Cremations of the Early Iron Age from Mound 36 at Voulokalyva (ancient Halos) in Thessaly: a bioarchaeological appraisal

Anna Lagia

Anastasia Papathanasiou

Zoi Malakasioti

Foteini Tsiouka

Zusammenfassung

Brandbestattungen der frühen Eisenzeit im Hügel 36 von Voulokalyva (antikes Halos) in Thessalien: Eine bioarchäologische Auswertung. Im Zusammenhang mit der Untersuchung des früheisenzeitlichen Hügels 36 von Voulokalyva in Thessalien werden die Probleme dargestellt, die mit der Fundinterpretation verbrannter Knochen verbunden sind. Die Knochen können entweder aus primären Brandplätzen stammen oder sekundär deponiert worden sein. Ein Vergleich mit gleichzeitigen griechischen Fundorten wird durchgeführt, um durch eine Gegenüberstellung von kontextuellen Parametern und Merkmalen verbrannter Knochen Informationen zur Bestattungspraxis zu erhalten. Die dabei erzielten Ergebnisse werden mit den Funden vom Hügel 36 verglichen. Es kann gezeigt werden, dass der Hügel vielfältig genutzt wurde und über einen langen Zeitraum höchstwahrscheinlich dem Ahnenkult diente. Es können Ähnlichkeiten zwischen Voulokalyva und Lefkandi festgestellt werden, für das ebenfalls komplexe Bestattungsriten vermutet werden. Im Hügel 36 konnten Erd- und Brandbestattungen sowohl für Erwachsene als auch für Säuglinge nachgewiesen werden. Allerdings wurden nur vereinzelte Säuglingsbrandgräber zwischen älteren Individuen gefunden.

Abstract

Through the analysis of the EIA Mound 36 at Voulokalyva in Thessaly we lay out the complexities involved in interpreting a context with cremated bones either as a primary cremation area or as a secondary deposition. We first provide comparative evidence from sites of this period from Greece to allow for correlations between contextual parameters and osseous characteristics to emerge and inform about the burial practice. We then contrast this evidence to finds from Mound 36 to demonstrate that its use was multifaceted and lasted for an extended period of time, most likely serving as a place of reverence and ancestral cult. Attention is drawn to similarities between Voulokalyva and Lefkandi, for which a complex burial program has also been suggested. The mound comprises inhumations and cremations of adults and infants, although cremated infant remains were found only sporadically among the cremated remains of more mature individuals.

1. Introduction

The Early Iron Age (EIA) mounds of ancient Halos have for a long time preoccupied researchers in terms of their meaning.[1] The dominant presence of cremations in more than 40 mounds surveyed in the area, following a period characterized by inhumations, has led to the formation of many hypotheses concerning their occurrence.[2] In this paper we try to fill a void in the assessment of the significance of the mounds by analyzing the diverse contexts of the precincts (περίβολοι) of a single mound from this area, Mound nr 36 at Voulokalyva, in relation to the presence of human skeletal remains. Curation of the majority of the human skeletal remains from this mound during a recent excavation by the IG Inspectorate of Prehistoric and Classical Antiquities at Volos has made this appraisal possible.

A search for the meaning that mortuary rites and rituals may have had for the living, their possible symbolism, and their relation with social, political, economic and cosmological phenomena has deep roots in anthropology.[3] It has for a time become apparent that to fully appreciate the significance of a mortuary context, the integration of all of the parameters involved is important, including a comparison of the osteological evidence with feature content and structure.[4]

Our analysis begins with the premise that the remains of a deceased, who was cremated, are either left at the place of the cremation, which therefore also served as the place of burial, or, are transferred elsewhere to be buried as part of a secondary burial rite, or receive no burial being scattered over land or water.[5] In the latter cases, the identification of the cremation area or the pyre, as well as the differentiation of the remains of pyres from secondary burials and deposits with pyre debris can be a problem.[6] This difficulty has been addressed archaeologically for the EIA in Greece by Stambolides,[7] however integrated anthropological and archaeological investigations are pending.

In the following overview it becomes apparent that the quantity of cremated bone may vary according to context; a correlation, nevertheless, of bone weight with the occurrence of primary or secondary burial contexts is not straightforward. Experiments as well as the evidence from modern crematoria suggest that, depending on the sex, age and state of health of the deceased, an adult skeleton that is completely cremated weighs on average 2400 grams.[8] However, at the mound of Voulokalyva, as in other EIA cemeteries discussed below, the mean quantity of bone per context often weighs considerably less, i.e. frequently less than an average of 50 grams.

Furthermore, inhumations and cremations may coexist at one site, as is the case for Mound 36, where inhumations of infants and adults are found *in situ* among or underneath pits containing sparse fragments from cremations. The latter are often encountered scattered among well-preserved logs of charred wood, which generally preserves less than cremated bone.[9] Contextual evidence therefore suggests that taphonomic agents do not suffice to explain the scarcity of cremated bone in the mound. Instead, questions relating to the formation of the assemblage and the diversity of rites performed on the mound need to be addressed.

Before we proceed with the analysis of Mound 36, comparative evidence from Late Helladic (LH) IIIC and EIA cremations in Greece that have also been analyzed anthropologically, will be presented. Our aim is to let correlations between mortuary and osseous characteristics to emerge, thus providing, information on the mortuary practices. We then contrast these results with our evidence from Voulokalyva.

2. Overview of EIA cremations in Greece

Recent studies concerned with the reconstruction of funerary rituals from different periods and regions in Europe stress the difficulty – and often the lack of appropriate terminology – of distinguishing among the different structures found in funerary contexts.[10] An overview of the sites in Greece, where cremations of the LH IIIC and EIA have been analyzed anthropologically, shows that human skeletal remains that have undergone thermal alteration are found in the following contexts (Tab. 1):

1. Wace, Thompson 1912, 1–29. – Efstathiou, Malakasioti, Reinders 1990, 31. – Malakasioti, Moussioni 2004. – Stissi, Kwak, de Winter 2004, 94–98. – Malakasioti, Tsiouka 2011.

2. Georganas 2002, for example attempts to refute earlier theories that attribute the erection of the mounds to settlers from the Northern Balkans by linking the new mortuary differentiation to a desire by the local society to create a new social identity by detaching itself from past traditions. Morgan (Morgan 2003, 192–195. – 2006, 246–247), on the other hand, employs the funerary variability observed in the tumulus cemeteries of Halos and in Thessaly overall, to support a more complex than conventionally view of the notion of *ethnos* in early Greece.

3. Rakita, Buikstra, Beck et al. 2005. – Morris 1992.

4. Beck 2005, 152.

5. Rakita and Buikstra (Rakita, Buikstra 2005, 104) draw attention to the possibility that the total absence of human bone from the ashes of a pyre may reflect an attempt to completely remove the corpse from the world of the living rather than merely to transform it.

6. McKinley 2006.

7. Stampolides 2001a.

8. Ubelaker 2009.

9. Marquer, Lebreton, Otto et al. 2012.

10. Polfer 2000. – McKinley 2000a.

Site	Context of cremated remains (sample size)	Average Weight (grams)	Range of weights	Mean maximum fragment size (mm)	Researcher
Mound 36, Voulokalyva, Thessaly	Unurned (74)	73.2	3–591	47.2 (range: 3.6–84)	This study
Perati, Attica	Urns undisturbed (3)	968	410–1741	78.3	Paidoussis, Svarounis 1975
	Unurned, perhaps from disturbed urns (9)	342.2	1–1112	84	
Lefkandi, Euboea	Pyres (42)	39.6	1–234	49.8	Musgrave 1980
	Urns (3)	1661.7	1168–2152	93.1	
Lower Gypsades, Knossos	Urns (11)	552.7	280–950	73.2	Callaghan, Coldstream, Musgrave 1981
Knossos North Cemetery	Urns (74)	650	1–2324	71.4	Musgrave 1996
Kavousi, Crete	Primary cremation burials (14)	1600.4	1121–2134		Liston 1993
	Disturbed cremations (34)	529.1	18–1102		
	Urns (3)	14	9–19		Liston 2007
Pézoulos Atsipadhes, Crete	Urns (3)	660	0–1780		Agelarakis, Kanta, Moody 2001
Agora, Athens	Urn (1)	1345			Liston, Papadopoulos 2004
Torone, Chalkidike	Urns (60)	301	9–1522	53	Musgrave 2005
Kerameikos, Athens	Urns (4)	595	260–1000		Lagia 2007

Tab. 1. Average weights, range and maximum fragment size of cremated human bone from diverse EIA contexts in Greece.

