats clustered around the meat profile, with mainly adult and subadult indivituals and few infants/juveiles. The results for cattle are closest to the traction profile, with an even smaller number of juveniles and a heavy bias toward adult individuals.

2.4.9. Faunal Reports Summary

These zooarchaeological studies and reports demonstrate the wide range in methods, thoroughness and availability of publication, and quality of data in the zooarchaeological literature in Greece. This is by no means an exhaustive review of every reported site, but rather a sample of pieces that will allow me to place Eleon in its context as an apparently thriving settlement in the post-palatial Bronze Age. From the available evidence, it appears that the material from Eleon should be expected to show a heavy bias toward sheep and goat remains, but the observed variability between sites cautions against further assumptions. Perhaps the most interesting question is the degree of apparent emphasis on sheep rearing for wool production. While the Lefkandi data suggest that sheep were being raised for milk during LH IIIC and the Early Bronze Age, Eleon could be expected to differ from this pattern, as it was certainly closer to the palace at Thebes, and possibly less economically independent, a trend noted by Foxhall (2005).

Chapter 3 - Methods

3.1. Recording the Assemblage

3.1.1. Recovery and Data Entry

My work at Eleon during the 2014 field season focused on material from SWB3a, SWB3b, and SWB3d, which were excavated between 2011 and 2013. These trenches contain several refuse deposits associated with a large structure dating to the LH IIIC period. Earlier, in 2012, I performed preliminary identification of all faunal remains recovered from Eleon during that excavation season; in 2013 I focused on new material excavated from the southwest only, due to the sheer amount of faunal material being recovered from the site. Bone excavated from SWB3b during the 2011 season was also recorded in the 2014 season, giving a more complete picture of the faunal material from this trench.

As identifications took place in the field laboratory, I did not have access to a comprehensive reference collection. As such, it was necessary to use field manuals and a small sample of reference skeletons borrowed from the Weiner Laboratory at the American School of Classical Studies in Athens. The whole skeletons of three individuals were available: one juvenile sheep, one adult sheep, and one adult goat. They provided a sample of the two most common domesticates in the region at different stages of development. For the identification of other species, I used two field manuals: *Atlas of Animal Bones* (Schmid 1972) and *Mammal Bones and Teeth* (Hillson 2005). These books provide illustrations of typical samples of each skeletal element from different taxa as well as written descriptions of diagnostic traits for each bone.

The bones within each lot were sorted by element, and subsequently identified to size class, family or species. Each fragment was first examined for diagnostic features such as articular surfaces or muscle attachments in order to identify it to element. While epiphyseal ends of long bones are highly identifiable, shaft fragments are notably more difficult to identify, relying largely on the cross-sectional profile of each fragment (for example, femora have a distinctly round cross-section, while humeri are more ovoid). Longbone fragments were recorded based on a system adapted from Reitz and Wing (2008), described below. Standardized measurements from Von den Driesch (1976) were taken for sheep and goat longbones, which were differentiated based on criteria identified by Zeder and Lapham (2010), also explained below.

All identifiable fragments were given a unique sequential ID number and recorded on a Microsoft Excel spreadsheet. The following data were included for each fragment: ID number, trench, locus, lot, side (left or right), element, species or size class, measurements, zones present, proximal and distal fusion, evidence of burning, and general notes. Each sheep or goat mandible was separated from its original lot and labelled with its trench, locus, lot, and ID number. A separate spreadsheet was created to record the tooth wear present on these mandibles.

3.1.2. Quantification

The quantification of faunal remains from archaeological sites is an important and hotly debated issue, as the ways in which fragments are grouped, classified, and recorded have great impact on data sets. Several standard methods have been widely adopted, but each has its own unique strengths and limitations. As such, zooarchaeologists must choose the method or methods best suited to their dataset. In the case of Greek zooarchaeology, it is important to note that NISP (Number of Identified Specimens), the most straightforward but problematic and roundly criticized method, is the only form of data available for many sites, meaning that comparisons between sites may be possible only through NISP.

NISP is the raw count of the number of fragments that are identified to each element and taxon, and it is almost universally presented in zooarchaeological studies. Its major shortcoming is that it cannot account for fragmentation, a serious problem given the highly fragmentary and degraded nature of many archaeological assemblages. This could result in the same element being recorded multiple times. For example, a tibia broken into five fragments will give an NISP of 5, while another that remained intact will only give an NISP of 1.

MNE (Minimum Number of Elements) attempts to account for fragmentation by attributing specimens to the smallest number of elements that would account for them. There are several methods for determining MNE (discussed below), each with their own advantages and limitations.

MNI (Minimum Number of Individuals) expands upon MNE, calculating the smallest number of individual animals that could be represented by the recovered elements. Typically, it is derived by dividing the most abundant element into lefts and rights, and using the larger of these numbers. Although this process seeks to avoid the multiple-counting issue of NISP, MNI is more sensitive to how the assemblage is aggregated (Grayson 1984). Choosing fewer, larger units of aggregation (such as trenches) will result in smaller MNE and MNI counts than using a larger number of small units (such as arbitrary levels or strata). Grayson (1984) suggests that this casts doubt on MNI counts when it is not possible to review the source data directly, as the degree that aggregation influences MNI is not predictable.

The most straightforward method of determining MNE is to physically search for joins between fragments in the assemblage. Fragments from adjacent units are laid out simultaneously and analysts try to conjoin each fragment with others of the same element. While this has the advantage of producing arguably the most accurate representation of the actual assemblage, it has several disadvantages. First, this method is extremely time consuming. In order to preserve the context of each fragment while comparing across loci, it would be necessary to label each fragment. The process of reconstructing bone breaks itself is then highly dependent upon the skill of the analyst and is relatively subjective. It is then difficult to tabulate and record the resulting joins. Furthermore, all analysis must be completed while researchers have access to the faunal remains. This is, of course, problematic for projects with limited resources or access to the materials in question.

The alternative to physically piecing bone fragments together is to employ recording methods using either diagnostic features, such as tuberosities, condyles, or foramina, or zones made up of arbitrary segments of the whole element. These segments, or zones, are defined for each element, and fragments are recorded based either the presence or absence of each zone, or the portion of each zone present. This theoretically eliminates repeated recording of the same element. Perhaps the first such method was used by Münzel (1988), who divided each bone into four longitudinal quadrants (left posterior, right posterior, right anterior, left anterior) and six equal transverse segments. Each fragment was then fitted onto this grid and recorded by which quadrant of each segment was present. Marean and Spencer (1991) developed a similar system for recording longbone destruction by hyenas in which each element was divided into five sections: proximal and distal ends, which coincided roughly with epiphyses, and three equal shaft sections: proximal, middle, and distal shaft. For each zone, the researchers recorded the aspect of the bone that was preserved (anterior, posterior, medial, lateral, postero-medial, etc.). Two methods of calculating MNE from these results were compared. In the first method, the percentage present for each zone was summed. In the second method, a computer program was used to calculate fragments with overlapping sections. Ultimately it was found that the results from the computer-aided method were no more reliable.

Experimental work has suggested that using morphological criteria is less reliable than diagnostic zones, as natural attritional processes often renders the former unrecognizable. This is especially the case with studies that used nutrient foramina to determine MNE for longbones. The inherent weakness of these structures results in fractures running through the foramen and making identification unlikely or impossible (Marean et al. 2001).

In the case of my project, time and space constraints made physically searching for joins impractical. Instead, I employed a method similar to both Münzel (1988) and Marean and Spencer (1991). Five equal zones were established for every longbone, and fragments were recorded based on what portion of each zone was present. Fragments were entered into Excel with a value from one to ten for each zone, as shown in the example below.

MNE for each element was determined separately for left and right sides, and by proximal and distal portions. MNE was calculated for proximal (zone 1), shaft (zones 2-4), and distal (zone 5) portions of bones. Fragments were combined if one had a zone present that the other did not, or if they added to 10 or less for the same zone. For example, if we had three fragments, one with zone counts of 10, 10, 3, 0, 0, one with counts of 0, 0, 3, 8, 9, and another with values of 0, 0, 1, 10, 10, this would give a proximal MNE of 1, a shaft MNE of 2, a distal MNE of 2, and a total MNE of 2. The total MNE of 2 reflects that fragment 1 could be combined with either fragment 2 or 3. This allows for the analysis of fragment distribution based on both elements and portions of elements.

The ratio between NISP and MNE for each element provides a rough indicator of the degree of fragmentation to which that element has been subjected; an NISP value that is much higher than MNE indicates that significant fragmentation has occurred. Like MNI, the calculation of MNE is also affected by decisions concerning aggregation, but the scale of potential error is much lower (on the level of single elements rather than entire individual animals).

Another important consideration taken into account in this analysis was the possibility of preservational bias. Certain parts of the skeleton are known to preserve better than others. The parts of the skeleton that are most dense and thus most resistant to destruction are the shaft of long bones. Taphonomic studies have found that long bone shaft fragments typically preserve much better than epiphyses, producing higher (and thus more accurate) MNE counts (Lam and Pearson 2004). However, shaft fragments are much more difficult to identify to species or element, requiring additional time for analysis. This process relied largely on identifying specific landmarks and determining the cross-sectional profile of each fragment (for example, femoral shafts have a distinctly round cross-section, while those of humeri are more ovoid).

While the relative abundance of species is typically illustrated using NISP, this measure is severely comprised by fragmentation (as noted above) and by the fact that species differ in their number of elements (for example, dogs and pigs have more metapodials and phalanges than do cattle, deer, and ovicaprids.) To provide an estimate of species abundance that accounts for these variables, MNE values were calculated for the primary long bones (humerus, radius, metacarpal, femur, tibia, and metatarsal) for the large mammal species represented in the assemblage. NISP and other MNE data will be presented in the description of each taxon.

3.1.3. Aggregation

The most pressing concern with the quantification of faunal assemblages is the problem of aggregation. How can the assemblage be divided into meaningful groups for analysis? For the calculation of MNE, results can be greatly influenced by where these divisions are made. For example, if the assemblage is treated as a single entity and fragments are combined regardless of their provenience, we will end up with a relatively low MNE that is likely not representative of the nature of the assemblage because fragments from different stratigraphic layers or time periods will be combined and assumed to have been from the same individual.

In the case of the Eleon assemblage, SWB3a, SWB3b, SWB3c, and SWB3d were separated for the purpose of quantification. Beyond this, aggregation is informed by the locus/lot system. MNE was calculated for each locus, aggregating roughly by excavation layer. It should be noted that trenches, and in some cases loci, are arbitrary distinctions. Ideally, fragments would have been analyzed by stratigraphic layer in order to account for related loci in these adjacent trenches. This was not possible, however, as my analysis took place after returning from Greece, using only the data that I had recorded. The possible effects of this decision are discussed in Chapter 5.

3.1.4. Measurements

Differentiating wild and domesticated pigs from archaeological assemblages can be difficult, as there are few skeletal features that can aid in the distinction. One element that does show variation is the lacrimal bone, whose shape is changed by the shorter snout found in domesticated pigs (Reitz and Wing 2008). This is not a particularly useful element for archaeological assemblages, however, as the lacrimal bone is small and fragile, and therefore unlikely to be recovered intact. With a lack of reliable skeletal features, researchers have instead turned to metrical methods (Rowley-Conwy et al. 2012). Standardized measurements established by Von den Driesch (1976) are taken for postcranial elements and teeth, and analyzed to determine the degree of variation. Variation is examined via the Coefficient of Variation (CV), which is calculated as the Standard Deviation (SD) of the sample as a percentage of the mean value. A higher CV indicates greater variation in the assemblage, which is taken to indicate that multiple distinct populations contributed to the sample.

$$CV = \left(\frac{SD}{Mean}\right) \times 100$$

Equation 1 - Coefficient of Variation

This method does have certain limitations. First, CV is easily distorted if a small sample has even a single outlier. One could argue, however, that the outlier would indicate that a second population was present, even if it did not contribute a large percentage of the recovered specimens. A more pressing issue is the size variation that could be found within the same population of domesticated or wild pigs. Sexual dimorphism cannot be accounted for unless all specimens are sexed, which is unlikely or impossible with incomplete remains. The age-at-death of individuals in the assemblage would also greatly affect size. Even if measurements are only taken from bones in which the epiphyses are fully fused, post-fusion growth can introduce variation. Payne and Bull (1988) noted that the long bones of the forelimb, in particular, of modern wild boars from Turkey continued to grow well after fusion was complete. Another factor that may influence the body size of individuals in the target population include the degree of domestication or "improvement" of the breed in question, as body size decreases immediately after a species is domesticated (Reitz and Wing 2008), but the population may be bred to increase body size and meat yield. The size of wild individuals may also vary significantly. Davis (1981) found that wild boar body size is inversely proportional to temperature, decreasing in hotter, dryer climates. This means that wild boars in the vicinity of LH IIIC Eleon would likely have been smaller than most European boars and may have experienced a decrease in size during the LBA-EIA drying period on the Greek mainland suggested by pollen cores from Mavri Trypa cave (Finné et al. 2017).

All pig specimens in the assemblage for which the measurement points identified by von den Driesch (1976) were present were measured and recorded. These measurements are widely used in the zooarchaeological literature, and also allow for size comparisons to material from other Greek sites, most notably Mulhall's (2016) report from Lefkandi, which includes sample sizes and CV values for all recovered pig elements.

3.2. Sheep and Goat Mortality Profiles

3.2.1. Recording Mandibular Tooth Wear

Each ovicaprid mandible specimen from Eleon was separated from its original lot and labelled with its trench, locus, lot, and a unique sequential ID number. The tooth wear analysis in this report is not restricted to the southwest, as all sheep and goat mandibles recovered between 2011 and 2013 from secure LH IIIC contexts in NWC2b and NWC3d (21 specimens) were included. Because of this, the total mandible sample is not directly comparable to the postcranial southwest material analyzed in this thesis. Isolated teeth were not considered, but individual teeth that were still contained within a mandible fragment were included in the analysis. This method was chosen because the stage of eruption is often discernable in individual teeth that area still attached to a mandible. Tooth eruption and wear was recorded using Grant's (1982) system, in which each tooth in a recovered mandible was recorded by its Tooth Wear Stage (TWS). Grant provides illustrations for wear stages of m_4, P_4, M_1/M_2, and M_3. Stages are denoted by letter, from wear stage *a*, in which no dentine has been exposed, to the most advanced wear stage, in which the entire occlusal surface is exposed dentine with only a ring of enamel surrounding it. The number of wear stages varies for each tooth type – M_1/M_2 has the most categories, with 20 wear stages. Once the TWS is recorded for each tooth, these values can be used to establish a Mandibular Wear Stage (MWS) for each mandible specimen. Each wear stage for permanent premolars and molars is given a numerical value, with C (perforation in crypt visible) = 1 and p (the most advanced observed wear stage) = 20. Once these values are obtained for each tooth, they are added into a total for each mandible. For example, a mandible in which P_4 = g, M_1 = h, M_2 = g, and M_3 = c would add up to a MWS of 48. A higher MWS suggests an older animal.

TWS for missing teeth were filled in using tables developed by Grant using known reference samples, which list the most likely value for missing teeth given the recorded value for the teeth that are present. In some cases, Grant noted a fairly large variation in possible wear stages for missing teeth, resulting in a range of possible TWS and MWS for a given specimen. Because of this, it was necessary to account for this range. Three values were recorded for each specimen: the lowest possible MWS, the median MWS, and the highest possible MWS.

Greenfield and Arnold's (2008) conversion tables were used to translate MWS to absolute age. Once age estimates were developed for each mandible, two methods were used to compare and present the data. The first method used Payne's (1973) hypothetical meat, wool, and milk kill-off patterns. Although these curves are problematic for several reasons described above, they have been widely applied in investigations of domesticate herding strategies and are useful for visually identifying trends in the assemblage. The second method hopes to address the issue of sample size by applying statistical analysis via a computer program used to plot age-at-death on ternary diagrams.

Greenfield's (2005:18) reconfiguration of Payne's survivorship curves was also applied to the mandible data, as it addresses several of the drawbacks in Payne's methodology. First, Greenfield amalgamates Payne's curves into a single graph, which is much larger and clearer than those provided by Payne thanks to modern graphing software. Second, and more importantly, Greenfield provides four age classes between 0 and 30 months, further breaking down Payne's ethnographic data. Differences in culling patterns during this early period may appear minute or unclear in Payne's original graphs, which have 10 equal 1-year increments along their *x*-axes. By abandoning this linear presentation, Greenfield distorts the curves such that more focus is placed on this crucial early-life time period, during which a difference of two months can be significant. For example, Greenfield's graph suggests that meat and wool models are identical from birth to 8 months, with just under 10% of animals culled in the first month of life, followed by a further 20% over the next 7 months. Between 8 and 18 months, however, the two strategies begin to diverge, with a drop of roughly 5% for wool production compared to a further 10% for meat production. This difference represents the consumption of yearlings, which occurs in wool flocks (particularly in the case of females that aren't needed for breeding) in smaller numbers than in flocks kept for meat. By the age of 3 years, the gap has widened significantly between meat and wool profiles, with 60% survivorship for wool sheep (representing the productive adult population) compared with only 30% of meat animals (kept on as breeding stock). At this point, the meat production curve merges with the milk production curve as breeding stock and dairying stock gradually succumb to attritional forces, and they remain identical for the rest of the graph. The milk production curve drops by 60% in the first 8 months after the infants that will not be used for dairying or breeding are no longer needed to induce the mother to let down milk. The drop-off after this point is gradual for the remainder of the graph after the population is established.

Sex differences in the sheep and goat survivorship curves are not considered here, for several reasons. First, and most importantly, the sex of sheep and goats is not readily apparent from mandibles. Recent studies (Zeder and Hesse 2000; Zeder 2001) suggest that the most reliable method for sexing ovicaprids is comparison of standardized measurements taken from long bones. Second, Payne and Greenfield both provided curves representing combined male and female mortality.

3.2.2. Ternary diagrams

In the past several decades, ternary diagrams, also known as triangle graphs, have become a popular method for visualizing and comparing mortality profiles. A ternary diagram is shaped like an equilateral triangle, allowing for three axes. Each axis has its zero point in the midpoint of one side of the triangle and runs perpendicular to this side into the opposite corner. Each axis represents what percentage of a sample falls into a given age group – typically juvenile, prime, and old. These age groups do not represent equal portions of an animal's lifespan measured by months or years. Instead, they represent developmental milestones, which influence the potential uses of the animal, as well as effecting the techniques required to manage and maintain them. The sample can then be plotted as a point within the triangle based on the percentage of each age group present. The closer a point is to a corner of the graph, the stronger the bias toward a particular age group. Points can be compared to zones developed from hypothetical mortality profiles representing different kill-off patterns or strategies. One of the advantages of this approach is that it can accurately analyze small samples. Stiner (1998) suggests that using only three age cohorts allows for samples as small as 12 individuals, compared with a minimum of 30 for analysis using nine cohorts. Ternary diagrams therefore have a clear advantage over displaying age-at-death data via histograms divided into years, another popular method of displaying mortality data.

The use of ternary graphs in studies of secondary products exploitation began with Greenfield's (1988) examination of changing patterns of domesticate exploitation across the Late Neolithic/ Early Bronze Age transition at several Serbian sites. Greenfield's graphs included points that represented hypothetical meat, wool, and milk production models, which could be compared to the points derived from assemblages. Stiner (1990) sought to establish a more systematic approach, developing five zones within the ternary diagram: old dominated, juvenile dominated, U-shaped (old and juvenile animals disproportionately represented), living structure (proportions of different age classes that would be observed in a living population), and prime dominated. By using zones instead of points, Stiner accounted for the variation inherent in real assemblages.

One issue with using ternary diagrams to analyze mortality profiles is that they can only compare data sets based on three age categories. Although Steele and Weaver (2002:318) suggest that this may in fact be an advantage because it allows comparison of data sets with “coarse-grained” age data, it does necessitate clearly defined and consistently applied divisions between the three age classes. Where these divisions are placed can highlight or obscure patterns in the mortality data.

Greenfield (Greenfield 1988, Greenfield 2005, Greenfield and Fowler 2003, Greenfield and Arnold 2008) uses stages identified as “very immature,” “subadult,” and “adult.” Very immature animals are under one year old, subadult animals are between one and three years old, and adults are over three years old.

Stiner (1990) divided mandible specimens into “juvenile”, “prime adult”, and “old adult”. Stiner identified juveniles by “the presence of deciduous dentition and/or emerging but unworn permanent teeth,” prime adults by a “full complement of adult teeth,” and old adults when “more than half of the tooth crown is worn away” (Stiner 1990:311-312). Stiner did not clarify which tooth this referred to, although she did include a figure based on Grant’s (1984) tooth wear diagrams showing the proposed wear range only for P4 (the permanent fourth premolar). Mulhall (2016) expanded upon Stiner’s method, using the same categories, but beginning the prime adult category when M3 is fully erupted and the old adult category when P4 reaches Payne’s 12S wear stage. Mulhall appears to have chosen P4 based on Stiner’s table, which he interpreted as meaning that Stiner used only that tooth. If M3 or P4 was missing from a specimen, Mulhall filled it in using Grant’s (1982) table, which gives the most probable value for a missing tooth based on the teeth that were present.

While Mulhall’s method is certainly an improvement over Greenfield’s or Stiner’s, it is nonetheless somewhat problematic in that it relies on a single tooth to identify adult and old adult individuals. The lowest wear stage noted by Grant (1982) in which M3 was fully erupted was wear stage 27, which Greenfield and Arnold (2008) translate to an absolute age of 22-24 months. If we look to Linear B records from Knossos, sheep were recorded as adult males, adult ewes, yearlings, or old adults (Halstead 2003), with lambs apparently unrecorded. This suggests that a division at or around 24 months was salient to Late Helladic herders. It does also highlight, however, the problem of dividing a population into only three age categories – should yearlings be grouped with adults or juveniles? Sheep should reach puberty early in their second year at the latest - onset is typically between 4 and 15 months, with an average of 7.5 months) (Talafha and Ababneh 2011). This suggests that individuals could enter the breeding population by 24 months.

The P4 wear used by Stiner and Mulhall to identify old adults translates to Grant's (1982) wear stage "k." This stage occurs between 48 and 72 months of age, with an average of 60 months (Greenfield and Arnold 2008). This is in line with practices noted in modern sheep and goat herders in Jordan (Abu Zanat et al. 2005), who begin to cull animals due to old age at 60 months.

For the Eleon assemblage, I created ternary diagrams using both Greenfield's (1988) age categories (renamed infant/juvenile, subadult, and adult for clarity) and a modified version of Stiner (1990) and Mulhall's (2016) (labelled juvenile, adult, and old adult). Instead of using wear stages to denote age classes, I defined juveniles as individuals less than 24 months of age, prime adults as individuals between 24 and 60 months, and old adults as those above 60 months. Absolute age was derived from Greenfield and Arnold's (2008) suggested age ranges for Grant's mandible wear stages, which were calculated from wear for each entire mandible. This makes the resulting ternary diagrams broadly comparable with Mulhall's data from Lefkandi, while avoiding over-reliance on a single tooth to define each age category.

Steele and Weaver (2002) introduced the "modified triangular graph" in order to address two other issues inherent in the use of ternary diagrams: First, ternary diagrams plot data based on percentages, obscuring differences in size between samples. Second, comparisons of samples using ternary diagrams have often relied on visually assessing the proximity of each sample's point on the diagram. The modified triangular graph uses a process called bootstrapping, which uses the known data to create and plot new samples. This is done by randomly re-sampling the data set with replacement, meaning that after each data point is chosen, it is "replaced" into the pool from which the next point is chosen. For example, if we resampled the numbers 1, 2, 3, 4, and 5 without replacement, the resulting sample would always add up to 15, with a mean of 3. On the other hand, if we sampled these numbers with replacement, our new sample could be very different from the original, e.g. 2, 2, 4, 5, 4, giving a sum of 21 and a mean of 4.2. In this way, bootstrapping creates new data sets using only the values that are known to be possible from the data that was gathered.

The method developed by Steele and Weaver (2002) bootstraps 10,000 new hypothetical samples, then plots the percentages of young, prime, and old individuals from these new samples on the graph. A 95% density contour is then plotted on a ternary diagram by excluding the furthest outlying 5% of results. The resulting density contours are smaller for larger samples because the results approach a normal distribution curve as the sample size increases. If the density contours from two points do not overlap, the difference is said to be statistically significant.

Although bootstrapping increases the usefulness of ternary diagrams by allowing statistical comparisons, it has one fatal flaw: it doesn't work if one age class makes up 0% of a sample. Furthermore, while bootstrapping does account for smaller sample sizes, it becomes less accurate as sample sizes decrease. Weaver et al. (2011) revisited the work of Steele and Weaver (2002) in order to address these issues. They developed a likelihood method that calculates the probability of observing certain percentages of juvenile, prime, and old individuals in the recovered assemblage (x_j, x_p, x_o) given that the "real" living assemblage was $(\theta_j, \theta_p, \theta_o)$. First, the likelihood of particular values for θ_j, θ_p, and θ_o are found by holding x_j, x_p, and x_o constant and changing θ_j, θ_p, and θ_o while maintaining $\theta_j + \theta_p + \theta_o = 1$. The program then plots a contour on the ternary diagram that includes all points where the likelihood in the original assemblage is 95% or greater.

The Eleon sample was entered into Weaver et al.'s program three times, using the lowest possible MWS for each mandible, the median MWS for each mandible, and the highest possible MWS for each mandible, in order to assess the effect on the resulting graphs.

3.2.3. Percent Survivorship curves

Payne (1973) represented mortality profiles using graphs that demonstrate attrition in a sample population over time. These survivorship curves treat the assemblage as a sort of cohort – a living population where all members were born at the same time. Each zooarchaeological specimen (in our case, a mandible) represents the death of a member of the population. Survivorship curves are plotted on a graph, with a percentage of the total population on the *y*-axis and ages in years along the *x*-axis. Each curve starts with 100% survivorship at 0 years of age and diminishes to 0% once the oldest specimen has "died."

As an example, consider an archaeological sample consisting of five right sheep mandibles. Age-at-death analysis for the sample gave ages of two months, three months, two years, three years, and five years. After one year, three out of five individuals "survive," giving a percent survival of 60%. 40% survive two or more years, and so on, until we reach six years, at which time 0% of the population survives and the trend line meets the *x*-axis.

I have developed survivorship curves for sheep, goat, and indeterminate sheep/goat mandibles based on these graphs, which allow for comparison to Payne's hypothetical models. This age-at-death data is based on NISP for mandibles rather than MNI. This was done to maintain consistency with the units of aggregation used in the rest of the assemblage; however, it should be noted that individuals may have been counted twice in the mandible sample.

Chapter 4 - Results And Discussion

4.1. Introduction

The results of my analysis are generally in line with the pattern that was hypothesized based on patterns from other Late Helladic sites. Overall trends, as well as results for each taxon, are described below. Discussion and analysis is included within the subsection for each taxon, with comparisons to relevant assemblages and studies.

Species	NISP	% NISP
Sheep/goat	464	42.7%
Sheep	87	8.0%
Goat	39	3.6%
Pig	151	13.9%
Cow	100	9.2%
Roe/fallow deer	98	9.0%
Dog	64	5.9%
Red deer	25	2.3%
Turtle/tortoise	21	1.9%
Horse	19	1.7%
Micromammal	12	1.1%
Rabbit/hare	3	0.3%
Bird	2	0.2%
Human	1	0.1%
Total	1086	

Table 4-1 - NISP and %NISP for the Eleon assemblage by species. "Sheep/goat" includes only fragments that could not be identified more precisely.

Table 4-1 shows NISP for each species from the Southwest trenches at Eleon. Sheep and goat remains that could not be precisely identified to species dominate the assemblage. Pigs are the next most common species, followed by cattle, roe or fallow deer, dogs, and red deer. Small wild taxa are present in small numbers and include birds, tortoise, and micromammals. No fish have been identified, but it should be noted that the studied assemblage was hand-collected and it is possible that small fish bones will subsequently be recovered from soil samples during flotation or wet screening. In this stage of analysis, without access to a larger reference collection, bird and turtle/tortoise remains were not identified to species. In addition, a large percentage of mammalian fragments could only be identified to size class: small, medium, or large (see Table 4-2). The small size class may include dog, cat, and the juveniles of larger mammals. The medium size class includes sheep, goat, pig, and smaller deer species such as fallow or roe deer, as well as juvenile cattle, horse, and red deer. The large size class includes adult cattle, red deer, and horse.

	NISP	% NISP
Small	51	3.5%
Medium	169	11.7%
Large	133	9.2%
Identified to species	1086	75.6%

Table 4-2 - NISP and %NISP for fragments that were identified only to size class vs. those identified to species.

It is possible to plot a trend in the proportion of sheep and goats in Greek assemblages over the Bronze Age and Early Iron Age. The relative proportion of sheep and goat remains rises from the MH to the LH, peaking in LH IIIB before falling slightly in LH IIIC and rising again through the Geometric period. This trend can be seen in the material from several sites. At Lerna, sheep and goats made up only 13% of NISP in MH layers compared with a high of 86% in Late Helladic layers (Reese 2008), although the coarse time period resolution of the material is problematic. At Nichoria, sheep and goats fall from 43% in LH IIIB to 35% in the Early Geometric (Mancz 1989). Sheep and goats make up roughly 50% of all time periods at Lefkandi between LH IIIC and the Early Geometric. The percentage is much higher in Middle and Late Geometric material from Oropos, at 77% (Trantalidou 2007). These sites range across the entirety of the Greek mainland and represent a wide range of recovery and identification methods, however, making comparisons tentative.

