

From snout to tail

Exploring the Greek sacrificial animal
from the literary, epigraphical,
iconographical, archaeological,
and zooarchaeological evidence

Edited by Jan-Mathieu Carbon
& Gunnel Ekroth

EDITORIAL COMMITTEE

Prof. Henrik Gerding, Lund, Chairman
Dr Mikael Johansson, Gothenburg, Vice-chairman
Mrs Kristina Björkstén Jersenius, Stockholm, Treasurer
Dr Susanne Carlsson, Stockholm, Secretary
Prof. Gunnel Ekroth, Uppsala
Dr Therese Emanuelsson-Paulson, Stockholm
Dr Johan Eriksson, Uppsala
Dr Ulf R. Hansson, Rome
Prof. Christer Henriksen, Uppsala
Dr Jenny Wallensten, Athens
Mr Julian Wareing, Stockholm
Dr Lewis Webb, Gothenburg

EDITOR

Dr Julia Habetzeder, Stockholm

SECRETARY'S & EDITOR'S ADDRESS

Department of Archaeology and Classical Studies
Stockholm University
SE-106 91 Stockholm
secretary@ecsi.se | editor@ecsi.se

DISTRIBUTOR

Eddy.se AB
Box 1310
SE-621 24 Visby

For general information, see <https://ecsi.se>
For subscriptions, prices and delivery, see <http://ecsi.bokorder.se>

Published with the aid of grants from the Royal Swedish Academy of Letters, History and Antiquities, Birgitta Bergquists stipendiefond and Vilhelm Ekmans Universitetsfond.

The English and French text was revised by Jan-Mathieu Carbon, Queen's University

ISSN 0586-0539

ISBN 978-91-7916-069-2

© Svenska institutet i Athen and authors

Printed by PrintBest (Viljandi, Estonia) via Italgraf Meda AB (Stockholm, Sweden) 2024

Cover and dust jacket: illustrations by Julia Habetzeder.

ABSTRACT

Animal sacrifice fundamentally informed how the ancient Greeks defined themselves, their relation to the divine, and the structure of their society. Adopting an explicitly cross-disciplinary perspective, the present volume explores the practical execution and complex meaning of animal sacrifice within ancient Greek religion (c. 1000 BC–AD 200).

The objective is twofold. First, to clarify in detail the use and meaning of body parts of the animal within sacrificial ritual. This involves a comprehensive study of ancient Greek terminology in texts and inscriptions, representations on pottery and reliefs, and animal bones found in sanctuaries. Second, to encourage the use and integration of the full spectrum of ancient evidence in the exploration of Greek sacrificial rituals, which is a prerequisite for understanding the complex use and meaning of Greek animal sacrifice.

Twelve contributions by experts on the literary, epigraphical, iconographical, archaeological and zooarchaeological evidence for Greek animal sacrifice explore the treatment of legs, including feet and hoofs, tails, horns; heads, including tongues, brains, ears and snouts; internal organs; blood; as well as the handling of the entire body by burning it whole. Three further contributions address Hittite, Israelite and Etruscan animal sacrifice respectively, providing important contextualization for Greek ritual practices.

Keywords: Greek animal sacrifice, anatomy, division, butchery, body part, multi-disciplinary approaches, zooarchaeology, iconography, epigraphy, texts, cross-cultural comparisons

<https://doi.org/10.30549/actaath-4-60>

BOOK EDITORS

Jan-Mathieu Carbon, Department of Classics, Queen's University
501 Watson Hall, 49 Bader Lane, Kingston, ON, Canada K7L 3N6
(jmc32@queensu.ca) & Gunnel Ekroth, Department of Archaeology and Ancient History, Uppsala University, Box 626, SE-751 26 Uppsala, Sweden (gunnel.ekroth@antiken.uu.se).

3. Beyond burned thighbones

The anatomy of ancient Greek sacrifice

Abstract

This paper examines the relationship of anatomical patterns of burned and butchered bones to ancient sacrificial ritual. The anatomical patterns in sanctuary contexts are compared to those found in settlement contexts in the Greek world. The pattern of burned upper hindquarters (thighs and tails) is found in assemblages from many sanctuary sites. However, a pattern of burned lower limbs (and sometimes heads) is found in several private contexts dating from the Late Bronze Age through the Hellenistic period. The burning of these less meaty elements potentially relates to a passage in the *Homeric Hymn to Hermes*. Large-scale sacrificial feasting assemblages at several sites show the use of large cleavers to efficiently butcher animals. At Azoria, this pattern contrasts with residential butchery conducted with smaller knives. The tight anatomical patterning of cleaver-chops found in communal dining middens are indicative of professionally trained butchers. At the Athenian Agora, the relative absence of cutmarks on unburned femora, indicates that commercial butchers treated these parts specially. These contexts reveal butchery as an important spectacle within the setting of sacrificial feasting.*

* I am grateful for permission to study and publish material from Iulian Birzescu (for Histria), John Camp (for the Athenian Agora), Donald Haggis (for Azoria), Nancy Wilkie (for Nichoria), and from the Greek Ministry of Culture and the Institute of Archaeology in Romania. Ioanna Damanaki was an immense help in obtaining permits to study material from the Athenian Agora, Azoria, and Nichoria. I am grateful to the directors of the Wiener Laboratory (Sherry Fox and Takis Karkanas) and staff at the laboratory at the American School of Classical Studies at Athens for help with studying material. I am grateful to Adam Rabinowitz for originally inviting me to study material from Histria, Romania. I am grateful to Joseph and Maria Shaw for allowing me to briefly inspect sacrificial material from Kommos. Various aspects of this paper were improved by discussions with Jan-Mathieu Carbon, Jack Davis, Harold Dibble, Gunnel Ekroth, Gerhard Forstenpointner, Donald Haggis, Paul Halstead, Valasia Isaakidou, Kathleen Lynch, Michael MacKinnon, Jake Morton, Katie Rask, David Reese, and Charles Stocking. Thanks to Jonida Martini for help with photographs and images. And thanks to Gunnel Ekroth and Jan-Mathieu Carbon for the invitation to the workshop and for their valuable comments on an earlier draft of this chapter. All mistakes are my own.

Keywords: zooarchaeology, Azoria, Histria, Athenian Agora, bone assemblage, sacrificial feasting, settlement, residential butchery, burning, lower limb, head

<https://doi.org/10.30549/actaath-4-60-03>

Ancient animal sacrifice was messy with blood, guts, bones, and smoke. Prometheus knew this as he carefully highlighted one portion as edible, yet unappealing (the meat wrapped in the hide and covered in the stomach), and another as inedible, yet appealing (the bones wrapped in fat).¹ According to Hesiod, this trick lies at the heart of ancient Greek sacrificial ritual, where bones are burned as offerings for the gods or other supernatural forces. While the gods enjoy the fragrant bone-smoke rising to the heavens, the tasty meat is left for human tongues. Like Prometheus, ancient artists also avoided depicting the messiness of sacrificial ritual. Even though iconographic depictions of the proud animal being led to slaughter are common, and there even exist a few depictions of bone burning, the act of slaughter is rarely shown.² Finally, scholars of ancient sacrifice also recognize the complexity that is our evidence. Our dataset is incomplete and fragmentary, and there always seems to be an exception—or three—to any pattern that we try to discern.

This paper adds to the complexities of our data on ancient sacrifice by contextualizing the sacrificial treatment of animal limbs from sanctuaries with the evidence from ancient Greek settlements. While the zooarchaeological remains from Greek sanctuaries have been extensively examined for evidence of

¹ Hes. *Theog.* 534–557.

² Durand 1986, 10–11.

ritual activity, the evidence from settlements rarely enters the scholarly discourse on animal sacrifice. The zooarchaeological patterns from settlements present a very different picture of sacrificial ritual from that presented at sanctuaries. Despite the scholarly consensus that most domesticated animals were sacrificed,³ many animal remains from Greek settlements relate only ambiguously to such ritual activity.

Therefore, in the vein of an approach from snout to tail, this paper explores anatomical variability in the evidence for ancient sacrifice in both ancient Greek sanctuaries and settlements. The zooarchaeological remains from these deposits show that combining the evidence for anatomy with that of burning and butchery yields new insights into ancient Greek sacrificial ritual. While sanctuaries are often filled with a normative sacrificial assemblage—burned thigh and/or tail elements—, in settlements, most zooarchaeological material is unburned, including thighbones.⁴ The burned elements that are encountered in settlements frequently derive from elsewhere on the skeleton: mostly lower limbs and, sometimes, head elements.⁵ Similarly, butchery methods in deposits associated with sacrificial feasting frequently differ from butchery methods identified from residential, and sometimes commercial, contexts. The sacrifice of a large group of animals necessitated the use of more efficient methods and tools, specifically cleavers. The fact that some cultic officials (*mageiroi*, *hieropoioi*, etc.) carried out the acts of slaughter and butchery perhaps points to the fact that butchery was, alongside bone burning, part of the spectacle of ancient sacrifice.⁶

³ Rightly critiqued by Ekroth 2007, who writes, 251: “The religious as well as socio-political significance of animal sacrifice and the division, distribution and consumption of meat have led modern scholars to claim that *all* the meat the ancient Greeks ate was linked to the sacrifice of domestic animals in some sense, and that meat normally could not be eaten except on the occasion of a sacrifice and according to its rules. Sacrifice has been seen as a prerequisite for meat eating, and consequently the reason for performing animal sacrifice in antiquity has been explained as a way of legitimating the killing of animals for human purposes.”

⁴ Most ancient Greek sanctuary deposits that have been published focus on assemblages of burned bone (with a few notable exceptions such as Gebhard & Reese 2005 and Ruscillo 1993). So, it is plausible that there are larger assemblages of unburned bones from sanctuaries that have yet to be published (or were perhaps not collected or saved from early excavations). The overwhelming majority of unburned bones in most ancient Greek settlements can be seen in Dibble 2017; 2021.

⁵ This pattern is presented in more detail below.

⁶ This argument is presented in more detail below.

Identifying sacrificial ritual from the bones

Several scholars have subscribed to the idea that “all consumable meat comes from ritually slaughtered animals ...”⁷ However, Gunnell Ekroth and Robert Parker have noted that meat from wild animals and those that have died of natural causes would not have derived from such ritual slaughter.⁸ Moreover, Jeremy McInerney has discussed textual citations mentioning the commerce of both sacrificial and non-sacrificial meat derived from domesticated animals.⁹ Without the presence of some other, more clear, form of evidence for ancient sacrifice—found in a sealed deposit next to an altar, perhaps?—the identification of most zooarchaeological assemblages as relating to sacrificial ritual is ambiguous. While it is certainly possible that bone fragments from a pit within a settlement derive from sacrificial activity, it is not easy to be sure, in the absence of unambiguous non-bone evidence from the same context.

An approach grounded in contextual taphonomy, examining a range of zooarchaeological variables across both sanctuary and settlement contexts is the first step towards better classifying and understanding sacrificial rituals.¹⁰ Most zooarchaeological studies from historical Greece (in the Archaic through Hellenistic period) have focused on sanctuary deposits,¹¹ while

⁷ Detienne 1989, 3.

⁸ Ekroth 2007; Parker 2010.

⁹ McInerney 2010, 179, quoting Arist. *Oec.* 2.1349b: “The citizens were angry when they realized they had been tricked and began to kill and sell off their beasts. Dionysios responded with a decree that only as many animals could be slain as were needed each day, whereupon the owners retorted by designating their animals as sacrificial victims.” This quote implies that owners could select some domestic animals to be killed in the context of sacrifice and others not. Cf. also McInerney 2010, 184, quoting [Arist.] *Mir.* 123, 842b1: “It is said among the people of Elis there is a type of kite that snatches meat from those carrying it across the market, but that it will not touch sacrificial meat.” This quote implies that both sacrificial and non-sacrificial meat was available in the market.

¹⁰ For contextual taphonomy in zooarchaeology, see Meier & Yeshurun 2020.

¹¹ While this is not a complete bibliography, it gives a sense of the focus on sanctuary deposits: Amathous, Temple of Aphrodite: Hermay & Columeau 2008. Athens, the Altar of Aphrodite Ourania: Reese 1989. Azoria, Protoarchaic Building: Dibble 2017. Corinth, Demeter and Kore sanctuary: Bookidis *et al.* 1999. Kyrene, Sanctuary of Demeter and Persephone: Crabtree & Monge 1990. Delos, Serapeion: Brun & Leguilloux 2013. Ephesos, Temple of Artemis: Bammer 1998; Forstenpointner 2001; 2003. Eretria, Temple of Apollo: Chenal-Velarde 2001; Chenal-Velarde & Studer 2003. Isthmia, Temple of Poseidon: Gebhard & Reese 2005. Kalapodi, Temple of Artemis/Apollo: Stanzel 1991. Karystos: Groot 2014. Knossos, Sanctuary of Demeter: Jarman 1973. Kommos: Reese *et al.* 2000. Kourion, Temple of Apollo: Davis 1996. Kythnos: Theodoropoulou 2013; Trantalidou & Theodoropoulou 2017. Lykaion, the ash altar: Starkovich 2014. Messene, Temple of Demeter and heroon: Nobis 1997. Miletos, Temple of Aphrodite: Peters & von den Driesch 1992. Mytilene: Ruscillo 1993. Nemea, Sanctuary of Opheltes: MacKinnon 2010; 2013. Olympia, Artemision: Benecke 2006. Samos, Heraion:

there are few from settlement contexts.¹² This contextual focus presents a biased picture of ancient animals and clouds our understanding of ancient sacrifice. After all, are the zooarchaeological patterns initially studied at sanctuaries consistent with those of settlements? We need to use our sets of evidence from each of these locales to contextualize the other and provide further nuance to our understanding of ancient sacrifice and meat eating.