2.1 Pyres and Cremation areas that also served as the place of burial, or Cremation Burials

Anthropological analyses of undisturbed cremation areas that also served as the burial are only known from the Late Geometric (LG) (second half of the 8th c. BC and Early Orientalising) site of Kavousi in Eastern Crete.[11] At this site, *in situ* cremations were found in cist graves that intruded in the settlement area of an earlier deposit of the Late Minoan (LM) IIIC and Subminoan period (12th–11th c. BC). They were identified as such *in situ* cremations due to the presence in the cists "of anatomically ordered but completely calcined skeletons".[12] Remarkably, many joints of the skeletons were found flexed,[13] because of contraction of the tendons during the exposure of the body to high temperatures. This effect is known from experimental pyres, modern crematoria, as well as victims of modern and ancient thermal catastrophes.[14] The retention of anatomical order is confirmed by experimental studies which demonstrate that after the collapse of a pyre, provided that the remains were not manipulated during cremation, "the skeletal remains will retain anatomical order which will be clearly visible in the final stages".[15]

The stone-lined cists had a rectangular form, 1.80–2 m × 1 m in area, and were superficial above ground, which enabled the flow of adequate oxygen to the pyre.[16] The experimental simulation of the pyres suggested that the walls of the cists sufficed "to retain the falling logs, and to provide additional support and structure to the pyre during its final and least stable phases".[17] Pieces of charcoal were found in addition to the burned soil, bedrock and stones on the sides and floors of the cists. The analysis of the skeletal remains

11. Gesell, Day, Coulson 1995.

12. Liston 1993, 125–126.

13. Liston 1993, 122 and figs. 6/2–5.

14. Heglar 1984. – Capasso 2000, 1345.

15. McKinley 2000b, 407.

16. For this reason no ventilation channels were found as has been reported for deeper pyres, Liston 1993, 45.

17. Liston 1993, 118.

demonstrated that most areas of the skeleton were present, while the average weight was 1600 g, ranging between 1121 to 2134 grams.[18] The preserved weight of the cremation burials was found to be significantly different from the disturbed primary cremations at the site. The latter term describes cases where the bones remained in the original place of the cremation, i.e. the cist grave, but were deliberately moved to the side when the grave was reused, or were disturbed after their deposition. On average these weighed 529 g (ranging between 18 to 1102 grams) and comprised 65.4 % of cist burials at Vrondas, a further 27 % of the graves were undisturbed cremation burials.[19]

2.2 Pyres or Cremation areas that did not serve as the place of burial

Such contexts can either be individual or collective and are known as *ustrina* in Roman archaeology.[20] They are often accompanied by postholes, beneath or in their immediate surroundings, for posts which, according to ethnographic evidence, may have served to stabilize individual pyres.[21]

Pyres are frequently situated in the vicinity of the secondarily deposited remains, with little or no associated architecture; the dimensions of a pyre are equivalent to a human body or larger (i.e. 2 × 1 m), they are rectangular or oval in shape, and oval in cross section, with a depth of 70–80 cm, and there is a distinct dark coloration all around it due to the burned soil.[22] They usually contain logs of charred wood, a layer of pebbles or stones around it and under the deposit, which may have helped with ventilation, a layer of ash, 10–40 cm thick,[23] as well as minimal amounts – no more than 50 grams – of small fragments of cremated human and animal bone in addition to sherds dispersed in a relatively thick layer of black soil. Only two such pyre sites were identified at Kavousi and were distinguished from ash dumps by the presence of "little or no associated architecture, minimal amounts of cremated human bone, and burned soil and stone around and under the deposits of ash".[24]

Cremation areas that were consecutively or collectively used by a community may have occupied an area of 50–100 m² with a varying area and depth.[25] Such an area has been identified at Palaio Gynaikokastro in Macedonia, where a mound of similar structure to Voulokalyva but of an earlier date (LH IIIC to the 9th c. BC) is located. The mound comprises twelve precincts with 542 cinerary urns. On its northwestern borders the excavator identified an area of approximately 50 m², characterized by a 30–50 cm thick layer of ash and ample evidence of scattered bone suggesting it was an area where consecutive cremations took place for an extended period of time.[26]

Single pyres that did not serve as the place of burial comprise one of the most challenging contexts given the lack of specialists in the *anthropologie de terrain*[27] and the proclivity to attribute the sparse presence of bone to post-depositional disturbance. A most intriguing example in this category comes from the site at Lefkandi in Euboea where pyres and inhumations coexist. The paucity of skeletal remains from the majority of these has been attributed, among other, to postmortem destruction due to the aggressiveness of the soil. Soil analyses, however, do not confirm this.[28] In stark contrast to the meager bone in the pyres, large quantities of cremated bone (1662 g on average) were found in three urns buried in shaft graves of the "trench and hole" type known from Athens.[29]

It is interesting that certain pyres from Lefkandi have the characteristic irregular shape, depth, size and features of cremation areas.[30] "On the floor of some of the pyre cuttings were found large boulders, blackened and calcined by fire, possibly placed there to produce a good draught and a higher temperature".[31] Broken pottery and personal offerings burned with the body were also present. The intriguing absence of burned bone from 33 out of the 71 excavated pyres and the occurrence of a few bone fragments in only 38 pyres, all of which contained a fill of black ash, raised "the question as to whether the bones were normally collected after cremation".[32] Based on the combination of archaeological and anthropological parameters the occurrence of a complex funerary ritual has been suggested for Lefkandi: while certain pyres served as the cremation area, others were also the site of burial. Moreover, urn burials in cist or shaft graves were practiced while secondary depositions of to-

18. Liston 1993, tab. 6/1.
19. Liston 1993, tab. 6/1.
20. Polfer 2000, 30.
21. Wahl, Wahl 1983.
22. Keiling 1962.
23. Stambolides 2001b, 192.
24. Little 1993, 45.
25. Polfer 2000.
26. Savvopoulou 2001, 171.
27. Duday 2006.
28. Themelis 1980, 210.
29. Sackett 1980, 200.
30. For example Pyre 8 at Toumba cemetery (Popham, Sackett, Themelis 1980, Plate 166); Pyres 2 and 3 at Skoubris cemetery (Plate 90).
31. Sackett 1980, 201.
32. Themelis 1980, 210–212.

ken cremated bones with offerings also seem to have been present.[33]

Concerning the pyre areas at the Protogeometric (PG) Kerameikos where urns and ash pits (Aschengruben) have been found, Kraiker and Kübler suggest that the pyres took place close to the area where the urns were buried, in non-permanent cremation structures.[34] The ashes, including earth from beneath the pyre and even the sherds that were burned with the dead, the remains of the jewelry and weaponry, were gathered and placed in the hole of the grave. According to Kraiker and Kübler, this was done rather carelessly, which explains why many sherds that were burned with the dead are often missing. Remarkably, McKinley has suggested that "the inclusion of pyre debris in many grave structures suggests not only the proximity of the pyre site, but that burial occurred shortly after cremation," as bone for burial, unlike pyre debris, may be more easily curated and transported.[35]

A similar account has been offered to explain the formation of at least some of the cremation tombs at the EIA coastal site of Torone on the Chalkidike peninsula. At Torone, tomb pits are generally circular or elliptical and their diameters never exceed 0.70–0.80 m. No characteristic features of cremation areas have been observed. The pits contained the remains of the pyre (such as charred wood), a small quantity of cremated human bone, along with sherds which were altered by fire. Therefore the excavator believes that for at least some of the graves "the place of cremation was located near enough for these remains to be collected and transferred to or swept into the tomb pit." In order to explain the general lack of such remains in other tombs it is suggested that the pyre may have been at some distance from the cemetery, for example on the beach.[36] The ample evidence of beach material (seashell and smooth leach pebbles) found in the ash suggests that at least some cremations took place on the shore.

2.3 Urned and unurned secondary depositions of cremated remains

These comprise burials in urns or open spaces in which some, or rarely all of the cremated bone was deposited after removal from the cremation site. Such contexts are often wrongly referred to as "secondary cremations" although they are merely secondary depositions of primary cremations.[37] It has been noted that unurned burials are extremely difficult to identify and to differentiate from the pyre debris which remained behind when pyre sites were not completely cleared, or from debris redeposited elsewhere. They are sometimes identified by "the discrete concentration of bones within the grave fill" and are believed to have been contained in an organic container made of textile, skin or basketry that did not survive.[38]

Unurned cremated remains have been found in chamber tombs from the LHIIIC period at Perati in Attica, Elateia in Central Greece, and from the Geometric period at Kavousi and the Knossos North Cemetery in Crete. At the Perati chamber tombs, cremations were an exception comprising 18 out of the 159 inhumations.[39] The cremations from the 12 contexts analysed ranged 1–1741 g with an average weight of 499 g;[40] two of the largest quantities were associated with undisturbed urns, while the lowest came from heavily disturbed contexts. At Elateia cremations form a small minority among the numerous inhumations in the chamber tombs and were found deposited on the floors and in pits of the chambers while three were contained in urns.[41] Unurned cremations apparently form the majority of the deposits at Knossos North Cemetery although the anthropological analysis concentrated on 74 out of the 363 contexts that "definitely came from numbered urns".[42] These yielded one of the largest quantities of urned cremated bone from this period, ranging from 1–2324 g with an average of 650 grams[43]. At Kavousi unurned secondary deposits of cremated bone were placed on the floor surfaces, in corners or doorways, of the abandoned buildings, often together with burned sherds, vessels and ashes.[44]

Urn cremation is a well-known practice in the EIA in Greece though it appears to have been the exception rather than the rule at Perati, Lefkandi (see above), Kavousi and Voulokalyva (see the analysis below). At Kavousi, a context which in many respects is rather unusual in comparison to what is so far known from the mainland, three amphorae were found in two cist graves among primary and dis-