Mulhall (2016) identified a different trend among LH IIIC to Late Geometric sites from the mainland, the Cyclades, and Crete, suggesting that the proportion of sheep and goats relative to cattle or pigs correlated with elevation. Low elevations (below 200m ASL) showed no clear pattern, but the proportion of sheep and goats increased as elevations rose, which Mulhall suggests is due to the availability of vegetation favouring either sheep/goats, cattle, or pigs. The divisions between elevation zones were not chosen arbitrarily, but were based on Mulhall's observations of the naturally occurring vegetation at different elevations on the island of Euboea. Eleon sits at roughly 250m ASL, placing it in the 200-400m category. When only sheep/goats, pigs, and cattle are counted, the relative %NISP for each species is 70.2%, 17.9%, and 11.9%, respectively. These values all lie very close to the median values identified by Mulhall, as is demonstrated by the boxplot below.

While this data does offer one possible explanation for the species representation seen at Eleon, the pattern suggested by Mulhall is not overly convincing. Out of 4 elevation groups, the lowest is discounted due to high variation, leaving only 3 categories in which to identify a trend (Figure 4-1, below). An examination of Mulhall's table from which the elevation chart was created also shows that the 400-600m data are derived from a single site in Crete, Kavousi Vronda. Examining the remaining two categories, there is no clear remaining trend, and the median values for the higher elevation category are also close to the data points from Eleon. The data for pigs shows an even weaker pattern, with nearly identical second and third quartiles for the lowest elevation and 200-400m. What we can perhaps say is that the relative proportions of the main domesticated species at Eleon fit with the pattern observed at sites higher than 200m ASL.

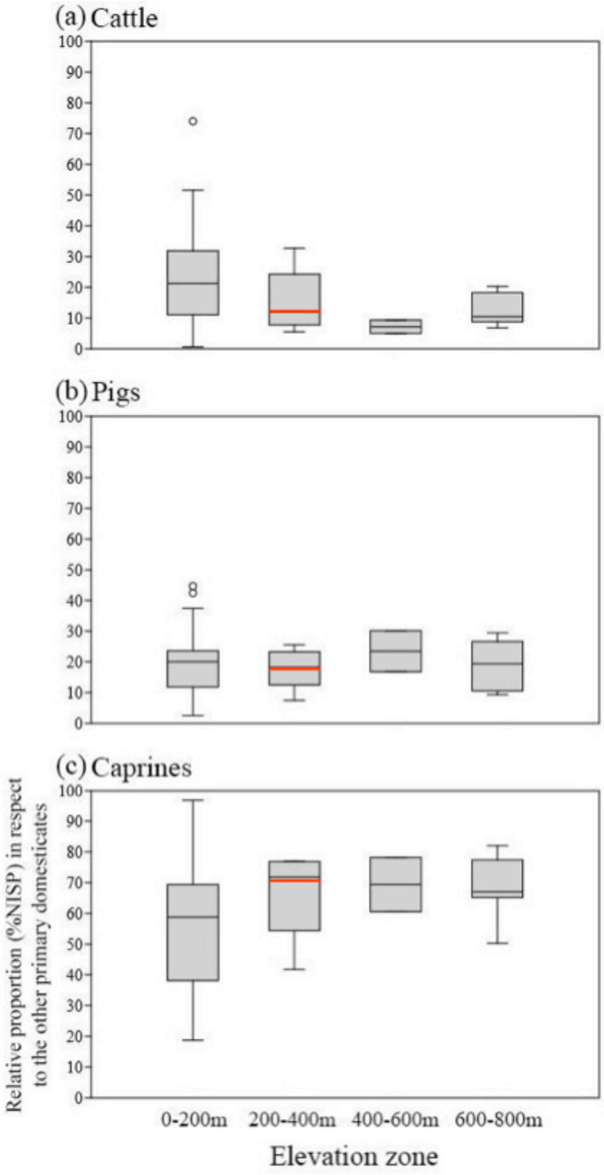


Figure 4-1 - Boxplot from Mulhall (2016) showing percentages of the primary domesticated species. %NISP for Eleon is plotted in red.

When comparing the elevation of sites, it should be noted that the topography of the surrounding areas is perhaps more relevant than the elevation of the site itself. Eleon itself sits on an acropolis on a high point in the valley, overlooking fields that are roughly 100m lower. The faunal remains at Eleon, as at any settlement site, represent animals that were raised in an area of unknown size surrounding the settlement, and herds would have moved throughout the landscape. In modern Greece, for example, sheep and goats are typically pastured in lowlands during the wetter winter months and moved to high elevations during the hot, dry summer (Halstead 1996).

The notion that the faunal assemblage at Eleon originated from a surrounding catchment area raises the question of what "target population" this study is aiming to examine. A target population is the actual living cohort of animals that contributed remains to the assemblage (Reitz and Wing 2008). In some cases, such as in a catastrophic kill-off by natural disaster or disease, a target population could be a single herd. In most other cases, however, there would be many reasons why an individual would end up in the assemblage. In another example from relatively modern Greek pastoralists (around the turn of the 20th century), Halstead (1996) noted that nomadic groups sold off juvenile males for meat in order to minimize their intake of their mothers' milk, which was then sold to cheese merchants. Sedentary farmers in the same regions who practiced mixed strategies, on the other hand, would consume a portion of their herd's milk while allowing lambs and kids to live into their second or third year to maximize the yield of meat, which would be preserved. The lambs and kids sold or traded by the nomadic herders may end up spread throughout a relatively large territory, while the individuals slaughtered by household herders may have been deposited near farmsteads, or within the walls of settlements, depending on whether animals were processed by specialized butchers or by their owners. If a large portion of the remains were aggregated in a settlement, the resulting mixed mortality profile would provide an inaccurate picture of what was in reality a combination of several specialized production strategies. The image could be further skewed by cultural preferences for the meat of a particular species or age class. In light of this, we must be aware that the target population for the Eleon assemblage cannot be conceptualized as a homogeneous population, but rather as a collection of animals raised in an undetermined area for an undetermined number of purposes.

Animals raised throughout a large region, and using various strategies, could therefore contribute to faunal remains found in settlements. There are several methods to differentiate these populations, although they are beyond the scope of this study. For example, tooth microwear can be used to identify what livestock were feeding on, and infer where they were being pastured. Mainland (2000) demonstrated that sheep from Orkney that were fed seaweed show distinctive microwear not present in grazing sheep, a signature that could suggest that a flock was located in a coastal environment. With that in mind, the presence of certain specimens can fairly strongly support the presence of certain practices within the landscape surrounding Eleon. For instance, Payne's (1973) models suggest that sheep above six years of age are more than three times as common in herds raised for wool than for meat or milk. The presence of wild species such as red deer also fairly unambiguously suggests the hunting of large game, although it is possible that large bones or antlers would be traded as raw materials.

The discussion below of results for individual species from the Eleon southwest assemblage addresses both statistical trends among the recovered remains and individual noteworthy specimens that may have significant implications. Comparisons to other sites focus heavily on Lefkandi due to the remarkable similarities in material culture between the sites, as well as the quality of the comparative sample.

4.2. Ovicaprid (Undetermined Sheep/Goat, Sheep, and Goat)

This section uses the term “Ovicaprid” to refer to all sheep and goat fragments, whether they could be identified to taxon or not. Sheep/goat refers only to fragments that could not be identified to species. The vast majority of ovicaprid specimens could not be identified specifically to either sheep or goat. Ovicaprid fragments dominate the Eleon assemblage, with a total NISP of 590, or 39.8% of total NISP, of which 126 could be identified specifically to sheep or to goat (Table 4-3).

Element	Sheep	Goat	Sheep/goat	Ovicaprid (al)
Tooth	9	5	109	123
Tibia	7	3	57	67
Mandible	1		65	66
Radius	8	3	33	44
Humerus	5	2	36	43
Metatarsal	8	1	26	35
Femur		1	30	31
Metacarpal	9	3	16	28
Horn core	17	9	1	27
Innominate			18	18
Phalanx 1	3	2	9	14
Calcaneus	8	1	4	13
Ulna	2	1	9	12
Astragalus	6	2	3	11
Maxilla	1		7	8
Lumbar vertebra			7	7
Scapula			5	5
Phalanx 2			4	4
Cervical vertebra			3	3
Horn			3	3
Metapodial		2	1	3
Sacrum			3	3
Thoracic vertebra			3	3
Axis	1	1		2
Sacral vertebra			2	2
Atlas			1	1
Cranium		1		1
Frontal bone		3		3
Magnum			1	1
Patella			1	1
Phalanx 3	1			1
Temporal bone	1			1
Total	**87**	**39**	**464**	**590**

Table 4-3 – NISP for ovicaprids by element.

NISP for sheep is 87. These specimens are limited to those elements for which sheep and goat display significant morphological differences, such as the horn core, astragalus, calcaneus, and long bones for which the articular surfaces were preserved (Zeder and Pilaar 2010). Seventeen horn cores, whose bases range in diameter from 9mm to 44mm, are included in these fragments, largely clustered in SWB3b loci 61-62 (6), SWB3d loci 2-4 (4), and SWB3d locus 16 (5). These fragments provide the most conclusive evidence of the presence of sheep, as their horn cores (which are D-shaped in cross section, with porous centres) are easily differentiated from those of goats (which are rounder, with large cavities) (Schmid 1972). Forty-two of the long bone specimens come from the lower limbs (radius/ulna, tibia, and metapodials), compared to only 8 from the meatier upper limbs (all from the humerus, none from the femur) (Figure 4-2). MNE for sheep is nearly identical to NISP, with the exception of radii (NISP of 8 vs. MNE of 5) and metatarsals (NISP of 8 vs. MNE of 7). This suggests a low degree of fragmentation among specimens identified as sheep.

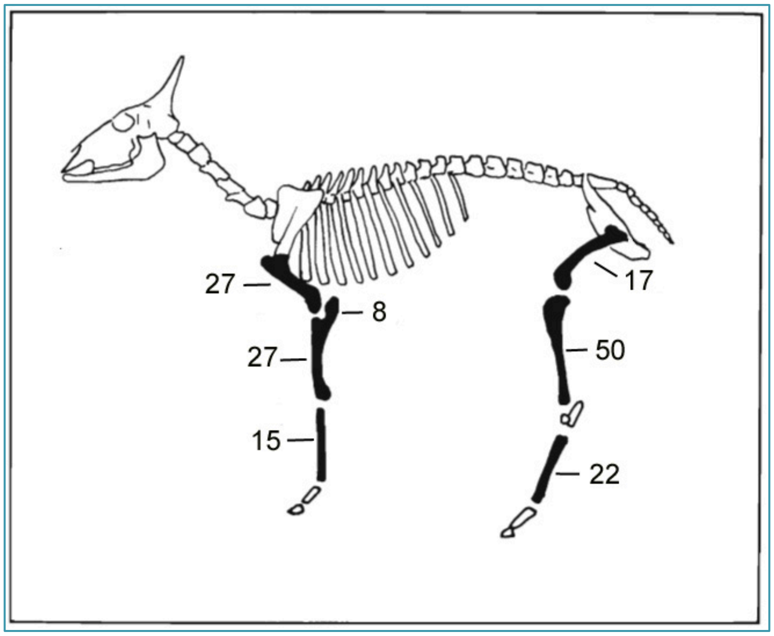


Figure 4-2 - Ovicaprid long bone MNE, diagram adapted from Brain (1967).

NISP for goat is 39. Of these, nine were horn cores found in SWB3b, locus 30 (1), 37 (3), 38 (1), and 63 (2); two other horn cores were found in SWB3a locus 16 and in SWB3d locus 2. Interestingly, no locus contained horn cores from both sheep and goat. MNE for goat is the same as NISP with the exception of metacarpals, indicating a low degree of fragmentation (see Table 4-4).

Because of the similarity of sheep and goat skeletons, most specimens could only be identified as "sheep/goat". An examination of long bone NISP and MNE values for the combined "sheep/goat" category shows some interesting patterns. Most notably, there is a marked bias toward the tibia (NISP = 59; MNE = 50), particularly in comparison with the other long bone elements of the hindlimb: femur (32; 17) and metatarsal (26; 22). Survivorship of the proximal and distal portions of long bones is generally low compared with shaft fragments, with the notable exception of the distal humerus, which is a relatively dense epiphyseal portion. However, even in this case, the distal humerus produced an MNE of only 16, compared to an MNE of 27 based on the shaft of the humerus.

Revisiting the assemblage from Nichoria, Dibble (2017) noted that element representation for each of the major domesticated species (sheep, goats, pigs, and cattle) is biased toward mandibles, distal humeri, and distal tibiae. Table 4-4 shows a similar pattern for ovicaprid long bone MNE at Eleon, with distal tibiae making up the largest number of long bone epiphyses for sheep, goat, and sheep/goats, and distal humeri either second most abundant or tied for second most abundant. Mulhall (2016) suggests that a similarly strong bias toward distal tibiae in the ovicaprid material from all time periods at Lefkandi may be indicative of the practice of disposing of the entire lower hindlimb as a unit. He offers as further evidence the relative paucity of calcanei and astragali despite their high density and resistance to weathering, suggesting that depositing entire lower hindlimbs "made it easier for scavengers to locate, access, and destroy the ankle joint" (Mulhall 2016:201-202). Mulhall also suggests that sheep hindlimbs may have been disposed of in this manner more frequently than goat hindlimbs. Of the calcaneus/astragalus joints recovered at Lefkandi, 6 were sheep, while 1 was goat and 1 was indeterminate sheep/goat. This pattern is somewhat reflected in the Eleon material (see table 4-3), where 8 calcanei and 6 astragali were identified as sheep, 1 calcaneus and 2 astragali as goat, and 4 calcanei and 3 astragali as sheep/goat. It should be noted, however, that it appears that Mulhall was referring to articulated specimens.

	Sheep/goat				Sheep				Goat			
Element	**Proximal**	**Shaft**	**Distal**	**Total**	**Proximal**	**Shaft**	**Distal**	**Total**	**Proximal**	**Shaft**	**Distal**	**Total**
Humerus	4	27	16	27	1	5	4	5	0	0	2	2
Radius	12	27	1	27	5	5	4	5	3	2	0	3
Ulna	4	8	0	8	2	2	0	2	1	1	0	1
Metacarpal	8	15	2	15	4	9	2	9	1	2	0	2
Femur	5	17	7	17	0	0	0	0	0	0	1	1
Tibia	2	50	17	50	0	6	7	7	0	2	3	3
Metatarsal	11	22	1	22	7	7	1	7	0	1	0	1
Metapodial	1	1	0	1	0	0	0	0	0	0	2	2
Total	67	167	44	167	19	34	18	35	5	8	8	15

Table 4-4 - Long bone MNE for ovicaprids by element.

Can we then suggest that the ovicaprid remains from Eleon represent primary butchery in this area of the site? Structure B's location near the ramp and threshold at the eastern boundary of the site would make it a plausible location for the butchery of animals that were either herded into the settlement or brought into the settlement as whole, undressed carcasses. The answer may lie in the butchery marks present on the remains. Unfortunately, due to time constraints in the field, it was decided that butchery marks would not be recorded in this study. Future research, however, should examine long bones and vertebrae to compare the incidence of different types of butchery marks. Shallow cut marks and light chop marks are considered to represent dismemberment, while deeper marks more consistent with cleaving represent more expedient sectioning of carcasses into portions (Mulhall 2016). Dibble (2017) suggests that sectioning is associated with increased specialization, perhaps by professional butchers, either in the context of large-scale ritual feasting or as a response to increased demand for meat in growing urbanized settlements. Although Dibble identifies specialized butchery primarily in Classical deposits at the Athenian Agora, which he contrasts with earlier LHIIIB/LHIIIC and EIA remains from Nichoria and Azoria that largely show shallow cut marks, it is possible that it would be present in palatial and post-palatial Late Helladic contexts. If found at Eleon, these specialized butchery marks could indicate a continuation into LHIIIC of the large-scale feasting that is typically associated with the palatial period. This would be consistent with the high incidence of low-utility elements in the Eleon assemblage.

Of the fragments that could be identified to species, the ratio of sheep to goat is roughly 2:1. NISP is 87 for sheep and 39 for goat, while MNE is 35 for sheep and 15 for goat. The results from the sheep and goat mandibles, however, are reversed, as goat mandibles outnumber sheep mandibles 32 to 15. The pattern remains even if we discount the mandibles from the northwest, as 9 of these were identified as goats and 3 as sheep, leaving 23 goat mandibles and 12 sheep mandibles from the southwest trenches.

Several possible explanations for this discrepancy are suggested by the fact that many of the goat specimens were infants or juveniles. First, the bones of these young individuals would be less durable than those of adult sheep or goats. It is possible that the post-cranial bones of the younger individuals were simply too fragmented at the time of recovery to be identified to species, and they were therefore categorized as "sheep/goat". Furthermore, the features that are needed in order to differentiate sheep and goats are found on the epiphyses of bones, which would be the most susceptible portions to natural wear and canine ravaging, as well as likely being unfused and easily separated from the rest of the bone.

The high number of goat mandibles could also reflect my own inexperience, which may have resulted in the consistent misidentification of dP3 (the third deciduous premolar). Zeder and Pilaar (2010) identified dP3 as the most reliable tooth for differentiating sheep from goats, but did find that analysts of various skill levels falsely identified 25% of sheep as goats when the identification was made based on shape of the tooth ("heavier and squarer" for sheep and "narrowly triangular" for goats). The most reliable criterion (the shape of the metaconoid, a protrusion on the lingual aspect of the premolar), which resulted in no misidentifications in their test, is only discernable when a tooth is unworn or very slightly worn, and therefore often cannot be used. Unfortunately, I did not record which criterion was used to identify each tooth, meaning that I cannot adjust for this issue. The effects of misidentifying dP3 would greatly alter the ratios of sheep to goats in the assemblage. Of the 15 mandible specimens where dP3 was present, 14 were identified as goats and only 1 as sheep. If these specimens are excluded from analysis, the ratio of goats to sheep is 18 to 14 rather than 25 to 15.

The postcranial sheep to goat ratio is likely more reliable than the mandible ratio. Testing analysts of various skill levels, Zeder and Lapham (2010) found that postcranial elements were considerably more reliable for differentiating sheep and goats than teeth, with analysts correctly identifying 100% of domestic sheep and goat specimens for nearly all elements. The only goat specimens that were incorrectly identified as sheep were 6.3% of the 2nd phalanges. The sheep elements were only slightly less reliable. Analysts incorrectly identified 13.3% of 2nd phalanges, 10% of humeri, and 5.3% of metatarsals as goats. None of these problematic elements are present in large numbers in the Eleon assemblage. Of 7 identified humeri, 5 are from sheep and 2 from goats. Similarly, only 1 out of 9 total metatarsals was identified as goat. No 2nd phalanges were identified to sheep or goat.

What, then, can we interpret from the high ratio of sheep to goat bones in the Eleon assemblage? The observed pattern persists if MNI is calculated for ovicaprids (see Table 4-5), using the number of elements in the entire assemblage for each species.

Taxon	MNI	Most abundant element	Side
Sheep/goat	23	Tibia	R
Sheep	6	Calcaneus	L
Goat	4	Horn core	R

Table 4-5 - MNI for ovicaprid remains in the Eleon assemblage, calculated from total MNE.

As discussed in Chapter 2, the relative proportion of sheep to goats in an assemblage has been used as an indicator of *which* primary or secondary products were desired from raising the herd (Payne 1973), or of the *degree* to which herders were specializing their flocks for either maximum economic output or long-term sustainability (Sasson 2010).

Redding (1985:225-226) suggested that three factors influence the sheep/goat ratio of a given herd:

(1) The difference between sheep and goats in ecological, behavioural, physiological, production, and reproductive characteristics.
(2) The environment, physical and cultural, in which the decisions on herd structure are being made.
(3) The goal of the herder or herding unit.

The ecological, behavioural, physiological, production, and reproductive differences between sheep and goats are theoretically relatively constant, although differences between modern and ancient breeds are not known. Redding suggests that goats are better adapted to arid climates, resulting in a higher reproductive rate than sheep in the same environment (likely taking into account both birth rate and infant/juvenile mortality). Middle Eastern sample herds could best maintain their population over time if the ratio was between 1:1 and 1:1.7 in favour of goats. Conversely, sheep were better adapted to wetter climates, resulting in a reversal of the ratio in favour of sheep.

The physical environment in which sheep and goats were being herded at Eleon was likely fairly similar to the present day, as the climate in mainland Greece appears to have been relatively arid during LH IIIC. The most relevant climate-related data to Eleon comes from oxygen and carbon isotope analysis of a stalactite in Mavri Trypa cave, on an island near Pylos, which showed evidence for a dry period (relative to the comparatively wet Bronze Age conditions) beginning in roughly 1200 BC (Finné et al. 2017). This fits with a larger warming trend in the eastern Mediterranean during that period, which has been posited as a contributor to the collapse of the Mycenaean and Minoan palatial sites (Kaniewski et al. 2015).

In light of the warm and dry conditions of the period, we might expect goats to outnumber sheep in LH IIIC and Early Iron Age assemblages. This does not appear to be the case, however. Mulhall (2016) reviewed sheep to goat ratios in faunal reports from LH IIIC (or LM IIIC) and the EIA from Crete, the Cyclades, and mainland Greece, and found that sheep outnumbered goats at nearly all sites. Interestingly, the only exception to this trend was EIA Oropos, where NISP was 50 for sheep and 54 for goats (Trantalidou 2007), although it should be noted that this is a small fraction of the 3454 fragments that were identified as sheep/goat. Mulhall's own data from Lefkandi show that sheep and goats generally each made up roughly 10% of the total NISP from

LH IIIC to the Late Geometric (Mulhall 2016). The widest gap noted was from material excavated in the 1960's that was dated to the category "LH IIIC-SMyc" (roughly 1200 to 1000 BC), in which sheep made up 14.8% and goats 10.6%.

The high sheep to goat ratio at Eleon is therefore an anomaly among LH IIIC and Early Iron Age sites. The age-at-death data from the sheep and goat mandibles may provide further insight into the economic decisions underlying this difference.

4.2.1. Sheep and goat mandibles

A total of 95 ovicaprid mandibles were analyzed to determine species and age at death. Of the 95 mandibles, 32 were identified as goat, 15 were identified as sheep, and 48 could not be identified to species. This contrasts sharply with the long bone data, in which 14 were goat, 50 were sheep, and 216 fragments could not be identified to species.

Mandible wear stages, as illustrated by Grant (1982), were difficult to determine for many specimens, as complete rows of teeth were rare. Of the mandible sample, 25 had only one tooth, 29 had two teeth, 19 had three teeth, 17 had four teeth, 3 had five teeth, and only 1 had a full row of six teeth. Grant's table was used to fill in likely values for the missing teeth in each mandible. For example, mandible 31 has only M2 present, which is at wear stage g. This gives a possible MWS between 27 and 41 months. Because of this, most specimens fall within a large range of possible wear stages, while a few fall within a narrow range or are identifiable to a single stage.

When all of the ovicaprid mandibles from Eleon (sheep, goat, and sheep/goat) are plotted together on a cumulative percentage graph as Payne did for the ovicaprids in his study (Figure 4-3), they conform most closely to his meat exploitation model. Survivorship at Eleon is 83% at 6 months, 68% at 1 year, 52% at 2 years, 33% at 3 years, 20% at 4 years, 8% at 5 years, 2% at 6 years, and 1% at 7 years. This follows Payne's meat model until the three-year mark, after which the mortality rate decreases significantly in the model but continues to rise in the Eleon sample.

The goat sample (totaling 32 specimens) shows heavier mortality among individuals less than one year of age, with only 65.6% survivorship at 6 months, and 56.3% at 1 year. Survivorship at two years is 43.8%, falling to 15.6% at 3 years, followed by 9.4% at 4 years. No individuals older than 4 years were represented in the sample.

Of the 15 sheep specimens, only one was under 2 years of age, while 8 were 4 years or older. Survivorship to 4 years is 53.3%, much higher than in goats (9.4%) or the combined samples (20%). This pattern corresponds most closely with Payne's wool model, with both showing survival rates of over 50% at the 4-year mark. Most individuals were allowed to live well into adulthood.

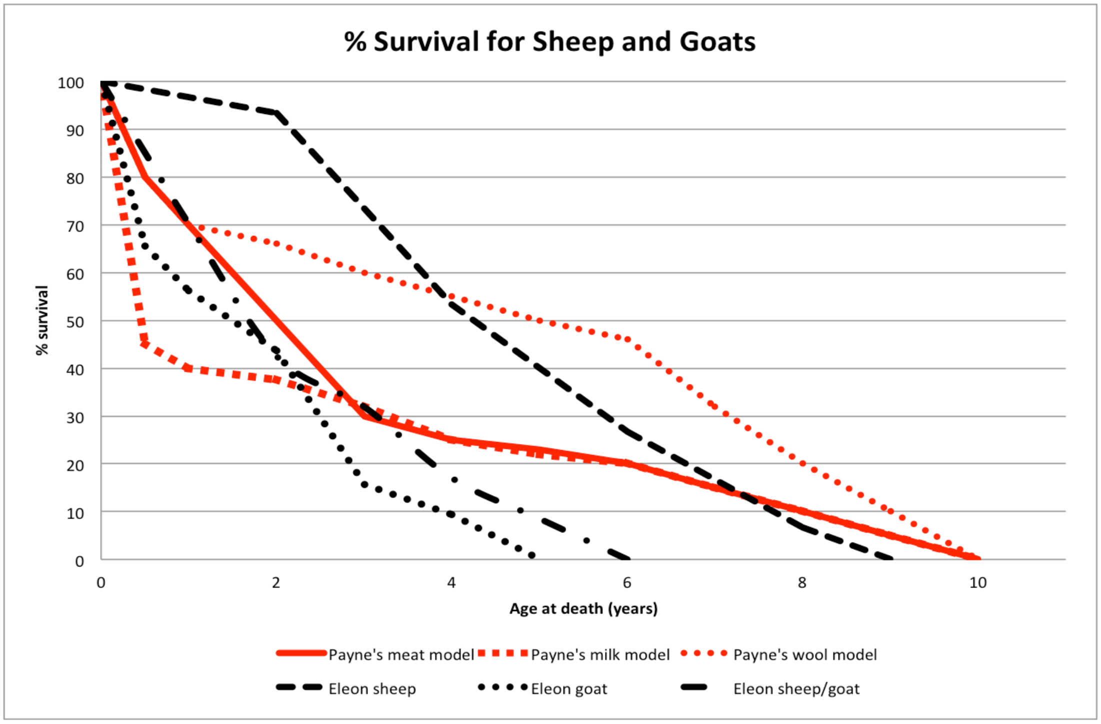


Figure 4-3 - % survival curves for sheep, goats, and sheep/goat mandibles from Eleon. Plotted lines showing Payne's (1973) models are adapted from Greenfield (2005).

4.2.2. Ternary diagrams

Three ternary diagrams were created using the program developed by Weaver et al. (2011): one using the lowest possible MWS for each specimen, one using the median MWS, and one using the highest possible MWS (Figures 4-4, 4-5, and 4-6). This allows for comparison between methods of accounting for the large ranges in possible MWS results for specimens missing one or more teeth. Regions identified by Greenfield and Fowler (2003) as representing idealized meat, milk, and wool production models were overlaid over the resulting diagrams. It should be noted that Greenfield and Fowler did not explicitly define the contours of these regions, but simply overlaid the labels on their ternary diagrams. This lack of precision is problematic; however, it does provide a general idea of where each of the idealized profiles lie, as well as allowing comparisons with Greenfield and Fowler's diagrams.

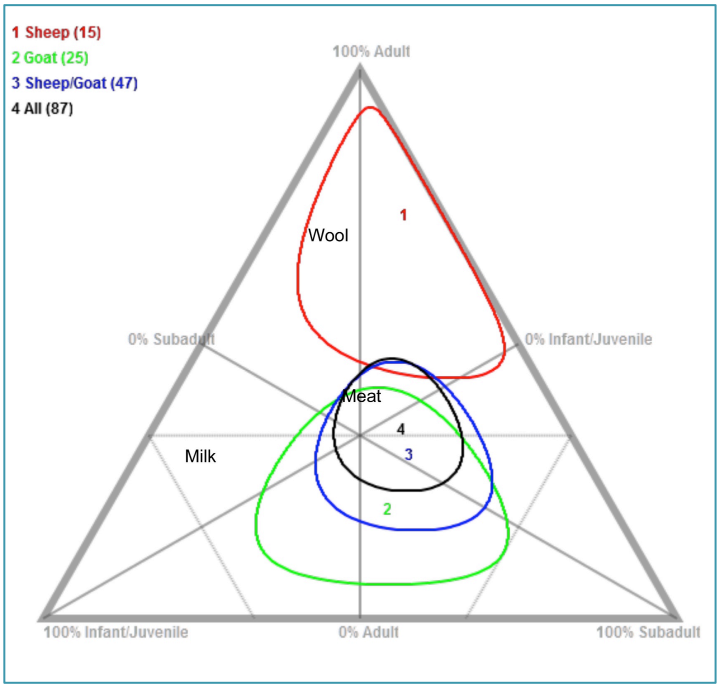


Figure 4-4 - Mortality ternary diagram for ovicaprids from LHIIIC Eleon using the lowest possible mandible wear stage for each specimen. Plotted using Weaver et al.'s (2011) likelihood-based program.

