Home, refuse, and reuse during the Early Helladic III to the Middle Helladic I transitional period
A social zooarchaeological study of the Asine bothroi

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Published in:
Opuscula: Annual of the Swedish Institutes At Athens and Rome

2016

Document Version:
Publisher’s PDF, also known as Version of record

Link to publication

Citation for published version (APA):
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Abstract*
The practice of digging, using, and filling large pits, cut into the ground and sometimes lined with clay, was extensive from the Early Helladic III to the Middle Helladic Period I (c. 2,200–1,900 BC) in large parts of the Aegean area. This particular type of feature is called bothros and has been reported since the early 20th century from many settlements, mainly from the Greek mainland. Although the bothroi are numerous in the archaeological record, few studies of them have been made. During the excavations at Asine, a prehistoric coastal settlement in the Argolid, a number of bothroi were identified. This paper is a contribution to the study of bothroi, and in particular of the faunal remains found within these features. I propose that the bothros was an important part of the domestic organization at Asine. Not only did it reflect spatial boundaries but it was also vital in the construction of “home”. This is based on the zooarchaeological analysis and subsequent statistical processing of the faunal remains recovered from the features. New radiocarbon dates are presented which are used in establishing a chronology of the bothroi at Asine.

Keywords: Asine, bothroi, Early Bronze Age, social zooarchaeology, correspondence analysis, waste management, home

Introduction
Located a few kilometres to the west of Nauplion in the Argolid, Asine is a prehistoric settlement with long continuity. It was excavated by Swedish scholars in two large and several small campaigns during the 20th century.1 It is foremost famous for its Middle Helladic (MH) and Late Helladic (LH) settlements and burials, but the excavation of the site during the 1920s also revealed remains of an Early Helladic (EH) settlement. During the earlier campaigns, several pits called bothros (pl. bothroi) were found, which since then have remained relatively neglected in the general literature. The bothros is defined as a large, often find-rich, pit. It is usually found cut in the bedrock or clay-lined.2 The function of this type of pit has been much discussed since the findings of the first bothroi at the EH settlement of Orchomenos.3 Disregarding the discussion of the function, for now, the fact that they were relatively common during a certain period of time would indicate that the maintaining of a bothros was an important part of social life at many places.4 This of course presupposes a good established chronology of the bothroi.

In this article I attempt to illustrate the social importance of the bothroi at Asine by analysing the faunal remains found in them. The bothroi contain other categories of finds, especially ceramic artefacts, which need their own separate study and will not be considered here. A zooarchaeological perspective can give new knowledge and information on this feature type. By examining the animal bones I aim to study how the management and deposition of the animal remains can reflect social boundaries and behaviour or traditions regarding the closing of the features. To underline the importance of chronology in terms of restricted temporality of the bothroi, this

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3 Bulle 1907.

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* The animal bones from the Asine bothroi are part of the Asine collection at Museum Gustavianum, Uppsala University, and I am grateful to the Museum for the loan of the material as well as the permit to sample it for radiocarbon dating. This study has gracefully received financial aid for the radiocarbon dating from the Karin & Hjalmar Tornblads Fond, Kungliga Fysiografiska Sällskapet. For valuable comments and feedback on early drafts, I wish to thank Dimitra Mylona and Anne Ingvarsson-Sundström, Michael Lindblom, and Gullög Nordquist. I am also very grateful for the information on typological dating and general assessments of the pottery from M. Lindblom and G. Nordquist. Additionally, I wish to thank Michael MacKinnon and one anonymous reviewer who provided valuable comments on an earlier version of this article. Any faults or misconceptions are my own.
The animal bone assemblages are investigated by traditional zooarchaeological methods as well as through statistical processing. As the title suggests, in the final discussion I use three thematic approaches in the discussion of the bothroi. First, I discuss them with regard to their place in the EH III household organization and the possible connection to the concept of home. Secondly, I illustrate the importance of the bothroi as refuse pits and the social management of this. Thirdly, the remembrance of bothroi after they were actively used is briefly touched upon.

THEORETICAL PERSPECTIVES

Central to my attempt to connect the household with the bothroi from a zooarchaeological perspective is the concept of waste management. This notes the inevitability of waste production and consequences that may come from handling the waste. Any society must deal with this, and does so in its own specific ways. When applied to zooarchaeological material, it gives importance to the animal remains as refuse and not only as mirroring the animal husbandry on the site. The concept of waste management implies active decisions and management tied to cultural norms and organization in regard to waste and waste production. It is used here as an alternate approach to the concept of structured deposition, which is a much-used and discussed term, describing the nature of material patterning often as symbolically meaningful. Waste management is particularly useful regarding zooarchaeological material, which is produced by many means, such as consumption or production. The material properties of organic animal waste will change as it decomposes, and this influences the ways that people handle it. Change in smell is one such example. Since waste is connected to consumption activities as well as the living space, the waste management system can be connected to a level of practice, as for example in the physical acts of handling waste. As such it has been discussed as an important factor in everyday life on a domestic level.

During the 1990s the concept of home and its applicability in archaeology was of interest. It has not been widely used since then, probably because it is difficult to use as an absolute concept in archaeological settings. We cannot know what the idea of home comprised for members of prehistoric communities; one’s concept of home is contained within a specific time and place. Home is created by the people within it only to dissolve when the household members no longer feel the sense of or need for solidarity that keeps the home together. According to M. Douglas, the home is a kind of space organized over time by responding to memory of events, such as hot summers. Storage, she says, is a common feature of the home, and involves an intentional planning for the future. The home is contained within strict rules of behaviour, and to break them implies a threat to the community sharing the home. Even if it is problematic to use the idea of home in archaeological contexts, it is important to be able to think about the home since it is a universally known and vital idea. In other words, even if we can never fully know what “home” comprised on an individual level in prehistory, we should be able to discuss general features of the home, or specific aspects of home. Such features could be, for instance, common architectural elements of dwellings and traces of depositional practices, which are also important when studying household organization.

METHODS

The animal remains found within the bothroi have been zooarchaeologically examined to determine species and anatomical element. Too few fragments could be used for age or sex assessment, and so this aspect of study is not in focus here. Taphonomic markers such as weathering, gnawing, and thermal modification were noted. The osteological examination was made with access to a large zoological reference collection at the Osteological Laboratory at Lund University. The assemblage is quantified by Number of Specimens (NSP) and Number of Identified Specimens (NISP).

In this study I have chosen to analyse the data by means of correspondence analysis (CA). CA is a statistical analysis that aims to visualize the dependency between rows (objects, e.g. bones) and columns (variables, e.g. species, body parts) in a contingency table, i.e. a cross-table. The CA produces coordinates of each observation in the table, based on chi-square

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6 E.g. Richards & Thomas 1984; Hill 1995; Garrow 2012; Rudebeck & Macheridis 2015.
9 In other words, home is a concept which has an emotional and ideological connotation; it is private and intimate. The archaeological consideration of home should not be confused with the household. One can live in a household, yet never call it one’s home. In this article it is used as a term for briefly discussing emotional attachments to the household and its organization.
13 Discussions of households can be found in e.g. Glowacki 2007; Routledge 2013; Wieberg 2007.
15 For a practical introduction on correspondence analysis, see Greenacre 2007. For an illustrative archaeological application of the method, see Alberti 2013.
statistics. Each observation point (observation with coordinates) is then plotted on a map, or rather a developed scatterplot, similar to principal component analysis (PCA) and factor analysis (FA). These co-ordinates form the basis of distances of the observations to the average profile, meaning the relative distribution of observations in each row on average. This average is placed where there is no variation from the average, i.e. where the assumption of homogeneity would be placed.