33. Sackett 1980, 202. – Themelis 1980, 214–215.
34. Kraiker, Kübler 1939, 181.
35. McKinley 2006, 86.
36. Papadopoulos 2005, 383.
37. On the inapt use of the term "secondary cremation" as seen from an archaeological point of view see Stambolides 2001b, 198. In a rather different context Piga et al. 2010, 449 note that the term "secondary cremation" is used to describe the occurrence of cremation after the intentional stripping of the flesh.
38. McKinley 2000a. – McKinley 2008, 171.
39. Iakovidis 1969/1970, 32.
40. Paidoussis, Svarounis 1975.
41. Deger-Jalkotzy this volume.
42. Musgrave 1996, 678.
43. Musgrave 1996, 686 and tab. 26.
44. Liston 1993, 46.

turbed cremated remains, containing no more than 20 grams of bone. Liston proposes that these tiny amounts of bone "must represent the deliberate choice of the anatomical area to be buried not merely careless collection, of the cremated remains".[45]

One of the best known examples of urn cemeteries in Greece is the Kerameikos in Athens where cremated remains of the PG period were found mostly in amphorae, in relatively large quantities with well-preserved bone. Furthermore, cremated bone at the Kerameikos was also found in "Aschengruben" or "Brandlöcher"[46] (ash pits) along with pyre debris and sherds. Because these pits include large quantities of burned human bone together with grave goods and pyre debris they comprise unurned secondary deposits rather than ash dumps, with which they share a number of characteristics. A recent analysis of the contents of an Aschengrube from the Kerameikos, which was excavated in the 1930s, showed that it contained, besides charcoal and sherds, 440 g of cremated bone, including large identifiable fragments from the axial and appendicular skeleton.[47] The presence of large diagnosable human bone fragments found among the pyre contents of Brandlöcher is also described in earlier studies.[48]

While no bone weight is reported by E. Breitinger, his description of the inventory of the bones suggests the preservation of a substantial quantity and quality of bone from single cremations. Segments of the cranium with diagnostic parts, large parts of the mandible, long bone diaphyses, and large parts of short bones such as the patellae, talus and calcaneous are included. It is also noteworthy that short bones of the hands and feet such as phalanges, metacarpals and metatarsals, in addition to rib fragments are reported. Considering that such bones are frequently missing, even from well preserved inhumations, the collection of the cremated remains from the pyres from the PG Kerameikos comprise one of the largest quantities of well-preserved cremated bone from this period. All human remains were white, unlike the animal remains found with them, which were blue-black, suggesting that they were exposed to fire for a lesser period of time. According to E. Breitinger perhaps they were thrown onto the pyre towards the end of the cremation process.[49] A later analysis of five previously unstudied cremations from the same cemetery showed a similar, rather good state of preservation of completely cremated remains, the weight of which averaged approximately 600 g (range 240 to 1000 g).[50] Similarly, the cremated human skeletal remains found in urns of the Geometric period at Lower Gypsades in Knossos weigh an average of 553 g and never less than 280 g.[51]

The preservation of a substantial quantity of cremated bone in urns is also known from the EBA mound of Kriaritsi in Chalkidike,[52] which bears morphological similarities to the mound of Voulokalyva, comprising 30 precincts surrounding shafts (θήκες) with urns. Anthropological analysis of the undisturbed urns in and above the precincts showed that the preservation of human skeletal remains in these contexts averaged 800 grams, ranging from 21.5 g (in juveniles), or 294 g (in adults) to 2013 grams.

A smaller quantity of cremated bone was included in the pots at Torone. Anthropological analysis points to an average weight of 301 grams with a range between 2–1522 g.[53] Only three of the 58 analyzed tombs occupy the highest end of this range and two of these are attributed to two individuals. While it is obvious that at least some of the smallest quantities stem from heavily disturbed urns or tombs, a number of urns contain well over 200 grams of bone. The fragmentation size at Torone is also one of the lowest in Greece (53 mm on average), although a bimodal distribution in mean maximum fragment size is noted which seems to reflect disturbance.[54] The absence of very small pieces of bone and the lower weight scores in Torone, as at Lefkandi, according to Musgrave, indicates a disinterest of the mourners in the skeletal remains once the funerary rituals relating to the transformation of the body were completed.[55]

Exceptional cases where most of the cremated remains were carefully collected and placed in an amphora are known from this as well as from other periods in Greece. In the Athenian Agora a richly furnished cinerary urn from the Early Geometric contained large pieces of completely calcined (white) bones that allowed the identification of large anatomical areas such as the skull.[56] The bones weighed 1345 grams and contained the remains of a 30–35 year old female

45. Liston 2007, 63.

46. Kraiker, Kübler 1939, 181. – Kübler 1943, 2–3.

47. Lagia 2007, 277. – Ruppenstein 2007, 30.

48. For example in Aschengrube 42 there were apparently enough diagnosable fragments to allow Breitinger to conclude that they belonged to a man, Kübler 1943, 3.

49. Breitinger 1939, 260.

50. Lagia 2007.

51. Eleven out of the 35 urns in a chamber tomb of moderate wealth were analyzed anthropologically: Callaghan, Coldstream, Musgrave 1981.

52. Asouhidou 2004. – Triantaphyllou 2004b.

53. Musgrave 2005, tab. A/1, graph A/1.

54. Musgrave 2005, graph A/4.

55. Musgrave 2005, 248. – Musgrave 1980, 444.

56. Liston, Papadopoulos 2004.

and a fetus/newborn (8 to 9 lunar months). Such exceptional preservation of urned remains is also known from prominent burials of later periods[57] and points to a differential handling of the cremated remains during all stages of the funerary process.

2.4 Deposits (pits) filled with discarded pyre remains (debris), or ash dumps

These are deposits of apparently discarded ashes with minimal amounts of bone and no signs of burning of the soil or the walls of the enclosure. They differ from graves in that they contain what is left behind, rather than the bone that is selected for burial elsewhere. "Sweepings from a cremation event should include a mixture of very small fragments of bone, ash, and other debris".[58] Ash dumps at Vronda comprise deposits containing large quantities of ash and burned soil, small amounts of human bone and burned pottery. There is a lack of architecture and of evidence of *in situ* firing on the underlying soil.[59] It is interesting that in this site joins were found between bone and pottery fragments from the dumps with likes from adjacent graves confirming the observation that "the inclusion of pyre debris in many grave structures suggests the proximity of the pyre site".[60] As explained above, although the ash pits, which are known as "Aschengruben" and "Brandlöcher" from the Kerameikos in Athens, bear many features of ash dumps (i.e. they describe a hole with ashes, charcoal and earth from the pyre), in fact they comprise unurned secondary deposits because of their inclusion of large quantities of cremated bone and burned grave goods.

2.5 "Smoked" bone

Inhumed bone that underwent incomplete combustion after decomposition of the corpse forms a special category of skeletal remains bearing evidence of thermal alteration. Experimental evidence has shown that such color patterning cannot be the result of cremation of bones with flesh on them.[61] Smoked bones have been identified in a number of prehistoric contexts in Greece[62] and are most likely related to cathartic rituals within the burial environment.[63]

From this overview it becomes apparent that besides the contextual features in which bones are found, the quantity and quality of the cremated remains is of paramount importance in the interpretation of a funerary context, i.e. one of a cremation burial, a pyre or cremation area that did not serve as the site of burial, or a secondary deposition reflecting secondary burial rites and/or pyre debris. Much larger quantities of cremated bone are found *on average* in cremation burials (either disturbed or undisturbed) and urns compared to that found scattered in pyres that were not further used for burial and in pyre debris. In light of these finds we proceed with the analysis of the mound of Voulokalyva at ancient Halos.

Fig. 1a. Mound 36 at Voulokalyva (ancient Halos) in Thessaly.

3. Mound 36 at Voulokalyva (ancient Halos) in Thessaly

The site of Voulokalyva, situated 1km north of Hellenistic Halos at the Almyros plain in Thessaly, comprises a cemetery of approximately 40 mounds extending in an area of 2.5 km².[64] The site was excavated for the first time in 1912 by Wace and Thompson[65] and much later by the IG Inspectorate of Prehistoric and Classical Antiquities at Volos. In 1999 Mound 36 was intensively excavated by the IG Inspectorate (Fig. 1a). A mantle of stone covered a mound with the dimensions 30.6 × 30.2m and a height of 1m. The mound comprised rectangular, elliptical or irregular precincts that

57. For example at Vergina, Derveni, Nea Michaniona (Musgrave 1990. – Musgrave 1996) and Athens (Charlier, Poupon, Goubard et al. 2009).
58. Beck 2005, 152.
59. Liston 1993, 48.
60. McKinley 2006, 86.
61. Buikstra, Swegle 1989, 252.
62. Duday 1981. – Herrmann 1992, 193, 745. – Triantaphyllou 2004a. – Papathanasiou 2009.
63. Cavanagh, Mee 1998, 112.
64. Efstathiou, Malakasioti, Reinders 1990, 31. – Stissi, Kwak, de Winter 2004, 94–98. – Malakasioti, Mousioni 2004.
65. Wace, Thompson 1912, 1–29.