The standard methods used for the zooarchaeological identification of sacrificial ritual rely on two components: 1) archaeological context and 2) anatomically patterned burning. With regards to the first point, scholars focusing on sanctuary assemblages have it a little easy. Many of the remains from a sanctuary derive to some degree from the activity of animal sacrifice or ritual dining. Different archaeological contexts within the sanctuary, therefore, reveal different ritual activities over time or space. For example, at the Sanctuary of Poseidon at Isthmia, Elizabeth Gebhard and David Reese have identified changes in victim choice that correlate with the prosperity of the sanctuary: more sheep/goat in periods of disturbances and more cattle in periods of expansion.¹³ Furthermore, different assemblages distributed spatially across a sanctuary can reveal different types of activity, or stages of deposition.

In settlements, zooarchaeologists are left with few contextual clues that might relate an assemblage of bones to sacrificial ritual. Do animal bones deriving from the floor of a house or a dense dump of dining ceramics and bones from a civic dining building necessarily reveal evidence for animal sacrifice?

The answer is to turn to the ritual treatment of the bones themselves, to discern patterns inherent in archaeological assemblages that can help us identify ancient sacrifice. The most obvious pattern would be that mentioned by Hesiod: bones

were burned in an offering to the gods.¹⁴ Burning is an important component of the ritual that can be unambiguously identified in a zooarchaeological assemblage.

However, we cannot simply identify every single burned bone as the product of animal sacrifice. Bones, after all, might have been burned for a wide variety of reasons. Bones could be used as fuel for a fire.¹⁵ They might have been disposed of in a fire or burned accidentally.¹⁶ Grilling bone-in cuts of meat might have burned certain portions of the bones.¹⁷ We are lucky that ancient texts often specified the anatomical portions to be burned. Typically, these were the thighbones and tails of the animal.¹⁸ Given the anatomically patterned nature of sacrificial ritual, it is possible that anatomical patterns within assemblages of unburned bones might also help us identify ancient sacrificial activity in settlements. Similarly, provided the right pattern and depositional context, anatomically patterned butchery methods can potentially relate to sacrificial ritual and feasting.

While the color, age, sex, or other features of a sacrificial victim might be specified in texts, these are not identifiable from most bone fragments.¹⁹ Nor must a clear pattern related to the ages and sexes of the animals found in a deposit necessarily relate to ritual selection. Ages and sexes of slaughtered animals can equally relate to economic choices pertaining to animal husbandry strategies.²⁰ One might expect that if ages and sexes correlated to a sacrificial pattern then it would be one unexplainable by economic strategy. On the other hand, it is possible that ritual and economic strategies mutually reinforced each other. For example, pigs are animals with large litters and without secondary products (e.g. milk); there are therefore few benefits to keeping them alive long. Thus, the frequent sacrifice of piglets (at Demeter sanctuaries) matches potential economic strategies focusing on quantity and quality of pork.²¹ Without additional context, therefore, it is dif-

Boessneck & von den Driesch 1981. Stymphalos, temple: Ruscillo 2014. Tamassos, Temple of Aphrodite: Nobis 1976–1977. Tegea, Temple of Athena Alea: Vila 2014. Tenos, Temple of Poseidon: Leguilloux 1999. Thasos, Herakleion: des Courtils *et al.* 1996. Zone, Thrace, Temple of Apollo: Veropoulidou & Nikolaidou 2018.

¹² Arcadia: Forstenpointner & Hofer 2001. Athens, Agora: MacKinnon 2014; Dibble 2017. Azoria: Dibble 2017; 2021. Eleutherna: Vila 1994. Eretria: Chenal-Velarde 2006. Isthmia, Rachi settlement: Reese 1993. Kassope: Boessneck 1986. Knossos: Dibble 2012. Magoula Plataniotiki: Filioglou *et al.* 2021. Miletos: Peters & von den Driesch 1992. New Halos: Prummel 2003; Filioglou *et al.* 2021.

¹³ Gebhard & Reese 2005, 147: “It is interesting to note the high proportion of the less expensive sheep or goat in 1.G immediately following destruction of the temple in ca. 450 B.C. ... In contrast, the pre-fire deposit 1.E, which is of equal weight and ceramic distribution, contains mainly cattle. Cattle also predominated during periods of new building in the later 5th century B.C. (1.I, 1.J) and again at the end of the 4th century B.C. (1.L).”

¹⁴ Hes. *Theog.* 557: “the peoples on earth have burned white bones for the immortals on aromatic altars” (transl. West 1988).

¹⁵ Costamagno *et al.* 2009; Théry-Parisot & Costamagno 2005.

¹⁶ The heat of a fire can be conducted through up to 10 cm of sediment, meaning that even buried bones can be altered by a fire on a surface above. See Aldeias *et al.* 2016 for controlled experiments demonstrating how heat can alter buried archaeological materials.

¹⁷ Since the meat shields the bone from the heat, grilled assemblages are identified from burned bone ends or a transition from unburned to burned on a specimen (Gifford-Gonzalez 1989, 193–194).

¹⁸ For an extensive exploration of the textual, iconographic, and zooarchaeological evidence for this pattern see Ekroth 2009. See also Morton in this volume, *Chapter 2*.

¹⁹ While ageing and sexing certain specimens from certain anatomical elements is possible, it is not possible for the majority of recovered specimens, especially if they are limited to a select few anatomical elements (thighs and tails).

²⁰ Payne 1973, 281–283.

²¹ Pig remains are typically the most common found at sanctuaries of Demeter and Persephone: Jarman 1973; Crabtree & Monge 1990.

ficult to disentangle ritual from economic considerations in zooarchaeological age and sex data (or even knowing what these considerations were to ancient peoples).

Thighbone *thysiai* and curling tails

The chapters in this volume highlight the variable ways in which different body parts could be treated in the course of sacrificial ritual. Heads and horns could be decorative.²² Various cuts of meat, usually—but not only—from the limb, could be either burned on an altar or left as an unburned offering on table. Yet, as the description of sacrificial ritual in the Homeric epics and other texts show, there is a type of sacrifice that we can see as “typical”. Scenes of sacrificial ritual from Homeric poetry to Pausanias consistently describe the selection of the fat-wrapped thighbones (*meria*) as the offering to be burned (*thysia*) to the gods.²³ Less commonly there are references to burning an entire animal (holocaust) or other parts of an animal that might include bones and meat (the neologism *moirocaust* has been used to describe these cuts).²⁴ The typical sacrifice of burned thighbones is complemented with evidence for the burning of the tail (*osphys*) because of the divinatory manner in which it curls.²⁵ Certainly, Hesiod’s description of Prometheus and Zeus shows that the burning of bones constituted one of the most important ritual components of the sacrificial act.

Iconography depicting ancient sacrifice confirms the patterns presented in texts. Curling tails are a prominent component of these scenes, an action that Aristophanes portrays as a good omen.²⁶ Experiments have shown that the tail typically curls as it contracts from losing moisture.²⁷ Vase-paintings of sacrificial scenes sometimes include a packet placed on the flaming altar. These have been convincingly interpreted to be the fat-wrapped thighbones.²⁸ Other vase-paintings depict the hind limb as an honorary share of meat, thought to have been awarded to the official conducting a ceremony.²⁹ The depiction of these cuts of meat as “floppy” indicates that the thighs had already been deboned, with the bones potentially wrapped in fat and burned as a *thysia* offering.³⁰

Since Reese’s publication of a large group of burned sheep and goat hindquarters found in the altar of Aphrodite Ourania in Classical Athens,³¹ several zooarchaeological analyses of animal bones from ancient Greek sanctuaries have confirmed that *thysiai* of the thighbones are the most common form of ancient sacrifice, which are frequently (but not always) accompanied by tails.³² These burned bones can be broadly classified as upper hindquarter elements, including the thighbone (femur) and tailbones (sacrum and caudal vertebrae) and sometimes anatomically adjacent elements such as the hip (pelvis), kneecap (patella), and shinbone (tibia). Occasionally, more precise patterns can be found, as in the shrine of Opheltes at Nemea where left-sided hindquarters were burned.³³ There are a handful of exceptions to the pattern, including evidence for holocaust and *moirocaust* sacrifice and variably patterned burned assemblages in Bronze Age deposits.³⁴ But overall, burned upper hindquarters, mostly thighbones, dominate published zooarchaeological assemblages from sanctuaries or altars firmly identified as evidence for sacrificial ritual.³⁵

Similar to the de-boned limbs found on vases, it is sometimes possible to identify evidence for sacrificial ritual in deposits of unburned bones where thighbones are missing. Gebhard and Reese observed this pattern at the Sanctuary of Poseidon at Isthmia.³⁶ While burned femora were exceptionally common among burned material located in association with the Long Altar to Poseidon, femora were exceptionally uncommon among mostly unburned material from the nearby Large Circular Pit associated with a dining area.³⁷ The excavators surmised that the latter deposit represented feasting debris accumulated from *thysia* sacrifices burned on the altar.³⁸ A similar pattern has been published at the Temple of Apollo Daphnephoros at Eretria, where burned thighbones are found near the Geometric altar and unburned deposits from the subsequent period lack thighbones.³⁹ I have also identified a similar assemblage of dining debris from the Archaic Temple of Zeus at Histria (now in Romania) where the

²² For this aspect, see the contribution by Zachari in this volume, *Chapter 7*.

²³ Hom. *Od.* 3.364–365; Ar. *Pax* 1039; Paus. 1.24.2, 2.10.1 and 2.11.7.

²⁴ Gebhard & Reese 2005, 137–139 document holocaust sacrifices to Palaimon at Isthmia. Ekroth 2008, 90–93 connects *moirocausts* to holocausts.

²⁵ Ekroth 2009, 149; see also Morton’s paper in this volume, *Chapter 2*.

²⁶ Ar. *Pax* 1055.

²⁷ Jameson 1986, 60–61; Ekroth 2009, 143 and 148; Morton 2015, 66–75.

²⁸ Forstenpointner 2003, 210–211, fig. 21.6; Ekroth 2007, 133; 2013, 20. See also Morton’s paper in this volume, *Chapter 2*.

²⁹ Tsoukala 2009.

³⁰ Durand 1984, 32; Ekroth 2013, 21.

³¹ Reese 1989.

³² E.g., Chenal-Velarde & Studer 2003; Gebhard & Reese 2005; Groot 2014; Reese *et al.* 2000.

³³ MacKinnon 2010, 254–256; 2013, 137–138.

³⁴ Isaakidou *et al.* 2002; Hamilakis & Konsolaki 2004; Cosmopoulos & Ruscillo 2014. See below for more detail on these Bronze Age examples of burned sacrifice.

³⁵ Forstenpointner 2003.

³⁶ Gebhard & Reese 2005, 140–147.

³⁷ While Gebhard & Reese 2005 note that the burned material associated with the Long Altar derived from much of the animal, excepting the forelegs, the data published in table 1 shows that hindquarters were typically more common. This matches the comment on p. 144 that, within the burned deposits, “particularly well represented is the upper hind limb, the femur.”

³⁸ Gebhard & Reese 2005, 147.

³⁹ Chenal-Velarde & Studer 2003.

absence of thighbones is likely due to the fact that they were burned on the altar and discarded elsewhere.⁴⁰

The preponderance of burned thighbones at sanctuary sites in Greece contrasts sharply with the relative absence of thighbones (burned or unburned) at settlement sites. Thighbones are typically the least commonly represented long bone (humerus, radius, femur, and tibia) at Greek settlements.⁴¹ When compared to other forelimb and hindlimb elements also present twice in a skeleton, it is clear that thighbones are largely underrepresented in settlement contexts. Is it fair to conclude that thighbones are underrepresented at settlements because they were burned at sanctuaries?

Unfortunately, I do not think so. As we shall see in the next section, it was not only the upper hindquarters that could be selected for burning. Furthermore, the femur is a notably fragile skeletal element, as those with hip or knee problems know. Both the proximal and distal ends of the femur are late-fusing, meaning they are growing lengthwise throughout the entirety of childhood, leaving rather thin-walled cortical bone.⁴² Given that many animals found in sanctuary contexts were slaughtered prior to or around the age of adulthood, many femora are found unfused, making them more susceptible to taphonomic attrition.⁴³ Additionally, Lee Lyman has observed that anatomical elements with high utility (those with more meat and other nutrients), such as femora, are often among the least dense, further rendering them more susceptible to attrition.⁴⁴ On average, femora are less robust than other long bones within an animal skeleton.