This procedure is related to the concept of inertia, which measures the variation in the contingency table visualized by the CA. The inertia will be higher with higher association between rows (objects) and columns (variables), and it will be lower as more observations conform to the average. This correspondence or association is visible on the map as proximity between the variables or the objects, and/or the average. A crucial aspect of CA is the so called reduction of dimensions. In large data sets, the number of columns can be high, but since it is hard for us to observe any points in more than three dimensions, we need to reduce the number of dimensions in which they are present. CA tries to do this by “locking” the data where all points are represented. How successful this has been is measured by the percentage of inertia. If 90% of the inertia, which as mentioned above is a measure of variation, is visible in the display, i.e. on the map, it means that 10% of the variation is not displayed.

The graphical display produced by CA facilitates interpretation of large data sets. The distances between different points can help the analyst interpret any correlation between them and specific variables. If we are interested in how certain artefact categories are combined in graves, and in which grave and/or the average. A crucial aspect of CA is the so called reduction of dimensions. In large data sets, the number of columns can be high, but since it is hard for us to observe any points in more than three dimensions, we need to reduce the number of dimensions in which they are present. CA tries to do this by “locking” the data where all points are represented. How successful this has been is measured by the percentage of inertia. If 90% of the inertia, which as mentioned above is a measure of variation, is visible in the display, i.e. on the map, it means that 10% of the variation is not displayed.

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The software used to analyse the data is CAP-CA—an add-in to Microsoft Excel.

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**THE EH III BOTHROS IN AEGEAN ARCHAEOLOGICAL RESEARCH**

Bothroi from EH III contexts are numerous, and they have been reported from many settlements in the Aegean, although predominantly from the Greek mainland. During the excavations at Lerna, on the western outskirts of the Argive Plain, c. 200 bothroi were uncovered. At Orchomenos so many bothroi were identified that the excavator named the archaeological horizon in which they occurred after them. Further away, instances of bothroi are found at, for example, Troy, and Thermi in Lesbos. Other EH III bothroi have been recorded at prehistoric settlements at Korakou, Malthi, and Berbati. Even if we focus just on the EH III period, it is worth mentioning that instances of earlier EH bothroi have been found at sites such as Tzoungiza and Aghios Kosmas, as well as Lerna and Orchomenos. The EH III bothroi are much more numerous and frequent.

H. Bulle was the first to use the term bothros when describing this type of pit from a prehistoric setting. The explanation he offered for the Orchomenos bothroi differs from most of the later reports of the 20th century. Bulle came to the conclusion that they seemed to have had ritual significance, in part because of the clay lining and the ash layers with burnt animal bones within them. He suggested that the ash itself was of religious importance and through the conservation of this in the pits the power of the substance was kept. Since Bulle’s ritual explanation of the Orchomenos bothroi, the general view on this feature type has shifted to a more functional one. Based on ethnographic analogies, it has been suggested that they were built as some sort of oven, or containers of storage, more specifically silos or granaries. According to T.F. Strasser, the storage idea is supported by their construction, i.e. that they were clearly cut in rock, or clay-lined, which would protect from dampness, and also by the amount of ash

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25 Caskey 1960; Banks 2013.
26 Bulle 1907.
27 Troy (Blegen et al. 1950) and Thermi in Lesbos (Lamb 1936).
28 Korakou (Blegen 1921), Malthi (Valmin 1938), and Berbati (Säflund 1965).
29 Tzoungiza (Pullen 2011, 93) and Aghios Kosmas (Mylonas 1934), as well as Lerna (Caskey 1960) and Orchomenos (Bulle 1907).
30 Bulle 1907.
31 Bulle 1907, 30–34.
32 Bulle 1907, 34.
33 Wace & Thompson 1912, 95.
34 Valmin 1938; Marinatos 1968.
35 Säflund 1965; Caskey 1960; More recently, J. Rutter acknowledges that bothroi might have had many functions, but that they ultimately ended up as pits for refuse disposal (Rutter 2008, 463).
The prehistoric bothroi of Asine

During the initial excavations at Asine several bothroi were excavated. Some of them were reported in the publication, but most are described in the excavations journals only. A total of 17 bothroi are presented, located on Terraces I–III. They represent the documented set of bothroi excavated during the 1926 season. Table 1 illustrates the general morphology and other characteristics of the Asine bothroi. The zooarchaeological analysis and the CA is, however, restricted to the 14 \textsuperscript{bothroi} containing bone dated to the EH III–MH I periods. \textsuperscript{44} Fig 1 presents a plan of Terraces I–III at Asine with mentioned bothroi located. As illustrated, the largest number was found on Terrace III. No bothroi were found inside houses, as opposed to at Orchomenos. \textsuperscript{45} The information about their location and general characteristics is gathered from the detailed descriptions made by the excavator of the area, E.J. Knudtzon. \textsuperscript{46}

**Chronology**

The stratification and the small-scale taphonomy of each bothros are very important for investigating patterns in cultural deposition. For the Asine bothros, this is problematic. In the publication few notes on the stratigraphy of the bothroi were made. \textsuperscript{47} The excavators kept very detailed diaries, now archived at the Museum Gustavianum, Uppsala University. From notebooks as well as the find labels, it has proven possible to reconstruct, in relative terms, the stratigraphy of some bothroi. Table 2, which presents a general chronology of each bothros (Bs), includes the number of separated fills, if possible. The stratigraphy of these pits should not be considered fully reconstructed. But the information we do have, is that some bothroi contained many different layers (such as Bs-11), while some fewer (such as Bs-2). Perhaps this reflects different depositional histories, where some bothroi were open during a longer time. I will return to this later.

The problem of recorded stratification is also related to chronology. In order to supplement typological dates and to establish an absolute chronology, 19 animal bones were sampled for radiocarbon dating from 12 bothroi. These bothroi were selected because of their clear stratigraphy and well-preserved bone content. The sampling of them aimed to represent as many stratigraphic levels as possible, including both stratigraphically older and younger fills. Bs-1, -13, and -15 provided suitable bone samples from the older levels. Bs-15 was excavated in spits meaning that we do not know whether this pit contained different fill layers or not. The sampling of other bothroi with more than one layer \textsuperscript{48} (Table 1) remains restricted to the middle and upper stratigraphic levels, due to various degrees of bone quantity and quality.

\textsuperscript{37} Strasser T.F. 1999; Marinatos 1968.
\textsuperscript{38} Examples of interpretations from Banks (2013, 413–416) are foundation bothroi, clearing bothroi, bothroi with special features (Lerna IV:1–2), bothroi marked with slabs or stones, clay-lined bothroi (Lerna VI:3), storage bothroi and bothroi with metallurgical activities (Lerna VI:3). See also Rutter’s work on EH III drinking behaviour in the Aegean (Rutter 2008). He bases his arguments partly on the ceramic contents of two Lerna bothroi, Bothros B-Uu and Bothros B-O.
\textsuperscript{39} Banks 2013, 416–417.
\textsuperscript{40} Nilsson 2014.
\textsuperscript{41} Nilsson 2014.
\textsuperscript{42} Frödin & Persson 1938, see Nordquist & Hägg 1996, 14; Hutchinson 1935, 3.
\textsuperscript{43} This count excludes Bs-21 since it is from an earlier period, see below discussion on stratigraphy and absolute dates. Bs-5 and -10 are also excluded, because they contained no animal bones. Bs-10 was not excavated, but why Bs-5 contained no bones could be interesting to investigate. This is not within the scope of the article, which focuses on bothroi with bone assemblages.