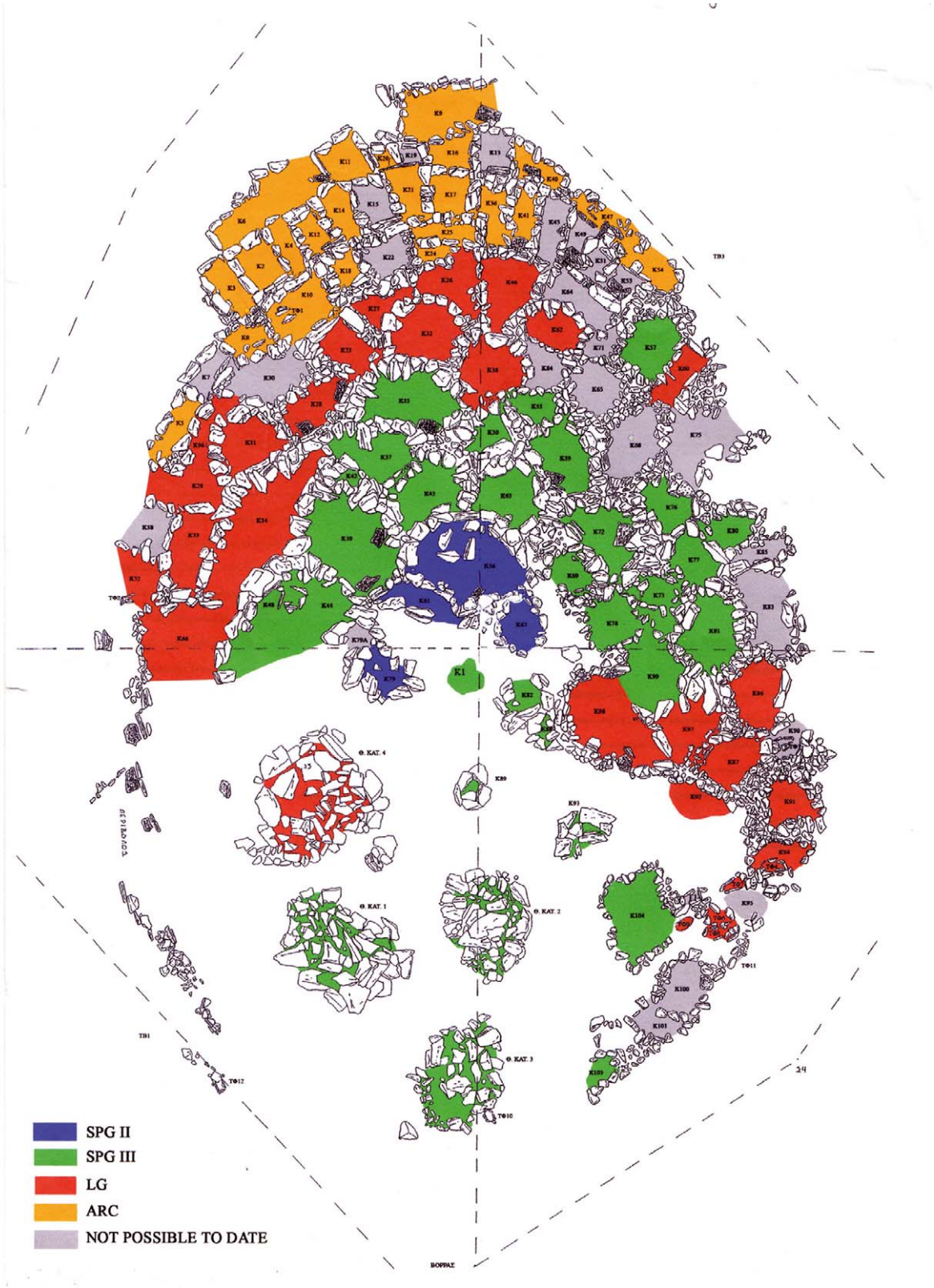


Fig. 1b. Diagram of Mound 36 illustrating its chronological development.

Fig. 2. Precinct 92: Adult inhumation in anatomical order *in situ,* in extended position, along with cremated remains; preservation is very poor.

Fig. 3. Cist grave of an infant.

date from the Sub-Protogeometeric II (SPG II) to the Late Geometric and the Archaic periods (9th to 7th c. BC).[66]

The most startling characteristic of the mound is its concentric/beehive-like structure, in which the earliest precincts served as a nucleus around which the later structures developed concentrically, mostly towards its southern axis (Fig. 1b). During the Archaic period rectangular stone cists of smaller dimensions were added to the southern edge of the mound. Although the scarcity of precincts on the northeastern area of the mound can be partially explained by the intensive use of the land for cultivation, the four earliest vaulted structures are conspicuously situated on the northern part of the mound, set apart from one another and from the tightly built-up precincts on the southern area. It is noteworthy that the majority of infant inhumations were situated on the periphery of the northern part of the mound.

In total, 98 precincts, 4 vaulted structures and 3 urns were excavated, as well as 16 infant and 4 adult inhumations. The precincts primarily comprise the remains of cremations including among other burned human bone. The condition of preservation of the latter differs drastically from that of the inhumations. Offering tables and grave markers (*semata*) were recovered from a number of precincts while pottery and metal objects were abundant. Weapons, exclusively made of iron, appear in the SPG II and increase toward the Archaic period while the amount of pottery decreases.[67] High status items, probably imported, were found in three precincts in addition to three cases of "killing of weapons".

66. Malakasioti, Tsiouka 2011, 613–615.

67. Malakasioti, Tsiouka 2011, 616.

3.1 The Inhumations

The human skeletal remains from four adults, one 10 year old child and ten infants were analyzed anthropologically. The adult inhumed skeletal remains were found in a poor state of preservation in anatomical order *in situ,* in extended position (k. 61, 92) (Fig. 2), or commingled and fragmented among cremated remains (k. 81, k. 93–88). The bones were rather brittle and disintegrated upon lifting and laboratory analysis. In contrast, the skeleton of the ten year old child was in excellent preservation despite its young age, often contended to be responsible for the poor preservation of juvenile bones. Likewise the skeletal remains of most of the infants fared better than those of the adults. This is most likely due to the well-protected microenvironment provided by the large slabs delineating their graves (Fig. 3). Nevertheless, the skeletons of several infants were also fragmented.

The sex and age-at-death of the adults could be determined in only a few cases with some degree of accuracy due to the poor state of preservation of the axial skeleton. Based on metric characteristics of the long bones it appears that at least one adult was male (k. 81). Moreover, the relatively advanced stage of dental wear and cranial suture closure (k. 92), plus the signs of degeneration in the form of osteophytosis on the lower thoracic and lumbar areas of the spines of two adults (k. 81 and ex. 93–88) indicate that they were probably not young at the time of death.

The well-preserved skeleton, including the dentition, of the ten-year-old child was found in precinct 104. Based on the stage of development of the permanent dentition and of secondary centers of ossification the age-at-death could be determined with accuracy. The child shows clear signs of stress episodes during growth in the form of linear enamel hypoplasia, bilateral *cribra orbitalia* and porosity on the

Fig. 4. Precinct 81 (SPG III): The layer of ash is limited within the confines of a fragmented vessel – 212 grams of burned human bone were included.

Fig. 5. Precinct 42 (SPG III): Urn with ash in its surrounding containing 6,9 g of cremated animal fragments.

cranial vault. These are often linked to (although do not cause) premature death due to a weakened state of health.[68] The stress episodes that lead to the formation of the growth arrest lines on the dentition were formed in the ages of 2–3.5 years of age as indicated by the double lines present on the maxillary and mandibular canines.[69] Interestingly, evidence of stress episodes during growth was also observed on the cranial vault of one adult (ex. 93–88) in the form of "healed" porosity.

Finally, the ages-at-death of infants ranged from newborn to 9 months of age based on the stage of crown formation, and the stage of development of the external acoustic meatus, the occipital bone, the neural arches of the vertebrae, and the petrous bone.[70] A number of cranial and long bones show signs of periosteal reaction suggesting the presence of infections at the time of death.

3.2 The Cremated Human Skeletal Remains

Context and Condition of the Burned Human Bone

Cremated human bone in Mound 36 was recovered from 74 precincts in very small quantities (73 grams on average but see below for a finer analysis), fragmented and dispersed in a 10–60 cm layer of ash (mostly at the lower end), often among charred logs of wood, carbonized plant and animal remains, as well as pottery, metal objects and surrounding rocks bearing evidence of exposure to fire.[71] The mound, however, also included a number of precincts with clear evidence of an *in situ* pyre (as inferred by the presence of carbon fill, charred wood, and burned material) but no indication of burned human bone. Furthermore, cremated human bone was found in precincts that did not contain any significant evidence of an *in situ* pyre, but instead, were contained, along with ash, within a limited area inside the precincts, sometimes defined by the boundaries of a fragmented vessel (Fig. 4). Finally, there is limited evidence of burned bone contained in urns deposited in precincts (Fig. 5), and of multiple modes of disposal within the same precinct. For example, an ash dump and an urn appear to coexist with the remains of a pyre in a two-tiered precinct (Fig. 6a).