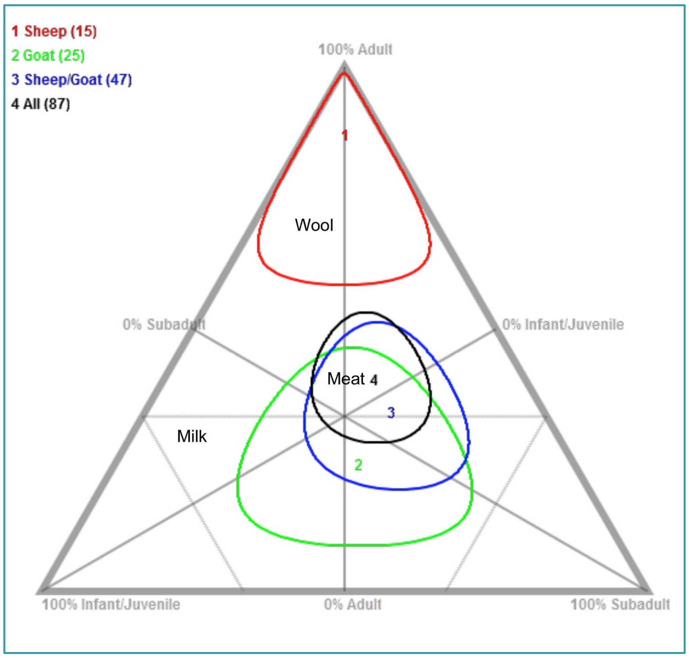


Figure 4-5 - Mortality ternary diagram for ovicaprids from LHIIIC Eleon using the median mandible wear stage for each specimen. Plotted using Weaver et al.'s (2011) likelihood-based program.

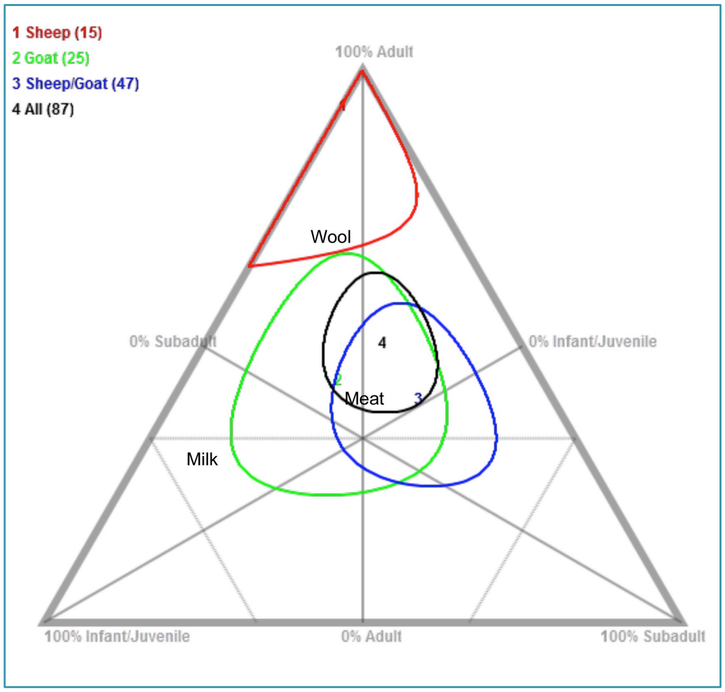


Figure 4-6 - Mortality ternary diagram for ovicaprids from LHIIIC Eleon using the highest possible mandible wear stage for each specimen. Plotted using Weaver et al.'s (2011) likelihood-based program.

All three graphs show similar results: the sheep data include the wool production point, while all other samples roughly centre on the meat production point. The sheep sample and the goat sample do not overlap on any of the three graphs, suggesting a statistically significant difference, as no point could be included in both contours.

The overall impression from the mandibular data is one of a mixed meat, wool, and milk economy. Goats may have been used as a meat source more than sheep. The ternary diagrams show the sheep sample centered roughly on the wool region of the diagram, while the goat sample and the sheep/goat sample plot around the meat region. Material culture from Eleon supports wool production. The size and weight of spindle whorls recovered from the Northwest Complex at Eleon are largely consistent with wool, rather than the smaller, lighter whorls typical of flax textile production (MacDonald 2017).

Mulhall (2016) also charted mortality profiles from sheep and goat mandibles at Lefkandi using Weaver et al.'s (2011) likelihood method, allowing relatively direct comparison to the sheep and goat mandibles from Eleon. Mortality data from Eleon was plotted using Mulhall's age categories – juvenile (0-24 months), prime adults (24-60 months) and old adults (above 60 months). Sample sizes for the Lefkandi material are low for all periods except LHIIIC-SMyc, the period contemporaneous with the Northwest Complex and the Structure B fill at Eleon. Differences between the sheep and goat samples from this period are statistically significant (demonstrated by a lack of overlap in the ternary diagram), but only when plotted with a 90% confidence interval.

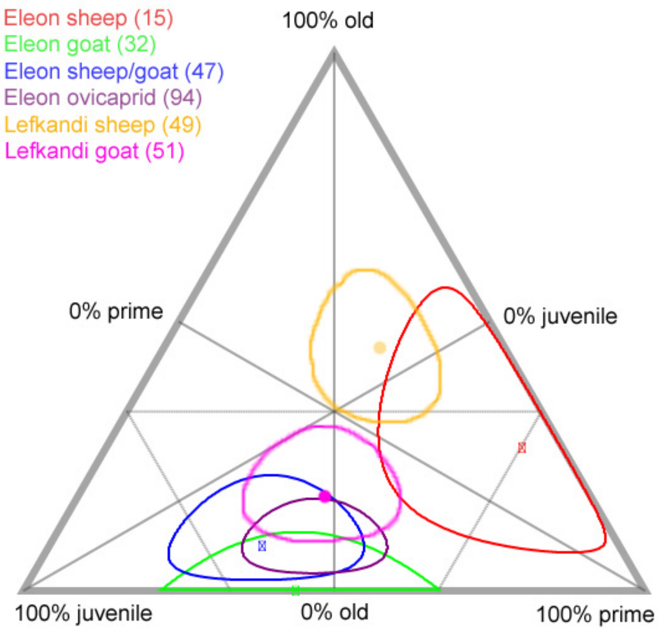


Figure 4-7 - Ternary diagram for ovicaprids from LH IIIC Eleon and from LH IIIC/SMyc Lefkandi (Mulhall 2016:970), plotted using Weaver et al.'s (2011) likelihood-based program.

Figure 4-7 compares the Eleon and Lefkandi ovicaprid samples. The sheep and goat samples from each site overlap with one another, suggesting that there is not a statistically significant difference in mortality profiles between the sites. The difference between taxa is considerably larger in the Eleon sample. This largely reflects the lack of goats 5 years and older, and the presence of only one sheep in the juvenile category. It should be noted that Mulhall used MinAU rather than NISP for mortality profiles.

Unfortunately, comparable sets of sheep and goat mandibular data are not available from other contemporaneous sites. This is largely a problem of methodology stemming from the age of the analyses in question. As the above diagrams demonstrate, combined sheep/goat samples are likely to produce an apparently mixed or meat-focused result that differs greatly from the results for either species. Reliable methods for differentiating sheep and goat mandibles (Zeder and Pilaar 2010) are a relatively recent advancement, and could be considered a prerequisite for developing meaningful mortality profiles. Even comparatively recent publications suffer from methodological issues. For example, age-at-death data from Oropos were calculated using loose teeth rather than mandible specimens (Trantalidou 2007:411) and did not differentiate between sheep and goats.

4.3. Suid (Pig/Wild boar)

Element	NISP
Mandible	16
Humerus	8
Radius	8
Ulna	8
Astragalus	7
Phalanx 1	6
Tibia	5
Metacarpal 4	4
Scapula	4
Calcaneus	3
Femur	2
Metacarpal	2
Metacarpal 3	2
Phalanx 2	2
Innominate	1
Metacarpal 2	1
Metatarsal	1
Metatarsal 4	1
Total	**81**

Table 4-6 - NISP for suids by element.

NISP for pigs is 151, of which 47 were long bone fragments (Table 4-6). Metapodials were the most common element, but this is to be expected in pigs as they have four metapodials in each limb, as opposed to the single fused metapodial in two-toed ungulates. Overall, pig long bone elements are roughly evenly represented, with the exception of femora, which were represented by only 2 specimens (Table 4-7).

Element	Proximal	Shaft	Distal
Humerus	1	8	7
Radius	7	8	1
Ulna	3	7	0
Femur	0	2	1
Tibia	1	5	3

Table 4-7 – Long bone MNE for pigs by element.

There were few pig specimens in the assemblage for which standardized measurements from von den Driesch (1976) could be taken, as the fragile epiphyses of long bones generally have to be fully intact to allow for accurate measurements. Unfused specimens were not included, in order to minimize the effect of age on measurements. Only two measurements had samples greater than one: humerus Bd, defined as the "greatest breadth of the distal end, measured without the Processus supracondylicus radialis" (von den Driesch 1976:117) and radius Bp, defined as the "greatest breadth at the proximal end" (von den Driesch 1976:79).

Measurement	Sample	*n*	Min	Max	Mean	SD	CV
Humerus Bd	Eleon	5	30.3mm	35.6mm	33.2mm	1.91	5.75
	Durrington Walls	165	34.6mm	47.4mm	40.3mm	-	5.70
	Kizilcahamam	15	-	-	46.3mm	2.73	5.90
	Lefkandi (LHIIIC-Smyc)	24	30.61mm	37.76mm	34mm	2.07	6.10
	Lefkandi (EPG-LG)	7	32.16mm	36.78mm	34.5mm	1.82	5.29
Radius Bp	Eleon	3	22.1mm	23.8mm	23mm	0.85	3.71
	Durrington Walls	190	24.3mm	37.1mm	29.4mm	-	6.20
	Kizilcahamam	15	-	-	32.6mm	1.84	5.60
	Lefkandi (LHIIC-Smyc)	23	20.9mm	34mm	24.3mm	3.60	14.82
	Lefkandi (EPG-LG)	9	22.3mm	26.8mm	24.1mm	1.47	6.09

Table 4-8 - Measurements from fused pig/boar humerus Bd and radius Bp from Eleon, Durrington Walls (Albarella and Payne 2005), Kizilcahamam (Payne and Bull 1988), and Lefkandi (Mulhall 2016). Values for Durrington Walls and Kizilcahamam reproduced from Rowley-Conwy et al. (2012:15-16).

Suid samples from Eleon were analyzed using the method developed by Rowley-Conwy et al. (2012), which assesses the degree of variation in standardized measurements from pig elements in order to differentiate wild and domestic samples. Table 4-8 compares the metrical results from the Eleon pig remains with the same measurements taken from a domesticated pig population, a wild boar population, and the LHIIIC-Sub Mycenaean and Early Protogeometric to Late Geometric material from the Lefkandi faunal assemblage. The domestic pig data used by Rowley-Conwy et al. (reproduced here) comes from the Late Neolithic site of Durrington Walls in Wiltshire, UK (Albarella and Payne 2005:594). The wild boar sample comes from modern specimens in Kizilcahamam, Turkey (Payne and Bull 1988). Although the sample sizes differ considerably, CV is similar for the purely wild and purely domesticated populations, ranging from 5.7 to 6.2. Mean sizes are larger for the wild boar specimens than for domesticated pigs, a finding that is consistent with the decreased size of Neolithic and Bronze Age domesticates compared with their wild counterparts (Rowley-Conwy et al. 2012). Mean measurements for both elements are consistent between Eleon and both represented time periods from Lefkandi, but CV varies for radius Bp. While CV for this measurement is remarkably low at Eleon, this could be a result of the small sample size, although a small sample could also produce much higher variation if there is even one outlier. The Lefkandi EPG-LG radii show only slightly more variation than the comparative wild and domestic samples, but the LHIIIC-SubMyc sample has a CV more than two times higher. The maximum measurement from this sample is also nearly 10mm larger than the mean for Eleon or Lefkandi. This suggests that there are two distinct populations represented at Lefkandi at the end of the Late Bronze Age, but not during the Early Iron Age. This result is supported by other measurements from Lefkandi, most notably from 10 scapula glenoid processes with a CV of 18.77, which Mulhall compared with CV of 6 from the Kizilcahamam boars.

The Lefkandi results demonstrate that it is necessary to incorporate as many measurements as possible, as CV can vary from element to element within the same assemblage. Rowley-Conwy et al. (2012) also noted this trend among pig remains, suggesting that analysts combine metrical data from long bones with measurements from teeth, particularly the third maxillary and mandibular molars. The morphology of the third molar is greatly altered by the shortened snout characteristic of domesticated pigs, resulting in a wider, shorter tooth. Rowley-Conwy et al. also found that the width and length of M3 is unaffected by tooth wear, unlike other pig molars and premolars. Unfortunately, only two mandibular and one maxillary M3 are present in the southwest Eleon assemblage, meaning that CV calculations are not possible. The size of these specimens is consistent with domestic rather than wild pigs, however. The mandibular teeth are 30mm long by 15mm wide and 29mm long by 14mm wide. The single maxillary specimen measured 25mm by 15mm. Because the length of M3 in wild boars is generally 40mm or more (Rowley-Conwy et al. 2012), these teeth offer further evidence that the pigs found at Eleon were domesticated.

We can therefore tentatively suggest that the Eleon pig remains represent a single population of domesticated individuals, a finding that differs from the Lefkandi assemblage. The pig sample is, however, quite small, and it is important to keep in mind that the measurements listed in Table 4-8 are from the forelimb, whose bones may continue to grow even after complete fusion (Payne and Bull 1988). There is also the question of worked boars’ tusks, which have been recovered elsewhere at Eleon and are a component of the boars' tusk helmets documented at Eleon in the *Iliad* (10.254-271) (Murray and Wyatt 1999). It is possible, however, that the raw tusks were simply imported from elsewhere to be worked, or were worked elsewhere.

4.4. Cervid

Three species of deer are present in modern-day Greece: roe deer (*Capreolus capreolus*), fallow deer (*Dama dama*), and red deer (*Cervus elaphus*). These species represent a fairly wide range of sizes, with the smallest (roe deer) standing under 60cm at the shoulder, fallow deer standing between 65 and 100cm, and red deer roughly 100-120cm. Because of their large size, red deer in the Eleon assemblage could be readily differentiated from the other species. Roe and fallow deer, on the other hand, were not differentiated. It is also possible that fragments from smaller or younger red deer were identified in the general "deer" category. Because roe deer and fallow deer may overlap in size with sheep and goats, fragmented specimens that could not be identified to taxon were recorded under the size class "medium ungulate." Red deer, on the other hand, are much larger, with fragmented specimens potentially being mistaken for those of cattle; fragments of this size that could not be identified to taxon were recorded as "large ungulate."

Deer are not uncommon in Late Helladic or EIA assemblages, but they typically do not account for a large percentage of NISP. Red deer are the most commonly found, but fallow deer are also present at some sites (including Kalapodi in Boeotia) and have been identified in frescoes, pottery sherds, and seals from Mycenae (Yannouli and Trantalidou 1998).

Element	**Roe/fallow deer**	**Red deer**	**Grand Total**
Tooth	26		26
Mandible	13	1	14
Phalanx 1	7	5	12
Antler	8	4	12
Tibia	7	3	10
Metacarpal	7	2	9
Radius	6	2	8
Metatarsal	3	4	7
Astragalus	5	2	7
Phalanx 2	4	1	5
Humerus	1	1	2
Ulna	2		2
Femur	1		1
Calcaneus	1		1
Maxilla	1		1
Scapula	1		1
Phalanx 3	1		1
Metacarpal 4	1		1
Naviculocuboid	1		1
Scaphoid	1		1
Trapezoid-magnum	1		1
Total	**98**	**25**	**123**

Table 4-9 - NISP for roe/fallow deer and red deer by element.

At 123, NISP for deer is higher than for cattle (Table 4-9). Two distinct sizes are apparent in the deer remains. 26 of the 123 fragments were identified as red deer due to their significantly larger size compared to other deer fragments, which in turn were slightly larger than sheep or goat specimens. It should be noted that 26 of the roe or fallow deer specimens are isolated teeth, most of which are clustered into groups from single loci that each could have originated from a single individual. For example, SWB3d, locus 20, produced 6 deer teeth.

	Fallow and roe deer			Red deer		
Element	**Proximal**	**Shaft**	**Distal**	**Proximal**	**Shaft**	**Distal**
Humerus	0	1	1	1	1	0
Radius	1	3	4	0	1	1
Ulna	0	1	0	0	0	0
Metacarpal	1	6	1	1	0	1
Femur	0	1	0	0	0	0
Tibia	0	6	6	3	3	3
Metatarsal	1	3	0	1	4	2

Table 4-10 - Long bone MNE for roe/fallow deer and red deer by element.

Similar to the sheep and goat remains, long bone MNE for deer is biased toward the less meaty bones, in this case the tibia and metacarpal for the smaller species, and the tibia and metatarsal for red deer. The upper limb bones (the humerus and femur) are poorly represented. These higher utility bones may have either been too fragmented to be identified, or simply not present.

The most notable red deer specimen is a large, complete antler recovered from locus 2 of SWB3d. Several other large antlers were found in nearby loci, including SWB3b, locus 27 and 30. Those whose basal diameters could be measured were 76mm and 57mm wide. They are not, however, necessarily an indication of hunting activity, as they were not found fused to cranial fragments and may have been shed naturally. It is conceivable that some or all of these antlers were collected for tool-making or other possibly ceremonial purposes. Shed red deer antlers have been recorded at the Athenian Agora (MacKinnon 2014), but the presence of cranial fragments and teeth elsewhere within the assemblage at Eleon indicate that the entire heads of large game were present at the site. This contrasts with findings at Oropos, where only limb bones of red deer were present (Trantalidou 2007). One possible explanation is that the deer at Eleon were tamed, as tablet Cn 868 from Pylos lists deer as either wild or tamed (Yannouli and Trantalidou 1998), although it does not differentiate between red and fallow deer. If tamed deer were kept at or near Eleon, shed antlers would be fairly common. Another Pylos tablet, Py Ub1318, lists hides that were provided to craftspeople for leatherworking, including deer, goat, cow, and sheep

(Yannouli and Trantalidou 1998). Deer leather is valued for its strength and tear resistance, which is nearly twice that of cow leather, and red deer provide both the largest quantity (due to their size) and highest quality leather (Sizeland et al. 2013). In light of this, the high quantity of deer in the Eleon assemblage could represent the exploitation of wild or tame deer primarily for their skins, which would also explain why antlers appear to have been left intact.

4.5. Cattle

Element	**NISP**
Tooth	36
Metacarpal	10
Horn core	8
Phalanx 1	6
Tibia	5
Metatarsal	5
Phalanx 2	4
Calcaneus	4
Phalanx 3	4
Ulna	3
Maxilla	3
Radius	2
Astragalus	2
Humerus	2
Cervical vertebra	2
Cranium	2
Patella	2
Femur	1
Scapula	1
Total	**102**

Table 4-11 - NISP for cattle by element.

NISP for cattle in the assemblage is 102, or 9.2% of total NISP, including cranial fragments and loose teeth (Table 4-11). Of these, only 29 fragments are from long bones. Low-utility body parts such as the cranium and lower limbs dominate the cattle assemblage (Table 4-12). Metacarpals and metatarsals are the most abundant elements, but they are also relatively complete. This is demonstrated by a comparison between NISP and MNE counts for both elements – metacarpal MNE is 8 compared with an NISP of 10, while metatarsal MNE and NISP are identical. The differential fragmentation of low and high utility elements may be due to the destruction of femora and humeri for marrow extraction. The more highly fragmented specimens may then have been classified in the "large ungulate" category, as they could be mistaken for red deer or horse.

There is very little age data that could be discerned from the cattle remains. No mandibles were recovered, precluding tooth wear analysis. Only two postcranial fragments were unfused: a proximal tibia from SWB3d, locus 3, and a distal radius from SWB3b, locus 27. These epiphyses both fuse at between three and four years of age (Grigson 1982).

Element	**Proximal**	**Shaft**	**Distal**
Humerus	0	0	2
Radius	1	1	0
Ulna	2	3	0
Metacarpal	8	8	2
Femur	0	1	0
Tibia	1	2	3
Metatarsal	2	5	3

Table 4-12 - Long bone MNE for cattle by element.

Cattle are more relatively abundant at Lefkandi than at Eleon. For the material from the original 1960's excavations, cattle make up 17.8% of a total NISP of 4131 fragments in the LHIIIC-Submycenaean period and 20.7% of a total NISP of 521 in the EPG-LG period. There is a slight increase in the relative abundance between these periods, but the smaller sample size is considerably smaller for EPG-LG. The more recently excavated material from the 2000's excavations produced similar sample sizes for both time periods, at 1038 fragments in the LHIIIC-SubMycenaean period and 1284 in the EPG-LG period. %NISP is similar, with cattle making up 20.9% of NISP in the LHIIIC-SMyc period, and 21.0% in the EPG-LG period (Mulhall 2016:525). In order to account for the issues inherent with NISP, Mulhall also calculated MinAU, which divides the most abundant element for each taxon by the number of times it occurs in the skeleton (Grayson and Frey 2004). The MinAU data suggest slightly lower cattle abundance. In the 1960's material, cattle make up 14.8% of 1687.5 in LHIIIC-SMyc and 18.4% of 179.5 in EPG-LG. The 2000's material is similar, with cattle making up 16.7% of 362.25 in LHIIIC-SMyc and 15.2% of 404 in EPG-LG. Both NISP and MinAU data from Lefkandi suggest that cattle numbers were relatively stable across the transition from the Late Bronze Age to the Early Iron Age.

Unfortunately, Mulhall's sample size of cattle mandibles was small, making the application of Weaver et al.'s (2011) likelihood-based method. The small sample sizes produced large 95% confidence intervals, but a clear bias toward older individuals can be seen. This tentatively suggests that cattle at Lefkandi were being exploited primarily for traction during both periods.

Cattle NISP for Middle to Late Geometric Oropos is similar to Eleon, at 7.8% of NISP (Trantalidou 2007). Once again, there is a lack of specimens that can provide age-at-death data, and no mandibles were recovered. The longbone fusion data tentatively suggest that individuals were generally of prime age or older, as only one fragment, listed as either a distal metapodial or tibia, was unfused. Trantalidou suggests that these elements all fuse at between 24 and 30 months.

This very limited regional comparison suggests that cattle were more abundant on Euboea than in Eastern Boeotia, both immediately after the palatial period and into the EIA. The data from Eleon and Oropos are contrary to the pattern suggested by McInerney (2010), who notes an increase in cattle after the palatial collapse, which he suggests indicates a move toward specialized cattle herding in the EIA. McInerney bases this largely on faunal remains from Nichoria, where cattle make up 21.2% of NISP in LHIII, increasing to 42% in EIA levels (Mancz 1989). The largest issue with this proposed trend is that the Nichoria fauna are identified by very broad time periods – all of LHIII is compared with the entire EIA. The more finely dated material from Eleon, Lefkandi, and Oropos suggests that this trend may not be applicable throughout the Greek mainland.

Relative proportions of cattle in assemblages (especially when these are calculated using NISP) are perhaps misleading, however, as an indicator of the importance or influence of the species compared to other domesticates. The most immediately apparent reason for this is the greater body size, and consequent meat and milk yield, of cattle vs. sheep, goats, and pigs (Reitz and Wing 2008). Perhaps the most significant impact of cattle, however, is the use of oxen for traction. As noted in Chapter 2, the introduction of plough oxen in the Early Helladic period enabled the establishment of larger settlements by allowing for more efficient cultivation of existing arable land, as well as making it possible for rocky or hard soils to be cultivated (Pullen 2008). Plough animals do, however, require a great deal of feed and pasture land. McInerney (2010) suggests that Mycenaean palatial administrations mobilized their resource base to maintain herds of oxen, which played both agricultural and religious roles. He posits that cattle were the primary resource that was distributed to settlements by Mycenaean and Minoan palatial administrations in exchange for staple goods. Tablet Ch 902 from Knossos, Crete, records groups of animals consisting of one ox and twelve young calves that were allocated to individuals located at settlements within the sphere of the palace's influence (e.g., "*Mi-ru-ro* at *Si-pe-we*: one ox, twelve young calves"). McInerney notes that these oxen were most likely not sent to provide traction, as working oxen were referred to using a different term (*We-ka-ta*) and were sent in pairs to settlements rather than to individuals. The oxen may instead have been intended as sacrifices, fulfilling a religious or ceremonial obligation of the palace. He does, however, suggest that these oxen had previously served as ploughing animals in palatial herds. Textual evidence from Pylos suggests that the palatial administration was more intimately involved with managing the allocation and movement of cattle than sheep or goats. McInerney notes that shepherds are only mentioned five to six times in the Pylos Linear B texts, while "cowherders" (*qu-o-ko-ro*) are mentioned 280 times. It is unclear, however, whether these individuals were involved with herding, ploughing, or both. The exact role of the *qu-o-ko-ro* would have a large impact on the implications of the Pylos texts, as a herder may have cared for a sizeable herd of cattle, while a ploughman might have been in charge of only one team of oxen (likely two animals, although the practices recorded at Knossos may not be applicable to the mainland).

What, then, can be made of the significant increase in cattle numbers at EIA Nichoria, and why is this trend not seen at Eleon, Oropos, or Lefkandi? McInerney (2010) proposes that cattle numbers increased following the palatial collapse in part because of the sudden availability of large tracts of land that were previously used for palatial herds of cattle or flocks of sheep and goats. Cattle were needed in order to efficiently cultivate this land for staple crops. In light of the Eastern Boeotian/Euboean network outlined by Knodell (2017), land use in the area may have been largely unaffected by the collapse of the palace at Thebes, reducing the necessity for larger numbers of oxen for traction.

4.6. Equid

Element	**NISP**
Phalanx 1	3
Mandible	2
Metacarpal	2
Phalanx 2	2
Phalanx 3	2
Astragalus	1
Humerus	1
Maxillary molar	1
Metacarpal II	1
Radius	1
Scapula	1
Tibia	1
Ulna	1
Total	**19**

Table 4-13 - NISP for horse by element.

The equid sample is small, with only 19 specimens identified (Table 4-13). The majority of the equid remains are long bones (Table 4-14) from what is likely a single individual in SWB3b, locus 37. Several of these long bones are complete, including a left radius, metacarpal, and two phalanges. A left distal humerus with a spiral fracture and the proximal articular portion of a left ulna both articulate with the radius. A right mandible containing two premolars in heavy states of wear suggests that this individual was advanced in age, although a precise age at death was not determined. The species that these remains represent is unclear, as they could be from a small horse, donkey, wild ass, or mule. Although cut marks were not a focus of this study, a large number of marks around the joints of the locus 37 equid remains were remarkably apparent, indicating that this individual was intentionally (though sloppily) disarticulated. A third phalanx was also found in locus 38, although it was from a larger individual than the specimens from locus 37, likely a larger horse. As all of the equid bones were fully fused (adult), it appears that the size difference is not attributable to age, and that at least two distinct breeds or taxa of equid are represented at Eleon.

Element	Proximal	Shaft	Distal
Humerus	0	1	1
Radius	1	1	1
Ulna	0	1	0
Metacarpal	1	1	2
Tibia	0	0	1

Table 4-14 - Long bone MNE for horses by element.

The equid remains from Lefkandi also show two distinct size classes, which Mulhall (2016) posited as horses and donkeys. Element distribution is biased toward mandibles and phalanges, which corresponds with the limited patterns that can be observed in the Eleon material. Due to the high proportion of lower utility elements, he suggests that horses were butchered on-site, a finding that is also consistent with the Eleon equid remains. Many of the Lefkandi horses, however, were recovered from burials in the LHIIIC middle Toumba cemetery complex, suggesting that they were sacrificed as part of funeral rites.

Because of the larger sample size (e.g., NISP of 229 during LHIIIC-SMyc) and greater number of mandibles, Mulhall was able to develop mortality profiles for horses and donkeys from tooth wear and epiphyseal fusion. Horses, it appears, were typically killed in their prime (around 3 years of age). Donkeys, on the other hand, were allowed to live until 10 years of age or more. Mulhall identified signs of spavin, a condition caused by osteoarthritis in the lower rear limb joints, on one EPG-LG horse bone, suggesting that at least some horses were used for traction. Cut marks were noted on equid bones from all time periods, with the highest percentage, 30.3%, coming from the LHIIIC-SubMyc sample.

Trantalidou (2007) also noted the small size of the 108 equid remains from EIA Oropos, noting that the size was consistent with four possible species: wild ass (onager), donkey, wild horses, or domestic horses. The only specimens that could be definitively identified to species were two donkey astragali, which possess a more prominent medial tuberosity than is found in wild asses. Unlike at Lefkandi and Eleon, no cut marks were found on the Oropos equid remains, and Trantalidou listed equids under the category “non edible species.” This could perhaps reflect a change in the treatment of horse carcasses in the region over time, as the majority of the Oropos remains date to between 760 and 700 BC. Burning, which may indicate ritual practices (Hamilakis and Konsolaki 2004), is noted on 5 of the 108 horse remains from Oropos.

4.7. Canid

Element	NISP
Phalanx 1	10
Phalanx 2	7
Phalanx 3	7
Mandible	6
Radius	4
Cranium	4
Maxilla	3
Metacarpal 2	2
Metacarpal 3	2
Metacarpal 4	2
Metatarsal 2	2
Metatarsal 3	2
Metatarsal 4	2
Tooth	6
Humerus	1
Ulna	1
Calcaneus	1
Metacarpal 5	1
Metacarpal V	1
Total	**64**

Table 4-15 - NISP for dogs by element.