\textsuperscript{44} The chronology used here follows Voutsaki et al. 2009. According to the authors, the EH III period ends at approximately 2,100 BC, while MH I lasted to approximately 1,900 BC.
\textsuperscript{45} Bulle 1907.
\textsuperscript{46} Knudtzon 1926. This field diary concerns the excavation of Terrace III at Asine during the 1926 season. It is catalogued as Diary 3.
\textsuperscript{47} Frödin & Persson 1938.
\textsuperscript{48} Of specific interest are Bs-11 which contained seven layers, as well as Bs-4 and Bs-2, of which both contained four layers each.
Fig. 1. Plan of mentioned bothroi and EH houses on Terraces I–III. Locations of bothroi are marked with the large-sized arabic numerals. The locations of bothroi -12 and -21 were not found when examining the documentation from the excavations. The drawing of Terrace III is from Frödin & Persson 1938, 92, fig. 68. The drawing of Terraces I–II is from Nordquist 1987, fig. 68. Both drawings of Terraces I–II and Terrace III are slightly modified.
The radiocarbon dating was performed at the Laboratory of Radiocarbon Dating at the Geological Department of Lund University. Most of the samples are dated to the EH III/MH I transitional period (2,200–2,000 cal. BC), regardless of stratigraphic level. The typological dates based on the pottery from the *bothroi* also point to this general tendency; those *bothroi* which are relatively dated are normally assigned the periods EH III or EH III/MH I. This is roughly consistent with the most intensive *bothros*-digging at Lerna IV, but also at Orchomenos and Berbati. In Table 2, we can see the calibrated 14C dates. Additionally, Figure 2 shows the most probable date range for the features when combined, which

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Table 1. The morphology of the EH bothroi at Asine. EJK is the initials for Erik Jo Knudzon.

<table>
<thead>
<tr>
<th>Bothros no.</th>
<th>Shape</th>
<th>Width (m)</th>
<th>Depth (m)</th>
<th>Cut in bedrock</th>
<th>Ashy layers</th>
<th>Clay-lining</th>
<th>Min. no. of infill layers</th>
<th>Other remarks</th>
<th>Diary reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bs-1</td>
<td>Round</td>
<td>1.10</td>
<td>1–1.15</td>
<td>Yes</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>2</td>
<td></td>
<td>EJK 3:2, 21ff.</td>
</tr>
<tr>
<td>Bs-2</td>
<td>Round</td>
<td>1.40–1.50</td>
<td>1.15–1.50</td>
<td>–</td>
<td>No, but inclusions of charcoal</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>4</td>
<td></td>
<td>EJK 3:1, 79, 81</td>
</tr>
<tr>
<td>Bs-3a</td>
<td>Slightly oval</td>
<td>c. 1–1.50</td>
<td>–</td>
<td>Yes</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>1</td>
<td>Cist grave (MH 98) abutting</td>
<td>EJK 3:2, 24</td>
</tr>
<tr>
<td>Bs-3b</td>
<td>Round</td>
<td>c. 1–1.50</td>
<td>–</td>
<td>Yes</td>
<td>No, but inclusions of charcoal</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>–</td>
<td>Overbuilt by House S</td>
<td>EJK 3:1, 44f.</td>
</tr>
<tr>
<td>Bs-4</td>
<td>Round or lunate</td>
<td>0.80–1.80</td>
<td>&gt;1</td>
<td>No&lt;sup&gt;1&lt;/sup&gt;</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>4</td>
<td>Overbuilt by House S; lunate stonelining laid on top</td>
<td>EJK 3:1, 53–54</td>
</tr>
<tr>
<td>Bs-5</td>
<td>Round</td>
<td>0.80–1.80</td>
<td>1.30–2</td>
<td>Yes</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>–</td>
<td>First 50 cm not recorded and mixed with surrounding soil</td>
<td>EJK 3:1, 52, 62</td>
</tr>
<tr>
<td>Bs-6</td>
<td>Round</td>
<td>0.80–1 m</td>
<td>1.30–2</td>
<td>Yes</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>–</td>
<td></td>
<td>EJK 3:1, 95–96</td>
</tr>
<tr>
<td>Bs-7</td>
<td>Round</td>
<td>0.80–1.80</td>
<td>–</td>
<td>Yes</td>
<td>No, but inclusions of charcoal</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>3</td>
<td>Infant grave (MH 70) dug into it</td>
<td>EJK 3:1, 81, 89–90</td>
</tr>
<tr>
<td>Bs-8</td>
<td>Round</td>
<td>0.8–1.20</td>
<td>–</td>
<td>Partly</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>–</td>
<td>Partly dug into Bs-10</td>
<td>EJK 3:1, 95</td>
</tr>
<tr>
<td>Bs-9</td>
<td>Round</td>
<td>0.80–1.20</td>
<td>–</td>
<td>No&lt;sup&gt;1&lt;/sup&gt;</td>
<td>–</td>
<td>2</td>
<td></td>
<td>EJK 3:1, 95–96</td>
<td></td>
</tr>
<tr>
<td>Bs-10</td>
<td>Round</td>
<td>0.80–1.20</td>
<td>–</td>
<td>Yes</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>–</td>
<td>No bones; not excavated</td>
<td>EJK 3:1, 96</td>
</tr>
<tr>
<td>Bs-11</td>
<td>Round</td>
<td>0.80–1.80</td>
<td>–</td>
<td>Yes</td>
<td>–</td>
<td>7</td>
<td></td>
<td>EJK 3:1, 103–105</td>
<td></td>
</tr>
<tr>
<td>Bs-12</td>
<td>Round</td>
<td>0.80–1.20</td>
<td>–</td>
<td>Yes</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>–</td>
<td></td>
<td>EJK 3:1, 105</td>
</tr>
<tr>
<td>Bs-13</td>
<td>Round</td>
<td>0.80–1.80</td>
<td>–</td>
<td>Yes</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>6</td>
<td></td>
<td>EJK 3:1, 110</td>
</tr>
<tr>
<td>Bs-14</td>
<td>Round</td>
<td>0.80–1.20</td>
<td>–</td>
<td>No&lt;sup&gt;1&lt;/sup&gt;</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>–</td>
<td></td>
<td>EJK 3:1, 112–113</td>
</tr>
<tr>
<td>Bs-15</td>
<td>Round</td>
<td>1.40–1.45</td>
<td>0.90</td>
<td>Yes</td>
<td>No</td>
<td>No&lt;sup&gt;4&lt;/sup&gt;</td>
<td>–&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Until 3 April 1926 called &quot;the well&quot; by EJK</td>
<td>EJK 3:1, 37–38</td>
</tr>
<tr>
<td>Bs-21</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>–</td>
<td>Not found on map or in diary</td>
<td></td>
</tr>
</tbody>
</table>

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<sup>1</sup> No description was given in the field diary.
<sup>2</sup> Size reconstructed from stratigraphic descriptions in the field diary specifying its location in regards to other features.
<sup>3</sup> Described as a “small bothros” in the field diary.
<sup>4</sup> No mention of ashy layers and/or clay-lining exists in the description in the field diary.
<sup>5</sup> Bs-15 was excavated in five units (or spits). This means we cannot use them as separated contexts.

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49 Lindblom and Nordquist, pers. comm., 2015.
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is c. 2,135–2,028 BC.\textsuperscript{53} The true date is possibly in the early years of this time span, i.e. 2,135–2,078 BC, indicated by the distribution of the higher percentages. Two samples deriving from bothroii Bs-4 and -21, which are discussed in the next section, deviate from this date range.