The areas designated as pyres comprise mostly rectangular, elliptical or irregular precincts with dimensions 1.6 × 1 m on average, although the external dimensions and form of the precincts do not always correspond to the underlying pyre. Even though for some precincts there is evidence of burning on the surrounding stone delineating the precinct, for others no such evidence exists, while the ash layer extends beyond the limits of the overlying boulders, suggesting that these were laid after the pyre (Fig. 6b). What's more, the dimensions of the precincts, which range from 0.40–4.20 m in length and 0.32–2.20 m in breadth, imply that only a number of precincts could have accommodated an adult human body during a pyre. Information from *ustrine*[72] and cremation burials[73] indicate that the size of cremation areas accommodating one or more individuals is generally 2–3 m in length and 1–1.5 m in breadth (Tab. 2). Interestingly, a clear temporal decrease in the size of the precincts is noted, with the smallest dimensions reached during the Archaic period.[74]

68. DeWitte, Woods, 2008.
69. Reid, Dean 2000.
70. Scheuer and Black 2000.
71. Malakasioti, Tsiouka 2011, 613.
72. Keiling 1962.
73. Liston 1993.
74. Malakasioti, Tsiouka 2011, Fig. 9.

Fig. 6a. Precinct 79 (SPG II): An "Aschengrube" with an urn?

Fig. 6b. Precinct 79: A two-tiered cremation, the lower layer of which extends well beyond the limits of the precinct.

Fig. 6c. Precinct 79: A complete fully calcined (white) pelvic bone on the uppermost layer of a double-tiered cremation precinct.

Site (number of cases)	Length (m)	Breadth (m)	Depth (m)	Weight (grams)	Max. Fragment Size (mm)	MNI
Mound 36, Voulokalyva (74)	1.61 (0.40–4.20)	1.06 (0.32–2.20)	0.92 (0.10–1.52)	73.2 (3–591)	47 (3.6–84)	1
Lefkandi, Skoubris Pyres (19)[1]	1.35 (0.60–1.75)	0.65 (0.40–1.00)	55.5 (0.20–1.00)	56.9 (1–126)	55.1 (14–84)	1
Lefkandi, Palia Perivolia Pyres (50)[1]	1.36 (1.00–1.82)	0.67 (0.49–0.90)	35.9 (0.10–0.80)	37.1 (1–234)	48 (25–87.4)	1
Lefkandi, Toumba Pyres (11)[1]	1.61 (1.45–1.80)	0.74 (0.60–1.00)	68.1 (0.25–1.60)	20.2 (3–36)	47 (28.6–65)	1
Lanz, Ludwigslust Ustrine[2]	2.96 (1.80–4.20)	1.57 (1.0–2.60)	0.54 (0.30–1.00)		64 (50–80)	1?
Kavousi cremation burials[3]	2.00	1.00				2
	1.80	1.50				8

[1]Popham, Sackett, Themelis 1980. – [2]Keiling 1962. – [3]Gesell, Day, Coulson 1995.

Tab. 2. The dimensions of the precincts at Voulokalyva in comparison to pyres, ustrine and cremation burials (average and ranges provided).

Fig. 7a. Precinct 93 (SPG III): The segment of a partially cremated (black) spine in articulation *in situ* among large logs of burned wood.

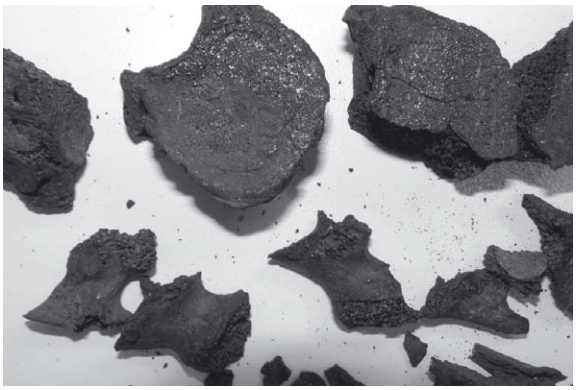


Fig. 7b. The charred vertebrae from precinct 93 found among fully calcined (white) bones.

Although Mound 36 was found in a cultivated field, only its northeastern part and the uppermost layers of the precincts appear to have been affected by cultivation. The architectural elements of the precincts were seldom found disturbed while the innermost portions of the precincts were found intact. The excavation was rather systematic and took place over a period of two years (1999–2001), being halted on occasion by rainfall that flooded the precincts. Due to weather adversities and time constraints the human skeletal remains were not exhaustively excavated and collected, nor was sieving applied during the dig. Nevertheless, the general impression during the excavation concerning the quantity of burned bone was that of a handful of bone per precinct. Laboratory analysis confirmed this observation for the majority of the precincts.

Furthermore, unlike the adult and infant inhumations on the mound, which were found in anatomical order *in situ*, there was scarcely any indication of burned bones found in anatomical order *in situ* at Voulokalyva, as has for example been found at the pyre burials at Kavousi. However, at least one single exception of cremated bones *in situ* appears to have existed: in one of the earliest precincts (93) a segment of a partially cremated (black) spine seems to have been found articulated *in situ* among large logs of charcoal (Figs. 7a–b). Given the excellent preservation of the typically brittle logs of wood in the vicinity of these bones it is hard to explain the absence of the remaining parts of the skeleton in terms of diagenesis.[75]

A complete fully calcined (white) pelvic bone on the uppermost layer of a double-tiered cremation precinct of the SPG II (Fig. 6c), encountered at least once during the excavation, is relevant to this observation. Although the pelvic bone fragmented during recovery, large pieces were preserved during the laboratory analysis. Its excellent preservation in a layer close to the surface is noteworthy, given that studies on skeletal preservation have shown that the quality of preservation decreases in burials located closer to the ground surface.[76] Moreover, experimental archaeology has revealed that the largest part of fragmentation of bones that underwent firing takes place soon after the cremation process rather than cumulatively with time.[77]

Therefore, the excellent preservation of cremated bone, either *in situ* amidst charred logs of wood or mixed in a superficial layer, in at least two precincts at Mound 36 suggests that the preservation pattern of the skeletal remains at Voulokalyva cannot be fully attributed to freezing, trampling, or other diagenetic/taphonomic factors that may have destroyed the majority of the bone from each pyre. Instead factors related to the cremation process and ritual need to be called upon in order to explain their void.

Weight of the Cremations

At Voulokalyva the average weight of cremated bone per precinct is 73 grams (Fig. 8), a quantity that is much lower than that "expected" from known archaeological *in situ* pyres that also served as burials, or from modern crematoria in which the weight is approximately 2000 grams or more[78] and varies between 1000–3000 grams per skeleton. The weight is still low compared to incompletely recovered (as a result of disturbance) *in situ* pyre burials for

75. Overall, 140 grams of burned bone were recovered from this precinct ranging in color from the fully calcined (white) cranial, cervical and long bone fragments to the black vertebrae.

76. Stojanowski et al. 2002.

77. Stiner, Kuhn, Weiner et al. 1995.

78. Wahl 2008, 149.

which 529 grams is reported, or to urn cremations where the mean weight ranges between 300–1600 g (Tab. 1 and overview above). Instead, the mean quantity of burned bone at Voulokalyva corresponds to the lowest values known from archaeological contexts of the EIA in Greece, resembling the pyres from Lefkandi.

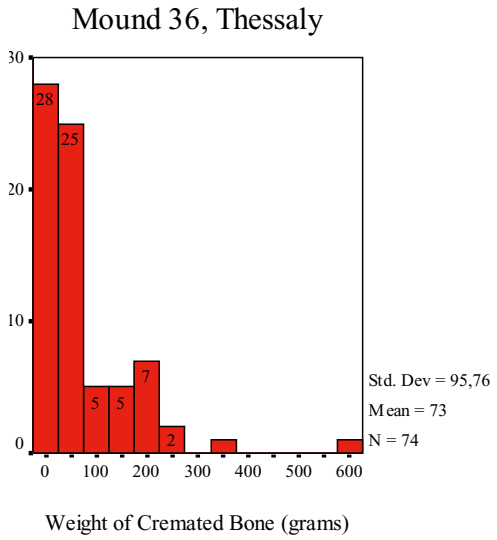


Fig. 8. Distribution of the weight of cremated bone (number of cases) in the precincts.

Remarkably, the quantity of burned bone from most, but not all of the pyres from Voulokalyva, corresponds to what is attested for cremation areas (ustrine) from Central Europe, which bear all the evidence of *in situ* pyres but contain tiny fragments of burned bone.[79] This similarity becomes apparent upon closer examination of the pattern of distribution of the weight, which demonstrates that the majority of precincts (55/74 or 74 %) contain less than 100 grams of bone (29 grams on average), while one fourth of the precincts (19/74 or 26 %) contain 201 grams on average. It is noteworthy that the latter originate from precincts with dimensions of a pyre "typical" for an adult, or from precincts in which the cremated bone and ash appear to be constrained within an area delimited by a broken vessel, while indications of *in situ* cremation appear to be absent. It is striking that a similar distribution of weights has been noted for Lefkandi but not for Torone where only 31.7 % of the urns weighed less than 100 grams.[80]

Furthermore, a clear correlation between the weight of burned bone and the length of the precincts is apparent (Tab. 3, Fig. 9). Given the temporal decrease in size of the precincts, it is probably not surprising that the average weight per precinct also follows a temporal trend, although not as unequivocal (Tab. 4, Fig. 10).

Weight of Cremated Bone

Length of precinct (m)	Mean	N	Std. Dev.
0.1–1.00	46.9	10	64.6
1.01–2.00	63.8	49	97.4
2.01–3.00	121.3	12	105.1
3.01–5.00	185.0	1	
Total	73.2	74	95.8

Tab. 3. Correlation between the length of the precinct and the weight of cremated bone.