Of the 64 dog bones recovered (Table 4-15), the vast majority (47) originated from SWB3b, locus 65. A small feature in this locus contained the complete metapodials and phalanges of one dog forelimb and one dog hind limb, as well as several cranial fragments, one left mandible and two right mandibles, indicating that at least two individuals were represented. These bones were very well preserved, with little evidence of weathering and no cut marks, although the cranium was fairly fragmented. It appears that the partial remains of two dogs were deposited in this locus and quickly covered over, preventing surface weathering or scavenging by other dogs and rodents. Other dog remains were found scattered throughout the assemblage. Despite the presence of the aforementioned foot bones (metatarsals and phalanges), there were no long bones of the hindlimb (femur, tibia, fibula) recovered (Table 4-16). The size of these specimens is consistent with a small breed, roughly the size of small modern terriers.

Element	Proximal	Shaft	Distal
Humerus	0	0	1
Radius	1	4	0
Ulna	1	1	0

Table 4-16 - Long bone MNE for dogs by element.

The dog remains in SW B3b are notable for their good state of preservation and the presence of partially articulated limbs (metapodials and phalanges). Although the remains are incomplete, the representation of elements is consistent with dog burials found in pits dug beneath the *thalamoi* (burial chambers) of Late Helladic *tholos* tombs, as well as chamber tombs, throughout mainland Greece and Crete (Preston Day 1984). Hamilakis (1996) suggests that dogs were often included in Mycenaean tombs as symbols of elite status and hunting prowess, a function that is inconsistent with a burial containing only a dog. If the remains from SWB3b do represent a burial, they would be unique among LHIIIC sites, as intramural dog burials are only noted at Athens, and are dated much later than the Eleon material, between the 2nd century BC and the 4th century AD (Preston Day 1984).

The best comparative sample of dog remains comes from two LH III A2 tholos tombs at Dimini. These remains originated from 8 individuals ranging in size from 50.3 to 60.9cm at the withers, and all were under 2 years of age (Prummel 2006). Skeletons were not articulated, and many elements were missing (for instance, only one right and one left humerus were recovered from pit 1, for which MNI was 5). Prummel interpreted the remains as having been reburied, perhaps in order to allow for re-use of the main chamber. The dog remains at Eleon appear to be slightly smaller than those from Dimini. The foramen magnum of the occipital recovered from the partially articulated dog in SW B3b is 17mm wide, compared with two specimens measuring 18.8mm and 20.8mm at Dimini. The only other specimens for which comparable measurements are available from both assemblages were radial shaft fragments. The Eleon radii are from SW B3d, loci 2 and 11, and have shaft diameters of 12.1mm and 13.7mm, respectively. Radial shaft diameters from the Dimini dogs ranged between 13.8mm and 14.3mm. The difference in size is relatively small, and may be attributable to age-at-death differences. Unfortunately, I did not perform tooth wear analysis of the dog mandibles.

4.8. Conclusion

What, exactly, can the southwest assemblage tell us? The architecture and material culture from the site point toward both strong ties with the decidedly non-palatial LHIIIC Middle phases at Lefkandi (through strong ceramic similarities; see Van Damme 2017a), palatial architecture and industry (most notably the inclusion of palatial architectural features), and the site's own pre-palatial past (through the association of the Northwest Complex and the MH Blue Stone mortuary complex (Van Damme 2017b)). The faunal material further supports this blending of influences in several ways. First, the relative abundance of species is more consistent with the proposed patterns of palatial sites than post-palatial sites. In particular, the trend proposed by McInerney (2010) toward higher proportions of cattle in LHIIIC and the EIA is not present in the assemblage from Eleon. However, the trend is largely based on the material from Nichoria (Mancz 1989) and is absent at the much closer sites of Lefkandi (Mulhall 2016) and Oropos (Trantalidou 2007), underscoring the danger of over-interpreting patterns based on small numbers of sites. Second, the relatively high number of deer remains is an unexpected pattern that is not reflected at other contemporaneous sites. It is especially noteworthy in comparison to the pig remains, in which wild specimens are surprisingly absent. In light of Linear B references to the high value of deer hides for leatherworking (Yannouli and Trantalidou 1998), and the disposal of low-utility body parts onsite, we can propose that leatherworking may have been taking place. When considered in conjunction with indications of textile production (particularly spindle whorls and bath tubs that may have been used to wash wool) and the presence of a roof tile in the Northwest Complex bearing a maker's mark only otherwise seen at palatial Thebes (Van Damme 2017b), this offers support to Van Damme's suggestion that Eleon may have been home to skilled craftspeople displaced from Thebes by the palatial collapse.

Based on analysis using Weaver et al.'s (2011) likelihood-based program, the mortality profiles from the sheep and goat mandibles in the Eleon assemblage appear to demonstrate statistically significant differences to one another, and, in the case of sheep, to the profile from Lefkandi. MacDonald's (2017) analysis of the spindle whorls form the Northwest Complex concludes that the material evidence of textile production at Eleon is consistent in type and scale to other secondary Mycenaean centres and to Lefkandi, however, the bias toward older sheep indicative of wool production is much stronger at Eleon than at Lefkandi. Whether this pattern is attributable to differences in palatial influence upon the two sites, to the sites' differing roles in a regional network as suggested by Mulhall (2016), or simply an artefact of the small sample size from Eleon, is unclear. The findings are, however, promising as an indicator of the potential for further analyses of faunal assemblages from smaller Mycenaean settlements to illuminate these relationships.

Chapter 5 - Conclusion

I approached the faunal assemblage from Eleon with several hypotheses: First, I expected sheep and goats to make up the majority of the assemblage, as is noted at most contemporaneous Greek sites. Mortality data from sheep and goats was expected to reflect a wool pattern for sheep, dominated by older individuals and infants/juveniles, and a meat or mixed meat and milk pattern for goats, made up of a broader mixture of infant/juvenile and adult individuals. I expected the other primary domesticates (pigs and cattle) to contribute the bulk of the remaining fragments. These hypotheses were largely supported by the analysis of the southwest assemblage and the sheep and goat mandible sample, with several exceptions. Sheep and goats made up roughly 40% of NISP, although the mandibular and postcranial data contradict one another in regards to the proportions of sheep to goats within this category. Postcranial sheep elements outnumber goats 2:1 by NISP and 3:1 by MNE, while goat mandibles outnumber sheep mandibles 2:1. Mortality profiles derived from the sheep and goat mandibles suggest that sheep were being raised primarily for wool, while goats demonstrate a mixed profile lying between meat and milk production. The sheep profile is considerably more heavily weighted toward wool production than the data from Lefkandi, a finding that is supported by Weaver et al.'s (2011) likelihood-based analysis program, which demonstrates a statistically significant difference between the assemblages. The goat samples, however, are remarkably similar between the two sites. Pigs are the next most common species, and metrical data suggest that they are entirely domesticated pigs rather than wild boars. A high representation of low-utility deer remains at the site is noteworthy, and may indicate that leatherworking was taking place at the site during LHIIIC. Other domesticates, including equids, cattle, and dogs, are consistent in size and relative quantities with nearby sites, although it should be noted that the possible intentional intramural burial (burial within the wall of a structure) of a single dog in SWB3b would be unique among pre-Classical sites.

The faunal remains presented here make a small but important contribution toward the expansion of our understanding of LHIIIC in Eastern Boeotia, and throughout mainland Greece. As noted in Chapter 2, there is currently a lack of reports that present detailed analyses of faunal remains from smaller settlements, and those that do exist are often outdated or unpublished. This study of the Eleon material can be seen as an early entry to a much-needed movement toward documenting assemblages from smaller settlements using modern methodology. In particular, improved criteria for differentiating sheep and goat mandibles (Zeder and Pilaar 2010) and postcranial elements (Zeder and Lapham 2010) are now available, making it possible to begin to address the previously necessary, yet highly problematic, practice of classifying these remains together as "sheep/goat." Furthermore, Weaver et al.'s (2011) likelihood-based program for plotting mortality profiles is an invaluable tool with great potential for enabling meaningful statistical comparisons within and between assemblages.

The application of improved methodology to Late Helladic and Early Iron Age assemblages in Greece contributes to the re-conceptualization of the Mycenaean economy. Finley's (1957) vision of the rigid Mycenaean "command" economy based on the collection and redistribution of staple commodities has given way to a more nuanced view (e.g., Cosmopoulos 2006, Killen 2008) more in line with Polanyi's (1944) original concept, which stressed that redistribution fulfilled social obligations. An example of this can be seen in McInerney's (2010) examination of cattle in Linear B tablets from Minoan Knossos, where he suggests that oxen were provided to settlements to be sacrificed, fulfilling a ceremonial obligation established between the palatial administration and local leadership. Published faunal reports (e.g., Hamilakis and Konsolaki 2004) focused on sacrifice and feasting represent one attempt to investigate these relationships, but these assemblages are often small, deposited during individual ritual events. There are, however, a number of potential avenues for research outlined among the corpus of more general Greek faunal reports. In particular, large assemblages that were published relatively long ago should be revisited using updated methodology for identifying and ageing sheep and goat mandibles. One of the most promising assemblages is the LH and EIA sample from Nichoria, last analyzed by Mancz (1989). Mancz's (1989:88) report includes analysis of sheep/goat tooth eruption from a relatively large sample that is temporally classified only as "Bronze Age." Eleon itself also has potential for further study. Excavations at the site are ongoing, and faunal material from the Northwest Complex and currently unexcavated areas adjacent to the fill of Structure B could offer intra-site comparisons.

Despite some promising findings, the present study is nonetheless affected by many of the same issues noted in the review of faunal reports in Chapter 2. The first issue relates to the recovery of specimens, which were almost exclusively hand-collected. Although this is unlikely to have affected the mandible sample, from which the most compelling and methodologically sound data in this study were derived, smaller species and infant individuals may be underrepresented in the results presented here. In particular, the complete absence of fish remains in the assemblage should not be considered strong evidence that fish were not being consumed at the site, as their bones would be difficult to identify and recover from excavated soils. The use of a partial reference collection and field manuals for identifying remains should also be noted. Although the three full ovicaprid skeletons provided by the Weiner Laboratory greatly facilitated the identification of sheep and goat remains, it should be noted that this may have added to the considerable bias toward these species in the assemblage. It is possible that some fragments of other species that were classified as "medium ungulate" could have been more accurately identified with a larger reference collection. It is also potentially problematic that the reference materials included one adult of each species, but only one juvenile (a goat). This may have resulted in a larger number of juvenile sheep being identified as goats. The use of Zeder and Lapham's (2010) criteria for differentiating the two species may have mitigated this issue somewhat. Perhaps the most pressing issue with the above data lies in the use of NISP for quantifying remains. While this did allow for comparison with more Greek sites because it remains the standard for quantification in the region, it has been rightfully criticized for its potential to distort results, particularly in highly fragmented assemblages (Reitz and Wing 2008). MNE counts from the assemblage, however, were largely very similar to NISP, suggesting that fragmentation did greatly not inflate NISP.

The faunal material from Eleon supports an image of the site during LHIIIC as a regional centre of trade and craft production, with strong ties throughout the area surrounding the Euboean Gulf. Proportions of species and mortality profiles reminiscent of Linear B accounts, as well as the possible presence of textile and leather production, underscore connections to the site's palatial-period past. As noted in Chapter 4, a full analysis of carcass utilization at Eleon was not possible in this thesis, as butchery marks were not recorded in the field. However, the high incidence of low utility ovicaprid elements in the southwest quadrant offers preliminary evidence of specialized butchery taking place near the access ramp and threshold, with high-utility portions perhaps being taken further into the settlement. As excavations continue in other areas of the site, further LHIIIC components may be uncovered that would allow for comparisons between areas of the site. The methods outlined here can also be applied to other contemporaneous sites, both within Boeotia and in the wider Greek mainland, where large faunal samples have been recovered and are waiting in storage. These further investigations will expand our knowledge of the social changes that accompanied the transition from the Mycenaean palatial period to a complex and dynamic Early Iron Age.

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Appendix A: Catalogue of identified faunal remains

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
1207	2013	SW B3a	5	27	R	Mand M3	Sheep/goat									Wear stage G
1208	2013	SW B3a	11	53	R	Mandible	Sheep/goat									dp1-3; Removed for ageing
1209	2013	SW B3a	12	48	L	Mandible	Sheep/goat									Fused ant. I-M3; 3 pieces; Glued; Removed for ageing
1210	2013	SW B3a	12	50	R	Mandible	Sheep/goat									M1(broken),M2,M3(erupting) ; may join with mandible from SW B3b 41.93; Removed for ageing
1212	2013	SW B3a	13	61	R	Metacarpal	Red deer	Bp = 42.33								
1211	2013	SW B3a	13	61	L	Mandible	Sheep/goat									M3; Removed for ageing
1213	2013	SW B3a	15	67	L	Mandible	Sheep/goat									Dp4; Removed for ageing
800	2012	SW B3a	16	74		Phalanx 2	Cow									
851	2012	SW B3a	16	74	L	Mandible	Large ungulate									P2, P3 sockets
853	2012	SW B3a	16	74		Femur	Medium ungulate					6			Unfused; missing	
802	2012	SW B3a	16	74	R	Astragalus	Sheep									Fused to 801
797	2012	SW B3a	16	74	L	Calcaneus	Sheep							Unfused; missing		
794	2012	SW B3a	16	74	R	Humerus	Sheep	Bd = 27.3			10	10	10		Fused	
801	2012	SW B3a	16	74	R	Tibia	Sheep						4		Unfused	Fused to 802
850	2012	SW B3a	16	74		Cervical vertebra	Sheep/goat									
796	2012	SW B3a	16	74	R	Femur	Sheep/goat					6	10		Fused	
795	2012	SW B3a	16	74	R	Humerus	Sheep/goat				10	10				Young sheep/goat?
852	2012	SW B3a	16	74		Tibia	Sheep/goat				6					2 pieces; shaft fragment
798	2012	SW B3a	16	74	L	Ulna	Sheep/goat		8	10						
799	2012	SW B3a	16	74	R	Ulna	Sheep/goat									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
761	2012	SW B3a	16	76		Max M	Cow									
764	2012	SW B3a	16	76		Max M	Deer									
762	2012	SW B3a	16	76	L	Max M3	Deer									
763	2012	SW B3a	16	76	R	Max M3	Deer									
732	2012	SW B3a	16	76	R	Radius	Deer				4	10	8		Fused	
759	2012	SW B3a	16	76	R	Mand M3	Goat									
769	2012	SW B3a	16	76		Cervical vertebra	Large ungulate									
749	2012	SW B3a	16	76		Metapodial	Large ungulate				4					
772	2012	SW B3a	16	76		Rib	Large ungulate									
766	2012	SW B3a	16	76		Femur	Medium ungulate									Shaft fragment
739	2012	SW B3a	16	76	L	Humerus	Medium ungulate					10	8		Unfused	Labelled; Deer?; Pig?; Posterior ridge distally
770	2012	SW B3a	16	76		Lumbar vertebra	Medium ungulate									
751	2012	SW B3a	16	76		Radius	Medium ungulate			4	10	6				Midshaft fragment
767	2012	SW B3a	16	76		Radius	Medium ungulate									Shaft fragment
773	2012	SW B3a	16	76		Rib	Medium ungulate									
768	2012	SW B3a	16	76		Thoracic vertebra	Medium ungulate									
771	2012	SW B3a	16	76		Vertebra	Medium ungulate									
736	2012	SW B3a	16	76	L	Humerus	Pig		10	8						Labelled
756	2012	SW B3a	16	76	L	Scapula	Pig									Neck
731	2012	SW B3a	16	76		Metatarsal	Red deer	Dd = 29.3			10	8	6		Fused	
744	2012	SW B3a	16	76	R	Calcaneus	Sheep								Fused	
765	2012	SW B3a	16	76	L	Horn core	Sheep	B=20.3; L=27.3								Juvenile
734	2012	SW B3a	16	76	L	Humerus	Sheep		10	8				Fused		
740	2012	SW B3a	16	76	R	Humerus	Sheep					6	10		Fused	
758	2012	SW B3a	16	76		Phalanx 3	Sheep									Whole
747	2012	SW B3a	16	76	L	Radius	Sheep		2						Fused	
741	2012	SW B3a	16	76	R	Radius	Sheep		4	6					Fused	
738	2012	SW B3a	16	76	L	Femur	Sheep/goat					10	10		Unfused	
737	2012	SW B3a	16	76	R	Femur	Sheep/goat	Bd = 34.1							Unfuse	Epiph only

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
															d	
742	2012	SW B3a	16	76	R	Femur	Sheep/goat			6	4				Fused	
743	2012	SW B3a	16	76	R	Femur	Sheep/goat						8		Fused	3 pieces of dist artics
752	2012	SW B3a	16	76	L	Humerus	Sheep/goat						4			Supratrochlear fossa
755	2012	SW B3a	16	76	L	Innominate	Sheep/goat									Acetabulum fragment and iliac ramus
750	2012	SW B3a	16	76	R	Innominate	Sheep/goat									Pubic ramus
754	2012	SW B3a	16	76	R	Innominate	Sheep/goat									Iliac ramus; 2 pieces
753	2012	SW B3a	16	76		Phalanx 2	Sheep/goat		10	10	10	10	10	Fused	Fused	
748	2012	SW B3a	16	76	L	Radius	Sheep/goat		2						Fused	
746	2012	SW B3a	16	76	R	Radius	Sheep/goat		2						Fused	
757	2012	SW B3a	16	76		Sacrum	Sheep/goat									
733	2012	SW B3a	16	76	R	Tibia	Sheep/goat	Bd = 28.2; Dd = 21.2			6	10	10		Fused	
745	2012	SW B3a	16	76	R	Ulna	Sheep/goat			6						
848	2012	SW B3a	16	77		NoID	Bird									Photographed by Yin
775	2012	SW B3a	16	77		Tibia	Cow					4	10		Fused	Articulates with 774
843	2012	SW B3a	16	77	R	Metatarsal	Sheep	Bp = 20	10	10				Fused		
844	2012	SW B3a	16	77	L	Humerus	Sheep/goat						6			
847	2012	SW B3a	16	77	R	Humerus	Sheep/goat					4				Anterior fragment
845	2012	SW B3a	16	77		Max M2	Sheep/goat									
849	2012	SW B3a	16	77	L	Tibia	Sheep/goat			4						Fragment of crista tibiae
846	2012	SW B3a	16	77	R	Tibia	Sheep/goat		4					Unfused		Epiphesis
774	2012	SW B3a	16	78		Astragalus	Cow									Articulates with 775
788	2012	SW B3a	16	78		Cranium	Cow									
789	2012	SW B3a	16	78		Max M	Cow									2 complete, 1 fragment
782	2012	SW B3a	16	78		Metacarpal	Cow	SD = 20.1	6	10	10	10	6			
787	2012	SW B3a	16	78	L	Horn core; Frontal bone	Goat									
790	2012	SW B3a	16	78		Lumbar vertebra	Large ungulate									
791	2012	SW B3a	16	78		Rib	Large ungulate									
792	2012	SW B3a	16	78		Rib	Medium ungulate									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
778	2012	SW B3a	16	78	L	Metacarpal II	Pig		6	10	10	10	10			
779	2012	SW B3a	16	78	L	Metacarpal III	Pig		10	10	10	10	10	Fused	Incomplete fusion	
780	2012	SW B3a	16	78	L	Metacarpal IV	Pig		10	10	10	10	8	Fused	Unfused; missing	
781	2012	SW B3a	16	78	R	Metacarpal	Sheep	Bp = 22.6; SD = 14.5; Bd = 25.7; L= 123.1	10	10	10	10	10	Fused	Fused	Complete
776	2012	SW B3a	16	78		Metacarpal	Sheep/goat					10	8		Unfused; missing	
786	2012	SW B3a	16	78		Metacarpal	Sheep/goat			4	10	4				Midshaft fragment
777	2012	SW B3a	16	78		Metatarsal	Sheep/goat		8	10	10	10	8	Unfused; missing	Unfused; missing	
783	2012	SW B3a	16	78		Phalanx 1	Sheep/goat		6	10	10	10	10	Unfused; missing	Fused	
784	2012	SW B3a	16	78		Phalanx 1	Sheep/goat		10	10	10	10	10	Fused	Fused	
785	2012	SW B3a	16	78	R	Tibia	Sheep/goat		8					Unfused		
793	2012	SW B3a	16	78		Vertebra	Small ungulate							Unfused; missing	Unfused; missing	
812	2012	SW B3a	17	81		Cranium	Medium ungulate									
813	2012	SW B3a	17	81		Lumbar vertebra	Medium ungulate									
808	2012	SW B3a	17	81		Dp4	Pig									
806	2012	SW B3a	17	81	R	Calcaneus	Rabbit/hare									
803	2012	SW B3a	17	81	R	Humerus	Sheep/goat				6	10	8		Fused	Burned around edge of trans fx
804	2012	SW B3a	17	81	R	Humerus	Sheep/goat					6				
810	2012	SW B3a	17	81		Incisor	Sheep/goat									
809	2012	SW B3a	17	81		Max M3	Sheep/goat									
807	2012	SW B3a	17	81		Tibia	Sheep/goat				6	10				

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
811	2012	SW B3a	17	81		Femur	Small ungulate			4	10	4				
805	2012	SW B3a	17	81		Humerus	Small ungulate					10	2			Very worn dist, 2 pcs
818	2012	SW B3a	17	82		Cervical vertebra	Medium ungulate									
817	2012	SW B3a	17	82	R	Tibia	Medium ungulate			10	10					
814	2012	SW B3a	17	82		Incisor	Pig									
816	2012	SW B3a	17	82	R	Tibia	Rabbit/hare					10	10			
815	2012	SW B3a	17	82		Incisor	Sheep/goat									
819	2012	SW B3a	18	80		Max M	Cow									
839	2012	SW B3a	20	83	R	Calcaneus	Deer									
824	2012	SW B3a	20	83	L	Radius	Goat		10	10	2					
825	2012	SW B3a	20	83		Femur	Large ungulate			10	10					
828	2012	SW B3a	20	83	L	Innominate	Large ungulate									Acetabulum
821	2012	SW B3a	20	83		Sacrum	Large ungulate									
835	2012	SW B3a	20	83	R	Scapula	Large ungulate									Spine fragment
822	2012	SW B3a	20	83		Tibia	Large ungulate			4	4	4				
837	2012	SW B3a	20	83		Shell	Marine mollusc									
832	2012	SW B3a	20	83		Humerus	Medium ungulate					4				Anterior
823	2012	SW B3a	20	83		Vertebra	Medium ungulate									Epiphesis
826	2012	SW B3a	20	83	L	Metacarpal III	Pig		10	10	10	10		Fused	Unfused; missing	
834	2012	SW B3a	20	83		Molar	Pig									
829	2012	SW B3a	20	83	L	Calcaneus	Sheep									
820	2012	SW B3a	20	83		Max M3	Sheep/goat									
833	2012	SW B3a	20	83		Max P	Sheep/goat									Very worn
827	2012	SW B3a	20	83	R	Tibia	Sheep/goat				2	10	10		Fused	
830	2012	SW B3a	20	83		Femur	Small ungulate				10	10				
831	2012	SW B3a	20	83		Femur	Small ungulate			4	8	6				

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
838	2012	SW B3a	20	83		Humerus	Small ungulate					10				
836	2012	SW B3a	20	83	R	Scapula	Small ungulate									
859	2012	SW B3a	20	84		Caudal vertebra	Large ungulate									
857	2012	SW B3a	20	84		Dp4	Sheep/goat									unworn
858	2012	SW B3a	20	84	L	Innominate	Sheep/goat									Small individual
867	2012	SW B3a	20	86		Patella	Medium ungulate									Not goat
869	2012	SW B3a	20	86		Dc	Sheep/goat									
870	2012	SW B3a	20	86		Di	Sheep/goat									
865	2012	SW B3a	20	86		Femur	Sheep/goat			2	2	2				
868	2012	SW B3a	20	86		Max M1	Sheep/goat									
864	2012	SW B3a	20	86	L	Metacarpal	Sheep/goat		2	2	2					
862	2012	SW B3a	20	86	L	Femur							4		Fused	Medial condyle
863	2012	SW B3a	20	86	L	Tibia			4					Fused		
866	2012	SW B3a	20	86	L	Ulna										
840	2012	SW B3a	20	87		Humerus	Large ungulate		4							Head fragment
842	2012	SW B3a	20	87		Femur	Medium ungulate					6				Shaft fragment
841	2012	SW B3a	20	87	R	Humerus	Small ungulate				4	10				
855	2012	SW B3a	20	89	L	Astragalus	Goat									Brittle, looks non-archaeological
856	2012	SW B3a	20	89	L	Tibia	Pig						6			
854	2012	SW B3a	20	89		Femur	Sheep/goat			4	4					
860	2012	SW B3a	20	94		Mand M	Cow									
861	2012	SW B3a	20	94		Cranium	Large ungulate									
878	2011	SW B3b	27	53		Horn core	Cow	B = 51.2								
888	2011	SW B3b	27	53		Max M	Cow									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
887	2011	SW B3b	27	53		Maxilla	Cow									Molars 1+2
886	2011	SW B3b	27	53	L	Mandible	Deer									Articulation. Removed for ID
873	2011	SW B3b	27	53		Femur	Large ungulate				4	4				
879	2011	SW B3b	27	53		Phalanx 1	Large ungulate									
880	2011	SW B3b	27	53		Scapula	Large ungulate									
881	2011	SW B3b	27	53		Scapula	Large ungulate									
877	2011	SW B3b	27	53		Tibia	Large ungulate					8				
884	2011	SW B3b	27	53		Radius	Medium ungulate				4					
882	2011	SW B3b	27	53		NoID	Micromammal									Longobne
876	2011	SW B3b	27	53		Phalanx 1	Pig		6	4						
871	2011	SW B3b	27	53	R	Humerus	Sheep	Bd = 29.3				2	8		Fused	
885	2011	SW B3b	27	53		Femur	Sheep/goat				6					2 pieces
872	2011	SW B3b	27	53	R	Humerus	Sheep/goat				6	10	4			
889	2011	SW B3b	27	53		Mandibles	Sheep/goat									Removed for analysis
875	2011	SW B3b	27	53		Radius	Sheep/goat				6					
874	2011	SW B3b	27	53	L	Tibia	Sheep/goat				6	10				
883	2011	SW B3b	27	53		Scute	Turtle/tortoise									
906	2011	SW B3b	27	55	L	Humerus	Cow	Bd = 67.5					6		Fused	
910	2011	SW B3b	27	55	L	Metacarpal	Cow					4	4			
911	2011	SW B3b	27	55		Phalanx 1	Cow									
912	2011	SW B3b	27	55		Phalanx 2	Cow									
907	2011	SW B3b	27	55	L	Radius	Cow	Bp = 62.2						Fused	Unfused; missing	
913	2011	SW B3b	27	55	L	Femur	Large ungulate						4		Fused	
916	2011	SW B3b	27	55	L	Femur	Large ungulate						2			Single condyle
917	2011	SW B3b	27	55	L	Tibia	Medium ungulate				4	8				Longitudinal recovery fx; 2 pieces
914	2011	SW B3b	27	55	L	Scapula	Pig									
915	2011	SW B3b	27	55	L	Scapula	Pig									
918	2011	SW B3b	27	55		Antler	Red deer	Bd = 76.4								

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
925	2011	SW B3b	27	55	R	Calcaneus	Sheep	GL = 57.2; GB = 18.4								
908	2011	SW B3b	27	55	R	Humerus	Sheep	Bd = 29.9				8	10		Fused	
926	2011	SW B3b	27	55		Femur	Sheep/goat					4				
909	2011	SW B3b	27	55	R	Humerus	Sheep/goat					8	6			
924	2011	SW B3b	27	55		Lumbar vertebra	Sheep/goat									
922	2011	SW B3b	27	55		Mand M	Sheep/goat									
919	2011	SW B3b	27	55		Mand M3	Sheep/goat									
920	2011	SW B3b	27	55		Mand M3	Sheep/goat									
923	2011	SW B3b	27	55		Mandible	Sheep/goat									Articulation
921	2011	SW B3b	27	55		Max M2	Sheep/goat									
943	2011	SW B3b	27	58	L	Metacarpal	Cow	Bp = 51.8	9	6						
931	2011	SW B3b	27	58	R	Humerus	Deer				6	7	8		Fused	
948	2011	SW B3b	27	58	L	Calcaneus	Goat									
951	2011	SW B3b	27	58		Femur	Large ungulate					5				
954	2011	SW B3b	27	58		Innominate	Large ungulate									
960	2011	SW B3b	27	58		Molar	Large ungulate									
936	2011	SW B3b	27	58		Radius	Large ungulate									
940	2011	SW B3b	27	58	R	Femur	Medium ungulate					8			Unfused; missing	
942	2011	SW B3b	27	58	R	Astragalus	Pig									Lateral half missing
956	2011	SW B3b	27	58		Mand I	Pig									Adult
955	2011	SW B3b	27	58	L	Mandible	Pig									Complete dental, only Dp3 and Dp4 present
947	2011	SW B3b	27	58		Metacarpal IV	Pig		10	10	10	10	5		Unfused; missing	Larger than suid Mc IV in lot 61; 2 individuals?
945	2011	SW B3b	27	58		Metatarsal III	Pig		10	10	10	10	5		Unfused; missing	
946	2011	SW B3b	27	58		Metatarsal IV	Pig		10	10	10	10	5		Unfused; missing	

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
949	2011	SW B3b	27	58	R	Scapula	Pig									
937	2011	SW B3b	27	58	R	Tibia	Pig		6	4				Unfused; missing		
941	2011	SW B3b	27	58	R	Astragalus	Sheep	GLl = 28; GLM = 28.6; Dl = 17								
944	2011	SW B3b	27	58	R	Metatarsal	Sheep	Bp = 21.2	10	4						
932	2011	SW B3b	27	58	L	Humerus	Sheep/goat					8	6		Fused	Chopped distally
957	2011	SW B3b	27	58		Mand	Sheep/goat									Removed for ID + dP4
958	2011	SW B3b	27	58		Max M	Sheep/goat									
959	2011	SW B3b	27	58		Max M	Sheep/goat									
933	2011	SW B3b	27	58	L	Radius	Sheep/goat	SD = 16.3			4	8				
934	2011	SW B3b	27	58	L	Radius	Sheep/goat	SD = 14.4	2	5						
938	2011	SW B3b	27	58	L	Tibia	Sheep/goat				8					
952	2011	SW B3b	27	58		Femur	Small ungulate				6	10				
953	2011	SW B3b	27	58		Innominate	Small ungulate									
935	2011	SW B3b	27	58	L	Radius	Small ungulate	SD = 12		8				Fused		
950	2011	SW B3b	27	58	R	Tibia	Small ungulate			8	10	10			Unfused; missing	
939	2011	SW B3b	27	58		Tibia?	Unidentified					8				Removed for Weiner lab
963	2011	SW B3b	27	61		Humerus	Micromammal									Photographed by Yin
962	2011	SW B3b	27	61		Metacarpal IV	Pig		10	10	10	10	5		Unfused; missing	
961	2011	SW B3b	27	61		Antler	Red deer	D = 40.5								Large antler fragment. Likely part of large antler base
902	2011	SW B3b	27	63		Lumbar vertebra	Large ungulate									
892	2011	SW B3b	27	63	R	Humerus	Pig									
891	2011	SW B3b	27	63	R	Humerus	Pig	Bd = 33.2			8	10	10		Fused	Removed for Weiner lab and drawing
904	2011	SW B3b	27	63		Incisor	Pig									
890	2011	SW B3b	27	63	R	Tibia	Pig	Bd = 25.2			6	8	10		Fused	Removed for Weiner lab
893	2011	SW B3b	27	63	R	Tibia	Pig	Bd = 34				8	10		Fused	
894	2011	SW B3b	27	63	R	Humerus	Red deer		10	8						Large - elk?