**Stratigraphic relations in relation to \(^{14}C\)-dates**

Houses R and S were the only buildings that were erected in the EH III period among the excavated remains. Previously, the construction of House R had been suggested to belong to the EH II period.\textsuperscript{54} House S overlies Bs-3b and -4.\textsuperscript{55} The stratigraphic relations with those bothroii, as well as the pottery indicate an EH III date.\textsuperscript{56} Bs-4 is dated both by pottery and radiocarbon analysis to EH II–III, and seems to have been used for a longer period than the others. This stratigraphic circumstance could indicate that House S was the younger of the two EH houses. If so, House R would perhaps have been contemporaneous with the construction and usage of at least Bs-3b and -4. Perhaps we have the remains of a sequence of at least two bothroii phases. First the bothroii beneath House S were used when this area was an open space. When the need to build another house (House S) arose, they were closed and new ones were constructed between House R and S. This would explain the earlier dates in Bs-4. Either way, House T was built over many of the bothroii in the early MH, destroying parts of House S and perhaps R during its construction.

The cluster of bothroii south-east of the middle ground between Houses S and R consists of Bs-7, -8, -9, -11, -13, and -14 (Fig. 1). Within this little gathering of pits we can observe the largest collection of MH graves on Terrace III, except for Room I of House R. In Bs-7 a burial of an infant of six ± two months of age (MH 76) was buried, during the construction of House T.\textsuperscript{57} Graves have also been dug in Bs-9 and -13, Bs-8, -10, -11 and -14 are in close proximity to graves. The placement of so many graves in and around this bothroii cluster might not be random. I suspect these bothroii would have been noticed when digging the graves. This visibility might have been important when choosing the spot for the burial. This in its turn could help us establish a relative sequence for them.

Among the bothroii (Bs-3b, -4, -5, and -6) in the vicinity of House S, only Bs-4 was in the close proximity to a burial and none of them was directly cut by burials (Fig. 1). Since graves often were made close to or in closed bothroii, as discussed above, this could be explained by the fact that these pits were already covered by House S and/or its surroundings. In that case, they should be considered to belong to the “first” bothroii phase, and belonged to House R, while the rest would have been constructed later between House R and S. This observation and the relation between graves and bothroii at Asine will be further explored in the discussion.\textsuperscript{58}

Bs-2 and -6 were not overbuilt by any constructions; however, their dates indicate the same time period as most of the other. Since they were not overlaid by any construction, then the fact that the radiocarbon dates are so consistent with those also overlaid by walls shows that the stratigraphy is not very mixed, and indeed that we can recognize closed units excavated during the 1920s. In that case, it is very probable that a distinct break, after which the bothroii were no longer used, filled up and closed, occurred. That time would have been the end of EH III, or early MH I.\textsuperscript{59}

The two earliest dates come from Bs-4 and -21. As mentioned above, Bs-4 seems to have ceased to be in use approximately the same time as the majority of bothroii, but was made much earlier. The sample from Bs-21 came from its uppermost layer. This suggests it was used and sealed in an earlier period than the other and should perhaps be dated late EH I to EH II. Because of its much earlier date, Bs-21 is excluded from the following analysis, which concentrates on the bothroii closed in the transitional period (EH III/MH I). Further studies on the early bothroii are needed to fully understand the evolution of the feature.

**Distribution of animal bones: analysis and results**

The reconstructed stratigraphy has shown that there seem to be several fill layers in some bothroii, while some were filled up more quickly. Regardless, the filling of these pits is dated to somewhere between 2,135–2,028 BC, most likely 2,135–2,078 BC (Table 2, Fig. 2). This is based on dates from both older and younger layers in the bothroii. The animal bones found in these layers should represent waste materials from this period. In this section I present an overview of the animal bones from the bothroii of Asine.\textsuperscript{60} This is followed by an

\textsuperscript{53} Calculated with the “combine date” function in Oxcal v. 4.2, web interface. All acquired dates have been calibrated with Oxcal v. 4.2 (Bronk Ramsey 2001; 2009), using IntCal13 atmospheric curve (Reimer et al. 2013).

\textsuperscript{54} Caskey 1960, 301; cf. Pullen 1987.

\textsuperscript{55} Frödin & Persson 1938; Nordquist 1987, 71.

\textsuperscript{56} Nordquist 1987, 72.

\textsuperscript{57} Nordquist 1987; Ingvarsson-Sundström 2008, 60.

\textsuperscript{58} This connection between graves and closed bothroii at Asine does not mean that all bothroii in Greece during this period became places for burials. This is a contextual observation, and is maybe relevant for Asine.

\textsuperscript{59} This break is also noticed at Lerna (Banks 2013), Berbati (Saflund 1965), and other sites (see Hutchinson 1935; Strasser T.F. 1999).

\textsuperscript{60} It should be mentioned that the animal bones were at least not discarded, as was often the case during the early years of archaeological excavation projects (e.g. MacKinnon 2007, 475). They are now stored at the facilities of Museum Gustavianum, Uppsala University.
Table 2. Chronology of the EH bothroi at Asine. Calibration of $^{14}$C dates derived from Oxcal v 4.2 (Bronk Ramsey 2001; 2009). The LuS nos are the numbers assigned by the Radiocarbon Dating Laboratory, Lund University.

<table>
<thead>
<tr>
<th>Bothros no.</th>
<th>Asine no.</th>
<th>LuS no.</th>
<th>Uncal. $^{14}$C-date BP</th>
<th>68.2% probability (cal. BCE)</th>
<th>95.4% probability (cal. BCE)</th>
<th>Typological date</th>
<th>Proposed date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bs-1</td>
<td>5168</td>
<td>10934</td>
<td>3655 ± 45</td>
<td>2129–1956</td>
<td>2192–1911</td>
<td>EH III</td>
<td>EH III–MH I</td>
</tr>
<tr>
<td>Bs-2</td>
<td>4523</td>
<td>10936</td>
<td>3655 ± 45</td>
<td>2129–1956</td>
<td>2192–1911</td>
<td>EH III</td>
<td>EH III–MH I</td>
</tr>
<tr>
<td>Bs-3b</td>
<td>2402</td>
<td>11548</td>
<td>3725±35</td>
<td>2197–2042</td>
<td>2275–2024</td>
<td>EH/MH I</td>
<td>EH III–MH I</td>
</tr>
<tr>
<td>Bs-4</td>
<td>5201</td>
<td>10938</td>
<td>3935 ± 45</td>
<td>2488–2346</td>
<td>2569–2292</td>
<td>EH II–III</td>
<td>EH II–III</td>
</tr>
<tr>
<td>Bs-7</td>
<td>5196</td>
<td>10930</td>
<td>3625 ± 35</td>
<td>2031–1940</td>
<td>2129–1892</td>
<td>EH/MH</td>
<td>EH III–MH I</td>
</tr>
<tr>
<td>Bs-15</td>
<td>4615</td>
<td>11528</td>
<td>3730 ± 35</td>
<td>2198–2044</td>
<td>2276–2028</td>
<td>EH III</td>
<td>EH III–MH I</td>
</tr>
<tr>
<td>Bs-21</td>
<td>2237</td>
<td>10942</td>
<td>4135 ± 45</td>
<td>2864–2628</td>
<td>2875–2581</td>
<td>EH I (II)</td>
<td></td>
</tr>
</tbody>
</table>

![Fig. 2. Combined date range for radiocarbon dates from the bothroi of Asine. This figure includes all derived dates except the early date from Bi-4, As 5201 (Table 2). It was made using Oxcal v 4.2 (Bronk Ramsey 2001; 2009).](image)
investigation of possible material patterning by means of correspondence analysis. The CA is done twice, for the species distribution and for the distribution of body parts.

The 14 bothroai zooarchaeologically investigated contained 861 animal bone fragments (8,703 g), of which 339 were identified to genus. As mentioned above only data on species and body parts and the distribution of these are presented, since too few fragments were suitable for age or sex assessment. A quantitative distribution can be seen in Fig. 3. As is visible, most fragments derive from Bs-4, -11, -13, -14, and -15, while the bothroai with the fewest bone fragments were Bs-3a, -6, -8, and -12. Cattle, sheep/goat, pig, red deer, horse, dog, and tortoise are identified.