If we examine archaeological sites well beyond the ancient Greek world, identifiable femora are typically underrepresented in comparison to other anatomical elements. For example, femora are the least common long bone represented at all the sites with anatomical counts presented in stand-

ard zooarchaeological textbooks.⁴⁵ This pattern is true for hunter-gatherer sites and agricultural settlements, ranging in time from Paleolithic assemblages to the modern day ethnoarchaeological collections. Clearly the individuals who created these thighbone-lacking-deposits were not participating in normative Greek animal sacrifice.

Other hindquarter elements also suffer from underrepresentation due to taphonomy, zooarchaeological methodology, and archaeological collection practices. Given the fact that vertebrae greatly outnumber limb bones within animal skeletons, and that many vertebra fragments are not closely identifiable, many specialists do not count them in the same way as limb bones. Sacra are notably porous and fragile and are rarely included in any published counts. Caudal vertebrae are extremely small and are frequently missed in the course of excavation, particularly if deposits are unsieved and not floated.⁴⁶

The underrepresentation of thighs and tails due to burned sacrificial ritual makes logical sense within the small confines of a sanctuary where one deposit contains burned hindquarters and another (excavated with similar methods) contains unburned skeletal elements lacking in hindquarter elements. Within larger settlements where sacrificial practice and animal slaughter took place for a diverse number of reasons, this conclusion is far less secure. As the saying goes, the absence of evidence is not necessarily evidence of absence. We need evidence from the thighbones themselves if we are to make the argument that thighbones were treated in a special manner at a particular place and time.

Sacrificial variability

Another important problem with identifying typical *thysia* sacrifice strictly from an absence of thighbones, is that a zooarchaeological study of Greek settlements shows that there are other types of burned sacrificial ritual. It is true that most of the evidence for burned sacrifice directly associated with sanctuaries is a typical *thysia* sacrifice. However, the problem

⁴⁰ This assemblage is unpublished but discussed in more detail below.

⁴¹ At settlements such as Early Iron Age Oropos (Trantalidou 2007, fig. 3), Archaic Azoria (Dibble 2017, table 5.5), the Archaic Athenian Agora (Dibble 2017, table 5.7; MacKinnon 2014, table 6 with discussion on pages 224–225), Hellenistic Eleutherna (Vila 1994, table 4), and Hellenistic Knossos (Dibble 2012, table 1.5), the femur is the most underrepresented limb bone for sheep/goat and/or cattle.

⁴² Silver 1969, table A provides fusion ages for various anatomical elements. While these ages have been updated (Zeder 2006 for sheep and goat), both the proximal and distal femora are consistently among the latest ends to fuse in most animal species found in ancient Greece.

⁴³ Reese 1989, 65 reports that over 98% of the femora from the Altar of Aphrodite Ourania were unfused. Ekroth 2014, 335 notes that “the zooarchaeological evidence from sanctuaries shows that most victims sacrificed and eaten were young ...”. See also the contribution by MacKinnon in this volume, *Chapter 5*.

⁴⁴ Lyman 1992, 19: “there appears to consistently be an inverse relationship between the volume density and utility of appendicular skeletal parts.”

⁴⁵ For these anatomical compositions see Davis 1987, table 1.3 (sheep/goat from Iron Age Tel Qiri in Israel); Lyman 1994, tables 7.2 (caribou from Nunamiut sites in Alaska), 7.5 (goat from a modern Hottentot village), 7.9 (marmots from White Mountain sites in California), 7.11 (deer-sized mammals from site 45CH302 in Washington), 7.13 (mammals from Plio-Pleistocene FLK Zinjanthropus in Tanzania), 8.10 (bison from the Late Prehistoric, horticultural site at Philips Ranch in South Dakota); Lyman 2008, tables 6.5 (pronghorn antelope from site 39FA83 in South Dakota), 6.9 (bison from sites 32SL4 in South Dakota), 6.15 (saiga antelope from Mousterian Prolom II Cave, Ukraine); O'Connor 2000, tables 7.2 (cattle from Medieval York), 7.3 (cattle from Roman baths at the Caerleon fortress).

⁴⁶ Payne 1972 describes how smaller anatomical elements are frequently underrepresented due to excavation collection methods.

with identifying a normative pattern—the commonality of “thighbone” sacrifice—is that other scholars know where to find it and replicate it: in deposits of burned bones excavated at sanctuaries. While this is good science, to confirm each other’s conclusions, in a largely inductive field like archaeology, it can lead to the development of a normative paradigm and accidental exclusion of other evidence. The zooarchaeology of Archaic, Classical, and Hellenistic Greece is largely dominated by sanctuary contexts, at the expense of studies on deposits from settlements with less clearly defined spaces.

The growing evidence for burned sacrificial ritual in Late Bronze Age Greece shows a greater diversity in the anatomy of burned bones. Burned specimens from the ash altar at Mount Lykaion reveal prehistoric evidence of a more normative *thysia* ritual.⁴⁷ All levels of the ash altar, including the Late Bronze Age levels, include a preponderance of burned thighbones and tail vertebrae from sheep or goats.

However, non-altar contexts in the Late Bronze Age show different patterns in ritually burned bone. At the Palace of Nestor at Pylos several deposits of burned bone have been analyzed by Valasia Isaakidou and Paul Halstead.⁴⁸ These burned assemblages were made up of the thighbones of cattle and red deer alongside mandibles and humeri (the upper forelimb counterpart to the thighbone). The largest of these deposits was located in the Archives Room of the palace.⁴⁹ This deposit derived from at least 19 cattle and one red deer and could have fed over 3,000 people.⁵⁰ It is possible that the burning of femora suggests that this burned sacrificial ritual, the only example published from a palatial context, could have been conceptualized similarly to a *thysia* deposit of burned thighbones.

Burned deposits from Late Bronze Age settlement contexts show a very different pattern. A burned assemblage of bones found near a hearth in a house/sanctuary at Agios Konstantinos on Methana included primarily pig bones.⁵¹ Yaniris Hamilakis and Eleni Konsolaki conclude that “the burnt bones also indicate that non-meaty parts of the skeletons such as phalanges were selected for burning, whereas meaty parts of the skeleton were first consumed by humans and then thrown into the fire (either as burnt offerings or in order to deliberately destroy by fire human food remnants).”⁵²

A similar assemblage of burned non-meaty parts of pigs (tarsals, metapodials, and phalanges) has been found in association with the platform of Megaron B at Eleusis.⁵³ Michael Cosmopoulos and Deborah Ruscillo have contrasted these

assemblages of burned lower limbs of pigs with the larger assemblages of burned bones from the Palace of Nestor at Pylos. They argue that these smaller assemblages represent “a small group of people (perhaps a family or clan?) conducted the sacrifice ... these sacrifices took place in a private setting and included the ceremonial burning of pigs ...”⁵⁴

The fact that so few Late Bronze Age deposits consist of burned thighs and tails has partially informed Helene Whittaker’s challenge to their identification as burned sacrificial ritual.⁵⁵ Whittaker argues that the burned bones at Pylos, Agios Konstantinos, and Eleusis might simply represent refuse from animal processing, food preparation, or consumption that were accidentally burned, or disposed of, within a fire. The detailed zooarchaeological publications of the burned material from these three sites do not support Whittaker’s argument, as these are all structured assemblages of carefully selected bones for burning.⁵⁶ The unburned bones from elsewhere at these sites do not match the anatomical pattern of those that were burned. There are no taphonomic indications that might suggest they were burned randomly as refuse. Furthermore, my analysis of bones from later settlements shows that the pattern of burned lower limb bones (sometimes accompanied by head elements) is a ritual pattern that persists at least into the Hellenistic period in the Greek world.

The earliest example that I have encountered of this sacrificial pattern is a deposit of burned lower limbs (42 identifiable, burned specimens) of sheep and cattle found near the hearth of Building A.2 at the LM IIIC settlement of Chalasmenos on Crete.⁵⁷ An articulating sheep ankle suggests this to be primary deposition.⁵⁸ Most of these burned specimens were completely carbonized, very few showed signs of calcining or intense fragmentation, and a few were only lightly carbonized.⁵⁹ The complete carbonization (of the entire surface of the bones) with minimal calcination suggests that they were burned at a temperature above that of cooking but only for a limited duration. It is possible to envision that this sacrificial fire was quenched early. Moreover, the fact that the articulating elements of the sheep ankle (a complete astragalus and a distal tibia fragment) were completely and evenly carbonized, shows that they had been carefully disarticulated prior to placing in the fire.⁶⁰ The unburned remains from the same room

⁴⁷ Starkovich 2014.

⁴⁸ Isaakidou *et al.* 2002.

⁴⁹ Stocker & Davis 2004.

⁵⁰ Halstead & Isaakidou 2004, 146–148.

⁵¹ Hamilakis & Konsolaki 2004, 138–143.

⁵² Hamilakis & Konsolaki 2004, 143.

⁵³ Cosmopoulos & Ruscillo 2014.

⁵⁴ Cosmopoulos & Ruscillo 2014, 270.

⁵⁵ Whittaker 2007.

⁵⁶ See Cosmopoulos & Ruscillo 2014 for a reply to Whittaker 2007.

⁵⁷ Dibble 2018, 89–92.

⁵⁸ Dibble 2018, pl. 20C.

⁵⁹ Dibble 2018, pls. 20B–D, 21A.

⁶⁰ If they had remained articulated, then the proximal half of the astragalus would have been shielded from the fire by the distal tibia and would have not been evenly carbonized across its surface. The same is true for the articular surface of the tibia, which would have been shielded by the articulating astragalus.

were dominated by meaty elements, indicative of food preparation or consumption waste.⁶¹

At Nichoria in Messenia, I have examined a heavily burned assemblage found in a stone-lined pit dating to the Early Iron Age that is mostly comprised of lower limbs from sheep and cattle (29 identifiable, burned specimens).⁶² The pit is not in clear association with any of the standing structures but contained a “good series of DA II pottery.”⁶³ The zooarchaeological material contrasts with that from Chalasmenos in that it is more intensively burned, with many specimens calcined and heavily fragmented. While initially identified as a refuse pit, it seems more likely that this contains a burned sacrificial assemblage corresponding to the pattern of burned lower limbs found elsewhere. It is the only concentrated assemblage of burned bones excavated from Nichoria, representing approximately 30% of all identifiable burned bones from Early Iron Age contexts at the site.⁶⁴ The selection of lower limbs for burning, and the careful deposition of these burned elements alongside numerous fineware drinking vessels in a pit highlights the likely ritual nature of this deposit.

At Azoria on Crete (*Fig. 1*), I have studied several deposits containing the burned lower limbs of goats, sheep, and occasionally cattle.⁶⁵ The most significant of these deposits (125 identifiable, burned specimens) comes from the vicinity of a large, multi-roomed complex named the Protoarchaic Building. The central room has a hearth, indicating to the excavators that this large structure might be a Cretan hearth temple with associated industrial activity, including a kiln.⁶⁶ A large ashy fill layer is found directly outside the Protoarchaic Building (in trench B3000), representing a longterm accumulation of hearth cleanings alongside a large quantity of fineware drinking vessels. Over one quarter of the zooarchaeological specimens in this assemblage of bone were burned (*Fig. 2A*).⁶⁷ These specimens were heavily burned, entirely carbonized and frequently calcined. They were heavily fragmented, and few of the burned bones could be identified.⁶⁸ However, similar to other contexts discussed here, over 80%

of the identifiable, burned assemblage derived from lower limb elements of sheep or goats.⁶⁹

A series of smaller structured, burned assemblages have also been found in Late Archaic contexts at Azoria. Three of these assemblages come from the floors of houses, and the fourth derives from a stone bin in a civic storage building.

The assemblage of burned bones (52 identifiable, burned specimens) from the floor of the kitchen (E100) in the North Acropolis Building was concentrated in a dump of burned plant and animal debris found adjacent to the hearth (*Fig. 2B*).⁷⁰ The burned material in this assemblage was partially carbonized to completely carbonized and very few specimens were calcined. While most of the burned material derived from sheep or goat, it included an articulated portion of a cow foot and an articulated goat ankle. Over 70% of the burned assemblage derived from lower limbs of cattle, sheep, and goats.⁷¹ The material was not heavily fragmented or trampled indicating it likely dates close to the abandonment of the settlement. The unburned assemblage embedded in the floor of the kitchen “contains a considerable component of major meaty limb-bone (food) elements ...”⁷²

Another assemblage from the kitchen of the Northeast Building (A2100) shows a similar anatomical pattern to burning (17 identifiable, burned specimens; *Fig. 2C*).⁷³ This assemblage is overwhelmingly comprised of lower limbs (94%) from goats and sheep. The material was completely and evenly carbonized but rarely calcined and not heavily fragmented. While the excavators did not note that these burned bones were found in one discrete deposit, their taphonomic and anatomical patterns match the pattern present elsewhere at Azoria, and their condition (fairly complete) indicates they were likely burned near to the time of abandonment and were not trampled.

The final residential assemblage showing signs of burning at Azoria comes from the floor of a hall in the Northwest Building (D1500; *Fig. 2D*).⁷⁴ Most of the burned material was heavily carbonized and occasionally calcined. With the exception of a few specimens (including an articulating goat ankle), this burned assemblage consisted mostly of burned right-sided sheep/goat metatarsals (lower back foot) and left-sided goat horn cores. The assemblage contains 39 identifiable, burned specimens, but seems to have very specific anatomical patterning.