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
900	2011	SW B3b	27	63	L	Femur	Sheep/goat				10	10				
895	2011	SW B3b	27	63	R	Metatarsal	Sheep/goat	Bp = 22.5	10	8				Fused		Large
896	2011	SW B3b	27	63		Radius	Sheep/goat	SD = 15.5								
897	2011	SW B3b	27	63	R	Tibia	Sheep/goat		8					Unfused		Epiphesis
901	2011	SW B3b	27	63	L	Humerus	Small ungulate			10	10	8				
903	2011	SW B3b	27	63		Shell	Unidentified									
898	2011	SW B3b	27	63	L	Mandible										P3-M3
905	2011	SW B3b	27	63		Mandibles										Removed for analysis
899	2011	SW B3b	27	63		Metacarpal III				10	10	10			Unfused; missing	
1030	2012	SW B3b	29	68		Femur	Large ungulate					4				
1031	2012	SW B3b	29	68		Mand Canine	Pig									broken longitudinally, missing enamel
1032	2012	SW B3b	29	68		Cervical vertebra	Sheep/goat									
1029	2012	SW B3b	29	68		Mand M1	Sheep/goat									Wear stage g
1033	2012	SW B3b	29	68		Thoracic vertebra	Sheep/goat									
1028	2012	SW B3b	29	68	L	Humerus	Small ungulate	SD = 11		9	10	9				
1034	2012	SW B3b	29	68		Humerus	Turtle/tortoise									Removed for Weiner lab
1378	2011	SW B3b	30	62	L	Calcaneus	Cow									
1387	2011	SW B3b	30	62	L	Humerus	Cow						3		Fused	
1400	2011	SW B3b	30	62		Mand M	Cow									
1399	2011	SW B3b	30	62		Maxilla	Cow									P4+M1; Wear stage K
1367	2011	SW B3b	30	62	R	Metacarpal	Cow	Bp = 57.5	9	4				Fused		2 pieces
1366	2011	SW B3b	30	62	R	Metatarsal	Cow		3		8	10		Fused		2 pieces
1405	2011	SW B3b	30	62		Tooth	Cow									Very worn. Possibly P

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
1129	2011	SW B3b	30	62		Phalanx 1	Deer									Large
1382	2011	SW B3b	30	62	R	Horn core	Goat									
930	2011	SW B3b	30	62	R	Humerus	Goat	Bd = 31.2					9			
1368	2011	SW B3b	30	62		Phalanx 1	Goat		10	10	10	10	10	Fused	Fused	
1130	2011	SW B3b	30	62	R	Radius	Goat	Bp = 28.3	10					Fused		Fused to 1131
1131	2011	SW B3b	30	62	R	Ulna	Goat		6	8				Fused		Fused to 1130
1398	2011	SW B3b	30	62	L	Mandible	Horse									P2+P3
1126	2011	SW B3b	30	62		Phalanx 1	Horse	Bp = 39.4; SD = 23.5; Bd = 34.2; L = 64.7						Fused	Fused	
1127	2011	SW B3b	30	62		Phalanx 2	Horse							Fused	Fused	
1128	2011	SW B3b	30	62		Phalanx 3	Horse							Fused	Fused	
1396	2011	SW B3b	30	62	L	Scapula	Horse									
1374	2011	SW B3b	30	62	L	Humerus	Large ungulate					3	3			
1388	2011	SW B3b	30	62		Innominate	Large ungulate									
1386	2011	SW B3b	30	62		Metapodial	Large ungulate		1	2						
1391	2011	SW B3b	30	62		Naviculo-cuboid	Large ungulate									
1371	2011	SW B3b	30	62		Tibia	Large ungulate				4	9				
1390	2011	SW B3b	30	62		Tibia	Large ungulate			4	2					
1395	2011	SW B3b	30	62		Scapula	Medium ungulate									
927	2011	SW B3b	30	62	L	Humerus	Pig	Bd = 33.8			5	10	10		fused	
1401	2011	SW B3b	30	62	L	Mandible	Pig									M1-M3; Wear stages: M1: D, M2: B, M3 erupting
1403	2011	SW B3b	30	62	L	Maxilla	Pig									M1-M2
1404	2011	SW B3b	30	62	L	Maxilla	Pig									M1-M2
1402	2011	SW B3b	30	62	R	Maxilla	Pig									P3, P4
1364	2011	SW B3b	30	62		Metacarpal III	Pig		10	3	1			Fused		
1369	2011	SW B3b	30	62		Phalanx 1	Pig		10	10	10	10	10	Fused	Fused	
1362	2011	SW B3b	30	62	R	Radius	Pig	Bp = 23.8	10	8				Fused		
1372	2011	SW B3b	30	62		Tibia	Pig			2	9					

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
1407	2011	SW B3b	30	62		Antler	Red deer	BD = 57								
1365	2011	SW B3b	30	62	L	Metatarsal	Red deer	Bp = 42.7	9	10	9			Fused		
1363	2011	SW B3b	30	62	R	Radius	Sheep	Bp = 28.2	10	2				Fused		
929	2011	SW B3b	30	62	R	Humerus	Sheep/goat					8	4		Partially fused	
928	2011	SW B3b	30	62	L	Humerus	Sheep/goat				2	10	6			
1389	2011	SW B3b	30	62	R	Innominate	Sheep/goat									
1370	2011	SW B3b	30	62		Lumbar vertebra	Sheep/goat									Split longitudinally; Removed for Jake
1381	2011	SW B3b	30	62		Lumbar vertebra	Sheep/goat									
1397	2011	SW B3b	30	62		Mandibles	Sheep/goat									NISP = 4; removed for ageing
1375	2011	SW B3b	30	62		Metatarsal	Sheep/goat			8	10	4				
1383	2011	SW B3b	30	62		Metatarsal	Sheep/goat				8					
1379	2011	SW B3b	30	62	L	Patella	Sheep/goat									
1394	2011	SW B3b	30	62		Phalanx 2	Sheep/goat									
1376	2011	SW B3b	30	62	L	Radius	Sheep/goat		1	6	8					
1377	2011	SW B3b	30	62	L	Tibia	Sheep/goat					3	4		Fused	
1380	2011	SW B3b	30	62	R	Tibia	Sheep/goat			4	4					
1373	2011	SW B3b	30	62		Tibia	Sheep/goat					10			Unfused, missing	
1385	2011	SW B3b	30	62		Tibia	Sheep/goat				10	8				
1384	2011	SW B3b	30	62		Femur	Small ungulate	SD = 12.9			10					
1392	2011	SW B3b	30	62		Scute	Turtle/tortoise									
1406	2011	SW B3b	30	62		Horn cores	Unidentified									Four large horn cores removed for Weiner lab
1393	2011	SW B3b	30	62		Innominat	Unidentifie									Lepus? Removed for ID

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
						e	d									
996	2011	SW B3b	30	63		Lumbar vertebra	Medium ungulate									
995	2011	SW B3b	30	63	R	Scapula	Medium ungulate									
993	2011	SW B3b	30	63		P3	Pig									
991	2011	SW B3b	30	63	R	Radius	Sheep	Bp = 28	9	2				Fused		
992	2011	SW B3b	30	63	L	Dp4	Sheep/goat									Worn, bone attached
997	2011	SW B3b	30	63		Mand M	Sheep/goat									1 broken
999	2011	SW B3b	30	63		Mand M3	Sheep/goat									Young
998	2011	SW B3b	30	63		Max M	Sheep/goat									
990	2011	SW B3b	30	63	R	Metatarsal	Sheep/goat		10	10				Fused		
989	2011	SW B3b	30	63	R	Humerus	Unidentified					7	10		Fused	Separated for Weiner lab. Flat anteriorly and medial bone spur
1016	2011	SW B3b	30	66		Mand M	Cow									Wear stage o
1014	2011	SW B3b	30	66	L	Patella	Cow									
1007	2011	SW B3b	30	66	R	Tibia	Cow	Bd = 55.5					7		Fused	
1006	2011	SW B3b	30	66	R	Radius	Deer	Bd = 29.3					8		Fused	
1008	2011	SW B3b	30	66	R	Ulna	Deer			5						
1015	2011	SW B3b	30	66	R	Naviculo-cuboid	Large ungulate									
1004	2011	SW B3b	30	66	R	Ulna	Large ungulate		7							
1011	2011	SW B3b	30	66		Femur	Medium ungulate	SD = 18.7			6					
1013	2011	SW B3b	30	66		Femur	Medium ungulate				8					
1005	2011	SW B3b	30	66		Humerus	Medium ungulate					6				
1019	2011	SW B3b	30	66		Dp	Pig									
1017	2011	SW B3b	30	66		Incisor	Pig									
1003	2011	SW B3b	30	66	L	Ulna	Pig		8							
1010	2011	SW B3b	30	66	L	Femur	Sheep/goat	SD = 16.8			5	5				
1018	2011	SW B3b	30	66		Mand M3	Sheep/goat									Wear stage j
994	2011	SW B3b	30	66	R	Mandible	Sheep/goat									Removed for ID

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
1000	2011	SW B3b	30	66	L	Radius	Sheep/goat	SD = 16.1		7	8					
1020	2011	SW B3b	30	66	R	Radius	Sheep/goat		8	9				Fused		
1001	2011	SW B3b	30	66		Radius	Sheep/goat	SD = 15.6				8				
1012	2011	SW B3b	30	66		Radius	Sheep/goat	SD = 14.5			10					
1009	2011	SW B3b	30	66	L	Humerus	Small ungulate	SD = 10.1								
1002	2011	SW B3b	30	66		Radius	Small ungulate	SD = 11								
1024	2011	SW B3b	31	65		Innominate	Large ungulate									
1025	2011	SW B3b	31	65		Femur	Medium ungulate			4	7					
1027	2011	SW B3b	31	65		Radius	Medium ungulate	SD = 16.1			8					
1022	2011	SW B3b	31	65		Max I	Pig									
1021	2011	SW B3b	31	65		Phalanx 2	Pig									
1023	2011	SW B3b	31	65		Max M3	Sheep/goat									Wear stage d
1026	2011	SW B3b	31	65		Metapodial	Small ungulate	SD = 7.7		10	10	10				
1035	2012	SW B3b	34	70		Horn core	Cow	SD = 54.8								2 pieces
1036	2012	SW B3b	34	70		Scapula	Pig									
1037	2012	SW B3b	34	70		Mand Dp4	Sheep/goat									Unworn
1038	2012	SW B3b	35	71	L	Tibia	Cow	Bd = 53.6					8		Fused	
1039	2012	SW B3b	35	71		Maxilla	Deer									P4 + M1. Wear stage c
1042	2012	SW B3b	35	71		Max I	Pig									
1040	2012	SW B3b	35	71		Mand M	Sheep/goat									Wear stage g
1041	2012	SW B3b	35	71		Mandible	Sheep/goat									Removed for ID
1048	2012	SW B3b	37	73		Antler	Deer									2 tines
1049	2012	SW B3b	37	73		Vertebra	Medium ungulate									
1047	2012	SW B3b	37	73	R	Ulna	Pig		8	8						
1043	2012	SW B3b	37	73	R	Metatarsal	Sheep/goat	Bp = 18.9; SD = 10.1	10	8				Fused		
1044	2012	SW B3b	37	73		Metatarsal	Sheep/goat	SD = 10.4		8	10	8				
1045	2012	SW B3b	37	73		Metatarsal	Sheep/goat					8		Unfused; missing		
1046	2012	SW B3b	37	73		Phalanx 1	Sheep/goat						Unfused;			

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
													missing			
1051	2012	SW B3b	37	75	L	Ulna	Cow		4	8						
1053	2012	SW B3b	37	75	L	Mandible	Deer									Articulation
1050	2012	SW B3b	37	75	R	Horn core	Goat	L = 240; SD = 28								
1052	2012	SW B3b	37	75	R	Mandible	Horse									P2-P4; heavy wear; photo
1054	2012	SW B3b	37	76		Metatarsal	Cow	Bd = 54			2	9	10		Fused	
1057	2012	SW B3b	37	76		Femur	Medium ungulate				4					
1055	2012	SW B3b	37	76	L	Tibia	Pig	Bd = 36			2	8	10		Fused	
1059	2012	SW B3b	37	76		Incisor	Sheep/goat									
1061	2012	SW B3b	37	76		Mandible	Sheep/goat									Articulation
1056	2012	SW B3b	37	76		Tibia	Sheep/goat	SD = 13.7			1	8	1			
1058	2012	SW B3b	37	76		Femur	Turtle/tortoise			8	10	10	2			
1060	2012	SW B3b	37	76		Tibia	Turtle/tortoise									
1123	2012	SW B3b	37	77		Horn core	Cow									
1124	2012	SW B3b	37	77		Horn core	Cow									
1117	2012	SW B3b	37	77	L	Mandible	Deer									P1, P2 present
1108	2012	SW B3b	37	77		Metatarsal	Deer	SD = 11.3								
1125	2012	SW B3b	37	77		Horn core	Goat									
1110	2012	SW B3b	37	77		Naviculo-cuboid	Large ungulate									
1105	2012	SW B3b	37	77	R	Radius	Large ungulate	SD = 37.3			8					
1107	2012	SW B3b	37	77		Femur	Medium ungulate				6					
1109	2012	SW B3b	37	77		Femur	Medium ungulate	SD = 14.5			2	10				
1106	2012	SW B3b	37	77	L	Ulna	Medium ungulate			8	6					
1119	2012	SW B3b	37	77		Mand Canine	Pig									
1122	2012	SW B3b	37	77		Mand P3	Sheep/goat									
1120	2012	SW B3b	37	77		Max M	Sheep/goat									Wear stage h
1121	2012	SW B3b	37	77		Max M	Sheep/goat									Wear stage f

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
1111	2012	SW B3b	37	77		Phalanx 1	Sheep/goat									
1118	2012	SW B3b	37	77		Sacrum	Sheep/goat									
1112	2012	SW B3b	37	77	L	Tibia	Sheep/goat			4						
1113	2012	SW B3b	37	77	R	Ulna	Sheep/goat		10	8						
1104	2012	SW B3b	37	77	R	Humerus	Small ungulate					8	4			
1115	2012	SW B3b	37	77		Humerus	Small ungulate					10				
1114	2012	SW B3b	37	77		Humerus	Turtle/tortoise		10	10	10	8		Fused		Small
1116	2012	SW B3b	37	77		Scute	Turtle/tortoise									
1334	2012	SW B3b	37	78	R	Calcaneus	Cow									
1360	2012	SW B3b	37	78		Mand P	Cow									
1327	2012	SW B3b	37	78	L	Metatarsal	Cow	Bp = 39; Bd = 45.5	10	10	10	10	10	Fused	Fused	
1342	2012	SW B3b	37	78		Phalanx 2	Deer									
1319	2012	SW B3b	37	78	L	Radius	Deer	Bp = 27.1	10					Fused		
1318	2012	SW B3b	37	78		Radius	Dog		2	10	10	10		Fused		
1348	2012	SW B3b	37	78		Radius	Dog				10	7				
1336	2012	SW B3b	37	78	R	Horn core	Goat									
1322	2012	SW B3b	37	78	L	Humerus	Horse	Bd = 60.1			2	5	9		Fused	
1324	2012	SW B3b	37	78	L	Metacarpal	Horse	Bp = 41.1; Bd = 35.4; SD = 24.4	10	10	10	10	10	Fused	Fused	
1347	2012	SW B3b	37	78		Metacarpal II	Horse		10	10	10	10	10	Fused	Fused	2 pieces
1325	2012	SW B3b	37	78		Phalanx 1	Horse		10	10	10	10	10	Fused	Fused	
1326	2012	SW B3b	37	78		Phalanx 2	Horse		10	10	10	10	10	Fused	Fused	
1323	2012	SW B3b	37	78	L	Radius	Horse	Bp = 62.9; Bd = 58.4; SD = 12.5	10	10	10	10	10	Fused	Fused	
1321	2012	SW B3b	37	78		Tibia	Horse						6		Fused	
1332	2012	SW B3b	37	78	L	Ulna	Horse			4						Articulates with 1323
1355	2012	SW B3b	37	78		Cervical vertebra	Large ungulate									
1349	2012	SW B3b	37	78		Femur	Large ungulate				10					2 pieces
1358	2012	SW B3b	37	78		Mandible	Large ungulate									No teeth
1343	2012	SW B3b	37	78		Metacarpal	Large ungulate		3							
1330	2012	SW B3b	37	78	L	Tibia	Large ungulate					4	4			

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
1344	2012	SW B3b	37	78	R	Tibia	Medium ungulate			5	5					Transverse chop marks on medial surface near each end
1317	2012	SW B3b	37	78	L	Humerus	Pig						8			Very weathered
1316	2012	SW B3b	37	78	R	Humerus	Pig	Bd = 30.3			5	10	10		Fused	Removed for Weiner lab
1335	2012	SW B3b	37	78	R	Innominate	Pig	Artic. D = 41.2								
1320	2012	SW B3b	37	78	R	Radius	Red deer	Bd = 46.8				2	10		Fused	
1337	2012	SW B3b	37	78	L	Horn core	Sheep	BD = 50								
1339	2012	SW B3b	37	78		Metacarpal	Sheep				7	6				
1354	2012	SW B3b	37	78		Metacarpal	Sheep				4					
1333	2012	SW B3b	37	78	R	Metatarsal	Sheep	Bp = 18.6	10	9	3			Fused		
1328	2012	SW B3b	37	78	R	Tibia	Sheep	Bd = 26.2		2	10	10	10		Fused	2 pieces
1356	2012	SW B3b	37	78		Lumbar vertebra	Sheep/goat									Longitudinally chopped
1357	2012	SW B3b	37	78	R	Mandible	Sheep/goat									No teeth, I - P1
1359	2012	SW B3b	37	78		Max P	Sheep/goat									
1361	2012	SW B3b	37	78		Maxilla	Sheep/goat									2 molars, Wear stage j
1353	2012	SW B3b	37	78		Metapodial	Sheep/goat		1	1						
1338	2012	SW B3b	37	78	R	Radius	Sheep/goat			6	7					
1345	2012	SW B3b	37	78	R	Radius	Sheep/goat			1	10	8				
1340	2012	SW B3b	37	78		Radius	Sheep/goat					5				
1329	2012	SW B3b	37	78	L	Tibia	Sheep/goat	Bd = 24.5				6	8			Calcified, medial malleolus missing
1341	2012	SW B3b	37	78	L	Tibia	Sheep/goat			5	6					
1331	2012	SW B3b	37	78	R	Tibia	Sheep/goat				4	10	6		Fused	
1346	2012	SW B3b	37	78		Tibia	Sheep/goat				3	9				
1352	2012	SW B3b	37	78		NoID	Turtle/tortoise									Removed for Weiner lab
1350	2012	SW B3b	37	78		Scute	Turtle/tortoise									
1351	2012	SW B3b	37	78		Scute	Turtle/tortoise									
1081	2012	SW B3b	38	82		Mand M	Cow									Wear stage k
1070	2012	SW B3b	38	82	R	Radius	Deer						10		Unfused	Epiphesis
1071	2012	SW B3b	38	82	L	Horn core	Goat	SD = 28.9								
1072	2012	SW B3b	38	82		Femur	Large ungulate				3					
1064	2012	SW B3b	38	82		Metacarpal	Large ungulate		2	1	1			Fused		

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
1079	2012	SW B3b	38	82		Scaphoid	Large ungulate									
1068	2012	SW B3b	38	82		Metacarpal	Medium ungulate			1	1					
1065	2012	SW B3b	38	82	L	Radius	Medium ungulate	12.6		10						May join with 1066
1066	2012	SW B3b	38	82		Radius	Medium ungulate				8					May join with 1065
1067	2012	SW B3b	38	82	L	ulna	Medium ungulate			10						Articulates with 1065
1076	2012	SW B3b	38	82		Maxilla	Pig									Dp3, Dp4 (unerupted)
1073	2012	SW B3b	38	82		Metacarpal V	Pig									
1062	2012	SW B3b	38	82		Metacarpal	Sheep	Bd = 25				7	10		Fused	
1069	2012	SW B3b	38	82		Humerus	Sheep/goat					8				
1082	2012	SW B3b	38	82		Incisor	Sheep/goat									
1080	2012	SW B3b	38	82	R	Mandible	Sheep/goat									Articulation
1075	2012	SW B3b	38	82		Mandible	Sheep/goat									Removed for ID
1083	2012	SW B3b	38	82		Max P4	Sheep/goat									Wear stage h
1078	2012	SW B3b	38	82	L	Metacarpal	Sheep/goat	Bp = 20	8					Fused		
1063	2012	SW B3b	38	82		Metatarsal	Sheep/goat		10	8				Fused		
1077	2012	SW B3b	38	82	R	Tibia	Sheep/goat	Bd = 24.5					10		Fused	
1074	2012	SW B3b	38	82		Scute	Turtle/tortoise									
1086	2012	SW B3b	38	84	R	Radius	Deer	Bd = 28.4				8	10		Fused	
1084	2012	SW B3b	38	84	L	Tibia	Deer	Bd = 27.8				8	10		Fused	
1095	2012	SW B3b	38	84		Metacarpal V	Dog									
1087	2012	SW B3b	38	84		Phalanx 3	Horse									
1085	2012	SW B3b	38	84		Femur	Medium ungulate			1	8	3				
1096	2012	SW B3b	38	84		Femur	Medium ungulate				4					
1088	2012	SW B3b	38	84		Radius	Medium ungulate				5					
1098	2012	SW B3b	38	84		Max I	Pig									
1101	2012	SW B3b	38	84		Cervical vertebra	Sheep/goat									
1103	2012	SW B3b	38	84		Dp1	Sheep/goat									Unworn
1089	2012	SW B3b	38	84	R	Femur	Sheep/goat		2					Unfused		Greater trochanter
1090	2012	SW B3b	38	84		Femur	Sheep/goat		2							Head

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
1100	2012	SW B3b	38	84		Lumbar vertebra	Sheep/goat									
1099	2012	SW B3b	38	84	R	Mandible	Sheep/goat									Articulation
1094	2012	SW B3b	38	84		Max M	Sheep/goat									Wear stage g
1093	2012	SW B3b	38	84		Max P	Sheep/goat									Wear stage f
1097	2012	SW B3b	38	84	R	Metatarsal	Sheep/goat		3					Fused		
1092	2012	SW B3b	38	84	L	Scapula	Small ungulate									
1091	2012	SW B3b	38	84	L	Tibia	Small ungulate			10	10	10				
1102	2012	SW B3b	38	84		Teeth										Broken teeth
1196	2013	SW B3b	40	88	L	Mandible	Sheep/goat									Removed for ageing
1197	2013	SW B3b	40	89	R	Mandible	Sheep/goat									2 pieces, M1- M3; Removed for ageing
1198	2013	SW B3b	40	90	L	Mandible	Sheep/goat									2 pieces, dp1-M2; Removed for ageing
1199	2013	SW B3b	40	90	R	Mandible	Sheep/goat									dp1-M1; Removed for ageing
1472	2012	SW B3b	41	91		Max M	Cow									Heavy wear
1465	2012	SW B3b	41	91		Metacarpal	Goat			8						
1460	2012	SW B3b	41	91	L	Tibia	Goat	Bd = 24			10	10	10		Fused	
1469	2012	SW B3b	41	91	R	Astragalus	Pig									Chopped? Photo for Jake
1473	2012	SW B3b	41	91		Mand I	Pig									
1471	2012	SW B3b	41	91	R	Maxilla	Pig									Di2, Di3 unerupted
1467	2012	SW B3b	41	91	L	Ulna	Pig			8						
1470	2012	SW B3b	41	91	R	Astragalus	Red deer									Chopped? Photo for Jake
1468	2012	SW B3b	41	91	L	Calcaneus	Sheep/goat									
1462	2012	SW B3b	41	91	L	Humerus	Sheep/goat					8				
1477	2012	SW B3b	41	91	R	Innominate	Sheep/goat									
1474	2012	SW B3b	41	91	L	Mandible	Sheep/goat									No teeth
1200	2013	SW B3b	41	91	R	Mandible	Sheep/goat									P1-M1; Removed for ageing
1475	2012	SW B3b	41	91	L	Maxilla	Sheep/goat									M1, M2 unerupted
1476	2012	SW B3b	41	91	R	Maxilla	Sheep/goat									M1 M2
1463	2012	SW B3b	41	91	L	Radius	Sheep/goat			8						
1466	2012	SW B3b	41	91	R	Tibia	Sheep/goat			7						
1461	2012	SW B3b	41	91		Tibia	Sheep/goat				30	10				
1464	2012	SW B3b	41	91		Tibia	Sheep/goat					9				
1488	2012	SW B3b	41	93		Mand M4	Dog	GL = 20.1								

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
1491	2012	SW B3b	41	93		Metatarsal	Goat									
1478	2012	SW B3b	41	93	R	Tibia	Goat	Bd = 22				3	10		Fused	
1492	2012	SW B3b	41	93		Scapula	Large ungulate									
1494	2012	SW B3b	41	93	R	Astragalus	Pig									
1493	2012	SW B3b	41	93		Mand I	Pig									
1489	2012	SW B3b	41	93		Maxilla	Pig									Partially erupted M3
1490	2012	SW B3b	41	93		Phalanx 2	Pig									
1487	2012	SW B3b	41	93	L	Tibia	Red deer	Bd = 45.1				8	10		Fused	
1484	2012	SW B3b	41	93	R	Metatarsal	Sheep		2	2				Fused		
1482	2012	SW B3b	41	93	R	Femur	Sheep/goat					10				
1480	2012	SW B3b	41	93	R	Humerus	Sheep/goat						8		Fused	
1486	2012	SW B3b	41	93	R	Humerus	Sheep/goat			3						
1481	2012	SW B3b	41	93		Humerus	Sheep/goat					3				
1483	2012	SW B3b	41	93	L	Innominate	Sheep/goat									
1495	2012	SW B3b	41	93		Mand Di	Sheep/goat									
1496	2012	SW B3b	41	93		Mand I	Sheep/goat									
1479	2012	SW B3b	41	93	R	Radius	Sheep/goat			10						
1485	2012	SW B3b	41	93		Femur	Small ungulate				4					
1497	2012	SW B3b	42	92	L	Mandible	Deer									M1-M3, broken teeth
1498	2012	SW B3b	42	92	R	Mandible	Deer									P2-P4
1502	2012	SW B3b	42	92		Phalanx 2	Deer									
1499	2012	SW B3b	42	92	R	Calcaneus	Dog									
1501	2012	SW B3b	42	92		Phalanx 1	Pig									
1503	2012	SW B3b	42	92		Mand M	Sheep/goat									Wear stage g
1500	2012	SW B3b	42	92	R	Radius			4	10	2	10				4 pieces
1505	2012	SW B3b	44	94		Incisor	Cow									
1201	2013	SW B3b	44	94	R	Mandible	Sheep/goat									dp1-M1; Removed for ageing
1504	2012	SW B3b	44	94	L	Tibia	Sheep/goat					10				
1514	2012	SW B3b	46	97		Incisor	Cow									
1513	2012	SW B3b	46	97		Max C	Pig									
1515	2012	SW B3b	46	97		Max P	Sheep/goat									
1516	2012	SW B3b	46	97	L	Radius	Sheep/goat		2					Fused		