Many bothroai are dominated by cranial fragments, but this is not always the case. For example, Bs-3b, -7, -8, -9, and -12 contained more post-cranial than cranial fragments. This can be important information because cranial fragments, especially loose teeth, are known to be more prone to survive harsher conditions. That bone fragments deriving from all body regions are identified indicates, rather, that there is relatively good preservation of the bones. The occurrence of spongy bones in the different bothroai is also a sign of good preservation, as well as the well-preserved juvenile human remains from graves elsewhere on the site. The lack of fragile bones in some features could be a consequence of taphonomic loss. Because there are little to no different geological circumstances between the features, this speaks against it being a pure post-depositional bias. That bone fragments deriving from all body regions are identified indicates, rather, that there is relatively good preservation of the bones.

In Table 3, different taphonomic frequencies are presented. As one can see, the most common taphonomic marker amongst the bones is weathering. It seems that this process did affect some bones (51 fragments), but this is still a minor part (c. 8 %) of the total NSP. In addition to this, root etching appeared on 19 fragments. This could indicate that the assemblages in the bothroai were exposed for some time before deposition. However, this cannot be ascertained since root marks have been found also on human remains from graves, and roots might have reached deep under the ground. Furthermore, it has been said that the bothroai of Asine contained calcined bones. I have found no such indications: of all the bones recorded, only eight fragments were burned, and they were not calcined. Probably, these few fragments represent food preparation or something similar.

A closer look at Table 3 reveals that weathering is not recorded from all features. Only in about half of the bothroai are there bones which evidence this process. Together with the fact that gnawing appeared on fragments from almost all bothroai, perhaps it indicates that there were different strategies in the filling of the bothroai. The bothroai with the most fragments with weathering are Bs-14, from which no stratigraphy could be reconstructed, and Bs-4. If Bs-4 was in use the longest, which is supported by the 14C dates, it would be logical that it had been exposed for a longer time. Even if the lack of gnawing, weathering and other taphonomic markers does not automatically correspond to a quick depositional history, it does not contradict it. That the animal bone fragments are relatively well-preserved do point to a more likely scenario of closed refuse accumulation or quick filling events. Judging from the reconstructed stratification of the bothroai (see Table 2), and the taphonomy of the bone fragments, it does seem that some of the assemblages bear signs of longer accumulation periods, that is, time exposed, while others were relatively quickly deposited, perhaps during a year, some months or even less. It can thus also be argued that different modes of
handling the faunal remains, eventually deposited in bothroi, existed. The pottery sherds from the bothroi seem to be fragmentary in general, but not extremely worn. They appear to derive mainly from pots related to storage and cooking. For now, it appears that the handling of the material deposited in bothroi was different from case to case: some material was accumulated and exposed over a longer period while some was deposited relatively quickly. To confirm or contradict this general picture, more detailed studies of the pottery are needed. 66

CORRESPONDENCE ANALYSES

I have chosen to use correspondence analysis to visualize the distribution of animal bone fragments in the bothroi. The reason to use CA is that it is a way to get a more detailed overview of larger data set, such as this one, than general species lists and distributions of body parts. It is also a more effective way than producing graphs of frequencies of species and body parts for each bothros, and then to try to manually compare them. The assumption that underlies this exercise is that patterns of the discarded body parts within the bothroi reflect patterns in refuse disposal or management of these in the features. The CA is done once on species distribution and once on body part distribution. All data used in the analyses are presented in Table 4–5. The statistical analyses are restricted to cattle, sheep/goat, pig, and red deer. These are chosen because they are the dominant taxa of the assemblages from the bothroi. It is true that the NISP for red deer is low (n=28), but the numerous antler fragments/raw material refuse found elsewhere in the settlement make it interesting to include this animal. 67

First, we test the species distribution in the bothroi to see if it is random or not. The variables are cattle, sheep/goat, pig, and red deer. Also, in the data set in Table 4 we can already now see that red deer did not occur in each bothros, and might have been differently deposited. We want to know if there are specific associations between these four taxa, and if there is any clustering of bothroi in relation to the species distribution.

Second, we want to test the body part distribution among the bothroi. There seem to be an overrepresentation of cranial fragments, such as teeth, in some bothroi. But also more fragile bone fragments occur, which might indicate a diverse picture of the bothroi contents in terms of body parts. The aim of the second CA is to examine the body parts, in order to investigate if there are any useful patterns which can be used for the discussion of waste management of different body parts, butchery strategies, or activity areas in connection to the

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66 Preliminary information on the general characteristics of the pottery from the bothroi is provided by Lindblom and Nordquist, pers. comm.

67 Frödin & Persson 1938, 253–254; Nordquist 1987, 31, 40; cf. Moberg Nilsson 1996, 115. Most of these instances are later, dated to the MH. Still, it is interesting to test whether a different use of remains of red deer can be traced further back or not.
The assumption here is that different parts of the body from the most abundantly represented animals provide the best alternative to study patterning concerning refuse disposal or management of these in the bothroi. I have chosen not to separate the taxa in the second CA since this would lead to very low NISP counts resulting in insignificant statistics. The variables used are Head (calvarium, cornu, mandibula), Axial (vertebrae, costae), Upper (scapula, humerus, radius, ulna, osa coxae, femur, tibia, fibula), and Lower (ossa carpi/tarsi, metapodia, phalanges). This division of the body is a simplified categorization of the bulk of the animal body. It could be translated to meat-bearing regions (axial and upper extremities) and non-meat-bearing parts (head and lower extremities). This division is not entirely correct as the head is full of nutrients, although it takes longer to butcher.68 In many societies, the head, or parts of it, is considered to be a delicacy. I will not further relate these simple categories to cultural preferences as it is not my intent to equate them with a prehistoric concept of the animal body.

Species composition

The results of the analysis can be seen in Fig. 4a–c, which illustrates the graphs produced by the CA. All inertia, basically meaning variability,69 is contained within the first three dimensions. The percentage of inertia in the first axis, or dimension, is 42%, the second 33.4%, and the third 24.8%.70 This means that 75% of the variation is captured in Fig. 4a (first–second axes), 66.8% in Fig. 4b, etc.

As suspected, the most dominant pattern involves red deer and is visible in Fig. 4a. Here, the variable red deer is distances from the other domesticates. Red deer explains the first axis with c. 83%, meaning it is the most important variable in shaping the distances and/or proximities of the bothroi (rows) and variables (columns). Bs-3b, -6, -8, and -12 are forming a group around the red deer variable. This pattern is also clear in Fig. 4b, where the first and the third axes are combined. The second pattern lies with the three domesticates where cattle remains seem to have been deposited differently from the sheep/goat and pig. Cattle contribute with c. 71% to the second axis; sheep/goat with 55% and pig 23%. Cattle is thus the biggest factor in shaping the plotting of the observation points. This pattern is also clear in Fig. 4b, where the first and the third axes are combined. The second pattern lies with the three domesticates where cattle remains seem to have been deposited differently from the sheep/goat and pig. Cattle contribute with c. 71% to the second axis; sheep/goat with 55% and pig 23%. Cattle is thus the biggest factor in shaping the plotting of the observation points. This is visible in Fig. 4a along the second dimensions and in Fig. 4c. The sheep/goat variable is slightly closer to the middle, or the centroid, in Fig. 4a, indicating that it is of less significance in explaining any variability.71 The same can be said for cattle in Fig. 4b (third axis). Returning to the data set, we can see that cattle seem not to be as abundantly represented as sheep/goat and pig in general. Also, when pig remains appeared in larger counts, the number of cattle fragments became proportionally smaller, while sheep/goat remains approximately the same. This relationship is visible along the second axis in Fig. 4a.