A similarly patterned and burned assemblage (53 identifiable, burned specimens) was excavated in the summer of 2017

⁶¹ Dibble 2018, table 6.

⁶² Dibble 2017, 182–184, table 6.6.

⁶³ Coulson *et al.* 1983, 46. The DA II (Dark Age II) ceramic phase at Nichoria dates approximately from 975–850 BC.

⁶⁴ The remaining burned specimens from Early Iron Age Nichoria are scattered across various deposits.

⁶⁵ See Dibble 2021 for a more detailed statistical analysis of these sacrificial deposits at Azoria. It should be noted that study of zooarchaeological material at Azoria is still ongoing.

⁶⁶ Haggis & Mook 2013, 6–9.

⁶⁷ Dibble 2017, 184–186. This proportion of burning is exceptionally high for the site, especially for such a large deposit.

⁶⁸ Dibble 2017, table 6.8.

⁶⁹ Dibble 2017, table 6.9, fig. 6.13.

⁷⁰ Haggis *et al.* 2011b, 475–476.

⁷¹ Dibble 2017, 187–188.

⁷² Haggis *et al.* 2011b, 476.

⁷³ Dibble 2017, 188.

⁷⁴ Dibble 2017, 188–189.

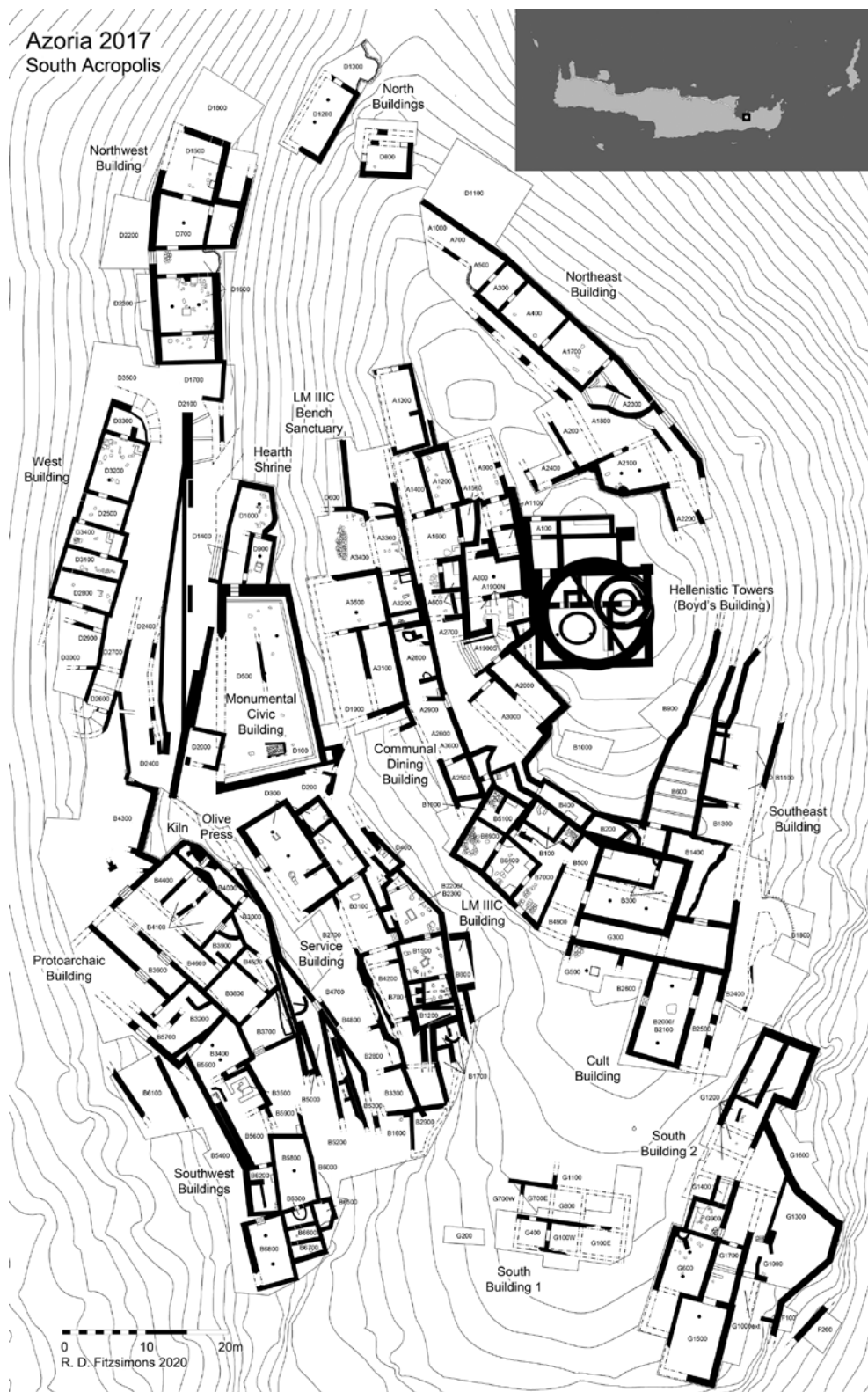


Fig. 1. Architectural and excavation plan (by Rodney Fitzsimons) of the south peak at Azoria with buildings and trenches labeled, courtesy of the Azoria Project. In upper right corner, the location of Azoria on the island of Crete (by Jonida Martini).

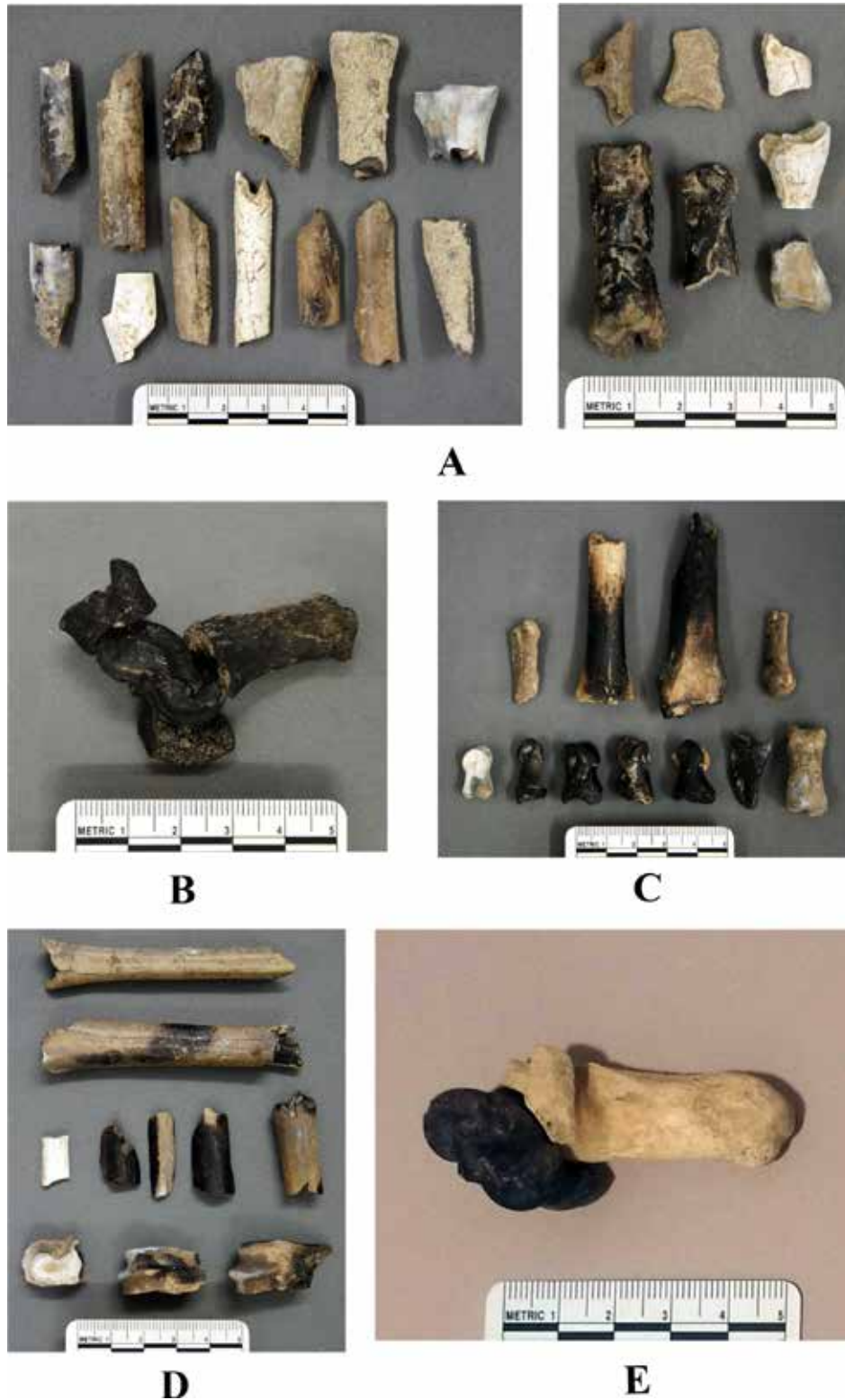


Fig. 2. A) selection of carbonized and calcined lower limb elements from B3000; B) an articulating and fully carbonized goat ankle (distal tibia, astragalus, and calcaneus) from E100; C) burned feet and toe bones from A2100; D) burned metatarsals from D1500; E) articulating goat ankle from D3200: burned astragalus and unburned calcaneus. Photographs: Flint Dibble.

from a stone-lined bin in a large civic storage building known as the West Building (*Fig. 2E*). While there is no evidence for side selection, the burned material from this bin mostly derives from the heads/horns/teeth and feet (85%) of sheep and goats (a few of the specimens were lower limbs from pigs and cattle). Like the residential deposits described above, most of the burned specimens in the bin here were completely carbonized with few examples of calcination. Interestingly, there is a completely carbonized astragalus that articulates with an unburned calcaneus. Both are complete and from the same goat ankle. The astragalus was evidently disarticulated from the calcaneus and burned separately, but both were deposited together. There are several examples of joining unfused epiphyses from both the burned and unburned zooarchaeological material in this assemblage,⁷⁵ suggesting both derived from the same activity that left a structured assemblage carefully deposited together in the stone-lined bin.

The settlement of Azoria seems to have been peacefully abandoned at the end of the Archaic period, around 480 BC. The valuables were removed, certain walls were dismantled, and the roofbeams were torched until the collapse of the clay roof smothered the flames. None of the burned bones from these highlighted assemblages show burning on a single side, although a few of the burned bones scattered elsewhere do.⁷⁶ Therefore, these anatomically patterned assemblages from the Late Archaic period were exposed to a fire on all sides, but a controlled fire that did not calcine nor heavily fragment them. All of these burned assemblages are dominated by lower limb bones, sometimes accompanied by head elements. This anatomical focus on lower limbs contrasts with the anatomical patterns of unburned bones in the same spaces and elsewhere on the site.⁷⁷ Given the context of these clearly structured and well-preserved assemblages on the floors of houses and within the bin of a civic storehouse, our current interpretation is that these represent abandonment sacrifices. These sacrificial deposits might have represented the last meal at their homes by the inhabitants of Azoria.

In Late Classical and Hellenistic Athens too, there are a number of assemblages of burned bones following a similar

pattern in “pyre” deposits found in the Industrial District.⁷⁸ These burned deposits included the “meat-poor” elements of sheep and goats, “primarily the lower limbs and feet, some skull fragments ...”⁷⁹ These “pyre” assemblages have been interpreted as sacrificial based on the zooarchaeological remains and other ritual vessels (including miniatures) deposited. Susan Rotroff suggests these form a kind of “Industrial Religion.”⁸⁰ Some are found in construction or renovation deposits (building offerings) while others are found in abandonment deposits, perhaps similar to those discussed above at Azoria. But others seem to have been deposited during the life of a building.

Finally, a re-examination of burned material from Kommos suggests this form of lower limb sacrifice was also present there in the early Archaic period. While burned bones in deposits from this period (both near to altars and further away) are mostly dominated by burned sheep and goat thighbones, the collection of burned cattle specimens provides a different story. A group of burned vertebrae in a deposit found near Altar U (700–600 BC) associated with Temple B indicates the offering of a tail (*osphys*). Also in these altar deposits is a group of burned lower limb elements from cattle.⁸¹ Most burned cattle remains from the sanctuary during the pre-hiatus period at Kommos consist of burned lower limbs.⁸² The burned remains during the subsequent Classical and Hellenistic periods are dominated by burned sheep and goat hindquarters.

The pattern of burned lower limb—and less commonly head—elements might relate to a scene in the *Homeric Hymn to Hermes*. After stealing a herd of Apollo’s cattle, Hermes expressed remorse. His first step was to try to hide the crime by stealing them at night and then marching the cattle backwards, so that the trail led in the wrong direction. While sheltering in a cave, Hermes invented fire to cook his meal.⁸³ Next, he slaughtered two of the cows and skewered and roasted the meat, fat, and innards. After laying out twelve portions by lot (presumably for the twelve gods), Hermes refrained from

⁷⁵ A burned pig distal humerus and a burned sheep first phalanx both included joining, burned epiphyses. Unburned joining epiphyses from this bin include two goat proximal radii, a goat distal metapodial, a sheep/goat distal metacarpal, and a sheep/goat proximal femur. It is likely that the whole assemblage derives from a single activity, a portion (mostly lower limb and head elements) was burned but all of the assemblage was deposited together.