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
1521	2012	SW B3b	46	98		Cervical vertebra	Cow									Diagonally chopped? Removed for Jake
1528	2012	SW B3b	46	98		Humerus	Dog						8		Fused	
1527	2012	SW B3b	46	98		Mand Dp4	Dog									
1523	2012	SW B3b	46	98		Metapodial	Goat						3			
1519	2012	SW B3b	46	98		Radius	Micromammal		10	10	10	10	10	Fused	Fused	
1518	2012	SW B3b	46	98		Metacarpal	Sheep			2	2	10				
1517	2012	SW B3b	46	98	R	Femur	Sheep/goat				5	10				
1524	2012	SW B3b	46	98		Max M1	Sheep/goat									
1525	2012	SW B3b	46	98		Max M2	Sheep/goat									
1526	2012	SW B3b	46	98		Max P3	Sheep/goat									
1520	2012	SW B3b	46	98		Metapodial										
1508	2012	SW B3b	46	99		Phalanx 3	Cow									
1507	2012	SW B3b	46	99	L	Femur	Sheep/goat		3					Unfused		Head
1509	2012	SW B3b	46	99		Mand M	Sheep/goat									Wear stage G
1202	2013	SW B3b	46	99	L	Mandible	Sheep/goat									M1+M2; Removed for ageing
1511	2012	SW B3b	46	99		Max M	Sheep/goat									
1510	2012	SW B3b	46	99		Metacarpal	Sheep/goat				6					
1506	2012	SW B3b	46	99	R	Tibia	Sheep/goat			10	10					
1512	2012	SW B3b	46	99		Ulna	Sheep/goat					8				
1534	2012	SW B3b	48	102		Cervical vertebra	Cow									Vertebral arch, chopped. Removed for Jake
1531	2012	SW B3b	48	102		Incisor	Cow									
1530	2012	SW B3b	48	102		Max M	Cow									Light wear
1537	2012	SW B3b	48	102		Metacarpal	Cow		2					Fused		
1532	2012	SW B3b	48	102		Phalanx 1	Deer									
1542	2012	SW B3b	48	102		Metatarsal 1	Human									Juvenile. Removed and placed with human remains
1540	2012	SW B3b	48	102		Humerus	Large ungulate				7					

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
1539	2012	SW B3b	48	102		Radius	Large ungulate		3	2				Fused		
1529	2012	SW B3b	48	102	R	Humerus	Pig	Bd = 33				2	10		Fused	
1533	2012	SW B3b	48	102	L	Maxilla	Pig									C-P2. No teeth present
1535	2012	SW B3b	48	102		Femur	Sheep/goat				3	4				Spiral
1538	2012	SW B3b	48	102		Femur	Sheep/goat				4					
1536	2012	SW B3b	48	102		Humerus	Sheep/goat				8					
1203	2013	SW B3b	48	102	L	Mandible	Sheep/goat									M3; Removed for ageing
1541	2012	SW B3b	48	102		Tibia	Sheep/goat					7				
1547	2012	SW B3b	49	103		Femur	Cow				2					
1546	2012	SW B3b	49	103		Maxilla	Cow									Max P
1543	2012	SW B3b	49	103	R	Tibia	Goat	Bd = 24.1				2	10		Fused	
1545	2012	SW B3b	49	103		Innominata	Sheep/goat									
1544	2012	SW B3b	49	103		Radius	Sheep/goat				7	9				
1551	2012	SW B3b	49	104	R	Tibia	Micromammal			10						
1548	2012	SW B3b	49	104		Phalanx 1	Pig									
1550	2012	SW B3b	49	104	L	Mandible	Sheep/goat									Articulation with R mandible and cranium; 2 pieces
1549	2012	SW B3b	49	104	L	Metatarsal	Sheep/goat		5	9				Fused		
1552	2012	SW B3b	49	105		Phalanx 1	Goat	GL = 34.2								
1557	2012	SW B3b	49	105	L	Femur	Pig	Bd = 39			1	10	10		Unfused	
1559	2012	SW B3b	49	105		Mand canine	Pig									
1560	2012	SW B3b	49	105		Mandible	Pig									Canine
1558	2012	SW B3b	49	105	R	Horn core	Sheep									
1554	2012	SW B3b	49	105		Canine	Sheep/goat									
1555	2012	SW B3b	49	105	L	Femur	Sheep/goat						6		Unfused	
1556	2012	SW B3b	49	10		Incisor	Sheep/goat									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
				5												
1561	2012	SW B3b	49	105	R	Innominate	Sheep/goat									
1553	2012	SW B3b	49	105		Mand Dm4	Sheep/goat									Wear stage G
1564	2012	SW B3b	50	107		Humerus	Bird						10			
1565	2012	SW B3b	50	107		Molar	Pig									Broken, half of loph
1204	2013	SW B3b	50	107	R	Mandible	Sheep/goat									M1 unerupted, M2; Removed for ageing
1563	2012	SW B3b	50	107	R	Tibia			3	6				Unfused		
1566	2012	SW B3b	50	108		Max M3	Sheep/goat									
1569	2012	SW B3b	50	108		Sacral vertebra	Sheep/goat									
1568	2012	SW B3b	50	108		NoID	Unidentified									Chopped; Removed for Jake
1567	2012	SW B3b	50	108		Molar										Broken, one loph
1442	2012	SW B3b	52	109		Mand I	Pig									
1443	2012	SW B3b	52	109		Mand I	Pig									
1446	2012	SW B3b	52	109	L	Mandible	Sheep/goat									Articulation
1445	2012	SW B3b	52	109		Max M	Sheep/goat									Broken
1444	2012	SW B3b	52	109		Max P4	Sheep/goat									
1447	2012	SW B3b	52	109		Lumbar vertebra										
1436	2012	SW B3b	52	113		Max P4	Dog									
1438	2012	SW B3b	52	113		Femur	Large ungulate					2				
1434	2012	SW B3b	52	113	L	Calcaneus	Sheep									
1431	2012	SW B3b	52	113	R	Radius	Sheep	Bp = 29.3; Bd = 27.3; SD = 15.1; GL = 137.4	10	10	10	10	10	Fused	Fused	
1432	2012	SW B3b	52	113	R	Ulna	Sheep		10	9						
1437	2012	SW B3b	52	113		Humerus	Sheep/goat			2	3					
1205	2012	SW B3b	52	113	L	Mandible	Sheep/goat									P1; Removed for ageing

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
1206	2012	SW B3b	52	113	R	Mandible	Sheep/goat									P2,P3; Removed for ageing
1439	2012	SW B3b	52	113		Mandible	Sheep/goat									Coronoid
1435	2012	SW B3b	52	113		Max M	Sheep/goat									
1433	2012	SW B3b	52	113		Radius	Sheep/goat			8						
1440	2012	SW B3b	52	116		Max M1	Pig									Wear stage e
1441	2012	SW B3b	52	116		Max P4	Pig									Wear stage c
1430	2012	SW B3b	53	111	L	Radius	Large ungulate		3					Fused		
1427	2012	SW B3b	53	111	L	Tibia	Pig			10	10	10			Unfused; missing	
1428	2012	SW B3b	53	111	L	Tibia	Rabbit/hare			10	10	10				
1429	2012	SW B3b	53	111		Metacarpal	Red deer	Bd = 51.8					9		Fused	
1448	2012	SW B3b	54	115		Tusk	Pig									Photo
1450	2013	SW B3b	55	114	L	Mandible	Deer									articulation and coronoid
1451	2013	SW B3b	55	114		Phalanx 2	Deer									
1449	2013	SW B3b	55	114	L	Radius	Red deer	Bd = 57.4					10		Unfused	Epiphesis
1452	2013	SW B3b	55	114		Phalanx 1	Sheep									
358	2013	SW B3b	59	119		Phalanx 2	Sheep/goat									
94	2013	SW B3b	60	123		Horn core	Cow									
69	2013	SW B3b	60	123		Femur	Medium ungulate									
390	2013	SW B3b	60	123		Radius	Medium ungulate									
118	2013	SW B3b	60	123	L	Humerus	Sheep/goat									
117	2013	SW B3b	60	123	R	Humerus	Sheep/goat	Epiph 30mm wide								
251	2013	SW B3b	60	123	R	Metacarpal	Sheep/goat									
663	2013	SW B3b	60	123		Tooth	Sheep/goat									
2	2013	SW B3b	61	124		Antler	Deer									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
665	2013	SW B3b	61	124		Tooth	Deer	23mmx14mm								
495	2013	SW B3b	61	124		Rib (x2)	Large Ungulate									
119	2013	SW B3b	61	124		Humerus	Medium ungulate									
496	2013	SW B3b	61	124		Rib (x5)	Medium ungulate									
730	2013	SW B3b	61	124		Vertebra	Medium ungulate									
227	2013	SW B3b	61	124	L	Maxilla	Pig									
150	2013	SW B3b	61	124		Mand M2	Sheep/goat									
188	2013	SW B3b	61	124	R	Mandible	Sheep/goat									
391	2013	SW B3b	61	124		Radius	Sheep/goat									
497	2013	SW B3b	61	124		Sacrum	Sheep/goat									
511	2013	SW B3b	61	124	R	Scapula	Sheep/goat									
512	2013	SW B3b	61	124		Scapula	Sheep/goat									
664	2013	SW B3b	61	124		Tooth	Sheep/goat									
666	2013	SW B3b	61	124		Tooth	Sheep/goat									
95	2013	SW B3b	61	124		Horn core										
21	2013	SW B3b	61	125	R	Calcaneus	Cow									
147	2013	SW B3b	61	125		Mand M	Cow									
368	2013	SW B3b	61	125		Premolar	Cow									
576	2013	SW B3b	61	125	L	Tibia	Cow									
3	2013	SW B3b	61	125		Antler	Deer	76mm long								
320	2013	SW B3b	61	125		Phalanx 1	Deer									
670	2013	SW B3b	61	125		Tooth	Deer									
71	2013	SW B3b	61	125	L	Femur	Large ungulate	122mm long, 32x31mm wide								
70	2013	SW B3b	61	125		Femur	Large ungulate									
393	2013	SW B3b	61	125		Radius	Medium ungulate	x section 12mmx7mm								

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
191	2013	SW B3b	61	125	L	Mandible	Pig									
319	2013	SW B3b	61	125		Phalanx 1	Red deer	54mm long, 21mm wide x 19 high mid								
96	2013	SW B3b	61	125		Horn core	Sheep	Base 38mm x 30mm								
97	2013	SW B3b	61	125		Horn core	Sheep/goat									
136	2013	SW B3b	61	125	R	Innominate	Sheep/goat									
189	2013	SW B3b	61	125	L	Mandible	Sheep/goat									Removed for ageing
190	2013	SW B3b	61	125	R	Mandible	Sheep/goat									Removed for ageing
252	2013	SW B3b	61	125		Metacarpal	Sheep/goat									
392	2013	SW B3b	61	125	L	Radius	Sheep/goat								Unfused; not present	
394	2013	SW B3b	61	125	L	Radius	Sheep/goat								Unfused; not present	
575	2013	SW B3b	61	125	R	Tibia	Sheep/goat								Unfused; not present	
577	2013	SW B3b	61	125	R	Tibia	Sheep/goat								Unfused	
667	2013	SW B3b	61	125	L	Tooth	Sheep/goat									Removed for ageing
669	2013	SW B3b	61	125	L	Tooth	Sheep/goat									Removed for ageing
671	2013	SW B3b	61	125	L	Tooth	Sheep/goat									Removed for ageing
668	2013	SW B3b	61	125	R	Tooth	Sheep/goat									Removed for ageing
321	2013	SW B3b	62	126		Phalanx 1	Cow	53mm long, 24x21mm xsection								
347	2013	SW B3b	62	126		Phalanx 2	Cow	36mm long, 22x20mm xsection								
348	2013	SW B3b	62	126		Phalanx 2	Cow	39mm long, 24x21mm xsection								
678	2013	SW B3b	62	12		Tooth	Cow	19x17mm								

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
				6												
685	2013	SW B3b	62	126		Tooth	Cow									
686	2013	SW B3b	62	126		Tooth	Cow	15x18mm								
5	2013	SW B3b	62	126		Antler fragments	Deer									
579	2013	SW B3b	62	126	L	Tibia	Deer									
369	2013	SW B3b	62	126		Premolar	Dog									
72	2013	SW B3b	62	126		Femur	Large ungulate									
84	2013	SW B3b	62	126		Frontal bone + horn base	Large ungulate									
121	2013	SW B3b	62	126		Humerus	Large ungulate									
513	2013	SW B3b	62	126		Scapula	Large ungulate									
584	2013	SW B3b	62	126	R	Tibia	Large ungulate	34mm long								
580	2013	SW B3b	62	126		Tibia	Large ungulate									
73	2013	SW B3b	62	126		Femur	Medium ungulate									
74	2013	SW B3b	62	126		Femur	Medium ungulate									
287	2013	SW B3b	62	126		Metatarsal	Medium ungulate	45mm long, 12mmx10mm x-section								
22	2013	SW B3b	62	126	L	Calcaneus	Pig									
196	2013	SW B3b	62	126	L	Mandible	Pig									
195	2013	SW B3b	62	126	R	Mandible	Pig	M2 20x13mm								
229	2013	SW B3b	62	126	L	Maxilla	Pig	M1 15x13mm								
230	2013	SW B3b	62	126	L	Maxilla	Pig									
231	2013	SW B3b	62	126	L	Maxilla	Pig	M2 13x11mm								
228	2013	SW B3b	62	126	R	Maxilla	Pig	M1 14x12mm, M2 20x16mm, M3 25x15mm								
723	2013	SW B3b	62	12	R	Ulna	Pig									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
				6												
100	2013	SW B3b	62	126	L	Horn core	Sheep									
98	2013	SW B3b	62	126	R	Horn core	Sheep	49x34mm at base								
99	2013	SW B3b	62	126		Horn core	Sheep	71mm long.								
101	2013	SW B3b	62	126		Horn core	Sheep	base 19x14mm								
120	2013	SW B3b	62	126	L	Humerus	Sheep/goat									
193	2013	SW B3b	62	126	L	Mandible	Sheep/goat									Removed for ageing
194	2013	SW B3b	62	126	L	Mandible	Sheep/goat									Removed for ageing
192	2013	SW B3b	62	126	R	Mandible	Sheep/goat									Removed for ageing
253	2013	SW B3b	62	126	R	Metacarpal	Sheep/goat									
254	2013	SW B3b	62	126		Metacarpal	Sheep/goat									
285	2013	SW B3b	62	126	L	Metatarsal	Sheep/goat									
286	2013	SW B3b	62	126		Metatarsal	Sheep/goat	58mm long								
395	2013	SW B3b	62	126		Radius	Sheep/goat	56mm long, 17x10mm xsection								
578	2013	SW B3b	62	126	L	Tibia	Sheep/goat	Bd = 27.1								
583	2013	SW B3b	62	126	L	Tibia	Sheep/goat	74mm long, 15x13mm xsection								
581	2013	SW B3b	62	126	R	Tibia	Sheep/goat	47mm long								
582	2013	SW B3b	62	126		Tibia	Sheep/goat	66mm long, 14x12mm xsection								
672	2013	SW B3b	62	126	L	Tooth	Sheep/goat									
674	2013	SW B3b	62	126	L	Tooth	Sheep/goat									
676	2013	SW B3b	62	126	L	Tooth	Sheep/goat									
681	2013	SW B3b	62	126	L	Tooth	Sheep/goat									
682	2013	SW B3b	62	126	L	Tooth	Sheep/goat									
683	2013	SW B3b	62	126	L	Tooth	Sheep/goat									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
684	2013	SW B3b	62	126	L	Tooth	Sheep/goat									
673	2013	SW B3b	62	126	R	Tooth	Sheep/goat									
675	2013	SW B3b	62	126	R	Tooth	Sheep/goat									
677	2013	SW B3b	62	126	R	Tooth	Sheep/goat									
679	2013	SW B3b	62	126		Tooth	Sheep/goat									
680	2013	SW B3b	62	126		Tooth	Sheep/goat									
687	2013	SW B3b	62	126		Tooth	Sheep/goat									
197	2013	SW B3b	62	126	R	Mandible	Small									
137	2013	SW B3b	62	126		Innominate	Small ungulate									
288	2013	SW B3b	62	126		Metatarsal	Small ungulate	47mm long, 9mmx9mm								
324	2013	SW B3b	62	127		Phalanx 1	Cow	29mm high								
694	2013	SW B3b	62	127		Tooth	Cow	28mm x 15mm(ant), 16mm(post)								
700	2013	SW B3b	62	127		Tooth	Cow									
257	2013	SW B3b	62	127		Metacarpal	Deer	51mm long, 17x9mm xsection								
322	2013	SW B3b	62	127		Phalanx 1	Deer	42mm long, 19mm wide at dist artic								
323	2013	SW B3b	62	127		Phalanx 1	Deer	33mm long								
701	2013	SW B3b	62	127		Tooth	Deer									
702	2013	SW B3b	62	127		Tooth	Deer									
724	2013	SW B3b	62	127	L	Ulna	Deer	82mm long								
202	2013	SW B3b	62	127	R	Mandible	Dog									
696	2013	SW B3b	62	127	L	Tooth	Goat									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
693	2013	SW B3b	62	127	R	Tooth	Goat									
695	2013	SW B3b	62	127	R	Tooth	Goat									
49	2013	SW B3b	62	127		Cranium	Large ungulate									
122	2013	SW B3b	62	127		Humerus	Large ungulate									
124	2013	SW B3b	62	127		Humerus	Large ungulate									
473	2013	SW B3b	62	127		Rib	Large ungulate									
474	2013	SW B3b	62	127		Rib	Large ungulate									
514	2013	SW B3b	62	127		Scapula	Large ungulate	Glenoid diameter 39mm								
515	2013	SW B3b	62	127		Scapula	Large ungulate	Glenoid diameter 40mm								
516	2013	SW B3b	62	127		Scapula	Large ungulate									
517	2013	SW B3b	62	127		Scapula	Large ungulate									
518	2013	SW B3b	62	127		Scapula	Large ungulate									
537	2013	SW B3b	62	127		Shell	Marine mollusc									
123	2013	SW B3b	62	127	L	Humerus	Medium ungulate									
139	2013	SW B3b	62	127		L vert	Medium ungulate									
201	2013	SW B3b	62	127	R	Mandible	Medium ungulate									
397	2013	SW B3b	62	127	R	Radius	Medium ungulate	111mm long, 14x7mm xsection								
398	2013	SW B3b	62	127		Radius	Medium ungulate	96mm long, 15x8mm xsection								
589	2013	SW B3b	62	127		Tibia	Medium ungulate	70mm long								
591	2013	SW B3b	62	127		Tibia	Medium ungulate									
198	2013	SW B3b	62	127		Mandible	Pig									
396	2013	SW B3b	62	127	L	Radius	Pig									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
13	2013	SW B3b	62	127	L	Astragalus	Sheep	25x16mm								
23	2013	SW B3b	62	127	L	Calcaneus	Sheep									
233	2013	SW B3b	62	127	L	Maxilla	Sheep									
697	2013	SW B3b	62	127	L	Tooth	Sheep									
698	2013	SW B3b	62	127	L	Tooth	Sheep									
688	2013	SW B3b	62	127		Tooth	Sheep									
699	2013	SW B3b	62	127		Tooth	Sheep									
17	2013	SW B3b	62	127		Atlas	Sheep/goat									
199	2013	SW B3b	62	127	R	Mandible	Sheep/goat									
200	2013	SW B3b	62	127	R	Mandible	Sheep/goat									
232	2013	SW B3b	62	127	L	Maxilla	Sheep/goat									
255	2013	SW B3b	62	127	L	Metacarpal	Sheep/goat									
256	2013	SW B3b	62	127	R	Metacarpal	Sheep/goat									
289	2013	SW B3b	62	127	L	Metatarsal	Sheep/goat	70mm long. Artic. 22X20mm								
590	2013	SW B3b	62	127	L	Tibia	Sheep/goat	50mm long								
585	2013	SW B3b	62	127	R	Tibia	Sheep/goat	61mm long, dist artic. 26X21mm								
586	2013	SW B3b	62	127	R	Tibia	Sheep/goat	52mm long								
588	2013	SW B3b	62	127	R	Tibia	Sheep/goat	65mm long								
587	2013	SW B3b	62	127		Tibia	Sheep/goat	40mm long								
689	2013	SW B3b	62	127		Tooth	Sheep/goat									
690	2013	SW B3b	62	127		Tooth	Sheep/goat									
691	2013	SW B3b	62	127		Tooth	Sheep/goat									
692	2013	SW B3b	62	127		Tooth	Sheep/goat									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
50	2013	SW B3b	62	127		Cranium	Small									
51	2013	SW B3b	62	127		Cranium	Small									
475	2013	SW B3b	62	127		Rib	Small									
476	2013	SW B3b	62	127		Rib	Small									
546	2013	SW B3b	62	127		Shell	Unidentified									
547	2013	SW B3b	62	127		Shell	Unidentified									
548	2013	SW B3b	62	127		Shell	Unidentified									
326	2013	SW B3b	63	128		Phalanx 1	Deer	46mm long								
327	2013	SW B3b	63	128		Phalanx 1	Deer	37mm long								
349	2013	SW B3b	63	128		Phalanx 2	Deer									
102	2013	SW B3b	63	128	R	Horn core	Goat	44mm long. 20X9mm xsection								
14	2013	SW B3b	63	128	L	Astragalus	Horse	Body 51mm wide artic 47x42mm – see sketch								
77	2013	SW B3b	63	128		Femur	Large ungulate	110mm long								
481	2013	SW B3b	63	128		Rib	Large ungulate									
125	2013	SW B3b	63	128	L	Humerus	Medium ungulate	60mm long, 23mm wide distally, 14mm midshaft								
399	2013	SW B3b	63	128		Radius	Medium ungulate	44mm long, 14x10mm xsection								
479	2013	SW B3b	63	128		Rib	Medium ungulate									
480	2013	SW B3b	63	128		Rib	Medium ungulate									
126	2013	SW B3b	63	128	L	Humerus	Micromammal	12mm wide at trochlea								
328	2013	SW B3b	63	128		Phalanx 1	Micromammal	9mm long, 5x4mm xsection midshaft								
75	2013	SW B3b	63	128		Femur	Pig	64mm long, 31x30mm distally								

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
203	2013	SW B3b	63	128	L	Mandible	Pig	M2 14x8mm								
325	2013	SW B3b	63	128		Phalanx 1	Red deer	50mm long								
24	2013	SW B3b	63	128	L	Calcaneus	Sheep	52mm long, 19mm wide dist of artic. Body 9mm wide								
258	2013	SW B3b	63	128		Metacarpal	Sheep	42mm long, 12x8mm xsection								
76	2013	SW B3b	63	128	L	Femur	Sheep/goat	43mm long, 18x14mm xsection								
204	2013	SW B3b	63	128	L	Mandible	Sheep/goat									
592	2013	SW B3b	63	128	L	Tibia	Sheep/goat	67mm long, 16mm wide								
703	2013	SW B3b	63	128	L	Tooth	Sheep/goat									
477	2013	SW B3b	63	128		Rib	Small									
478	2013	SW B3b	63	128		Rib	Small									
538	2013	SW B3b	63	128		Shell	Unidentified									
1417	2013	SW B3b	63	129		Horn core	Cow									
1166	2013	SW B3b	63	129		Max M	Cow									Wear stage l
1167	2013	SW B3b	63	129		Max M	Cow									Wear stage k
1160	2013	SW B3b	63	129		Phalanx 3	Cow									
1412	2013	SW B3b	63	129		Antler	Deer									
1155	2013	SW B3b	63	129		Metacarpal	Deer			3						
1422	2013	SW B3b	63	129		Molar	Deer									
1141	2013	SW B3b	63	129	L	Ulna	Dog	DPA = 20.5								
1416	2013	SW B3b	63	129	L	Astragalus	Goat									
1409	2013	SW B3b	63	129		Cranium	Goat									Occipital
1413	2013	SW B3b	63	129		Horn core	Goat									Cut marks?

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
1136	2013	SW B3b	63	129	R	Radius	Goat	Bp = 30.2	10	10	8				Fused	Fused to 1137
1419	2013	SW B3b	63	129		Cervical vertebra	Large ungulate									
1139	2013	SW B3b	63	129	R	Humerus	Large ungulate					8				
1156	2013	SW B3b	63	129		Innominate	Large ungulate									
1418	2013	SW B3b	63	129		Lumbar vertebra	Large ungulate									
1147	2013	SW B3b	63	129		Radius	Large ungulate					5				
1157	2013	SW B3b	63	129		Tibia	Large ungulate			5						
1414	2013	SW B3b	63	129		Tibia	Large ungulate			4						
1421	2013	SW B3b	63	129		Mandible	Medium ungulate									No teeth
1132	2013	SW B3b	63	129	L	Humerus	Pig				4	10	9		Partially fused	
1164	2013	SW B3b	63	129		Mandible	Pig									Left: C - M2; Right: P4,M1
1165	2013	SW B3b	63	129		Mandible	Pig									I2 unerupted; all other teeth missing
1163	2013	SW B3b	63	129	R	Maxilla	Pig									dp2-dp4; M1 unerupted
1420	2013	SW B3b	63	129		Maxilla	Pig									P1
1162	2013	SW B3b	63	129		Phalanx 1	Pig									
1138	2013	SW B3b	63	129	R	Radius	Pig	Bp = 23.1	10	10	10	6		Fused		
1140	2013	SW B3b	63	129	L	Ulna	Pig			10	6					
1415	2013	SW B3b	63	129	L	Astragalus	Sheep									
1144	2013	SW B3b	63	129		Phalanx 1	Sheep	GL = 36.7; Bp = 10.3; Bd = 10.7								
1135	2013	SW B3b	63	129	L	Tibia	Sheep	Bd = 29.7				6	10		Fused	
1134	2013	SW B3b	63	129	R	Tibia	Sheep	Bd = 25.4				8	10		Fused	
1137	2013	SW B3b	63	129	R	Ulna	Sheep		9	10	10					Fused to 1136
1142	2013	SW B3b	63	129	L	Femur	Sheep/goat		6	10	6			Unfused; missing		Juvenile cow?
1143	2013	SW B3b	63	129	L	Femur	Sheep/goat						8		Fused	