In Fig. 4b, we can observe that pig and cattle seem to be associated. This is probably because of the even number of cattle and pig in Bs-4 and -11. Two bothroi cluster around the sheep/

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**Table 4. Data set for the correspondence analysis of species composition within the bothroi, Asine.**

<table>
<thead>
<tr>
<th>Bothros no.</th>
<th>Ovis/ Capra</th>
<th>Sus</th>
<th>Cervus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bs-1</td>
<td>7</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>Bs-2</td>
<td>1</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>Bs-3a</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bs-3b</td>
<td>2</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Bs-4</td>
<td>15</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>Bs-6</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Bs-7</td>
<td>2</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Bs-8</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Bs-9</td>
<td>3</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Bs-11</td>
<td>21</td>
<td>12</td>
<td>22</td>
</tr>
<tr>
<td>Bs-12</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Bs-13</td>
<td>2</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>Bs-14</td>
<td>4</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Bs-15</td>
<td>23</td>
<td>23</td>
<td>32</td>
</tr>
</tbody>
</table>

**Table 5. Data set for the correspondence analysis of body parts’ distribution within the bothroi, Asine.**

<table>
<thead>
<tr>
<th>Bothros no.</th>
<th>Head</th>
<th>Axial</th>
<th>Upper extremities</th>
<th>Lower extremities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bs-1</td>
<td>13</td>
<td>0</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Bs-2</td>
<td>6</td>
<td>1</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Bs-3a</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bs-3b</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Bs-4</td>
<td>11</td>
<td>5</td>
<td>17</td>
<td>6</td>
</tr>
<tr>
<td>Bs-6</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Bs-7</td>
<td>3</td>
<td>1</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Bs-8</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Bs-9</td>
<td>5</td>
<td>1</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Bs-11</td>
<td>24</td>
<td>7</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>Bs-12</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Bs-13</td>
<td>16</td>
<td>2</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Bs-14</td>
<td>7</td>
<td>1</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Bs-15</td>
<td>44</td>
<td>5</td>
<td>28</td>
<td>13</td>
</tr>
</tbody>
</table>

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68 E.g. Stiner 1991, 471.  
69 Shennan 2006, 315.  
70 Cf. Greenacre 2007; Shennan 2006.  
71 Greenacre 2007, 22.
goat variable (Bs-1 and -2). This is because ovicaprine remains are more abundant in those pits than both cattle and pig, and red deer is not represented at all. Three bothroi, Bs-7, -9, and -13, remain close to the pig-variable in all dimensions. This could indicate that pig was specifically deposited in these pits. This is partially confirmed by returning to the data set in Table 4, where we can see that pig is indeed most numerous of all taxa in these bothroi.

Bs-15 is always close to the average. This can probably be explained by it actually being unique and ordinary at the same time. It is unique because of its rich bone content of all animal species. However, its relative proportions seem to be quite common in relation to the rest of the data set, that is, the contents of this particular bothros do not deviate from the calculated average profile of all objects (rows). This average has a low proportion of red deer and more even cattle and sheep/goat abundances, and a slightly higher content of pig.

All in all, according to the CA of species distribution, the typical pattern in a bothros at Asine is that all domestic animals are represented relatively evenly, with a low proportion of red deer. Depending on their abundance, the bothros will deviate from this pattern. This is visualized by closeness and distances of these variables in Fig. 4a–c. Red deer, which we already knew was much less abundant, did not cluster with the domesticated taxa. This probably indicates that red deer was not as commonly consumed, and it was not deposited in all bothroi. When it was deposited, it mainly ended up in Bs-3b, -6, -8, and -12. In general, cattle do not associate with sheep/goat and pig. This does not mean that they are not found together, but that there is a tendency of frequencies of cattle being lower when pig and sheep/goat occur in higher numbers. This could mean that some bothroi were more frequently used for the deposition of mediumsized domesticates.

Fig. 4a–c (from top to bottom). Results of correspondence analysis of species composition (cattle, sheep/goat, pig, and red deer) within the bothroi, Asine. 4a) observations along the first and second principal axes; 4b) observations along the first and third principal axes; 4c) observations along the second and third principal axes.
Body part distribution

In Fig. 5a–c we see the graphical results of the second CA, which investigated the body parts distribution between the bothroi. The first dimension contains c. 56% of the total percentage of inertia, the second 26% and the third 18%. The highest variation is thus explained in Fig. 5a (82%) and Fig. 5b (74%).

The first and third axes (Fig. 5a–b) both show a similar pattern where fragments from the head together with those from Lower are opposing those from Axial and Upper. In Fig. 5a–b we can observe two groups of bothroi returning. One group is associated with Axial and Upper (Bs-2, -4, -7, -8, -9, and -12) and one with Lower and Head (Bs-1, -3b, -13, -14, and -15). This pattern indicates dissociation between body parts with easy access to meat (Axial and Upper) and body parts with less meat or special in other ways (Lower and Head). It can be a sign of differentiated handling of the remains from butchering versus consumption. Perhaps this can be discussed in terms of proximity of butchery workshops or consumption areas. Bs-11 is close to the average in Fig. 5a–b, probably reflecting that its distribution of body parts is homogenous.

A second pattern lies along the second axis, visible in Fig. 5c. Here we see Head, but also Upper, close to the average, the centroid. Many bothroi are placed around the centroid. This is because they contained Head and Upper. Bs-3a is much distanced, because it only contained one cranial fragment. Similarly we have Bs-8, which contained both Head and Upper but not the other, and Bs-6 (Axial) and Bs-12 (Lower) where the opposite situation is occurring.

Returning to the data set in Table 5, we can see that the “normal” distribution consists of well-represented Head and Upper parts,
while the other two variables are more unusual. This reflects a taphonomic issue because cranial fragments such as teeth and compact fragments from long bones are more resistant to decomposition and density-mediated attrition, i.e. more prone to be overrepresented in zooarchaeological assemblages.72 This pattern is thus probably taphonomically biased, showing the features as deviating simply because they contained either only better-preserved body parts or unusually high degree of normally not as abundant body parts which are more prone to destruction after deposition.

Short summary

The two correspondence analyses revealed some interesting patterns. First, we have detected that red deer disassociates with the domesticated animals, and is specifically associated with Bs-3b, -6, -8, and -12. This does not mean that the domesticated animals did not occur in these bothroi. Further, red deer is also found, although sporadically, in other features. Cattle is not represented in Bs-6 and -8. Secondly, we can see that cattle contrasts with sheep/goat and pig. Bs-1, -2, -11, -13, and -14 should be associated with the deposition of mainly medium-sized animals. In a similar way, cattle should be associated with mainly Bs-3a, -4, and -11. In Bs-4 and -11 pig remains were also abundant. Again, this does not presuppose a lack of other animals in these bothroi, as e.g. cattle is abundant in Bs-1 and -14. But, it might mean that certain animal remains were deposited in certain bothroi rather than others, even if this rule was not followed strictly.

The third and the fourth patterns I choose to discuss are based on the CA of body parts’ distributions. The third consists of an association between Head and Upper while Upper and Axial group together. This might reflect a division in the deposition of meat-rich vs. non-meaty limbs and the head. At Asine this might translate to consumption and butchery waste. Finally, the fourth pattern is that of taphonomic bias in terms of post-depositional disturbance, in the sense that normal proportions of body parts are strongly overrepresented by Head and Upper. A majority of pits conform to this pattern. Thus, the CA has shown that while taphonomic processes have affected the material we have a stronger pattern which probably can be connected with the archaeological handling of bones or bodies at the settlement.