⁷⁶ One would expect bones trampled into the floor and burned during the destruction of a building to be burned (or more heavily burned) on the side of the bone exposed to the fire above.

⁷⁷ See Dibble 2017 for more detail on unburned assemblages at Azoria.

⁷⁸ See Rotroff 2013 for a detailed treatment of the context and material culture in these deposits. The name “pyre” is a misnomer related to the fact that initially it was thought that the burned bones in these deposit derived from humans.

⁷⁹ Rotroff 2013, 41, n. 158.

⁸⁰ Rotroff 2013, 75–85.

⁸¹ Reese *et al.* 2000, table 6.2 records a large number of burned tarsal (20 fragments), metapodial (15 fragments), and phalanges (26 fragments) found associated with Altar U.

⁸² For example, the burned cattle specimens from the Northeastern Dump #2 associated with Temple A also contained a large number of lower limb specimens (Reese *et al.* 2000, table 6.2). For more detail see Dibble 2017, 193 and figs. 6.21–6.23.

⁸³ There are several parallels between this myth and the Prometheus myth found in Hesiod (Stocking 2017, 24–25, 97–117), heightening the conclusion that the story involving Hermes might represent an alternative or related aetiology for this type of sacrifice.

eating, instead suffering to subsist only on the sweet smoke. Afterwards, the god cleaned up the space by packing up the remaining meat and fat, burning both the feet and heads of the cattle in the fire, and then quenching the fire.⁸⁴

It is unclear exactly how this passage maps out on the collections of burned lower limbs and occasional head/horn elements described above, but it does seem to provide an aetiology for a somewhat similar ritual. Not only are similar body parts burned, but frequently the deposits are small (less than a few dozen identifiable specimens), implying a small number of victims, and many of the specimens are completely carbonized, but not calcined, suggesting the flames were intentionally put out. Perhaps, given that Hermes was cleaning up after himself, this aetiological myth suggests that lower limb/head burning was conceptualized as a form of ritual cleaning. In any case, the large number of archaeological examples deriving from Late Bronze Age through Hellenistic Greek contexts indicates that burned lower limbs (and sometimes heads) were an important ritual pattern, frequently deposited in settlements or other private contexts, and occasionally in sanctuary contexts.⁸⁵ It is also possible that there are more patterns to be explored in burned bones from varied contexts, especially the tantalizing evidence of burned mandibles and humeri from the Palace of Nestor or that of burned astragali from the Sanctuary of Vryokastro on Kythnos.⁸⁶

Unburned bones and sacrificial butchery

Unfortunately, deposits of burned bones from sanctuary contexts provide little evidence as to how victims were transformed into cuts of meat and butchered bones. The redundant anatomical picture of burned thighbones combined with the fact that burning and fragmentation frequently obliterate evidence of cutmarks means we can say little beyond that these bones were burned. This is a shame because sacrificial butchery was conducted by cultic officials, an occurrence so regular that the term *mageiros* could refer to either a commercial butcher or a sacrificial officiant.⁸⁷ Vase-paintings and documentary descriptions of sacrifice show that sacrificial butchers performed their cultic role of carcass division; certain portions were divided among humans and others were kept aside for the divine.⁸⁸ It is plausible to consider that thighbones or other elements consecrated for the divine might have been treated differently than anatomical elements apportioned to humans.

I have studied a deposit of bones (255 identifiable specimens) from a fill layer of beach sand deposited during renovations under the floor of the Late Archaic period Temple of Zeus at Histria (now in Romania).⁸⁹ Two different assemblages sorted by taphonomy were excavated from the sandy fill: those that were abraded and beach worn and those that were not.⁹⁰ Both the beach worn and unworn assemblages lacked thighbones (only one beach worn sheep/goat femur was present) suggesting these derived from sacrificial practices at the altar. Given that most of the cattle and pig specimens were heavily beach worn, it is likely that these species were intrusive. The remaining assemblage of sheep and goat remains included meatier body parts (trunk and upper leg bones) that were mostly unworn and less meaty body parts (head and feet elements) that were mostly beach worn.

The taphonomic and anatomical pattern in this zooarchaeological deposit at Histria allows us to recreate much of the process of sacrifice at the sanctuary that contributed to this assemblage. After the slaughtering of an animal, the less meaty elements were deposited in one location near the beach, presumably where these early stages of slaughter and butchery took place. This process has been nicknamed “the Schlepp Effect”: it is easier to discard the less-meaty (and presumably less desirable) parts of the carcass near the initial slaughter since there is no need to “schlepp” them elsewhere.⁹¹ At some point, the thighbones were carefully cut out of the carcass, burned on the altar and deposited elsewhere. And finally, the meatier elements were deposited in a third, non-beach location, presumably after food preparation and/or consumption. Some of the slaughter refuse from the beach and meal refuse from elsewhere were eventually redeposited together (after enough time that the slaughtering refuse had become beach worn) to level the ground during subsequent renovations.

The butchery marks found on this unburned assemblage provide further evidence for carcass processing (Fig. 3). Many of the vertebrae from these sheep/goats were chopped in half with a cleaver, indicating that the carcass was bisected, likely while suspended in the air. Cleaver-chops through the shoulder and hip sockets show the manner in which the limbs were dismembered from the trunk.⁹² Both cleavers and smaller knives were used to break down the joints into smaller cuts and remove the meat from the bones, presumably in order to be boiled for a sacrificial feast. These operations provide details about large-scale sacrificial events and the various operations conducted around the sanctuary.

⁸⁴ *Hymn Hom. Merc.* 136–140.

⁸⁵ See Georgoudi in this volume, *Chapter 8*, for additional examples of the ritual treatment of heads.

⁸⁶ Trantalidou & Theodoropoulou 2017.

⁸⁷ Berthiaume 1982, 17–62.

⁸⁸ Berthiaume 1982; Tsoukala 2009.

⁸⁹ Excavations and zooarchaeological analysis of this deposit and sanctuary are ongoing: these results should be taken as preliminary.

⁹⁰ The temple is located near the ancient shore of the Black Sea.

⁹¹ Klein 1976, 87–88.

⁹² For more on hip-dismemberment see Morton in this volume, *Chapter 2*.



Fig. 3. Examples of cleaver-chopped specimens from the Temple of Zeus at Histria. A) bisected vertebrae; B) chops through the glenoid cavity of the scapula; C) chops through the acetabulum of the pelvis. Photographs: Flint Dibble.

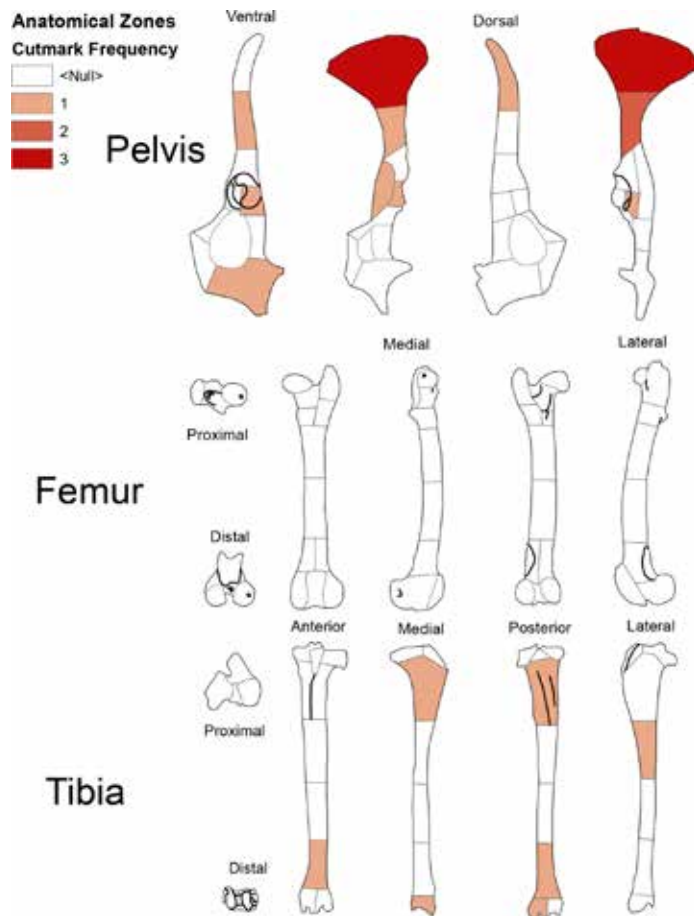


Fig. 4. Frequency of knife-slices within different anatomical zones of cattle pelvis, femurs, and tibiae from Late Archaic and Classical Athenian Agora. Drawing: Flint Dibble.

Similarly, it might still be possible to consider the distribution of cutmarks on unburned remains from settlements to examine sacrificial activity. For a detailed analysis of butchery in zooarchaeological assemblages, I designed a database to assign cutmarks to precise anatomical zones along all planes of an anatomical element.⁹³ The use of touch-screen technology to simply touch where a cutmark was located on a bone diagram allowed the rapid collection of detailed cutmark patterns within large assemblages.

Cutmarks on zooarchaeological specimens from the American School of Classical Studies at Athens excavations at the Athenian Agora provide evidence for the dynamic nature of butchery in the urban Greek environment.⁹⁴ Cleavers begin to replace knives in the Early Iron Age, and, by the Classical period, most visible cutmarks were made by cleaver-chops.⁹⁵ These changes in butchery likely relate to an increase in large-

scale sacrifice and the professionalization of butchery in the *polis*, both contexts where efficient methods would be useful.

Aside from a few specialty cuts of (likely preserved) pork,⁹⁶ the butchery patterns at the Athenian Agora are broadly similar to those described above at the Temple of Zeus at Histria. The spine of the animal was frequently chopped down the middle, and then the limbs were disjointed with cleaver blows. Cleavers were far more commonly used in Athens than at Histria to break down these larger joints into smaller cuts of meat, likely due to the commercial nature of most deposits with zooarchaeological assemblages excavated in the Agora. Commercial butchers aimed to operate efficiently.

Interestingly, if we examine the distribution of cutmarks on cattle skeletons in the Archaic and Classical Athenian Agora, there is a distinct absence of cutmarks on cattle thighbones. There is not a single knife-slice on a cattle femur specimen from the site during these periods (Fig. 4). This absence is striking given that (mostly unburned) femora are not drastically underrepresented in the Agora's assemblage. The few

⁹³ Dibble 2015, 254–255.

⁹⁴ Dibble 2017, 211–219.

⁹⁵ Dibble 2017, 212.

⁹⁶ Dibble 2017, 217.

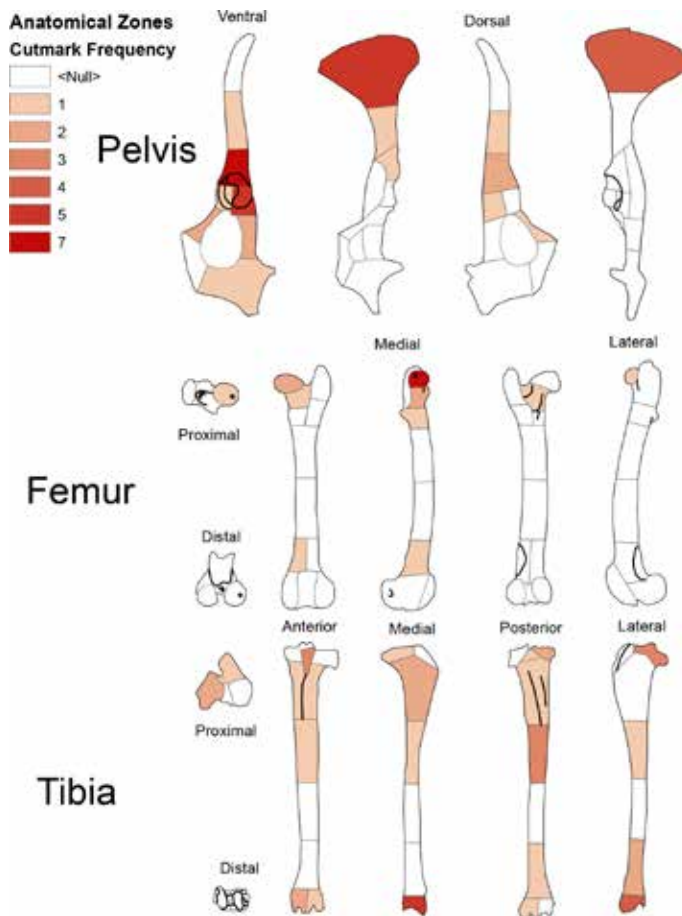


Fig. 5. Frequency of cleaver-chops within different anatomical zones of cattle pelvis, femora, and tibiae from Late Archaic and Classical Athenian Agora. Drawing: Flint Dibble.

cleaver-chops found on thighbones are almost entirely chops through the caput femoris (Fig. 5). After being chopped off the femur, this small ball-joint would have functionally been part of the pelvis, whose socket it remained embedded within. The remaining cattle femur fragments from the site are, for the most part, uncut.