Weight of Cremated Bone

Chronology	Mean	N	Std. Dev.
SPG II	114.2	2	87.1
SPG III	81.7	23	75.3
LG	133.0	18	149.3
Archaic	26.4	16	31.5
Total	*83.5*	*59*	*103.8*

Tab. 4. Correlation between the chronological period and the mean weight of cremated bone.

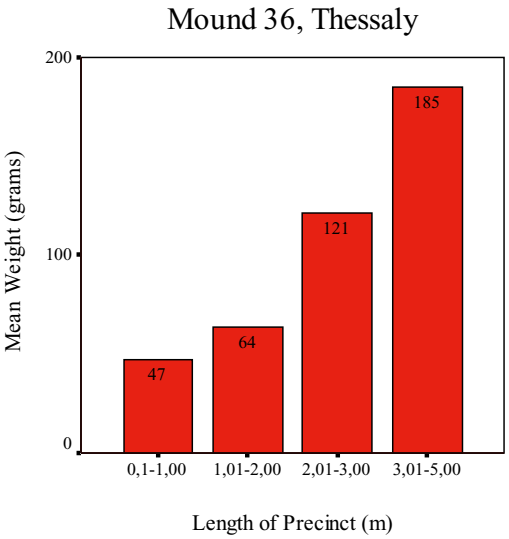


Fig. 9. Mean weight per precinct in relation to the length of precinct.

79. Keiling 1962.

80. Musgrave (Musgrave 1980, 443) notes that 77 % of the Lefkandi cremations weighed less than 50 g. – For Torone: Musgrave 2005, 246.

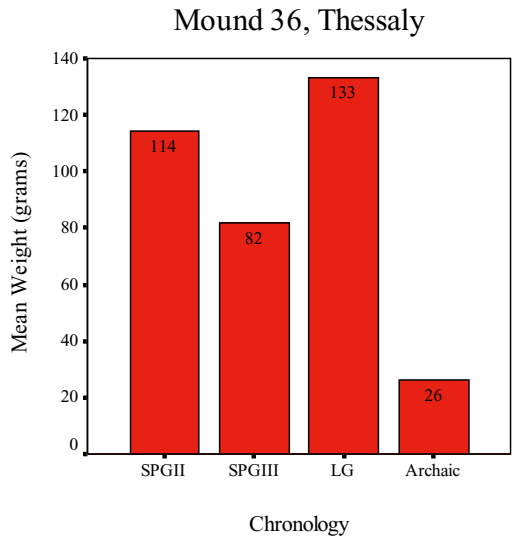


Fig. 10. Mean weight per precinct in relation to chronology.

Maximum Fragment Size

The average maximum fragment size (MFS) at Voulokalyva is 47 mm with a range of 3.6–84 mm (Fig. 11). Following the pattern of weight, the fragment size is larger in the larger precincts (Tab. 5, Fig. 12) while it decreases temporally (Tab. 6, Fig. 13). This latter fact is a remarkable observation given that it is the reverse to what would be expected if fragmentation was the result of weathering, including trampling due to herding and cultivation. As noted above, experimental archaeology has shown that fragmentation due to firing, unlike that due to weathering and fossilization, takes place immediately after burning, "within the same time frame as human activities at a site".[81] The pattern of fragmentation at Voulokalyva, therefore, reflects activities on the mound during the immediate period of its use, or/and rituals related to the formation of the burned bone assemblages in the precincts.

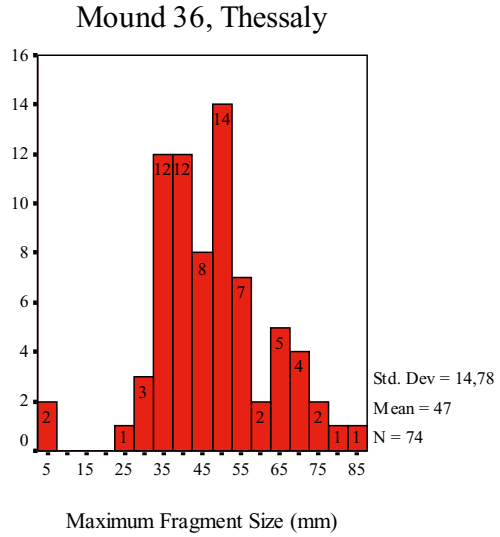


Fig. 11. Distribution of the maximum fragment size per precinct (nr of cases).

It is rather interesting that in this parameter as well, the cremated bones from Voulokalyva resemble the pyres from Lefkandi, in which the mean maximum fragment is 49.8 mm.[82] In both sites the MFS is much smaller than that of urned bone from diverse sites, which ranges between 70–90 mm on average.[83] Initially, the small size of the cremated bones from the pyres of Lekandi was attributed to "deliberate pounding by the mourners to reduce all the bones to a uniform and convenient size" as in modern crematoria[84] – although these bones were found in pyres rather than urns. In contrast, the bones from the exceptional three intact urns from Lefkandi were much larger than those from the pyres, averaging 93 mm. In later publications this view was revised and the effects of disturbance were considered.[85] Of note, the practice of pounding in modern crematoria produces tiny fragments of bone in the scale of 10–20 mm,[86] a size that is considerably smaller than that recorded from diverse archaeological contexts in Greece.

Maximum Fragment Size

Length of precinct (m)	Mean	N	Std. Dev.
0.1–1.00	45.6	10	16.7
1.01–2.00	45.0	49	12.3
2.01–3.00	55.4	12	20.8
3.01–5.00	66.0	1	.
Total	47.2	74	14.8

Tab. 5. Correlation between the length of precincts and the maximum fragment size.

81. Stiner, Kuhn, Weiner et al. 1995, 230.
82. Musgrave 1980.
83. The average MFS for the 60 urns from Torone is deceiving. As noted by Musgrave 2005, 248 and graph A/4, the undisturbed fragments at Torone were on average much larger than those from disturbed urns.
84. Musgrave 1980, 443.
85. Musgrave 2005, 248.
86. Bontrager, Nawrocki 2008, tab. 13/3.

Maximum Fragment Size

Chronology	Mean	N	Std. Dev.
SPG II	77.0	2	9.9
SPG III	50.5	23	16.1
LG	49.8	18	17.0
Archaic	42.6	16	9.8
Total	*49.0*	*59*	*15.8*

Tab. 6. Correlation between the chronological period and the maximum fragment size.

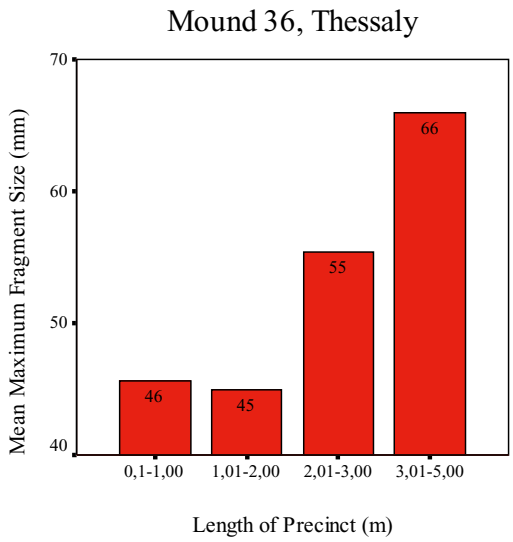


Fig. 12. Mean maximum fragment size in relation to length of precinct.

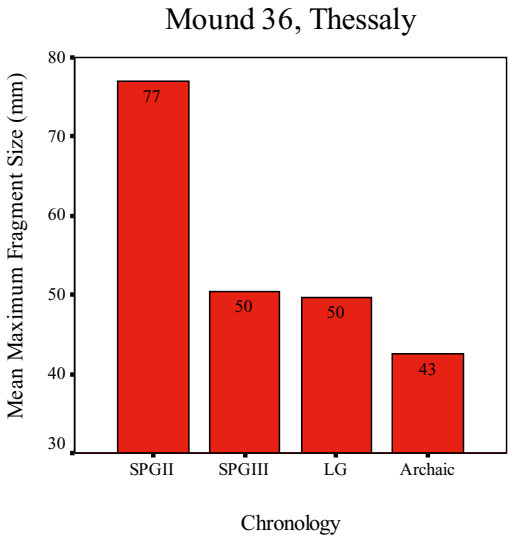


Fig. 13. Mean maximum fragment size in relation to chronology.

Color (grades of combustion)

The majority of cremated bone at Voulokalyva is fully calcined (white) at least on the outer surface but frequently also on the inner surface, suggesting that many bones reached temperatures above 700°C[87] (Fig. 14).

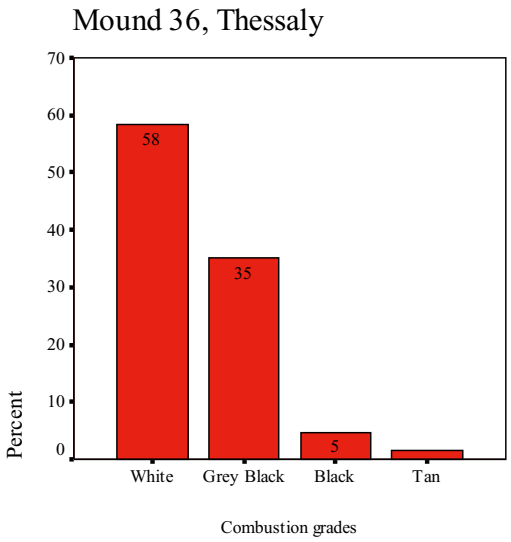


Fig. 14. Representation of the different grades of combustion among the burned skeletal fragments.