In Table 6 I have made a categorization of the bothroi according to the results of the above analyses. When considering Table 6, it is important to retain the notion that there is a taphonomic bias which strongly shaped the distribution of observations, and that these categorizations are based on deviations from it. I will not discuss the taphonomy more in this article, but it is clear that the analysis illustrates the potential of this method within the field of vertebrate taphonomy, and should be explored in future studies.

I have distinguished five groups in Table 6. Groups A, B, and C are based on species distribution. They do not correlate with groups D and E which are based on body part distribution. This means that each bothroi is assigned two groups: one on basis of species composition and one relating to distribution of body parts. Bs-11 and -15 are exceptions because Bs-15 could not be tied to any groups in the CA of species distribution; the same concerns Bs-11 in the CA of body part’s distri-

Table 6. Categorization of the bothroi of Asine according to the interpretation of the correspondence analysis.

<table>
<thead>
<tr>
<th>Group</th>
<th>Bothros no.</th>
<th>General characteristics</th>
<th>Explanation</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3b, 6, 8, 12</td>
<td>Association with red deer</td>
<td>Red deer and medium-sized are present, but not cattle.</td>
<td>Bothroi for the deposition of butchery and consumption waste from red deer, not cattle (sheep/goat and pig still present).</td>
</tr>
<tr>
<td>B</td>
<td>4, 11, 3a</td>
<td>Association with cattle and pig</td>
<td>Cattle and pig predominant. Presence of cattle in this proportion quite ordinary, therefore Bs-11 close to origo. Bs-3a is almost an outlier because it only contained one cattle fragment.</td>
<td>Bothroi for the deposition of cattle and pig.</td>
</tr>
<tr>
<td>C</td>
<td>7, 9, 13, 14, 2</td>
<td>Association with sheep/goat and pig</td>
<td>Sheep/goat and/or pig predominant. Proportionally low inclusions of large herbivores. Bs-7, -9, -13 dominated by pig.</td>
<td>Bothroi for the deposition of mainly medium-sized animals.</td>
</tr>
<tr>
<td>D</td>
<td>1, 13, 14, 15, 3a, 3b</td>
<td>Association with head and lower extremities</td>
<td>Relatively unusual large proportions of head and lower extremities.</td>
<td>Bothroi for the deposition of mainly butchery waste.</td>
</tr>
<tr>
<td>E</td>
<td>2, 4, 7, 9, 8, 6, 12</td>
<td>Association with axial and upper extremities</td>
<td>Relatively unusual large proportion of axial and/or upper extremities.</td>
<td>Bothroi for the deposition of mainly consumption waste.</td>
</tr>
</tbody>
</table>

72 Lyman 1994; Orton 2012.
buton. In these instances, these bothroi were placed close to the centroid of the CA, thus not conforming to any pattern. While one bothroi might have been the destination of primarily consumption waste from cattle and pig, another could have contained mainly butchery waste of medium-sized mammals. I do not wish to categorize them any further, e.g. “butchery waste from red deer”, since the results do not really support more detailed interpretation. Many of the Asine bothroi are represented by small sample sizes. For example, the “red deer” bothroi Bs-6, -8, and -12, contained very few bone fragments, as did Bs-3a. Their assignments to any of the anatomical groups D or E are perhaps dubious. Because of this quantitative issue, the categories in Table 6 remain interpretative in their nature. Nevertheless, the use of CA can, even in small samples, provide general patterns of archaeological interest.

**SPATIAL CONNECTIONS**

In Fig 6, I have merged my interpretations of the bothroi and their location on the map. Additionally, my perception of the chronology of the bothroi has been added. The reconstructed stratigraphy combined with absolute and relative dates indicates that although different strategies existed while filling the bothroi, they were probably filled up during the same approximate period. This could be during the same year, but it could also be two generations, if following the narrowest span of the calculated combined date, c. 2,135–2,078 BC (Table 2). It is thus possible that House S was not in use for a very long time. Shortly after filling up the bothroi, graves were dug into some of them and House T was erected. Phase 1 refers to the bothroi presumably older than House S. Phase 2 refers to bothroi in the middle of Houses R and S, and seems to constitute the last phase of usage. “Unknown phase” refers to the bothroi of Terraces I–II which might actually belong to phase 1, or more probably another household not yet excavated.

The most interesting spatial connections based on the CA and the categorization in Table 6 is contained within the cluster of bothroi south-east of the middle between Houses S and R. They formed two rows aligned north–south with three bothroi each: to the west Bs-7, -9 and -11, and to the east Bs-8, -13, and -14. Two of the western bothroi, Bs-7 and -9, are categorized as destinations of mainly consumption waste from medium-sized mammals (sheep/goat and pig), while the third one, Bs-11, is labelled a “cattle/pig” pit. Two of the eastern bothroi, Bs-13 and -14, contained butchery waste from medium-sized mammals (sheep/goat and pig). The third bothroi in the eastern row, Bs-8, is labelled a “red deer” pit. Thus, it seems that the western bothroi in the cluster between Houses R and S were destinations for mainly consumption waste, while the eastern pits might have been intended for butchery waste.

Southeast of this small cluster, we find Bs-1 and -3a which are not assigned to any phase on Fig. 6. They are also categorized as bothroi for butchery waste. If they were to be included in Phase 1, the interpretation that the eastern bothroi were destinations for mainly butchery waste would be reinforced. In the sense of spatial patterning, Phase 1 bothroi do not show any specific tendencies. Phase 1 organization might thus have been less formalized than phase 2, for reasons unknown.

**Discussion**

**THE BOTHROS AS PART OF THE HOUSEHOLD ORGANIZATION**

The results show that the distribution of animal bones in the Asine bothroi is not random. At least in the stage of closing the features, they should not be considered as uniform. This confirms my initial impression that the material is not coherent, but complex and variable. It is also probable that more than one phase in the life of a bothros existed. The patterns apparent in this study would support the hypothesis that bothroi were built at a domestic level. It is relatively clear they were constructed in similar manners, according to similar traditions. This is visible in the architecture and also in the chronology at Asine. Phase 1 bothroi might have been less formalized than phase 2, because they were connected to only one household (Fig. 6). In this case, it is possible that when either the household became crowded or the settled area became denser, it necessitated a more formal place of storage, the bothroi. These pits then conveniently became places for stricter waste management. This formalization combined with the diversity of the filling strategy would indicate that the digging of these features for one’s household was part of the normative behaviour connected to the idea of the “home”.

The concept of home at Asine was probably different from one household to another. We have no idea of the structure of family. Even if we did, we do not know if the family was the “embryonic community” that structured one’s home. What we can discuss however are house plans and storage features, refuse materials and consumption remains, which we connect to the household or the domestic sphere. It is obvious that bothroi were part of human life on a domestic as well as on a community level. The hypothesis that a bothros was constructed for storage on a domestic level includes an assumption that it was part of the household organization. It is thus possible

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73 Bs-11 could not be categorized according to body parts, see previous section.

74 This is also how I read Bank’s detailed study where the functional diversity of bothroi at Lerna IV is emphasized: Banks 2013.

Fig. 6. Plan of the Asine bothros used in the correspondence analyses, including interpretative categories, see Table 6.
that the *bothros* was a part of many persons’ home at Asine. It was important for the structuring of space and the function was tied to the memory of perhaps hot summers (storage). They were even important when used as refuse pits, in the sense that they continued to structure space and to direct movement and labour.⁷⁶

**WASTE MANAGEMENT AND DIVERSITY: THE CLOSING OF A *BOTHROS***

I have proposed that *bothroi* were built as part of the household organization. I suggest they were filled up at approximately the same time period, i.e. between 2,135–2,078 BC, although a more narrow date range might be possible. The features were filled up in different ways as suggested by the reconstructed stratigraphy. The most formalized deposition of faunal remains seems to regard the similar-sized *bothroi* clustering between Houses R and S. It is possible to argue that these pits were used in connection with different activities, reflected in the refuse disposal. Whereas Bs-13 and -14 were used for butchery waste of primarily sheep/goat and pig, Bs-7 and -9 were used for consumption waste of the same. In Bs-11 we found an association with cattle and pig. The above mentioned features differ finally from Bs-8 in which remains of red deer is associated.