This pattern contrasts with the femora of sheep/goat, which more frequently display cutmarks (Figs. 6–7).⁹⁷ It seems possible that cattle femora were treated specially by Classical Athenian butchers. Perhaps, on average, butchers expected cattle femora to be treated to a “normative” *thysia* style sacrifice, while the same was not true for other species. Given that most of the cattle femur fragments found in the Classical Athenian Agora were mostly unburned, not all specially-treated femora ended up as a *thysia* style sacrifice. However, the absence of cutmarks on these cattle thighbones is a testament to

the skill of these butchers who were careful not to leave such marks on this special anatomical element.

A similar analysis of butchery patterns at Archaic Azoria highlights the role of professional butchers in association with civic feasting, contrasting with less-efficient butchery methods found at houses in the settlement. The Communal Dining Building, located near the top of the South Slope, was an important locus for civic feasting.⁹⁸ It was a large complex of numerous dining rooms, kitchens, and storerooms. The zooarchaeological assemblage from the building, dominated by domesticated animals, is overall quite similar to that found in houses, located further downslope.⁹⁹ Goats are by far the most common animal throughout the site followed by sheep, pig, and cattle.

The primary difference between the animal remains from civic feasting contexts vs those found in household contexts is that more of the butchery marks found on bones in the Communal Dining Building derive from cleaver-chops (31%),

⁹⁷ The larger number of cutmarks on sheep/goat femora than on cattle at the Athenian Agora is notable given the similar number of femur specimens from each taxon (Dibble 2017, tables 5.7–5.8).

⁹⁸ Haggis *et al.* 2011a, 4–16.

⁹⁹ Dibble 2017, 150.

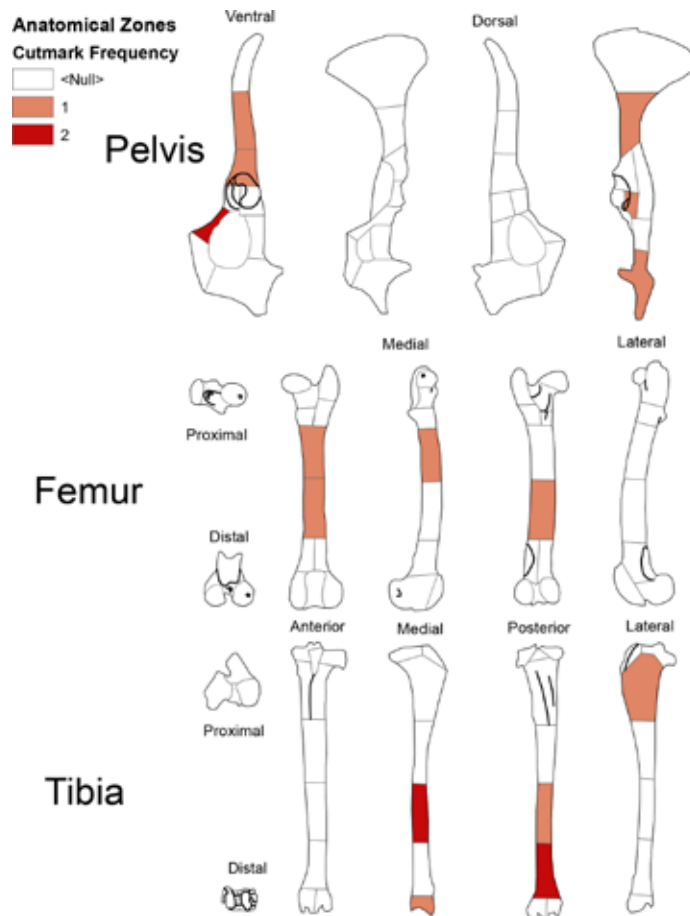


Fig. 6. Frequency of knife-slices within different anatomical zones of sheep/goat pelvis, femur, and tibia from Late Archaic and Classical Athenian Agora. Drawing: Flint Dibble.

while very few butchery marks from households derive from cleaver-chops (15%).¹⁰⁰ The chopped remains from the Communal Dining Building mostly derive from three of its middens, and not from the floor assemblages of its kitchens or halls. These cleaver-chops come from the same anatomical locations and originate either from splitting the vertebrae in half or chopping through the shoulder socket (glenoid cavity) or hip socket (acetabulum). The consistency of these chops, mostly located in midden deposits, suggests that different butchery procedures were used during large-scale feasts than in the course of smaller-scale civic or residential dining. The precision of these chops, those on the pelvis are almost entirely found in one tight zone located on the lateral half of the ventral surface of the acetabulum (Fig. 8), indicates that those performing them were likely professional butchers operating with consistent methods.¹⁰¹

There is only one altar associated with the Communal Dining Building, a ground altar found inside.¹⁰² The most common burned specimen in this altar is the thighbone (eight identifiable, burned specimens); however, the number of identifiable, burned specimens (19) is likely too small to be sure of a pattern.¹⁰³ The anatomical pattern from the large middens (as studied so far) shows that all body parts are present in large numbers, unburned.¹⁰⁴ These large-scale civic feasts were probably conceptualized as a sacrificial event. While there are no texts present from Azoria that might give an indication of how these events were conceptualized, contemporary texts from elsewhere on Crete identify cultic officials conducting sacrifice at urban sanctuaries.¹⁰⁵

¹⁰² Haggis *et al.* 2011a, 10–13.

¹⁰³ Dibble 2017, table 6.10.

¹⁰⁴ Dibble 2021, tables 1–6 present and analyze the data for several thousand identifiable specimens from the Communal Dining Building and its middens.

¹⁰⁵ Cf. e.g. Gagarin & Perlman 2016, 184, who present an inscription (Da1) from Datala (c. 500 BC) where the cultic official (*poinkastas*) performs sacrifices in exchange for revenue from the sanctuary.

¹⁰⁰ Dibble 2017, 205, table 7.4. The difference is statistically significant ($\chi^2 = 14.245$, $p < 0.001$)

¹⁰¹ Seventeen cleaver-chops are found in this tight zone. No other zone on the hindlimb has more than four cleaver-chops.

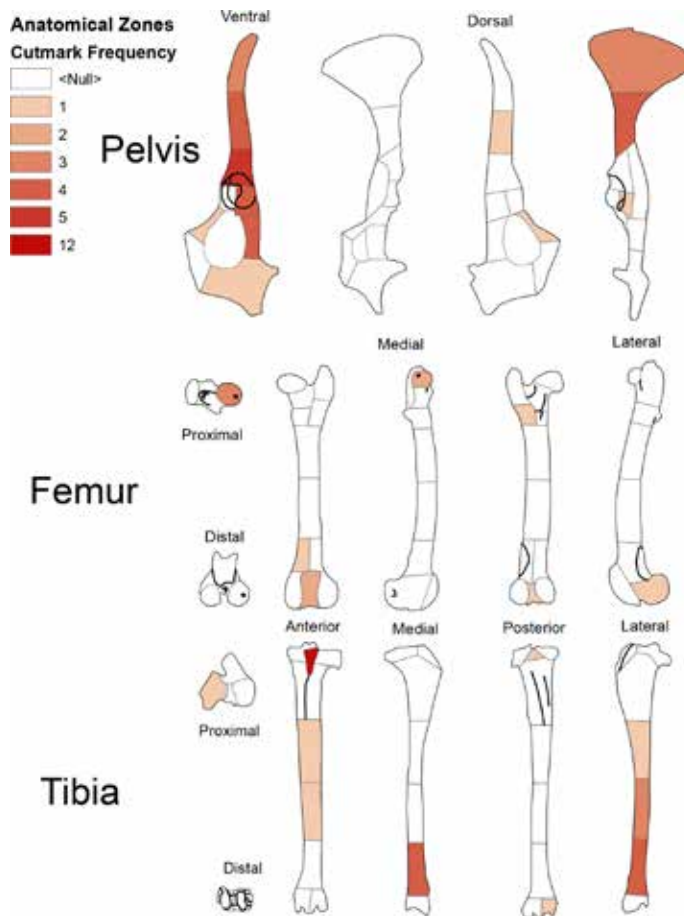


Fig. 7. Frequency of cleaver-chops within different anatomical zones of sheep/goat pelvis, femur, and tibia from Late Archaic and Classical Athenian Agora. Drawing: Flint Dibble.

Given the consistent location and professional nature of the butchery patterns, within a context for civic feasting, it seems likely that these chop marks were made by a cultic official, acting as butcher in the course of a sacrifice. It is possible that only a few specimens were burned inside on the ground altar (*pars pro toto*), an event involving a smaller group. However, the initial stages of butchery—slaughter and dividing the carcass into several larger joints—were perhaps the important spectacle performed for a larger group, with the remains deposited in a nearby midden.

Conclusions

The evidence presented above highlights various ways in which zooarchaeology can contribute to an anatomy of ancient sacrifice, from snout to tail. However, beyond that, the evidence also highlights a large degree of variability in sacrificial practices. It is necessary to break out of our comfort zone of sanctuary and altar contexts and engage with more ambiguous evidence for animal sacrifice deriving from ancient settlements. The differences and similarities between the two

contexts can only serve to inform one another. However, it is also important to be cognizant of the anatomical nature of the bones themselves, as the consistent underrepresentation of fragile thighbones in many contexts worldwide demonstrates.

It is interesting to note that most of the deposits that conform to the lower limb/head sacrifice—whose aetiology seems to be referenced in the *Homeric Hymn to Hermes*—derive from smaller houses/workshops or pits with small numbers of zooarchaeological remains. With few exceptions (the Proto-archaic Building at Azoria or Altar U at Kommos), these small deposits of burned bones contrast with the large deposits of burned thighbones and tails found in association with altars or sanctuaries. Perhaps these anatomical differences in burned bones relate to differences in sacrificial ritual between public vs private spheres rather than to any presumed differences between deities (e.g. “chthonic” vs Olympian).¹⁰⁶ Perhaps the use

¹⁰⁶ Cosmopoulos & Ruscillo 2014, 270 makes this argument for the small number of burned pig lower limb bones found in discrete deposits in Late Bronze Age Eleusis. This argument of a private sacrifice also correlates well with the suggestion by Rotroff 2013 that the pyres in Hellenistic houses/workshops at Athens were a part of “industrial religion.”

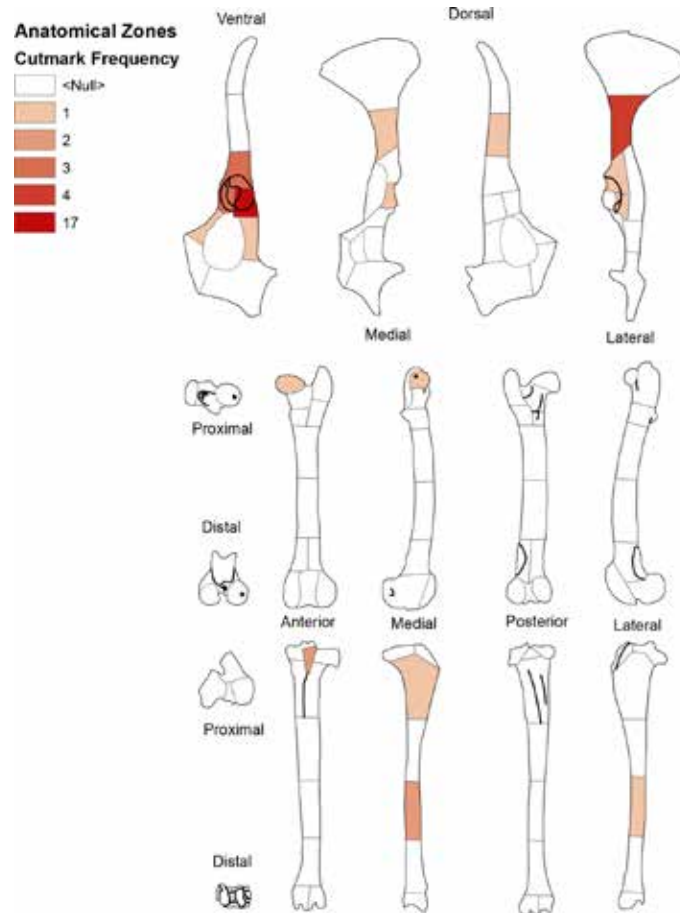


Fig. 8. Frequency of cleaver-chops within different anatomical zones of sheep/goat pelvises, femurs, and tibiae from Late Archaic Azoria.
Drawing: Flint Dibble.

of a lower-quality cut of meat made more sense in a private sphere, in contrast with the higher quality implied by a thigh-bone in a public setting.¹⁰⁷

Moreover, the treatment of unburned bones in sanctuary and settlement contexts provides further nuance to the anatomy of ancient sacrificial ritual. The remains from middens of the Communal Dining Building at Azoria highlight the fact that sacrificial feasting need not always include burned bones. Ekroth has proposed examining sacrificial rituals in terms of intensity.¹⁰⁸ She contrasts the normal *thysia* (thighs and tails) as “low-intensity,” with a holocaust as “high-intensity.” However, perhaps this idea should be expanded into a larger continuum, embracing unburned remains, lower quality portions, bones and fat from higher quality portions, portions with

the meat still attached (*moirocausts*), and the whole animal (*holocausts*).