Nonetheless, the co-occurrence of different colors within the same bone,[88] known as the "sandwich effect",[89] is also the case at Voulokalyva (Figs. 15 a–b), as is the coexistence of different combustion grades within the same precinct reflecting the dynamic nature of the burning of a body.[90] The pattern of bone color at Voulokalyva accords with the cremation of fleshed bodies rather than of "dry" bone.[91] In a few cases stark differences in color occurred among the bones from a single precinct. One such case with a rather well-preserved fully carbonised (black) vertebrae found *in*

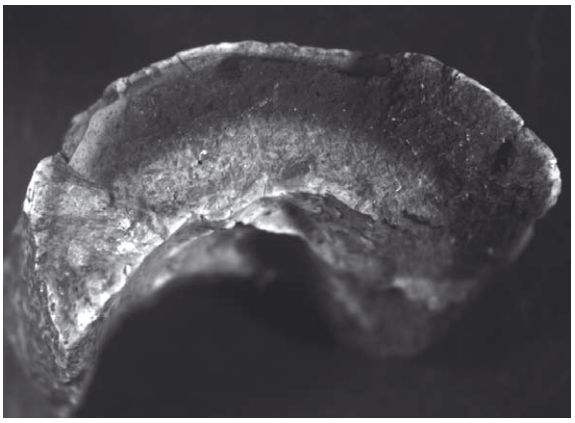
87. Wahl 2008, 150 and tab. 9/1.

88. The colors that usually co-occur are grey-blue on the outer cortex and black on the diploe/spongious part and the inner tables.

89. An effect that is due to the inward direction of bone oxidation, McKinley 2008, 165.

90. Many recent studies have demonstrated how the burning of a body is not a homogeneous process but instead is shaped by intrinsic factors related to the "tissue shielding the bone" (Symes, Rainwater, Chapman et al. 2008, 32–35) and the thickness of the bone itself, as well as by factors linked to the form of the pyre, the quality and quantity of wood, the sufficiency of oxygen supply and time for the body to oxidize, the weather conditions including wind and rain, and the presence of biers and wrapping material (McKinley 2008, 165–167).

91. Buikstra, Swegle 1989, 252.



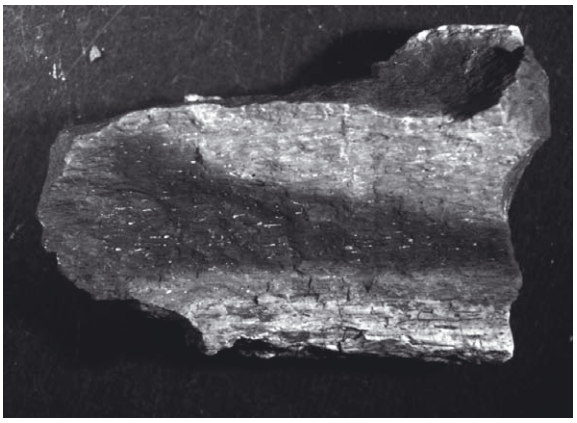


Fig. 15a and b. The co-occurrence of different colors within the same bone (the "sandwich effect").

Fig. 16. The characteristic "checked" appearance on the surface of bones burned "fresh".

situ among fully calcined cranial and long bone fragments was noted above and is corroborated by the presence in other precincts of incompletely cremated bones of the back of the cranium. Given that the back of the body is among the areas that are slower to burn,[92] it is rather likely that the bodies were laid supine during the pyre.

Surface Changes (fracture pattern)

The surface of the bones bears the characteristic "checked" appearance of cracks that are perpendicular and parallel to the main axis of the bone (Fig. 16). These are produced when bones that bear a significant component of organic material, i.e. that are fresh, "green", or fleshed, are burned.[93] The warping and longitudinal cracking present on many diaphyseal fragments is also characteristic of bones that have been burned "fresh".

Skeletal representation

The skeletal elements that are most frequent among the cremated bone from Voulokalyva principally comprise fragments of the long bones (74 %). Cranial fragments form only 17 % of the recognizable elements, while bones from the rest of the axial skeleton are minimally represented (Fig. 17) and stem mostly from the precincts with a sizeable quantity of skeletal preservation, i.e. the larger and earlier precincts. Studies on skeletal preservation in a variety of contexts have demonstrated that long bone fragments are, due to their resilience, the second most commonly preserved skeletal category after the cranial remains.[94] Moreover, surveys of secondary burial contexts have shown that the skull is the most frequently preferred element for secondary deposition.[95] In cremation contexts McKinley notes an apparent random selection of skeletal elements in deposits, with a predominance of skull fragments, whereas in burials fragments from each of the four skeletal areas are represented.[96] Liston reports that most areas of the skeleton were represented in the cremation burials at Kavousi, while both skeletal representation and weight differed significantly in the disturbed cremation contexts.[97]

92. Symes, Rainwater, Chapman et al. 2008, Fig. 2/8. – Fairgrieve 2008, 47.

93. Buikstra, Ubelaker 1994, 97.

94. Stojanowski 2002. The larger anatomical areas such as the skull, pelvis and spine also produce many fragments due to their substantial surface area, Symes, Rainwater, Chapman 2008, 218.

95. Bello, Andrews 2006, 9.

96. McKinley 2000b, 415. – McKinley 2008, 173.

97. Liston 1993, 127.

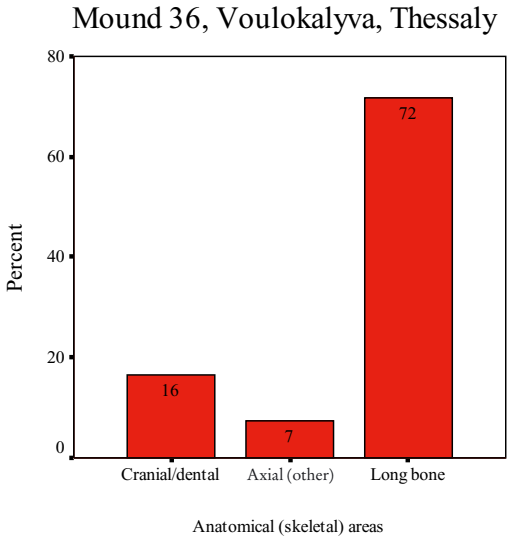


Fig. 17. The distribution of skeletal areas represented among the identifiable burned human fragments.

Furthermore, at Voulokalyva, tooth roots, commonly found in cremations, were only present in four cases, while small bones such as the carpals and tarsals, or the petrous of the temporal bone which tend to be preserved complete[98] are conspicuously absent. On the other hand, fragments of the cranium, the clavicles, ribs, spine and the pelvis were more regularly preserved in comparison to the meager preservation of phalanges (in two cases) and tooth roots. Although this could be the result of incomplete collection during the excavation it is noteworthy that phalanges and tooth roots were recovered from a single pyre from Lefkandi, occasionally from Torone, and Lower Gypsades, and more frequently from the urns at Knossos and the Kerameikos.[99]

Age-at-death

The majority of the cremated skeletal remains from Mound 36 appear to belong to adults, although a few bones from infants and children were recovered from six precincts among the remains of adolescents/young adults. In total 2 infants, 4 children, 3 adolescents/young adults, 17 probable young adults (based on the presence of completely open sutural fragments), 2 possible middle adults (based on the more advanced suture closure and the occurrence of degenerative changes to the spine), and 52 adults were identified in the 74 precincts with cremated bones, assuming that each precinct reflects a distinct non-overlapping context. The sex of the adults could only be speculated upon in a few cases based on the overall robusticity of bone fragments, which suggests the presence of both sexes in the assemblage. A preponderance of young adult females among the cremated remains has been noted for the LH IIIC at Elateia and the PG at Kerameikos, while in the latter, three out of the four males identified were mature adults.[100]

The juvenile remains

Fully calcined burned infant bone fragments were identified with certainty in one of the largest central vaulted structures (ΘK2) of the SPG II and include scapular, rib and cranial fragments (Fig. 18). Based on the approximated size of the scapula these appear to belong to an infant/young child (1 to 2 years of age).[101] The infant remains were found among the fully calcined bones of an adolescent/young adult who bears striking in terms of preservation and expression, traces of anemic episodes during growth in the form of *cribra orbitalia* (Fig. 19). Single fragments of infant bones appear to have been present in two further precincts (27, 86). Moreover, fully cremated remains of older children and early adolescents (approximately 10–15 years of age) were found in three precincts (86, 96 and 97a) as indicated by the occurrence of pelvic (iliac) fragments with completely open or incompletely fused iliac crests.[102]

Fig. 18. Vaulted Structure 2 (SPG II): Cremated infant remains.

98. Wahl 2008, 148. – McKinley 2000b, 405, 412.

99. Musgrave 2005, 248. – Musgrave 1996, 687. – Callaghan, Coldstream, Musgrave 1981, 162. – Breitinger 1939, 258. – Lagia 2007, 276.