Since the faunal remains should derive from the filling period, which could have been over several years, another scenario might be suggested. The *bothroi* could be seen as waste management systems, where certain remains of certain animals and/or body parts where thrown in certain pits. This would explain the presence of red deer specifically tied to certain *bothroi*, sheep/goat to others, and pig to yet others. It would also explain the seemingly linear disposal of the axial body and upper extremities versus heads and lower extremities, which in the Asine case can perhaps be translated into meaty versus non-meaty body parts. In this sense it is reasonable to think that in the closing of the *bothroi*, the type of refuse deposited in them would also have been sorted or at least considered. It does not necessarily imply strictly ritual behaviour. This waste management could have been directed from the perspective of activity areas (as butchery versus consumption areas), or simply waste categories (such as red deer versus cattle). It could be argued to have involved both, especially when regarding the "sheep/goat-and-pig-*bothroi*" where "non-meaty" parts were associated with Bs-13, -14, perhaps also Bs-1 and -3a, to the east, and meat-rich parts in Bs-7 and -9 to the west.

Spatial and social organization in relation to waste management can be observed in most societies. In modern Sweden, there is a rigorous practice concerning the everyday sorting and categorizing of waste. This is directed and normalized through governance and education.⁷⁷ In this setting, bones and other food waste are integrated in the same category. For the Dogon people of Mali, domestic waste is a positive disorder and is used to manifest the vitality of the household, while bodily waste and menstrual blood is considered dangerous and polluting.⁷⁸ On Greenland, the Inuits had for a long time an ideal practice of "nothing is wasted" regarding the consumption of caribou, meaning that virtually nothing was considered waste and only bone splinters would remain as waste from the animal body.⁷⁹ More ancient examples of waste management strategies have been evidenced from Neolithic Çatalhöyük, Central Anatolia, where refuse would have been handled as an intricate part of everyday life by removing it from the house context.⁸⁰ Other examples can be found at Early Neolithic Almhov, Scania, where refuse was disposed in certain pits,⁸¹ or the accumulation of refuse in the Late Bronze Age "middensites" in the United Kingdom.⁸² As the above ethnographic and archaeological examples demonstrate, the part of life involving the handling waste was and still is important. The *bothroi* seem to have been important in the spatial arrangement of things, in the social organization of the living area. The disposal of faunal remains, or rather, the remains of food consumption and animal processing, were probably a part of this arrangement. In this article the faunal remains are central to the discussion of household organization, and indubitably waste management is a part of this.

This study would definitely benefit from the comparison and inclusion of other zooarchaeological assemblages from waste-related contexts at the site. It would make it possible to test if the patterns from the *bothroi* are specific to the feature type or similar to general trends on site. This would in its turn also provide knowledge about the feature type as well as site function in terms of animal husbandry and economy. It would also add another spatial dimension of the management of waste. While this is clearly a desirable aspect, it is at the moment not possible, because the animal bones from the *bothroi* constitute the largest Asine assemblage from the EH III to the MH I transitional period at the moment. Hopefully more animal bones will be dated to this narrow time period in the near future. This study has focused on the zooarchaeological remains; however, other find categories found in the *bothroi* are important to include in future research. Such studies can

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⁷⁶ I.e. reinforcing the idea of how it should be done at home. Cf. Douglas 1991.

⁷⁷ Åkesson 2012.
⁷⁸ Douny 2007.
⁷⁹ Pasda & Odgaard 2011.
test the hypothesis proposed in this article, as well as contribute to the increased understanding of this pit phenomenon.

Few other zooarchaeological studies in the Aegean area focus solely on bothroi. P. Halstead has studied the animal bones from the Neolithic to Bronze Age settlement Tsoungiza in the Nemea Valley. Some of these bones derive from bothroi, but most are dated to EH I–II. Halstead acknowledges that individual variation within the context types is apparent (i.e. bone content can vary between pits) which suggests that the remains may reflect differential discard. This is consistent with the above interpretation of the Asine bothroi.

THE AFTERLIFE OF A BOTHROS AT ASINE

A few words can perhaps be devoted to the importance of the bothroi after their usage and closing. While erecting House T or perhaps directly after, Bs-7, an infant burial was still visible. On the plan in Fig. 6, all MH graves on Terraces I–III are plotted and we can observe a possible connection between them and the bothroi. Perhaps this meant that people were reminded of the past by the bothroi, at least for a few generations. This visibility does not necessarily mean that the original perception of the feature, i.e. as a pit, was transferred. The remains—a circled coloration and clustering of pottery, could be enough for it to transform in function and importance. In this sense, the bothroi were perhaps long-lived in prehistoric memory, although this is more of a speculative suggestion. In either case, the construction and use of bothroi was abandoned, and this happened quite abruptly. Could it be in association with new-coming ideals or migrants? Perhaps the settlement grew and bothroi fell out of fashion, because the spatial social organization changed? Since we see similar trends elsewhere on the mainland, perhaps these questions should be more regional relevant as well. Regardless of what processes triggered its existence and disappearance, the bothros can provide a good example of the social dynamics of this transitional period, in the sense of activity, function, and management of the household.

Concluding remarks

In this paper the EH III/MH I bothroi of Asine have been examined from a zooarchaeological perspective. The faunal remains from the features have also been studied by means of correspondence analysis (CA), in terms of species composition and body parts’ distribution. The CA of body parts distribution revealed a strong pattern related to taphonomy, most probably to post-depositional processes affecting the assemblages. This pattern consisted of higher proportions of cranial and compact fragments from the upper extremities. The fact that such a pattern can be visualized and strongly indicated by means of CA opens up to future studies of the identification of cultural versus natural processes in a specific material.

One important result is that the diversity of the faunal remains’ distribution in the bothroi further problematizes the view of them as functionally one type of unit. It is possible that they were tied to different activity areas within the settlement. Some were storage for grain or other food, some perhaps drying pits for food. Most, maybe all of them, ended up as refuse pits. Some were reused for burial, and some were not. The common denominator is the morphology of the pits and the synchronicity in the closing of them.

In this contextual and zooarchaeological study, I propose that the bothroi were part of the household organization. In that sense, they could have been connected to the cultural formal idea of home for many of the inhabitants at Asine. Even if this theory might suit the bothroi at Asine, it is however hard to use for explaining the multitude of bothroi at Lerna IV. As Weiberg proposes, the digging of this multitude of bothroi can indeed be seen as meaningful. However, the filling of them might also have been significant actions for the prehistoric people, but perhaps in another sense. Refuse disposal was necessary at Asine, just as in any other society. I have proposed there was an intentional waste management strategy tied to the filling and closing of the bothroi. This waste management should be connected to activity areas of butchering or consumption, as well as to formalized ideas of where to throw certain remains of certain animals.

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81 Halstead 2011, 780, 783.
82 Bothroi are called pits, a category which seems to include other types of pits such as suggested cisterns (e.g. EH I Cistern 2) (Halstead 2011, 783). This makes it hard to in detail use this study as comparative material.
83 Halstead 2011, 782–784. For example, the animal bones from Pit 55 contained remains of many neonates, but low degrees of gnawing, post-neonatal fragmentation, and no cattle, while Pit 32 contained higher fragmentation and gnawing, but few neonates.
84 Nordquist 1987.
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