Cultic officials were also well-known, not only as bone-burners, but as butchers (both commercial and sacred). The lack of cutmarks on thighbones at the Athenian Agora highlights the confusing relationship between these roles, as not all of the carefully deboned thighs were burned. However, the clear order of operations evident in the anatomically-patterned deposition of bone material at the Athenian Agora, Azoria, and Histria reveal both the professional nature of ancient cultic butchers, and the fact that butchery, itself, could perhaps be considered part of the spectacle.¹⁰⁹ At Azoria, it appears as if the large cleaver-chops used to transform the carcass into larger joints were made with different tools and in a different location than the smaller knife slices used to transform the joints into cuts of meat within the kitchen. As Isaakidou

¹⁰⁷ The use of the term *hypermeridia* in two Cretan inscriptions regulating the swearing of oaths—an Archaic inscription from Dreros (Gagarin & Perlman 2016, Dr7, 219–221) and a Hellenistic inscription from Eleutherna (*SEG* 41, 743)—potentially highlights the importance of the upper portion of the leg in contrast to a lower portion of the leg.

¹⁰⁸ Ekroth 2008, 90–93.

¹⁰⁹ Pl. *Phaedr.* 265e potentially alludes to professional butchers who carefully dismember animals at the joints. The prominent role butchery is given in some iconographic depictions (e.g. on the Euphronios Krater; Cerveteri, Museo Nazionale Cerite no number; *BAPD* 187) confirms the spectacular nature of the activity.

and Halstead have suggested with regards to ancient sacrifice: “zooarchaeologists may be investigating not *whether* but *how*—or *how ostentatiously*—the slaughter, consumption, and discard of animals was ritualized.”¹¹⁰ It seems likely that the actual dismemberment of an animal, and its transformation from the carcass of a victim to cuts of meat, was an important component of these ostentatious rituals.

The more we investigate these patterns, the more complex and messy our understanding of ancient sacrifice becomes. Ancient Greek cultic practice was not static, but rather dynamically variable across regions, chronological periods, groups of practitioners, and between different rituals. However, one thing is clear: animal sacrifice, evident in structured assemblages of burned and unburned bones, was a critically important component of many ancient rituals. The entire animal was crucial to these rituals, and various parts of the animal were treated differently based on the deity worshipped, the private or public context, the intensity of the spectacle, and numerous other factors. Additional investigation into anatomical patterns of distributions, cutmarks, and burning will only continue to add to our understanding of the anatomy of ancient sacrifice.

FLINT DIBBLE

School of History, Archaeology and Religion
Cardiff University
dibblew@cardiff.ac.uk

Bibliography

- Aldeias, V., H.L. Dibble, D. Sandgathe, P. Goldberg & S.J.P. McPherron 2016. ‘How heat alters underlying deposits and implications for archaeological fire features: A controlled experiment’, *JAS* 67, 64–79.
<https://doi.org/10.1016/j.jas.2016.01.016>
- Bammer, A. 1998. ‘Sanctuaries in the Artemision of Ephesus’, in *Ancient Greek cult practice from the archaeological evidence. Proceedings of the Fourth International Seminar on Ancient Greek Cult, organized by the Swedish Institute at Athens, 22–24 October 1993* (ActaAth-8°, 15), ed. R. Hägg, Stockholm, 27–47.
- Benecke, N. 2006. ‘Animal sacrifice in the Late Archaic Artemision of Olympia: The archaeozoological evidence’, in *Archaeozoological studies in honour of Alfredo Riedel*, eds. U. Tecchiata & B. Sala, Bolzano, 153–160.
- Berthiaume, G. 1982. *Les rôles du mégéiros. Étude sur la boucherie, la cuisine et le sacrifice dans la Grèce ancienne* (Mnemosyne Supplement, 70), Leiden.
<https://doi.org/10.1163/9789004327894>
- Boessneck, J. 1986. ‘Zooarchäologische Ergebnisse an den Tierknochen- und Molluskenfunden’, in *Haus und Stadt im Klassischen Griechenland*, eds. W. Hoepfner & E.-L. Schwandner, Munich, 136–140.
- Boessneck, J. & A. von den Driesch 1981. ‘Reste exotischer Tiere aus dem Heraion von Samos’, *AM* 96, 245–248.
- Bookidis, N., J. Hansen, L. Snyder & P. Goldberg 1999. ‘Dining in the Sanctuary of Demeter and Kore at Corinth’, *Hesperia* 68:1, 1–54.
<https://doi.org/10.2307/148389>
- Brun, H. & M. Leguilloux 2013. ‘Rituels sacrificiels et offrandes animales dans le Sarapieion C de Délos’, in *Bones, behaviour and belief. The zooarchaeological evidence as a source for ritual practice in ancient Greece and beyond* (ActaAth-4°, 55) eds. G. Ekroth & J. Wallensten, Stockholm, 167–179.
<https://doi.org/10.30549/actaath-4-55-13>
- Chenal-Velarde, I. 2001. ‘Des festins à l’entrée du temple ? Sacrifices et consommation des animaux à l’époque géométrique dans le sanctuaire d’Apollon à Erétrie, Grèce’, *Archaeofauna* 10, 25–35.
- Chenal-Velarde, I. 2006. ‘Food rituals? The exploitation of dogs from Eretria (Greece) during the Helladic and Hellenistic periods’, in *Dogs and people in social, working, economic or symbolic interaction*, eds. L.M. Snyder & E.A. Moore, Oxford, 24–31.
- Chenal-Velarde, I. & J. Studer 2003. ‘Archaeozoology in a ritual context: The case of a sacrificial altar in Geometric Eretria’, in *Zooarchaeology in Greece. Recent advances* (British School at Athens Studies, 9), eds. E. Kotjabopoulou, Y. Hamilakis, P. Halstead, C. Gamble & P. Elefanti, London, 215–220.
- Cosmopoulos, M.B. & D. Ruscillo 2014. ‘Mycenaean burnt animal sacrifice at Eleusis’, *OJA* 33:3, 257–273.
<https://doi.org/10.1111/ojoa.12037>
- Costamagno, S., I. Théry-Parisot, J.C. Castel & J.P. Brugal 2009. ‘Combustible ou non ? Analyse multifactorielle et modèles explicatifs sur des ossements brûlés paléolithiques’, in *Gestion des combustibles au Paléolithique et au Mésolithique : nouveaux outils, nouvelles interprétations*, eds. I. Théry-Parisot & A. Henry, London, 65–84.

¹¹⁰ Isaakidou & Halstead 2013, 88.

- Coulson, W.D.E., W.P. Donovan, R. Hope Simpson, N. Wilkie, D.K. Hagel & W.A. McDonald 1983. 'The architecture', in *Excavations at Nichoria in Southwest Greece* vol. 2. *The Dark Age and Byzantine occupation*, eds. W.A. McDonald, W.D.E. Coulson & J. Rosser, Minneapolis, 9–60.
- Crabtree, P.J. & J. Monge 1990. 'Part III: Faunal and human skeletal remains', in *The extramural Sanctuary of Demeter and Persephone at Cyrene, Libya. Final reports* vol. 4, ed. D. White, Philadelphia, 113–153.
- Davis, S.J.M. 1987. *The archaeology of animals*, London. <https://doi.org/10.4324/9780203060131>
- Davis, S.J.M. 1996. 'Animal sacrifices', in *The sanctuary of Apollo Hylates at Kourion: Excavations in the Archaic precinct* (SIMA, 109), ed. D. Buitron-Oliver, Jonsered, 181–182.
- des Courtis, J., A. Gardeisen & A. Pariente 1996. 'Sacrifices d'animaux à l'Hérakleion de Thasos', *BCH* 120:2, 807–827. <https://doi.org/10.3406/bch.1996.4628>
- Detienne, M. 1989. 'Culinary practices and the spirit of sacrifice', in *The cuisine of sacrifice among the Greeks*, eds. M. Detienne & J.-P. Vernant, Chicago, 1–20.
- Dibble, F. 2012. *Diachronic changes in animal use at Iron Age through early Roman Knossos: Lifestyle and economic choices in a changing environment*, Dissertation, University of Sheffield.
- Dibble, F. 2015. 'Data collection in zooarchaeology: Incorporating touch-screen, speech-recognition, barcodes, and GIS', *Ethnobiology Letters* 6:2, 249–257. <https://doi.org/10.14237/eb1.6.2.2015.393>
- Dibble, F. 2017. *Politika Zoa: Animals and social change in ancient Greece (1600–300 B.C.)*, PhD dissertation, University of Cincinnati.
- Dibble, F. 2018. 'Animal bones', in *Chalasmenos* vol. 1: *The Late Minoan IIIC settlement. House A.2* (Prehistory Monographs, 59), ed. M. Tsipopoulou, Philadelphia, 87–92. <https://doi.org/10.2307/j.ctv9zcgxt.14>
- Dibble, F. 2021. 'Bones around town: Taphonomic patterns from civic feasting and residential dining contexts at Late Archaic Azoria, Crete', *JAS Reports* 36, 102771. <https://doi.org/10.1016/j.jasrep.2020.102771>
- Durand, J.-L. 1984. 'Le faire et le dire. Vers une anthropologie des gestes iconiques', *History and Anthropology* 1:1, 29–48. <https://doi.org/10.1080/02757206.1984.9960733>
- Durand, J.-L. 1986. *Sacrifice et labour en Grèce ancienne : essai d'anthropologie religieuse* (Images à l'appui, 1), Paris & Rome.
- Ekroth, G. 2007. 'Meat in ancient Greece: Sacrificial, sacred or secular?', *Food & History* 5:1, 249–272. <https://doi.org/10.1484/j.food.1.100193>
- Ekroth, G. 2008. 'Burnt, cooked or raw? Divine and human culinary desires at Greek animal sacrifice', in *Transformations in sacrificial practices. From antiquity to modern times*, eds. E. Stavrianopoulou, A. Michaels & C. Ambros, Berlin, 87–111.
- Ekroth, G. 2009. 'Thighs or tails? The osteological evidence as a source for Greek ritual norms', in *La norme en matière religieuse en Grèce ancienne* (Kernos supplément, 21), ed. Pierre Brulé, Liège, 125–151. <https://doi.org/10.4000/books.pulg.562>
- Ekroth, G. 2013. 'What we would like the bones to tell us: A sacrificial wish list', in *Bones, behaviour, and belief. The zooarchaeological evidence as a source for ritual practice in ancient Greece and beyond* (ActaAth-4°, 55), eds. G. Ekroth & J. Wallensten, Stockholm, 15–30. <https://doi.org/10.30549/actaath-4-55-04>
- Ekroth, G. 2014. 'Animal sacrifice in antiquity', in *The Oxford handbook of animals in Classical thought and life*, ed. G.L. Campbell, Oxford, 324–354. <https://doi.org/10.1093/oxfordhb/9780199589425.013.020>
- Filioglou, D., W. Prummel & C. Çakirlar 2021. 'Animal husbandry in Classical and Hellenistic Thessaly (Central Greece): A zooarchaeological perspective from Almiros', *JAS Reports* 39, 103–164. <https://doi.org/10.1016/j.jasrep.2021.103164>
- Forstenpointner, G. 2001. 'Demeter im Artemision?—Archäozoologische Überlegungen zu den Schweineknochenfundten aus dem Artemision.' in *Der Kosmos der Artemis von Ephesos* (Österreichisches Archäologisches Institut. Sonderschriften, 37), ed. U. Muss, Vienna, 49–70.
- Forstenpointner, G. 2003. 'Promethean legacy: Investigations into the ritual procedure of 'Olympian' sacrifice', in *Zooarchaeology in Greece. Recent advances* (British School at Athens Studies, 9), eds. E. Kotjabopoulou, Y. Hamilakis, P. Halstead, C. Gamble & P. Elefanti, London, 203–213.