100. Breitinger 1939, 260.

101. Scheuer Black 2000, 271 and tab. 8/6.

102. Scheuer and Black 2000, 365.

Fig. 19. Vaulted Structure 2: *Cribra orbital* on the fully calcined orbit of an adolescent (?).

The meager presence, or complete absence, of juveniles among the cremations analyzed so far in Greece appears to be the norm. Infants and children have been reported in small numbers for LM IIIC at Kritsa Mirabelou in Eastern Crete,[103] and the EIA at Lefkandi, Torone, and Lower Gypsades.[104] They were completely absent from the 74 urns from Knossos North Cemetery and the Kerameikos PG amphorae despite the application of sieving of the urn contents in the latter site and the exceptional preservation of small bones and teeth in both sites.[105] The impressive inclusion of 10 fetal and 14 infant (0–2 years) remains in addition to 14 children aged between 3–11 years which were reported for the Kavousi cremations, forming 27.8 % of juveniles out of the 144 individuals analyzed, was partially attributed to the employment of water sieving during excavation.[106]

Double Cremations or "displaced" bones

No sound evidence exists for the presence of more than one adult in a precinct as no duplication of mature skeletal elements was observed. The occurrence of a two-tiered cremation in precinct 79 (see discussion on context above) suggests, however, that at least once a precinct was used for two consecutive cremations. Nonetheless, juvenile remains were found sporadically only among more mature remains. The presence of an adolescent in precinct 104, besides a mature adult (based on the presence of degenerative vertebral lesions), is surmised from the find of a single skeletal element (a rib sternal end). Similarly, the recovery of a few bones of infants and children among the more abundant remains of more mature individuals either in adolescence or young adulthood, often in a similar degree of combustion, points to their simultaneous cremation in a single pyre. This situation is known from a number of sites in Europe, while in Greece the preservation of fetal or infant remains with the "mother" is known from the LH IIIC at Elateia, the PG Agora, Torone, and Lower Gypsades, as well as from later periods.[107]

Pathology

The most recurring lesion in seven precincts was the presence of porosity on cranial fragments of adolescents and adults and one impressive case of *cribra orbitalia* as already mentioned. In a similar number of cases there were signs of periosteal reactions noted on adult long bone fragments. All these lesions are generally associated with the occurrence of episodes of under-nutrition, infection, or of other forms of stress during development, or before death, and can be used to reflect the state of health of a population.[108] Finally, degenerative changes were found on the cervical and thoracic vertebrae of a mature adult (104). Although the development of osteophytosis in the spine is an age-progressive phenomenon and is typically found in individuals over the age of 30 years, it can also be the result of cumulative and repetitive motions and can thus mirror the lifestyle and working habits in a population.[109]

4. Discussion

The analysis of the cremations from the EIA Mound 36 from Voulokalyva in Thessaly has demonstrated the complexities involved in the understanding of multifaceted funerary contexts with significant chronological components. We have presented comparative evidence from several LH IIIC and EIA cremation sites in Greece for which anthropological information is available, allowing for correlations between mortuary and osseous characteristics to emerge and indications concerning the mortuary practice

103. Tsipopoulou, Little 2001, 87–90.

104. Lefkandi: 7 out of the 71 individuals, Musgrave 1980, 439. – Lower Gypsades: 1 from the 11 urns, Callaghan, Coldstream, Musgrave 1981, 162. – Torone: 5 out of 107 urns. – Musgrave 2005, 251.

105. Musgrave 1996, 680. – Breitinger 1939 – Lagia 2007.

106. Liston 1993, 99–104 and tab. 5/5.

107. McKinley 2006, 85. – Deger-Jalkotzy this volume. – Liston, Papadopoulos 2004. – Musgrave 2005, 250. – Musgrave 1990. – Callaghan, Coldstream, Musgrave 1981, 162.

108. DeWitte, Woods 2008, 1439.

109. Goodman, Martin 2002, 41–44.

to transpire. It has been shown how primary cremation areas, which also served as burials, bear distinct characteristics from pyres and secondary depositions, such as urned and unurned contexts, or ash dumps. These were compared to respective evidence from Voulokalyva.

Attention was drawn to the small quantity and quality of burned human bone on average in Mound 36 in comparison to archaeological and forensic contexts in which intact or incompletely recovered cremation burials and urns were found. A finer assessment of the characteristics of the burned bones (weight distribution and maximum fragment size) in relation to contextual evidence concerning the length and temporal arrangement of the precincts, in addition to the presence of *in situ* firing, suggests the occurrence of diverse funerary contexts in the mound. The impressive temporal trend, according to which the larger bone fragments were found in the earlier precincts rather than in the later ones, accords well with micromorphological studies which demonstrate that the fragmentation pattern of cremated bone takes place immediately after the cremation event and reflects activities at a site that followed the cremation process rather than accumulated with time, as is the case in weathering and fossilization.[110] Even so the effects of weathering, including trampling and cultivation may exacerbate fragmentation. This evidence clearly suggests that taphonomic factors, including incomplete collection during excavation, do not suffice to account for the small quantity of burned human bone on the mound. Instead, factors related to the cremation process and rituals leading to the formation of the bone assemblages and the diverse contexts on the mound need to be called upon to explain their void.

The majority of the precincts (74 %) contained minimal amounts of burned bone, 29 g on average, a quantity that is known from pyres that did not serve as the place of burial, from ash-dumps and from urns at the lower end of the spectrum in urn cemeteries. This quantity of bone along with ash was principally, although not exclusively, found in pits with smaller dimensions and in urns within the precincts. The inconsistent evidence for *in situ* firing in the precincts and the occurrence of small quantities of burned bone and ash, not only in urns or ash dumps within the precincts but also in limited areas within the precincts, perhaps corresponding to the delineation of broken vessels, strongly points to the occurrence of different contexts with cremated bone on the mound.

Furthermore, 26 % of the precincts contained larger quantities of burned human bone which averaged 201 g (ranging between 100–591 g). These were mainly found in precincts with dimensions that could have accommodated a human body but also in precincts in which the ash and burned bone appear to be limited within the area of a broken vessel, while evidence of *in situ* cremation is lacking. Given that a clear temporal trend in the size of precincts on the mound has been noted, the correlation between chronology, size and quantity of burned bone is probably not surprising but points to a differentiation in the use of the mound through time. The occurrence in an earlier precinct of at least a single case, of well-preserved burned bones of the spine in anatomical order *in situ* among large logs of charred wood, clearly indicates the occurrence of *in* situ cremations in the mound. In addition, the find of at least a single case of intact calcined pelvic bones from the superficial layer of a well-preserved precinct with a rather complex use suggests that in certain cases the precincts also served as the site of burial.

Viewed from the broader perspective of cemeteries of the EIA in Greece in which cremation was practiced, it was noted that the mean fragment size and the quantity of burned bone at Voulokalyva, in addition to features relating to the occurrence of *in situ* firing, are impressively similar to certain pyres from Lefkandi. Although the scarcity of bone at Lefkandi was initially attributed to the aggressiveness of the soil, later chemical analyses did not support this interpretation. Instead, a complex mortuary ritual was suggested which encompassed diverse modes of disposal of the cremated remains. In both sites, albeit in vastly different numbers, inhumations coexist with the cremations.

At Voulokalyva, as opposed to the occurrence of 14 single cist graves with the well-preserved inhumations of infants and one older child, there are only a few instances of cremated infant and juvenile bones among those of more mature individuals. Adults were found both inhumed and cremated although the state of preservation of the latter allowed only a few observations to be made concerning their demography and health. Episodes of stress during development and degeneration due to ageing and perhaps lifestyle were noted both among the cremated as well as among the inhumed remains.

5. Conclusions[111]

The uninterrupted use of Mound 36 for more than two centuries and the great variation of its contexts raise

110. Stiner, Kuhn, Weiner et al. 1995.

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the question of whether the mound played a role that extended beyond mortuary practices. For a number of years anthropologists have reflected on the meaning of mortuary rituals, their political, economic, metaphysical dimensions, and the occurrence of beliefs concerning the presence of a soul and ancestral cult.[112] The evidence from the mound of Voulokalyva suggests that the relationship with the dead was much more complex than originally believed and was clearly not completed with the transformation of the body either through cremation or inhumation. Why would the living practice elaborate rituals with grave goods and offering tables if they did not believe that in some way their ancestors "exist" and "participate"?[113] The occurrence on the mound of rituals that encompass the cremation of human and animal remains, removal and secondary disposal of the remains, offering tables, funerary feasts, as well as the firing of metal and ceramic objects without further removal, reveal the presence of complex mortuary practices and extended rituals that went beyond the cremation and inhumation of the dead. The diachronic use of the mound suggests that the ancestral cult and its many aspects endured for an extended time within a period characterized by great sociopolitical changes.

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Anna Lagia
Wasagasse 33/25
A-1090 Wien
annalagia@gmail.com

Anastasia Papathanasiou
Ephorate of Paleoanthropology and Speleology of southern Greece
Hellenic Ministry of Culture
34B Ardittou St.
GR-11636 Athens

Zoi Malakasioti
Perraivou 10 St.
GR-38222 Volos

Foteini Tsiouka
IG' Ephorate of Prehistoric and Classical Antiquities
1 Athanasaki St.
GR-38001 Volos