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
1151	2013	SW B3b	63	129	L	Femur	Sheep/goat				10	7				
1150	2013	SW B3b	63	129	R	Femur	Sheep/goat						4		Unfused	2 pieces
1149	2013	SW B3b	63	129		Femur	Sheep/goat				4	5	1			
1423	2013	SW B3b	63	129	L	Humerus	Sheep/goat		2							
1146	2013	SW B3b	63	129	R	Humerus	Sheep/goat		5	6				Unfused		2 pieces
1148	2013	SW B3b	63	129		Humerus	Sheep/goat				9					
1153	2013	SW B3b	63	129		Humerus	Sheep/goat			8						
1158	2013	SW B3b	63	129	R	Innominate	Sheep/goat									
1424	2013	SW B3b	63	129		Lumbar vertebra	Sheep/goat									One split transversely
1408	2013	SW B3b	63	129		Mand M	Sheep/goat									Wear stage C
1411	2013	SW B3b	63	129		Mandible	Sheep/goat									Articulation
1154	2013	SW B3b	63	129		Metacarpal	Sheep/goat			2	3	3				
1145	2013	SW B3b	63	129		Metatarsal	Sheep/goat				10	8				
1159	2013	SW B3b	63	129		Metatarsal	Sheep/goat									
1425	2013	SW B3b	63	129		Sacral vertebra	Sheep/goat									Split longitudinally
1410	2013	SW B3b	63	129	L	Scapula	Sheep/goat									
1152	2013	SW B3b	63	129		Tibia	Sheep/goat				7	9				
1161	2013	SW B3b	63	129	L	Ulna	Sheep/goat			8	6					
1133	2013	SW B3b	63	129	R	Humerus	Small ungulate				6	10	2			
1426	2013	SW B3b	63	129		Thoracic vertebra										
259	2013	SW B3b	63	130	L	Metacarpal	Cow	90mm long, 55mm across, 33 deep								
82	2013	SW B3b	63	130		Frontal	Goat	Horn base 38mm x 24mm								
482	2013	SW B3b	63	130		Rib	Medium ungulate									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
519	2013	SW B3b	63	130	R	Scapula	Medium ungulate									
15	2013	SW B3b	63	130	L	Astragalus	Red deer	60mm long, 37 across, 32 deep								
25	2013	SW B3b	63	130	L	Calcaneus	Sheep/goat									
148	2013	SW B3b	63	130	Tooth	mand M1	Sheep/goat	13mm long, 8mm across at large crown								
290	2013	SW B3b	63	130		Metatarsal	Sheep/goat	37mm long, 10mm wide								
593	2013	SW B3b	63	130		Tibia	Sheep/goat	86mm long, 14mm wide								
539	2013	SW B3b	63	130		Shell										
273	2013	SW B3b	63	132		Metapodial	Large ungulate	39mm long, 16mm wide								
483	2013	SW B3b	63	132		rib	Medium ungulate									
205	2013	SW B3b	63	132	L	Mandible	Sheep/goat	M3 22mm long, 10mm at 1st crown								
704	2013	SW B3b	63	132	Tooth	Tooth	Sheep/goat									
705	2013	SW B3b	63	132	Tooth	Tooth	Sheep/goat	14mm long, 8mm at 2nd crown								
4	2013	SW B3b	65	133		antler	Deer	34x11mm								
16	2013	SW B3b	65	133	R	Astragalus	Deer									
293	2013	SW B3b	65	133	L	Metatarsal	Deer	Articulation 32mmx28mm								
302	2013	SW B3b	65	133	R	Naviculocuboid	Deer	36mmx30mm artic.								
52	2013	SW B3b	65	133		Cranium	Large ungulate									
53	2013	SW B3b	65	133		Cranium	Large ungulate									
142	2013	SW B3b	65	133		Lumbar vertebra	Large ungulate									
301	2013	SW B3b	65	133	Tooth	Molar	Large ungulate									
725	2013	SW B3b	65	133	L	Ulna	Medium ungulate									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
206	2013	SW B3b	65	133	L	Mandible	Pig	M3 29mmx14mm								
207	2013	SW B3b	65	133	R	Mandible	Sheep/goat	20mm across artic.								
291	2013	SW B3b	65	133		Metatarsal	Sheep/goat	X-section 11x10mm								
292	2013	SW B3b	65	133		Metatarsal	Sheep/goat	X-section 11x11mm								
540	2013	SW B3b	65	133		shell										
541	2013	SW B3b	65	133		shell										
708	2013	SW B3b	65	135		Tooth	Cow	22x14mm								
709	2013	SW B3b	65	135		Tooth	Cow	9mm wide at crown								
594	2013	SW B3b	65	135	L	Tibia	Deer	43mm wide								
60	2013	SW B3b	65	135		Cranium	Dog									
61	2013	SW B3b	65	135		Cranium	Dog									
62	2013	SW B3b	65	135		Cranium	Dog									
208	2013	SW B3b	65	135	L	Mandible	Dog	M1 20mmx8mm								
209	2013	SW B3b	65	135	R	Mandible	Dog									
212	2013	SW B3b	65	135	R	Mandible	Dog	79mm long, M1 20mmx8mm								
234	2013	SW B3b	65	135	R	Maxilla	Dog	M1 13mmx14mm								
260	2013	SW B3b	65	135		Metacarpal 2	Dog									
261	2013	SW B3b	65	135		Metacarpal 2	Dog									
262	2013	SW B3b	65	135		Metacarpal 3	Dog									
263	2013	SW B3b	65	135		Metacarpal 3	Dog									
267	2013	SW B3b	65	135		Metacarpal 4	Dog									
268	2013	SW B3b	65	135		Metacarpal 4	Dog									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
269	2013	SW B3b	65	135		Metacarpal 5	Dog									
295	2013	SW B3b	65	135		Metatarsal 2	Dog									
296	2013	SW B3b	65	135		Metatarsal 2	Dog									
297	2013	SW B3b	65	135		Metatarsal 3	Dog									
298	2013	SW B3b	65	135		Metatarsal 3	Dog									
299	2013	SW B3b	65	135		Metatarsal 4	Dog									
300	2013	SW B3b	65	135		Metatarsal 4	Dog									
303	2013	SW B3b	65	135		Occipital	Dog	Foramen magnum 17x17mm								
330	2013	SW B3b	65	135		Phalanx 1	Dog									
331	2013	SW B3b	65	135		Phalanx 1	Dog									
332	2013	SW B3b	65	135		Phalanx 1	Dog									
333	2013	SW B3b	65	135		Phalanx 1	Dog									
334	2013	SW B3b	65	135		Phalanx 1	Dog									
335	2013	SW B3b	65	135		Phalanx 1	Dog									
336	2013	SW B3b	65	135		Phalanx 1	Dog									
337	2013	SW B3b	65	135		Phalanx 1	Dog									
338	2013	SW B3b	65	135		Phalanx 1	Dog									
339	2013	SW B3b	65	135		Phalanx 1	Dog									
350	2013	SW B3b	65	135		Phalanx 2	Dog									
351	2013	SW B3b	65	135		Phalanx 2	Dog									
352	2013	SW B3b	65	135		Phalanx 2	Dog									
353	2013	SW B3b	65	135		Phalanx 2	Dog									
354	2013	SW B3b	65	135		Phalanx 2	Dog									
355	2013	SW B3b	65	13		Phalanx 2	Dog									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
				5												
356	2013	SW B3b	65	135		Phalanx 2	Dog									
360	2013	SW B3b	65	135		Phalanx 3	Dog									
361	2013	SW B3b	65	135		Phalanx 3	Dog									
362	2013	SW B3b	65	135		Phalanx 3	Dog									
363	2013	SW B3b	65	135		Phalanx 3	Dog									
364	2013	SW B3b	65	135		Phalanx 3	Dog									
365	2013	SW B3b	65	135		Phalanx 3	Dog									
366	2013	SW B3b	65	135		Phalanx 3	Dog									
706	2013	SW B3b	65	135	L	Tooth	Dog									
707	2013	SW B3b	65	135	R	Tooth	Dog									
211	2013	SW B3b	65	135		Mandible	Large ungulate									
485	2013	SW B3b	65	135		Rib	Micromammal									
486	2013	SW B3b	65	135		Rib	Micromammal									
487	2013	SW B3b	65	135		Rib	Micromammal									
488	2013	SW B3b	65	135		Rib	Micromammal									
210	2013	SW B3b	65	135	L	Mandible	Pig									
726	2013	SW B3b	65	135	L	Ulna	Pig	93mm long, trochlear artic. 23Mm								
710	2013	SW B3b	65	135	R	Tooth	Sheep	17x9mm								
127	2013	SW B3b	65	135	R	Humerus	Sheep/goat	64mm long, 27mm across troch								
329	2013	SW B3b	65	135		Phalanx 1	Sheep/goat	31mm long, 11mm wide prox + dist.								
340	2013	SW B3b	65	135		Phalanx 1	Small									Possibly dog
341	2013	SW B3b	65	135		Phalanx 1	Small									Possibly dog

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
54	2013	SW B3b	65	135		Cranium	Small									
55	2013	SW B3b	65	135		Cranium	Small									
56	2013	SW B3b	65	135		Cranium	Small									
57	2013	SW B3b	65	135		Cranium	Small									
58	2013	SW B3b	65	135		Cranium	Small									
59	2013	SW B3b	65	135		Cranium	Small									
484	2013	SW B3b	65	135		Rib	Small									
711	2013	SW B3c	4	5		Tooth	Cow									
30	2013	SW B3c	4	5		Carpal	Large ungulate									
342	2013	SW B3c	4	5		Phalanx 1	Large ungulate									
400	2013	SW B3c	5	17		Radius	Medium ungulate									
357	2013	SW B3c	5	17		Phalanx 2	Pig									
712	2013	SW B3c	5	17		Tooth	Sheep									
151	2013	SW B3c	6	17	L	Mandible	Deer									
531	2013	SW B3c	6	17		Shell	Unidentified									
534	2013	SW B3c	8	22		Shell	Marine mollusc									
373	2013	SW B3c	8	22		Radius	Sheep/goat	44mm long, 24mm wide								
535	2013	SW B3c	8	22		Shell	Unidentified									
36	2013	SW B3c	9	24		Cranium	Large ungulate									
270	2013	SW B3c	9	24		Metapodial	Large ungulate									
106	2013	SW B3c	9	24	R	Humerus	Medium ungulate									
145	2013	SW B3c	9	24		Mand incisor	Pig									
149	2013	SW B3c	9	24		Mand M2	Sheep/goat	15mm wide, cusp height 7mm, 6mm								
219	2013	SW B3c	9	25		Max M3	Goat	38mm long, 17mm wide at								

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
								crown								
218	2013	SW B3c	9	25		Max M	Horse									
146	2013	SW B3c	9	25		Mand incisor	Pig	57mm long								
412	2013	SW B3c	10	26		Rib	Small ungulate									
1216	2012	SW B3d	2	3	R	Astragalus	Deer	GLm = 46.7; GLl = 49.1; Dm = 27; Dl = 26.7								
1219	2012	SW B3d	2	3		Canine	Deer									
1218	2012	SW B3d	2	3		Carpal	Large ungulate									
1217	2012	SW B3d	2	3	L	Radius	Large ungulate	SD = 35.6			4	9			Unfused; missing	3 pieces (recovery fx), glued
1215	2012	SW B3d	2	3	L	Metatarsal	Sheep	Bp = 22.1	10	10	8			Fused		
1214	2012	SW B3d	2	3	R	Mandible	Sheep/goat									M1-M3(unerupted); Removed for ageing
1232	2012	SW B3d	2	4	R	Astragalus	Cow									
1237	2012	SW B3d	2	4		Mand M	Cow	B = 27.8								Wear stage B
1236	2012	SW B3d	2	4		Mandible	Deer									P2
1235	2012	SW B3d	2	4		Tibia	Deer					6			Unfused; missing	
1238	2012	SW B3d	2	4		Axis	Goat									
1228	2012	SW B3d	2	4		Phalanx 1	Horse	Bp = 56.8; Bd = 49.2; L = 90.6								
1234	2012	SW B3d	2	4	R	Radius	Large ungulate				2	8			Unfused; missing	
1229	2012	SW B3d	2	4	L	Astragalus	Pig									
1230	2012	SW B3d	2	4	R	Astragalus	Pig									
1233	2012	SW B3d	2	4	R	Calcaneus	Pig	GL = 26.9								Articulates with 1229
1239	2012	SW B3d	2	4		Horn core	Sheep									
1231	2012	SW B3d	2	4	L	Metatarsal	Sheep	Bp = 21	10	10				Fused		
1223	2012	SW B3d	2	5		Scapula	Large ungulate									
1224	2012	SW B3d	2	5		Thoracic vertebra	Large ungulate							Unfused		
1227	2012	SW B3d	2	5		Antler	Red deer									Large intact antler
1220	2012	SW B3d	2	5	L	Metatarsal	Sheep	Bp = 19.5; Bd = 22.5; SD =	10	10	10	10	10	Fused	Fused	

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
								11.9; L = 260								
1222	2012	SW B3d	2	5		Femur	Sheep/goat				5					
1221	2012	SW B3d	2	5		Humerus	Sheep/goat			6						
1226	2012	SW B3d	2	5		Scute	Turtle/tortoise									
1225	2012	SW B3d	2	5		Incisor	Unidentified									
1257	2012	SW B3d	2	7		Horn core	Cow									
1251	2012	SW B3d	2	7		Metacarpal	Deer					2				
1259	2012	SW B3d	2	7	L	Mandible	Dog									Small dog
1254	2012	SW B3d	2	7		Radius	Dog	SD = 12.1			6					
1258	2012	SW B3d	2	7		Horn core	Goat									
1253	2012	SW B3d	2	7		Tibia	Large ungulate			3						
1252	2012	SW B3d	2	7		Scapula	Medium ungulate									
1246	2012	SW B3d	2	7	R	Tibia	Micromammal			10	20	4		Unfused; missing		
1256	2012	SW B3d	2	7		Mandible	Pig									M3
1255	2012	SW B3d	2	7		Tusk	Pig	Bp = 27								Relatively small. Wild boar
1250	2012	SW B3d	2	7		Phalanx 1	Red deer	GL = 50.8	10	10	10	10	10	Fused	Fused	
1247	2012	SW B3d	2	7	L	Radius	Sheep	Bd = 27.7			2	8	10		Partially fused	
1249	2012	SW B3d	2	7	L	Tibia	Sheep	Bd = 25.4				4	5		Fused	
1245	2012	SW B3d	2	7	L	Mandible	Sheep/goat									P1-M3; 2 pieces; Removed for ageing
1248	2012	SW B3d	2	7	R	Radius	Sheep/goat				10					
1260	2012	SW B3d	2	7		Innominate	Small ungulate									
1240	2012	SW B3d	2	8	R	Humerus	Pig	Bd = 35.6			6	10	9		Fused	
1241	2012	SW B3d	2	8	L	Calcaneus	Sheep									
1243	2012	SW B3d	2	8	L	Horn core	Sheep	SD = 45								
1244	2012	SW B3d	2	8		Canine	Sheep/goat									
1242	2012	SW B3d	2	8	R	Radius	Sheep/goat		4	10				Fused		
1305	2012	SW B3d	2	13	R	Scapula	Cow	Artic = 52.1 x 42.3								
1309	2012	SW B3d	2	13	L	Astragalus	Deer	GL = 57.8								

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
1311	2012	SW B3d	2	13	R	Femur	Goat						10		Fused	
1310	2012	SW B3d	2	13	R	Naviculo-cuboid	Large ungulate									
1306	2012	SW B3d	2	13	L	Radius	Pig		4	10	8					
1307	2012	SW B3d	2	13	R	Radius	Pig		8	8						Smaller than 1306
1315	2012	SW B3d	2	13		Horn core	Sheep	SD = 9								Juvenile - very small
1308	2012	SW B3d	2	13	R	Tibia	Sheep	Bd = 24.2				2	10			
1312	2012	SW B3d	2	13		Femur	Sheep/goat					5				
1313	2012	SW B3d	2	13		Mand M	Sheep/goat									Wear stage G
1314	2012	SW B3d	2	13		Max M3										
1296	2012	SW B3d	3	11		Max P	Cow									Moderate wear
1267	2012	SW B3d	3	11		Metatarsal	Cow	Bd = 37.5				8	4			
1274	2012	SW B3d	3	11		Phalanx 3	Cow									
1288	2012	SW B3d	3	11	L	Tibia	Cow		8					Partially fused		
1271	2012	SW B3d	3	11	R	Ulna	Cow			8						
1298	2012	SW B3d	3	11		Antler	Deer									~20cm long fragment
1287	2012	SW B3d	3	11	L	Astragalus	Deer									slightly larger than ovis
1297	2012	SW B3d	3	11		Canine	Deer									
1292	2012	SW B3d	3	11	L	Mandible	Deer									P2-M1, Teeth missing
1268	2012	SW B3d	3	11		Metacarpal	Deer			10	1			Unfused; missing		
1278	2012	SW B3d	3	11		Metacarpal	Deer						5		Fused	Stained green - bronze?
1270	2012	SW B3d	3	11		Phalanx 3	Deer									
1263	2012	SW B3d	3	11	R	Metacarpal	Goat		7	10	9			Fused		
1275	2012	SW B3d	3	11		Metapodial	Goat						5		Unfused	Epiphesis
1283	2012	SW B3d	3	11	L	Femur	Large ungulate						4		Fused	
1284	2012	SW B3d	3	11	L	Humerus	Large ungulate						6			
1302	2012	SW B3d	3	11		Mandible	Large ungulate									Articulation
1282	2012	SW B3d	3	11		Tibia	Large ungulate			4						

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
1286	2012	SW B3d	3	11	L	Astragalus	Pig									
1285	2012	SW B3d	3	11	R	Astragalus	Pig									
1300	2012	SW B3d	3	11		Mand I	Pig									
1301	2012	SW B3d	3	11		Mand I	Pig									
1265	2012	SW B3d	3	11	R	Tibia	Red deer	Bd = 52				2	9		Fused	Fibula attached
1299	2012	SW B3d	3	11		Horn core	Sheep									
1262	2012	SW B3d	3	11	L	Metacarpal	Sheep	Bp = 21.6	9	10	10			Fused		
1280	2012	SW B3d	3	11		Phalanx 1	Sheep		10	10	10	10	10	Fused	Fused	
1279	2012	SW B3d	3	11	R	Radius	Sheep						10		Unfused	Epiphesis
1281	2012	SW B3d	3	11	L	Humerus	Sheep/goat		7	4				Partially fused		
1261	2012	SW B3d	3	11	R	Humerus	Sheep/goat				3	6	2			
1277	2012	SW B3d	3	11	R	Humerus	Sheep/goat			2	3	4				
1303	2012	SW B3d	3	11	L	Innominate	Sheep/goat									
1304	2012	SW B3d	3	11	R	Innominate	Sheep/goat									
1289	2012	SW B3d	3	11		Magnum	Sheep/goat									
1295	2012	SW B3d	3	11		Mand M	Sheep/goat									Wear stage F
1291	2012	SW B3d	3	11	L	Mandible	Sheep/goat									P1-M1, teeth broken; not removed
1290	2012	SW B3d	3	11	R	Mandible	Sheep/goat									P3-M3; M3 broken; Removed for ageing
1293	2012	SW B3d	3	11		Max M3	Sheep/goat									Broken
1294	2012	SW B3d	3	11		Max M3	Sheep/goat									
1272	2012	SW B3d	3	11		Metacarpal	Sheep/goat					8				
1276	2012	SW B3d	3	11	L	Radius	Sheep/goat		1	2	5			Fused		
1264	2012	SW B3d	3	11	L	Tibia	Sheep/goat				3	10	10			Calcinated
1269	2012	SW B3d	3	11	R	Tibia	Sheep/goat			2	10	9				
1273	2012	SW B3d	3	11	R	Ulna	Sheep/goat		3	8				Fused		
1266	2012	SW B3d	3	11		NoID	Unidentified									Long bone, one flat side, two articulations on one side and one on the other, roughly rounded; Removed for ID
1168	2013	SW B3d	5	47	R	Humerus	Goat	Bd = 32.2					8			
1169	2013	SW B3d	5	47	L	Scapula	Sheep/goat									
238	2013	SW B3d	6	18	R	Metacarpal	Cow	46mm wide,								

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
								27mm ant-pos								
152	2013	SW B3d	6	18	L	Mandible	Deer	dp 4 35mm longx9mm,10 mm,11mm (each cusp)								
153	2013	SW B3d	6	18	R	Mandible	Deer									
154	2013	SW B3d	6	18	R	Mandible	Dog	Mq 16mm long, 5mm wide								
27	2013	SW B3d	6	18		Carpal	Large ungulate									
28	2013	SW B3d	6	18		Carpal	Large ungulate									
29	2013	SW B3d	6	18		Carpal	Large ungulate									
33	2013	SW B3d	6	18		Cranium	Large ungulate									
552	2013	SW B3d	6	18	R	Tibia	Large ungulate									
551	2013	SW B3d	6	18		Tibia	Large ungulate	20mm wide x 19mm dist								
239	2013	SW B3d	6	18		Metacarpal	Medium ungulate	14x11mm midshaft								
241	2013	SW B3d	6	18		Metacarpal	Medium ungulate	Zone 3 AD								
499	2013	SW B3d	6	18		Scapula	Medium ungulate	Fragment								
500	2013	SW B3d	6	18		Scapula	Medium ungulate	Fragment								
370	2013	SW B3d	6	18	L	Radius	Pig	31mm wide prox, 22mm wide dist								
718	2013	SW B3d	6	18	L	Ulna	Pig	artic 25mm prox-dist								
306	2013	SW B3d	6	18		Phalanx 1	Red deer	51 mm long, 19wx22mm prox, 17wx15mm dist								
274	2013	SW B3d	6	18	L	Metatarsal	Sheep	23mm wide at dist art. 12 prox								
131	2013	SW B3d	6	18	L	Innominate	Sheep/goat	Acetabulum 25mm longitudinally								
240	2013	SW B3d	6	18	L	Metacarpal	Sheep/goat									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
305	2013	SW B3d	6	18		Phalanx 1	Sheep/goat	35mm long, 13wx16mm prox, 12wx10mm dist								
553	2013	SW B3d	6	18	R	Tibia	Sheep/goat									
601	2013	SW B3d	6	18	R	Tooth	Sheep/goat	16mm long, 9mm ant cusp, 7mm post cusp								
600	2013	SW B3d	6	18		Tooth	Sheep/goat	16mm long								
155	2013	SW B3d	6	19	R	Mandible	Deer	75mm ant-post								
554	2013	SW B3d	6	19	R	Tibia	Deer	Bd = 27.2			6	10	10		Fused	
602	2013	SW B3d	6	19		Tooth	Deer	16mmx9mm								
371	2013	SW B3d	6	19		Radius	Medium ungulate									
275	2013	SW B3d	6	19		Metatarsal	Red deer	Artic 42mm wide								
156	2013	SW B3d	6	19	L	Mandible	Sheep/goat	Dp2 18mmx7mm								
6	2013	SW B3d	6	21	R	Astragalus	Deer									
532	2013	SW B3d	6	21		Shell	Marine mollusc									
533	2013	SW B3d	6	21		Shell	Marine mollusc									
242	2013	SW B3d	7	20	R	Metacarpal	Cow	Prox art 47x25mm								
308	2013	SW B3d	7	20		Phalanx 1	Cow	29x26mm prox, 23x19 dist								
157	2013	SW B3d	7	20	R	Mandible	Deer	Artic 20mm med-lat								
503	2013	SW B3d	7	20	L	Scapula	Deer	Artic diameter 20mm								
604	2013	SW B3d	7	20		Tooth	Deer	25mm long, 11,9mm								
605	2013	SW B3d	7	20		Tooth	Deer	10mmx8mm								
221	2013	SW B3d	7	20	R	Maxilla	Dog	P4 - 14x5. Not attached								
222	2013	SW B3d	7	20	R	Maxilla	Dog	14x5mm								
502	2013	SW B3d	7	20	R	Scapula	Large ungulate									
501	2013	SW B3d	7	20		Scapula	Large ungulate									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
504	2013	SW B3d	7	20		Scapula	Large ungulate									
372	2013	SW B3d	7	20		Radius	Medium ungulate	44mm long, 16mm wide								
405	2013	SW B3d	7	20		Rib	Medium ungulate									
406	2013	SW B3d	7	20		Rib	Medium ungulate									
407	2013	SW B3d	7	20		Rib	Medium ungulate									
158	2013	SW B3d	7	20	L	Mandible	Pig									
220	2013	SW B3d	7	20	R	Maxilla	Pig									
607	2013	SW B3d	7	20		Tooth	Pig	18x8mm								
277	2013	SW B3d	7	20		Metatarsal	Red deer	Artic 45mm wide								
144	2013	SW B3d	7	20	R	Mand	Sheep/goat									
159	2013	SW B3d	7	20	R	Mandible	Sheep/goat	20mm long, cusps 5,7,8mm								Removed for ageing
160	2013	SW B3d	7	20	R	Mandible	Sheep/goat									Removed for ageing
276	2013	SW B3d	7	20		Metatarsal	Sheep/goat	Prox art 20x15mm								
307	2013	SW B3d	7	20		Phalanx 1	Sheep/goat	Prox art 11x13mm, dist 10x8								
555	2013	SW B3d	7	20	L	Tibia	Sheep/goat	48mm long, 15mm ant-post								
603	2013	SW B3d	7	20		Tooth	Sheep/goat									
606	2013	SW B3d	7	20		Tooth	Sheep/goat	11mmx9mm								
719	2013	SW B3d	7	20	L	Ulna	Sheep/goat									
492	2013	SW B3d	7	20		Rib	Small ungulate									
493	2013	SW B3d	7	20		Rib	Small ungulate									
494	2013	SW B3d	7	20		Rib	Small ungulate									
522	2013	SW B3d	7	20		Scute	Turtle/tortoise									
523	2013	SW B3d	7	20		Scute	Turtle/tortoise									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
408	2013	SW B3d	7	22		Rib	Medium ungulate									
409	2013	SW B3d	7	22		Rib	Medium ungulate									
410	2013	SW B3d	7	22		Rib	Medium ungulate									
63	2013	SW B3d	7	22	R	Femur	Sheep/goat									
103	2013	SW B3d	7	22	R	Humerus	Sheep/goat	52mm long, dist art 28mm wide								
243	2013	SW B3d	7	22	L	Metacarpal	Sheep/goat	Prox art 23x17mm								
374	2013	SW B3d	7	22	R	Radius	Sheep/goat	98mm long								
556	2013	SW B3d	7	22	R	Tibia	Sheep/goat	Dist art 27x19mm								
411	2013	SW B3d	11	23		Rib	Medium ungulate									
162	2013	SW B3d	11	23		Mandible	Pig									
609	2013	SW B3d	11	23		Tooth	Pig									
7	2013	SW B3d	11	23	L	Astragalus	Sheep/goat	27mm prox-dist, 18mm wide								
105	2013	SW B3d	11	23	L	Humerus	Sheep/goat	30mm wide								
104	2013	SW B3d	11	23	R	Humerus	Sheep/goat	76mm long, dist art 26mm wide								
161	2013	SW B3d	11	23	L	Mandible	Sheep/goat									
244	2013	SW B3d	11	23	R	Metacarpal	Sheep/goat	76mm long, dist art 26mm wide								
557	2013	SW B3d	11	23		Tibia	Sheep/goat	63mm long								
558	2013	SW B3d	11	23		Tibia	Sheep/goat	46mm long								
608	2013	SW B3d	11	23	L	Tooth	Sheep/goat	19mmx 7,5,3mm								
34	2013	SW B3d	11	23		Cranium	Unidentified									
35	2013	SW B3d	11	23		Cranium	Unidentified									
624	2013	SW B3d	11	34		Tooth	Cow	22x20mm								
132	2013	SW B3d	11	34	R	Innominate	Medium ungulate	63mm long								

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
444	2013	SW B3d	11	34		Rib	Medium ungulate									
171	2013	SW B3d	11	34	L	Mandible	Pig	Artic 21mm wide								Removed for ageing
625	2013	SW B3d	11	34		tooth	Pig	30mm long								
10	2013	SW B3d	11	34	L	Astragalus	Sheep	28x18mm								
9	2013	SW B3d	11	34	R	Astragalus	Sheep	GLl = 25.7; GML = 26.3; Dm = 14.3								
8	2013	SW B3d	11	34	L	Astragalus	Sheep/goat	GLl = 26.3; GLM = 25; Dm = 15.5								
172	2013	SW B3d	11	34	R	Mandible	Sheep/goat	M3 21x8mm								Removed for ageing
173	2013	SW B3d	11	34	R	Mandible	Sheep/goat	M2 14x7mm								Removed for ageing
225	2013	SW B3d	11	34	L	Maxilla	Sheep/goat	M3 18x11mm								Removed for ageing
1186	2013	SW B3d	11	35		Max P	Cow									Wear stage P
1181	2013	SW B3d	11	35		Femur	Deer				4					
1173	2013	SW B3d	11	35	L	Metacarpal	Deer	Bp = 27.2	10	4				Fused		
1182	2013	SW B3d	11	35		Metatarsal	Deer	SD = 23								
1178	2013	SW B3d	11	35		Radius	Deer	SD = 18.4			10					
1176	2013	SW B3d	11	35	L	Tibia	Deer	Bd = 26.6			3	10	10		Fused	
1183	2013	SW B3d	11	35		Radius	Dog	SD = 13.7								
1170	2013	SW B3d	11	35	L	Metacarpal	Goat	Bp = 22.9; SD = 15.5; Bd = 25.7; L = 99.7	10	10	10	10	10	Fused	Fused	Whole bone
1190	2013	SW B3d	11	35		Cranium	Large ungulate									Orbit
1192	2013	SW B3d	11	35		Innominate	Large ungulate									Two pieces
1187	2013	SW B3d	11	35		Maxilla	Pig									M2 + M3; Wear stage B
1174	2013	SW B3d	11	35	R	Radius	Pig	Bp = 22.1	10	8						
1171	2013	SW B3d	11	35	L	Metacarpal	Sheep	Bp = 22.7; SD = 15.4	10	10	8			Fused		
1172	2013	SW B3d	11	35	R	Metacarpal	Sheep	Bp = 22.6; SD = 13.9	10	10	9			Fused		

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
1194	2013	SW B3d	11	35	L	Innominate	Sheep/goat									
1193	2013	SW B3d	11	35	R	Innominate	Sheep/goat									
1195	2013	SW B3d	11	35	R	Innominate	Sheep/goat									
1188	2013	SW B3d	11	35		Thoracic vertebra	Sheep/goat									
1189	2013	SW B3d	11	35		Thoracic vertebra	Sheep/goat									
1175	2013	SW B3d	11	35	L	Tibia	Sheep/goat				8	7	2		Unfused; missing	
1177	2013	SW B3d	11	35		Tibia	Sheep/goat				3	8				
1180	2013	SW B3d	11	35		Femur	Small ungulate	SD = 11.4		4	10	3				
1184	2013	SW B3d	11	35		Humerus	Small ungulate			8				Unfused; missing		
1185	2013	SW B3d	11	35		Metatarsal	Small ungulate				6					
1179	2013	SW B3d	11	35		Tibia	Small ungulate				8					
1191	2013	SW B3d	11	35		Zygoma?	Unidentified									
635	2013	SW B3d	11	40		Tooth	Cow	26x15mm								
38	2013	SW B3d	11	40		Cranium	Large									
39	2013	SW B3d	11	40		Cranium	Large									
40	2013	SW B3d	11	40		Cranium	Large									
454	2013	SW B3d	11	40		Rib	Large ungulate									
455	2013	SW B3d	11	40		Rib	Medium ungulate									
179	2013	SW B3d	11	40		Mandible	Pig	87mm long								
180	2013	SW B3d	11	40		Mandible	Sheep									
636	2013	SW B3d	11	40		Tooth	Sheep	13x8mm								
66	2013	SW B3d	11	40	L	Femur	Sheep/goat	53mm long, 18x21mm								
178	2013	SW B3d	11	40	R	Mandible	Sheep/goat	53mm long								
282	2013	SW B3d	11	40	L	Metatarsal	Sheep/goat	58mm long, 12x10 midshaft								
281	2013	SW B3d	11	40	R	Metatarsal	Sheep/goat	93mm long, 20mm wide								

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
								prox artic, 12x11mm dist								
530	2013	SW B3d	11	40		Scute	Turtle/tortoise	38x12mm								
130	2013	SW B3d	12	24		Ilium	Medium ungulate									
1454	2013	SW B3d	12	26		Dm4	Cow									Wear stage L
1458	2013	SW B3d	12	26	L	Innominate	Large ungulate									
1456	2013	SW B3d	12	26		Axis	Sheep									
1455	2013	SW B3d	12	26	L	Radius	Sheep	Bd = 30					10		Unfused	Epiphesis
1453	2013	SW B3d	12	26	R	Tibia	Sheep	Bd = 25.3			3	10	10		Fused	
1457	2013	SW B3d	12	26		Femur	Sheep/goat						3		Unfused	
1459	2013	SW B3d	12	26	L	Innominate	Sheep/goat									2 pieces
536	2013	SW B3d	13	30		Shell	Marine mollusc									
31	2013	SW B3d	13	30		Cervical vertebra	Medium ungulate									
309	2013	SW B3d	13	30		Phalanx 1	Medium ungulate									
611	2013	SW B3d	14	28		Tooth	Deer									
375	2013	SW B3d	14	28		Radius	Medium ungulate	91mm long, 23mm wide at metaphesis								
413	2013	SW B3d	14	28		Rib	Medium ungulate									
559	2013	SW B3d	14	28	R	Tibia	Medium ungulate	49mm								
86	2013	SW B3d	14	28		Horn	Sheep/goat	49mm long								
163	2013	SW B3d	14	28	R	Mandible	Sheep/goat									
610	2013	SW B3d	14	28		Tooth	Sheep/goat	21mm long x 7,6,3mm								
505	2013	SW B3d	14	31		Scapula	Medium ungulate									
245	2013	SW B3d	16	32		Metacarpal	Deer	44mm long, 16x14mm								
498	2013	SW B3d	16	32	R	Scaphoid	Deer	32x20 medially								
560	2013	SW B3d	16	32	L	Tibia	Deer	63mm long, 27x16mm dist artic								
612	2013	SW B3d	16	32		Tooth	Deer	26x18,15mm								
613	2013	SW B3d	16	32		Tooth	Deer	10x7mm								