- Forstenpointner, G. & M. Hofer 2001. 'Geschöpfe des Pan: Archäologische Befunde zu Faunastik und Haustierhaltung im Hellenistischen Arkadien', in *Forschungen in der Peloponnes. Akten des Symposions Anlässlich der Feier '100 Jahre Österreichisches Archäologisches Institut Athen'*. Athen 5.3–7.3 1998 (Österreichisches Archäologisches Institut. Sonderschriften, 38), ed. V. Mitsopoulos-Leon, Athens, 169–179.
- Gagarin, M. & P. Perlman 2016. *The law of ancient Crete, c. 650–400 BCE*, Oxford.
- Gebhard, E. & D.S. Reese 2005. 'Sacrifices for Poseidon and Melikertes-Palaemon at Isthmia', in *Greek sacrificial ritual, Olympian and chthonian. Proceedings of the Sixth International Seminar on Ancient Greek Cult, organized by the Department of Classical Archaeology and Ancient History, Göteborg University, 25–27 April 1997* (ActaAth-8°, 18), ed. R. Hägg & B. Alroth, Stockholm, 125–153.
- Gifford-Gonzalez, D.P. 1989. 'Ethnographic analogues for interpreting modified bones: Some cases from East Africa', in *Bone modification*, eds. R. Bonnichsen & M.H. Sorg, Orono, 179–246.
- Groot, M. 2014. 'Burned offerings and sacrificial meals in Geometric and Archaic Karystos: Faunal remains from Plakari (2011–2012)', *Pharos* 20:2, 25–52.
- Haggis, D.C. & M.S. Mook 2013. 'Excavation of the Early Iron Age settlement at Azoria', *Kentro. The newsletter for the INSTAP Study Center for East Crete* 16, 3–9.
- Haggis, D.C., C.M. Scarry, M.S. Mook, L.M. Snyder, R.D. Fitzsimons & W.C. West 2011a. 'Excavations in the Archaic civic buildings at Azoria in 2005–2006', *Hesperia* 80:1, 1–70.
<https://doi.org/10.2972/hesp.80.1.1>
- Haggis, D.C., M.S. Mook, R.D. Fitzsimons, C.M. Scarry & L.M. Snyder 2011b. 'The excavation of Archaic houses at Azoria in 2005–2006', *Hesperia* 80:3, 431–489.
<https://doi.org/10.2972/hesperia.80.3.0431>
- Halstead, P. & V. Isaakidou 2004. 'Faunal evidence for feasting: Burnt offerings from the Palace of Nestor at Pylos', in *Food, cuisine and society in prehistoric Greece*, eds. P. Halstead & J.C. Barrett, Oxford, 136–154.
<https://doi.org/10.2307/j.ctvh1drns.11>
- Hamilakis, Y. & E. Konsolaki 2004. 'Pigs for the gods: Burnt animal sacrifices as embodied rituals at a Mycenaean sanctuary', *OJA* 23:2, 135–151.
<https://doi.org/10.1111/j.1468-0092.2004.00206.x>
- Hermay, A. & P. Columbeau 2008. 'Aménagements et mobilier archéologique liés aux sacrifices et aux offrandes', in *Amathonte VI. Le sanctuaire d'Aphrodite des origines au début de l'époque impériale*, Athens, 165–196.
- Isaakidou, V., P. Halstead, J.L. Davis & S.R. Stocker 2002. 'Burnt animal sacrifice at the Mycenaean 'Palace of Nestor', Pylos', *Antiquity* 76, 86–92.
<https://doi.org/10.1017/s0003598x00089833>
- Isaakidou, V. & P. Halstead 2013. 'Bones and the body politic? A diachronic analysis of structured deposition in the Neolithic–Early Iron Age Aegean', in *Bones, behaviour and belief. The zooarchaeological evidence as a source for ritual practice in ancient Greece and beyond* (ActaAth-4°, 55), eds. G. Ekroth & J. Wallensten, Stockholm, 87–99.
<https://doi.org/10.30549/actaath-4-55-08>
- Jameson, M.H. 1986. 'Sophocles, *Antigone* 1005–1022: An illustration', in *Greek tragedy and its legacy. Essays presented to D.J. Conacher*, eds. M. Cropp, E. Fantham & S.E. Scully, Calgary, 59–65.
- Jarman, M.R. 1973. 'Preliminary report on the animal bones', in *Knossos: The Sanctuary of Demeter*, ed. J.N. Coldstream, Athens, 177–179.
- Klein, R.G. 1976. 'The mammalian fauna of the Klasies river mouth sites, southern Cape Province, South Africa', *The South African Archaeological Bulletin* 31, 75–98.
<https://doi.org/10.2307/3887730>
- Leguilloux, M. 1999. 'Sacrifices et repas publics dans le sanctuaire de Poséidon à Ténos : les analyses archéozoologiques', *BCH* 123:2, 423–455.
<https://doi.org/10.3406/bch.1999.7235>
- Lyman, R.L. 1992. 'Anatomical considerations of utility curves in zooarchaeology', *JAS* 19:1, 7–22.
[https://doi.org/10.1016/0305-4403\(92\)90003-1](https://doi.org/10.1016/0305-4403(92)90003-1)
- Lyman, R.L. 1994. *Vertebrate taphonomy*, Cambridge.
<https://doi.org/10.1017/cbo9781139878302>
- Lyman, R.L. 2008. *Quantitative paleozoology*, Cambridge.
<https://doi.org/10.1017/CBO9780511813863>
- MacKinnon, M. 2010. 'Left' is 'right': The symbolism behind side choice among ancient animal sacrifices', in *Anthropological approaches to zooarchaeology: Complexity, colonialism, and animal transformations*, eds. D. Campana, P.J. Crabtree, S.D. deFrance, J. Lev-Tov & A.M. Choyke, Oxford, 250–257.

- MacKinnon, M. 2013. “Side” matters: Animal offerings at ancient Nemea’, in *Bones, behaviour and belief. The zooarchaeological evidence as a source for ritual practice in ancient Greece and beyond* (ActaAth-4°, 55), eds. G. Ekroth & J. Wallensten, Stockholm, 129–147.
<https://doi.org/10.30549/actaath-4-55-11>
- MacKinnon, M. 2014. ‘Animals, economics, and culture in the Athenian Agora: Comparative zooarchaeological investigations’, *Hesperia* 83:2, 189–255.
<https://doi.org/10.2972/hesperia.83.2.0189>
- McInerney, J. 2010. *The cattle of the Sun: Cows and culture in the world of the ancient Greeks*, Princeton.
- Meier, J. & R. Yeshurun 2020. ‘Contextual taphonomy for zooarchaeology: Theory, practice, and select Levantine case studies’, *JAS Reports* 34, 102602.
<https://doi.org/10.1016/j.jasrep.2020.102602>
- Morton, J. 2015. ‘The experience of Greek sacrifice: Investigating fat-wrapped thighbones’, in *Autopsy in Athens. Recent archaeological research on Athens and Attica*, ed. M.M. Miles, Oxford, 66–75.
- Nobis, G. 1976–1977. ‘Tierreste aus Tamassos auf Zypern’, *Acta Praehistorica et Archaeologica* 7–8, 271–300.
- Nobis, G. 1997. ‘Tieropfer aus einem Heroen- und Demeterheiligtum des antiken Messene (SW-Peloponnes, Griechenland)—Grabungen 1992 bis 1996’, *Tier und Museum* 5, 97–111.
- O’Connor, T. 2000. *The archaeology of animal bones*, College Station, Texas.
- Parker, R.C.T. 2010. ‘Eating unsacrificed meat’, in *Paysage et religion en Grèce antique. Mélanges offerts à Madeleine Jost* (Travaux de la Maison René-Ginouvès, 10), eds. P. Carlier & C. Lerouge-Cohen, Paris, 137–145.
- Payne, S. 1972. ‘Partial recovery and sample bias: The results of some sieving experiments’, in *Papers in economic prehistory*, ed. E.S. Higgs, London, 49–64.
- Payne, S. 1973. ‘Kill-off patterns in sheep and goats: The mandibles from Aşvan Kale’, *AnatSt* 23, 281–303.
<https://doi.org/10.2307/3642547>
- Peters, J. & A. von den Driesch 1992. ‘Siedlungsabfall versus Opferreste: Essgewohnheiten im Archaischen Milet’, *IstMitt* 42, 117–125.
- Prummel, W. 2003. ‘Animal husbandry and mollusc gathering’, in *Housing in New Halos: A Hellenistic town in Thessaly, Greece*, eds. H.R. Reinders & W. Prummel, Lisse, 175–221.
- Reese, D.S. 1989. ‘Faunal remains from the Altar of Aphrodite Ourania, Athens’, *Hesperia* 58:1, 63–70.
<https://doi.org/10.2307/148320>
- Reese, D.S. 1993. ‘Faunal remains from the well’, appendix in V.R. Anderson-Stojanovic, ‘A well in the Rachi settlement at Isthmia’, *Hesperia* 62:3, 301–302.
<https://doi.org/10.2307/148196>
- Reese, D.S., M.J. Rose & D. Ruscillo 2000. ‘The Iron Age fauna’, in *Kommos: An excavation on the South coast of Crete* vol. 4. *The Greek sanctuary*, eds. J.W. Shaw & M.C. Shaw, Princeton, 415–646.
- Rotroff, S.I. 2013. *Industrial religion. The saucer pyres of the Athenian Agora* (Hesperia supplement, 47), Princeton.
<https://doi.org/10.2972/j.ctv13nb772>
- Ruscillo, D. 1993. ‘Faunal remains from the acropolis site, Mytilene’, *EchCl* 37, 201–210.
- Ruscillo, D. 2014. ‘Faunal remains: Environment and ritual in the Stymphalos valley’, in *Stymphalos: The acropolis sanctuary* vol. 1, ed. G.P. Schaus, Toronto, 248–267.
<https://doi.org/10.3138/9781442662292-017>
- Silver, I. 1969. ‘The aging of domestic animals’, in *Science in archaeology*, eds. D. Brothwell & E.S. Higgs, London, 283–302.
- Stanzel, M. 1991. *Die Tierreste aus dem Artemis-/Apollon-Heiligtum bei Kalapodi in Böotien/Griechenland*, Dissertation, Ludwig-Maximilians-Universität, Munich.
- Starkovich, B.M. 2014. ‘Appendix 5. Preliminary faunal report’, in D.G. Romano & M.E. Voyatzis, ‘Mt. Lykaion Excavation and Survey Project, part 1. The Upper Sanctuary’, *Hesperia* 83:4, 644–648.
<https://doi.org/10.2972/hesperia.83.4.0569>
- Stocker, S.R. & J.L. Davis 2004. ‘Animal sacrifice, archives, and feasting at the Palace of Nestor’, *Hesperia* 73:2, 179–195.
<https://doi.org/10.2972/hesp.2004.73.2.179>
- Stocking, C.H. 2017. *The politics of sacrifice in early Greek myth and poetry*, Cambridge & New York.
<https://doi.org/10.1017/9781316687048>
- Theodoropoulou, T. 2013. ‘The sea in the temple? Shells, fish and corals from the sanctuary of the ancient town of Kythnos and other marine stories of cult’, in *Bones, behaviour and belief. The zooarchaeological evidence as a source for ritual practice in ancient Greece and beyond*

- (ActaAth-4°, 55), eds. G. Ekroth & J. Wallensten, Stockholm, 197–222.
<https://doi.org/10.30549/actaath-4-55-15>
- Théry-Parisot, I. & S. Costamagno 2005. 'Propriétés combustibles des ossements : données expérimentales et réflexions archéologiques sur leur emploi dans les sites Paléolithiques', *GalliaPrHist* 47:1, 235–254.
<https://doi.org/10.3406/galip.2005.2051>
- Trantalidou, K. 2007. 'The contribution of the study of animal bones in the social understanding of Early Iron Age Oropos', in *Oropos and Euboea in the Early Iron Age. Acts of an international round table, University of Thessaly, June 18–20, 2004*, ed. A. Mazarakis-Ainian, Volos, 379–426.
- Trantalidou, K. & T. Theodoropoulou 2017. 'Animal offerings in the sanctuary of Vryokastro on Kythnos', in *Les sanctuaires archaïques des Cyclades*, ed. A. Mazarakis-Ainian, Rennes, 257–273.
- Tsoukala, V. 2009. 'Honorary shares of sacrificial meat in Attic vase painting: Visual signs of distinction and civic identity', *Hesperia* 78:1, 1–40.
<https://doi.org/10.2972/hesp.78.1.1>
- Veropoulidou, R. & D. Nikolaidou 2018. 'Ritual meals and votive offerings: Shells and animal bones at the Archaic sanctuary of Apollo at ancient Zone, Thrace, Greece', in *The bioarchaeology of ritual and religion*, eds. A. Livarda, R. Madgwick, & S.R. Mora, Oxford & Philadelphia, 86–98.
<https://doi.org/10.2307/j.ctvh1dpkx.13>
- Vila, E. 1994. 'Les vestiges osseux animaux de l'habitat hellénistique d'Eleutherna', in *Ελεύθερνα* vol. 2:2: *Ενα ελληνιστικό σπίτι, "Σπίτι Α", στη θέση Νησί*, eds. T. Kalpakxis, A. Furtwängler & A. Schnapp, Rethymno, 193–209.
- Vila, E. 2014. 'Étude archéozoologique des vestiges osseux de la fouille dans le temple', in *Tegea I. Investigations in the Temple of Athena Alea 1991–94* (Papers and monographs from the Norwegian Institute at Athens, 3), eds. G.C. Nordquist, M.E. Voyatzis & E. Østby, Athens, 547–562.
- West, M.L. 1988. *Hesiod. Theogony. Works and Days. A new translation*, Oxford.
- Whittaker, H. 2007. 'Burnt animal sacrifice in Mycenaean cult. A review of the evidence', *OpAth* 31–32, 183–190.
- Zeder, M.A. 2006. 'Reconciling rates of long bone fusion and tooth eruption and wear in sheep (Ovis) and goat (Capra)', in *Recent advances in ageing and sexing animal bones from archaeological sites*, ed. D. Ruscillo, Oxford, 87–118.
<https://doi.org/10.2307/j.ctvh1ds02.10>