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
717	2013	SW B3d	16	32	L	Trapezoid-magnum	Deer	30x28 prox artic								
83	2013	SW B3d	16	32	R	Frontal bone	Goat	Base 29x18mm								
32	2013	SW B3d	16	32		Cervical vertebra	Large ungulate									
64	2013	SW B3d	16	32		Femur	Large ungulate	47x41mm								
414	2013	SW B3d	16	32		Rib	Large ungulate									
415	2013	SW B3d	16	32		Rib	Large ungulate									
416	2013	SW B3d	16	32		Rib	Large ungulate									
417	2013	SW B3d	16	32		Rib	Large ungulate									
110	2013	SW B3d	16	32		Humerus	Medium ungulate	57mm long								
140	2013	SW B3d	16	32		Lumbar vertebra	Medium ungulate	23mm across body, 50mm tall								
246	2013	SW B3d	16	32		Metacarpal	Medium ungulate	64mm long								
247	2013	SW B3d	16	32		Metacarpal	Medium ungulate									
310	2013	SW B3d	16	32		Phalanx 1	Medium ungulate	26mm long								
424	2013	SW B3d	16	32		Rib	Medium ungulate									
425	2013	SW B3d	16	32		Rib	Medium ungulate									
426	2013	SW B3d	16	32		Rib	Medium ungulate									
427	2013	SW B3d	16	32		Rib	Medium ungulate									
428	2013	SW B3d	16	32		Rib	Medium ungulate									
429	2013	SW B3d	16	32		Rib	Medium ungulate									
430	2013	SW B3d	16	32		Rib	Medium ungulate									
431	2013	SW B3d	16	32		Rib	Medium ungulate									
432	2013	SW B3d	16	32		Rib	Medium ungulate									
433	2013	SW B3d	16	32		Rib	Medium ungulate									
434	2013	SW B3d	16	32		Rib	Medium ungulate									
435	2013	SW B3d	16	32		Rib	Medium ungulate									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
436	2013	SW B3d	16	32		Rib	Medium ungulate									
437	2013	SW B3d	16	32		Rib	Medium ungulate									
438	2013	SW B3d	16	32		Rib	Medium ungulate									
439	2013	SW B3d	16	32		Rib	Medium ungulate									
440	2013	SW B3d	16	32		Rib	Medium ungulate									
441	2013	SW B3d	16	32		Rib	Medium ungulate									
442	2013	SW B3d	16	32		Rib	Medium ungulate									
443	2013	SW B3d	16	32		Rib	Medium ungulate									
506	2013	SW B3d	16	32		Scapula	Medium ungulate	66mm long								
550	2013	SW B3d	16	32		Thoracic vertebra	Medium ungulate	52mm long								
561	2013	SW B3d	16	32		Tibia	Medium ungulate	76mm long								
621	2013	SW B3d	16	32		Tooth	Medium ungulate									
622	2013	SW B3d	16	32		Tooth	Medium ungulate	28mm long x 7mm wide								
623	2013	SW B3d	16	32		Tooth	Medium ungulate	Root fragment								
272	2013	SW B3d	16	32		Metapodial	Micromammal									
164	2013	SW B3d	16	32	L	Mandible	Pig									
166	2013	SW B3d	16	32	L	Mandible	Pig	10x12								
165	2013	SW B3d	16	32	R	Mandible	Pig	Dp4 16x10mm								
271	2013	SW B3d	16	32		Metapodial	Pig	45mm long								
376	2013	SW B3d	16	32	R	Radius	Pig	56mm long, artic 24x15mm								
614	2013	SW B3d	16	32		Tooth	Pig									
615	2013	SW B3d	16	32		Tooth	Pig									
549	2013	SW B3d	16	32		Temporal bone	Sheep									
87	2013	SW B3d	16	32		Horn	Sheep/goat									
88	2013	SW B3d	16	32		Horn	Sheep/goat									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
107	2013	SW B3d	16	32	R	Humerus	Sheep/goat	27mm across trochlea								
108	2013	SW B3d	16	32	R	Humerus	Sheep/goat	26mm across trochlea								
168	2013	SW B3d	16	32	L	Mandible	Sheep/goat	15mm across artic								
170	2013	SW B3d	16	32	L	Mandible	Sheep/goat	M2 16x7mm								
167	2013	SW B3d	16	32	R	Mandible	Sheep/goat	M1 10x7mm								
169	2013	SW B3d	16	32	R	Mandible	Sheep/goat	M1 13x7mm								
224	2013	SW B3d	16	32	L	Maxilla	Sheep/goat									
223	2013	SW B3d	16	32	R	Maxilla	Sheep/goat	M2 15x13mm								
278	2013	SW B3d	16	32	R	Metatarsal	Sheep/goat	69mm long, Prox artic 21x19mm								
618	2013	SW B3d	16	32	L	Tooth	Sheep/goat	17x10mm								
616	2013	SW B3d	16	32		Tooth	Sheep/goat	9x8mm								
617	2013	SW B3d	16	32		Tooth	Sheep/goat	8x7mm								
619	2013	SW B3d	16	32		Tooth	Sheep/goat	17x10								
620	2013	SW B3d	16	32		Tooth	Sheep/goat	17x10mm								
109	2013	SW B3d	16	32	R	Humerus	Small ungulate	40mm long								
418	2013	SW B3d	16	32		Rib	Small ungulate									
419	2013	SW B3d	16	32		Rib	Small ungulate									
420	2013	SW B3d	16	32		Rib	Small ungulate									
421	2013	SW B3d	16	32		Rib	Small ungulate									
422	2013	SW B3d	16	32		Rib	Small ungulate									
423	2013	SW B3d	16	32		Rib	Small ungulate									
524	2013	SW B3d	16	32		Scute	Turtle/tortoise									
525	2013	SW B3d	16	32		Scute	Turtle/tortoise									
526	2013	SW B3d	16	32		Scute	Turtle/tortoise									
628	2013	SW B3d	16	35		Tooth	Deer	14x10								

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
65	2013	SW B3d	16	35		Femur	Large ungulate									
507	2013	SW B3d	16	35		Scapula	Large ungulate	71mm long								
37	2013	SW B3d	16	35		Cranium	Medium ungulate									
112	2013	SW B3d	16	35	L	Humerus	Medium ungulate	26mm long, 27 across dist								
380	2013	SW B3d	16	35		Radius	Medium ungulate	45mm long								
508	2013	SW B3d	16	35		Scapula	Medium ungulate	45mm long								
11	2013	SW B3d	16	35	L	Astragalus	Pig	38x22mm								
89	2013	SW B3d	16	35		Horn core	Sheep	71mm long, 37mm wide at base								
279	2013	SW B3d	16	35		Metatarsal	Sheep/goat	79mm long, 11x11mm midshaft								
312	2013	SW B3d	16	35		Phalanx 1	Sheep/goat	30mm long, 10x9 midshaft								
378	2013	SW B3d	16	35	L	Radius	Sheep/goat	59mm long, 25mm across artic								
379	2013	SW B3d	16	35	L	Radius	Sheep/goat	82mm long, 16mm wide sidshaft								
377	2013	SW B3d	16	35	R	Radius	Sheep/goat	85mm long, 17mm wide midshaft								
562	2013	SW B3d	16	35	R	Tibia	Sheep/goat	85mm long, artic 22x18mm								
626	2013	SW B3d	16	35		Tooth	Sheep/goat	17x10mm								
627	2013	SW B3d	16	35		Tooth	Sheep/goat	13x8mm								
445	2013	SW B3d	16	35		Rib	Small ungulate									
527	2013	SW B3d	16	35		Scute	Turtle/tortoise									
85	2013	SW B3d	16	37		Frontal bone + horn core	Cow									
280	2013	SW B3d	16	37	L	Metatarsal	Cow	62mm long, 35x38mm								
304	2013	SW B3d	16	37	L	Patella	Cow	63mm long, 52mm wide								
404	2013	SW B3d	16	37	R	Radius + ulna	Cow	70mm long, 58mm wide at								

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
								artic								
631	2013	SW B3d	16	37		Tooth	Cow	28x21mm								
264	2013	SW B3d	16	37		Metacarpal 4	Deer	52mm long, 3x8 prox, 5x5 dist								
629	2013	SW B3d	16	37		Tooth	Deer	13x10mm								
630	2013	SW B3d	16	37		Tooth	Deer	25x12mm								
133	2013	SW B3d	16	37	R	Innominate	Large ungulate	55mm long								
446	2013	SW B3d	16	37		Rib	Large ungulate	99mm long, 18x13mm								
175	2013	SW B3d	16	37		Mandible	Medium ungulate									
447	2013	SW B3d	16	37		Rib	Medium ungulate									
448	2013	SW B3d	16	37		Rib	Medium ungulate									
449	2013	SW B3d	16	37		Rib	Medium ungulate									
174	2013	SW B3d	16	37	L	Mandible	Pig	M3 30x15mm								
381	2013	SW B3d	16	37	R	Radius	Pig	27x20mm								
90	2013	SW B3d	16	37	L	Horn core	Sheep	76mm long, 33x31mm base								
91	2013	SW B3d	16	37	R	Horn core	Sheep	61mm long, 44x31mm base								
92	2013	SW B3d	16	37	R	Horn core	Sheep	55mm long, base 24x12mm								
18	2013	SW B3d	16	37	R	Calcaneus	Sheep/goat	54mm long								
113	2013	SW B3d	16	37	R	Humerus	Sheep/goat	41mm long 21mm across dist								
141	2013	SW B3d	16	37		Lumbar vertebra	Sheep/goat	30x16mm								
176	2013	SW B3d	16	37	R	Mandible	Sheep/goat									
509	2013	SW B3d	16	37	R	Scapula	Sheep/goat									
563	2013	SW B3d	16	37	R	Tibia	Sheep/goat	55mm long, dist artic 25x20mm								
720	2013	SW B3d	16	37	L	Ulna	Sheep/goat									
450	2013	SW B3d	16	37		Rib	Small									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
							ungulate									
451	2013	SW B3d	16	37		Rib	Small ungulate									
528	2013	SW B3d	16	37		Scute	Turtle/tortoise									
111	2013	SW B3d	17	33	L	Humerus	Medium ungulate	67mm long, 29mm across dist								
311	2013	SW B3d	17	33	L	Phalanx 1	Sheep/goat	30mm long, 12x13 prox, 10x9 dist								
359	2013	SW B3d	18	38		Phalanx 3	Cow	46mm long, 23x26 artic								
632	2013	SW B3d	18	38		Tooth	Cow	26x19mm								
634	2013	SW B3d	18	38		Tooth	Deer	31mm long, 9mm wide								
313	2013	SW B3d	18	38		Phalanx 1	Large ungulate	52mm long, 26x22 prox, 21x18 dist								
452	2013	SW B3d	18	38		Rib	Large ungulate									
134	2013	SW B3d	18	38	R	Innominate	Medium ungulate									
383	2013	SW B3d	18	38		Radius	Medium ungulate	59mm long,								
453	2013	SW B3d	18	38		Rib	Medium ungulate									
510	2013	SW B3d	18	38	R	Scapula	Medium ungulate	38x21mm								
565	2013	SW B3d	18	38	R	Tibia	Red deer	71mm across artic								
177	2013	SW B3d	18	38	L	Mandible	Sheep/goat	M3 18x8mm								
382	2013	SW B3d	18	38	R	Radius	Sheep/goat	51mm long								
633	2013	SW B3d	18	38		Tooth	Sheep/goat	15x12mm								
226	2013	SW B3d	18	38	R	Maxilla	Small ungulate									
564	2013	SW B3d	18	38	R	Tibia	Small ungulate	44mm long, 14mm wide midshafe								
529	2013	SW B3d	18	38		Scute	Turtle/tortoise	42x24mm								
314	2013	SW B3d	20	44		Phalanx 1	Cow	48mm long, prox 25x26mm, dist 22x16mm								
638	2013	SW B3d	20	44		Tooth	Deer	26x16mm								

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
639	2013	SW B3d	20	44		Tooth	Deer	30x13								
640	2013	SW B3d	20	44		Tooth	Deer	26x15mm								
641	2013	SW B3d	20	44		Tooth	Deer	16x13								
642	2013	SW B3d	20	44		Tooth	Deer	14x19mm								
643	2013	SW B3d	20	44		Tooth	Deer	31mm long, 7mm wide								
67	2013	SW B3d	20	44		Femur	Large ungulate	Head diameter 44mm								
456	2013	SW B3d	20	44		Rib	Large ungulate									
457	2013	SW B3d	20	44		Rib	Large ungulate									
458	2013	SW B3d	20	44		Rib	Large ungulate									
567	2013	SW B3d	20	44	L	Tibia	Large ungulate	147mm long								
569	2013	SW B3d	20	44		Tibia	Large ungulate									
41	2013	SW B3d	20	44		Cranium	Medium ungulate									
42	2013	SW B3d	20	44		Cranium	Medium ungulate									
43	2013	SW B3d	20	44		Cranium	Medium ungulate									
44	2013	SW B3d	20	44		Cranium	Medium ungulate									
45	2013	SW B3d	20	44		Cranium	Medium ungulate									
46	2013	SW B3d	20	44		Cranium	Medium ungulate									
47	2013	SW B3d	20	44		Cranium	Medium ungulate									
48	2013	SW B3d	20	44		Cranium	Medium ungulate									
386	2013	SW B3d	20	44	R	Radius	Medium ungulate	56mm long, 15mm wide midshaft								
385	2013	SW B3d	20	44		Radius	Medium ungulate	61mm long								
459	2013	SW B3d	20	44		Rib	Medium ungulate									
460	2013	SW B3d	20	44		Rib	Medium ungulate									
461	2013	SW B3d	20	44		Rib	Medium ungulate									
462	2013	SW B3d	20	44		Rib	Medium ungulate									
463	2013	SW B3d	20	44		Rib	Medium ungulate									
568	2013	SW B3d	20	44		Tibia	Medium ungulate	53mm long, 23mm wide								

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
								midshaft								
181	2013	SW B3d	20	44	L	Mandible	Pig									
182	2013	SW B3d	20	44		Mandible	Pig									
265	2013	SW B3d	20	44		Metacarpal 4	Pig	66mm long, prox 14x13mm, dist 13x15mm								
343	2013	SW B3d	20	44		Phalanx 1	Pig	22mmlong								
637	2013	SW B3d	20	44		Tooth	Pig	19x15mm								
721	2013	SW B3d	20	44	L	Ulna	Pig	85mm long, artic 21mm								
183	2013	SW B3d	20	44	R	Mandible	Red deer	artic 30mm								
93	2013	SW B3d	20	44		Horn core	Sheep	21mm long, 13x8mm at base								
654	2013	SW B3d	20	44		Tooth	Sheep	25mm long, 6mm wide								
19	2013	SW B3d	20	44	R	Calcaneus	Sheep/goat	45mm long, 21mm across								
344	2013	SW B3d	20	44		Phalanx 2	Sheep/goat	24mm long, 13x11mm prox, 8x10mm dist								
384	2013	SW B3d	20	44	L	Radius	Sheep/goat	63mm long								
566	2013	SW B3d	20	44	R	Tibia	Sheep/goat	93mm long, artic 27x20mm								
644	2013	SW B3d	20	44	R	Tooth	Sheep/goat									
645	2013	SW B3d	20	44	R	Tooth	Sheep/goat									
646	2013	SW B3d	20	44	R	Tooth	Sheep/goat	16x11mm								
647	2013	SW B3d	20	44		Tooth	Sheep/goat									
648	2013	SW B3d	20	44		Tooth	Sheep/goat	15x9mm								
649	2013	SW B3d	20	44		Tooth	Sheep/goat	14x10mm								
650	2013	SW B3d	20	44		Tooth	Sheep/goat	15x11mm								
651	2013	SW B3d	20	44		Tooth	Sheep/goat	15x11mm								
652	2013	SW B3d	20	44		Tooth	Sheep/goat									
653	2013	SW B3d	20	44		Tooth	Sheep/goat									
114	2013	SW B3d	20	44	R	Humerus	Small ungulate	37mm long, 25mm wide								

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
								dist								
316	2013	SW B3d	24	48		Phalanx 1	Cow	51 mm long, 30x33mm prox, 27x20mm dist								
135	2013	SW B3d	24	48		Innominate	Large ungulate	33mm across articulation								
387	2013	SW B3d	24	48		Radius	Medium ungulate	76mm long								
315	2013	SW B3d	24	48		Phalanx 1	Red deer	50mm long, 21x24 prox, 21x16 dist								
345	2013	SW B3d	24	48		Phalanx 2	Red deer	41mm long, 21x28 prox, 18x26 dist								
570	2013	SW B3d	24	48	L	Tibia	Sheep/goat	88mm long, 24x19mm at distal artic								
571	2013	SW B3d	24	48	L	Tibia	Sheep/goat	102mm long, 24x19mm at distal artic								
655	2013	SW B3d	24	48		Tooth	Sheep/goat									
248	2013	SW B3d	24	50	L	Metacarpal	Cow	52mm long								
249	2013	SW B3d	24	50	L	Metacarpal	Cow									
250	2013	SW B3d	24	50		Metacarpal	Horse	26x34mm at artic								
464	2013	SW B3d	24	50		Rib	Large ungulate									
68	2013	SW B3d	24	50	R	Femur	Medium ungulate	89mm long								
115	2013	SW B3d	24	50	R	Humerus	Medium ungulate	60mm long, 23mm wide dist								
317	2013	SW B3d	24	50		Phalanx 1	Medium ungulate	12mm tall at dist art								
318	2013	SW B3d	24	50		Phalanx 1	Medium ungulate	27mm long, dist art 10x9mm								
346	2013	SW B3d	24	50		Phalanx 2	Medium ungulate	Dist art 10x8mm								
467	2013	SW B3d	24	50		Rib	Medium ungulate									
468	2013	SW B3d	24	50		Rib	Medium ungulate									
469	2013	SW B3d	24	50		Rib	Medium ungulate									
722	2013	SW B3d	24	50	L	Ulna	Medium ungulate	62mm long, 17mm at artic								

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
20	2013	SW B3d	24	50	L	Calcaneus	Pig	52mm long, 21mm across at artic								
185	2013	SW B3d	24	50	R	Mandible	Pig	15mm wide								
266	2013	SW B3d	24	50		Metacarpal 4	Pig	57mm long								
657	2013	SW B3d	24	50		Tooth	Pig	29mm long, 4mm wide								
12	2013	SW B3d	24	50	L	Astragalus	Sheep/goat	18mm wide								
184	2013	SW B3d	24	50	L	Mandible	Sheep/goat	dp 4 16x6mm								
283	2013	SW B3d	24	50	L	Metatarsal	Sheep/goat	95mm long, prox artic 19x18mm								
284	2013	SW B3d	24	50		Metatarsal	Sheep/goat	51mm long								
656	2013	SW B3d	24	50		Tooth	Sheep/goat	15x8mm								
465	2013	SW B3d	24	50		Rib	Small ungulate									
466	2013	SW B3d	24	50		Rib	Small ungulate									
1	2013	SW B3d	24	51		Antler	Deer									
116	2013	SW B3d	24	51	R	Humerus	Medium ungulate	60mm long, 31 wide dist								
572	2013	SW B3d	24	51	R	Tibia	Medium ungulate	95mm long								
658	2013	SW B3d	24	51		Tooth	Pig	34mm long, 11mm wide								
659	2013	SW B3d	24	51		Tooth	Pig	33mm long, 5mm wide								
660	2013	SW B3d	24	51		Tooth	Sheep									
574	2013	SW B3d	24	51	L	Tibia	Sheep/goat	156mm long, 23x19mm dist artic								
573	2013	SW B3d	24	51	R	Tibia	Sheep/goat	130mm long, 24x18mm dist artic								
661	2013	SW B3d	24	51		Tooth	Sheep/goat	17x11mm								
662	2013	SW B3d	24	51		Tooth	Sheep/goat	18x8mm								
388	2013	SW B3d	25	52		Radius	Medium ungulate	37mm long, 22mm wide at epiph								
470	2013	SW B3d	25	52		Rib	Medium ungulate									

ID no.	Year	Trench	Locus	Lot	Side	Element	Taxon/ Size class	Measurements	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Fused prox?	Fused Dist?	Notes
471	2013	SW B3d	25	52		Rib	Medium ungulate									
472	2013	SW B3d	25	52		Rib	Medium ungulate									
186	2013	SW B3d	25	52	R	Mandible	Sheep/goat	21mm wide								
187	2013	SW B3d	25	52		Mandible	Sheep/goat									
389	2013	SW B3d	25	52		Radius	Small ungulate	42mm long								

Appendix B: Ovicaprid mandible data tables

ID	Grid Square	Locus	Lot	Taxon	Side	dp2	dp3	dp4	P2	P3	P4	M1	M2	M3	MWS	Mean MWS	Suggested age range (Greenfield and Arnold 2008)
0076	NWC2b	3	7	Capra	R				3	4	g	g			30-36	33	24-48 months
0072	NWC2b	4	9	Capra	L					4							
0074	NWC2b	4	9	Capra	R	3	3	c							2-6	4	2-5 months
0075	NWC2b	4	9	Capra	R						h	h	g	g	37	37	36-48 months
0093	NWC2b	6	16	Capra	L				4	5	e	j	g	g	40	40	48-72 months
0094	NWC2b	6	16	Capra	L	3	5	m				d	2				
0081	NWC3d	2	3	Capra	L		5	g				b			8-10	9	2-5 months
0082	NWC3d	2	3	Capra	R		5	g				b			8-10	9	2-5 months
0090	NWC3d	4	9	Capra			5	j									
0069	SWB2d	8	20	Capra	R	3	4	g							5-22	13	2-22 months
0066	SWB3a	11	53	Capra	R		3	b							2	2	0-2 months
0085	SWB3a	40	117	Capra	L				3	4	g	j	g		34	34	24-48 months
0084	SWB3a	40	117	Capra	R						g	h	g	c	33	33	24-36 months
0003	SWB3b	27	53	Capra	L	3	4								1	1	0-2 months
0004	SWB3b	27	53	Capra	L			k				f	a	C	18	18	6-12 months
0028	SWB3b	27	53	Capra	L				3	5	k	k			38-41	39	48-72 months
0007	SWB3b	27	58	Capra	R		3										

0024	SWB3b	27	63	Capra	R					3	4	g	g	c	32	32	36-48 months
0022	SWB3b	27	63	Capra	R				3	4	h				31-43	37	24-96 months
0025	SWB3b	30	62	Capra	L					5	h	g			31-36	33	24-48 months
0006	SWB3b	30	66	Capra	R	3	4	f							4-12	8	2-6 months
0026	SWB3b	38	82	Capra	R					4	h	l			38-42	40	48-96 months
0027	SWB3b	40	90	Capra	R				2	2	2	f			23	23	16-22 months
0001	SWB3b	44	94	Capra	R	3	4	g				2					4-6 months
0008	SWB3b	52	113	Capra	L		3										
0019	SWB3b	61	125	Capra	R				4	4	g				30-37	33	24-48 months
0018	SWB3b	63	129	Capra	R						1	f	b		19	19	12-15 months
0048	SWB3d	2	7	Capra	L					5	g	e	g		31-34	32	24-36 months
0044	SWB3d	11	25	Capra	R	4	5	n				g			28	28	22-24 months
0041	SWB3d	11	40	Capra	R	1	1								1	1	0-2 months
0050	SWB3d	12	26	Capra						5							
0055	SWB3d	16	32	Capra	R						f	g			30-34	32	24-48 months
0078	NWC2b	3	7	O/C	R							f	2		14-16	15	6-12 months
0077	NWC2b	3	7	O/C	R							e	d		21-24	22	16-22 months
0079	NWC2b	3	7	O/C	R	2											
0088	NWC2b	4	10	O/C	L							e	2		13-14	13	6-12 months

0087	NWC2b	4	10	O/C	R							g	d		25-29	27	22-36 months
0095	NWC2b	6	16	O/C	R							g	g		28-36	32	24-48 months
0091	NWC2b	11	28	O/C	R							m	h	g	42	42	72-96 months
0070	SWB2d	8	16	O/C	r							g	b	1	20	20	12-15 months
0071	SWB2d	8	16	O/C									d		21-29	25	6-24 months
0064	SWB3a	12	50	O/C	R								f	2	26	26	16-22 months
0068	SWB3a	13	61	O/C	L									g	36-46	41	36 months +
0063	SWB3a	15	67	O/C	L			k							16-25	20	6-22 months
0033	SWB3b	11	34	O/C								f			13-24	18	6-22 months
0043	SWB3b	27	50	O/C				b							2	2	0-2 months
0014	SWB3b	27	53	O/C	L			j				d	2		12	12	6-12 months
0011	SWB3b	27	53	O/C	R			k				f	d	C	21	21	16-22 months
0013	SWB3b	27	63	O/C	L							g	f	c	31	31	24-36 months
0040	SWB3b	30	62	O/C	L	1									1	1	0-2 months
0012	SWB3b	30	62	O/C	L								d		21-22	21	16-22 months
0030	SWB3b	30	62	O/C	L							h	g		32-37	34	24-48 months
0036	SWB3b	30	62	O/C									d		21-29	25	12-36 months
0037	SWB3b	35	75	O/C	L									c	29-34	31	24-48 months

0009	SWB3b	40	88	O/C	L					1	2	f-g			23-26	24	16-22 months
0015	SWB3b	40	89	O/C								m	j	g	43	43	72-96 months
0002	SWB3b	40	90	O/C	L			a							1	1	0-2 months
0010	SWB3b	40	90	O/C	R							e	1		12	12	5-6 months
0017	SWB3b	46	99	O/C	L							g	f	b	30	30	24-36 months
0034	SWB3b	48	102	O/C	L									e	34-38	36	36-70 months
0032	SWB3b	50	107	O/C	R								f		25-33	29	16-36 months
0062	SWB3b	61	124	O/C										g	36-46	41	36 months +
0038	SWB3b	62	126	O/C	L									d	32-34	33	36-48 months
0031	SWB3b	62	126	O/C	L								g		27-41	34	22-70 months
0029	SWB3b	62	126	O/C	R									g	39-46	42	48 months +
0035	SWB3b	62	126	O/C									h		38-42	40	48-96 months
0039	SWB3b	62	132	O/C	L								j	g	41-43	42	72-96 months
0016	SWB3b	63	129	O/C	R									g	36-45	40	48 months +
0005	SWB3b	63	129	O/C				j							11-22	16	5-22 months
0052	SWB3d	2	3	O/C	R							h	g	2	26	26	16-22 months
0058	SWB3d	2	7	O/C	L									g	36-46	41	36 months +
0057	SWB3d	11	25	O/C	L								e		23-30	26	16-36 months
0059	SWB3d	11	25	O/C	R									e	34-38	36	36 months +

0051	SWB3d	11	34	O/C	R							m	h	f	41	41	48-72 months
0061	SWB3d	12	26	O/C	L							g	e		23-29	26	16-36 years
0054	SWB3d	16	32	O/C									1		5-14	10	2-12 months
0056	SWB3d	17	20	O/C	R							g	2		15-17	16	6-12 months
0053	SWB3d	17	20	O/C	R									f	35-39	37	36-72 months
0060	SWB3d	18	38	O/C								m	h	g	42	42	72-96 months
0046	SWB3d	24	50	O/C				g				b			8-10	9	5-6 months
0080	NWC2b	3	7	Ovis	L						h	h	g	f	36	36	36-48 months
0073	NWC2b	4	9	Ovis	R						h		f		31-34	32	24-36 months
0086	NWC2b	4	12	Ovis	L					5	h		g		31-40	35	24-72 months
0083	NWC3d	2	3	Ovis	L					5	j	l			38-45	41	48 months +
0089	NWC3d	4	9	Ovis							j	m	h	g	42	42	72-96 months
0067	SWB3a	12	48	Ovis	L						h	g			31-36	34	24-48 months
0065	SWB3a	12	48	Ovis	L				4	5	j				37-43	40	36-96 months
0092	SWB3a	42	120	Ovis	L					5	l	m	k	g	44	44	72-96 months
0020	SWB3b	27	63	Ovis	R					5	j	m	h	g	42-43	42	72-96 months
0023	SWB3b	41	93	Ovis	R					5	j	h	g	g	37	37	36-48 months
0021	SWB3b	61	125	Ovis	L					5	k				38-46	42	48 months

0049	SWB3d	3	11	Ovis	R						h	l	h	d	40-41	40	48-72 months
0045	SWB3d	14	28	Ovis	R					5	l	n	l	h	47	47	96-120 months
0047	SWB3d	16	32	Ovis	R				5	j	j				38-43	40	48-96 months
0042	SWB3d	17	20	Ovis	L	1	1								1	1	0-2 months

*TWS entries in red were missing, and were filled in with the most probable stages identified by Grant (1982)