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Complexity of Factors Implicated in the Forensic Assessments of Ancient Human Cremated Skeletal Tissues Including the Possibility for Methodological Problems and Biases of Interpretation: Exploring the Cases of the Geometric-Archaic Burial Ground at Orthi Petra in Eleutherna, Crete, and the Classical Necropolis of Abdera in Thrace, Greece

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Πρακτικά του Συμποσίου

ΚΑΥΣΕΙΣ ΣΤΗΝ ΕΠΟΧΗ ΤΟΥ ΧΑΛΚΟΥ ΚΑΙ ΤΗΝ ΠΡΩΙΜΗ ΕΠΟΧΗ ΤΟΥ ΣΙΔΗΡΟΥ

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Complexity of factors implicated in the forensic assessments of ancient human cremated skeletal tissues including the possibility for methodological problems and biases of interpretation: Exploring the cases of the Geometric-Archaic burial ground at Orthi Petra in Eleutherna, Crete, and the Classical necropolis of Abdera in Thrace, Greece.

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Preface

The earliest references ever made to *osteologoi* and cremations reflecting on aspects of their duties and functions stem from the Homeric narration of the Iliad (1). These experienced individuals, cognizant of the abilities of the fiery power to hungrily consume flesh and viscera, would have the capacity and stamina—despite the cloud of lamentation, to recognize and segregate from other organic and inorganic materials, as well as to selectively collect from the midst of the ashes of a subdued pyre the osseous cremated remains of human individuals, for purposes of subsequent funerary customs and practices including processes of interment. Modern osteologists, specialists trained in the fields of Physical/Forensic Anthropology, when archaeologically recovering and studying cremated human skeletal remains, aim to enhance understandings relative to this ancient funerary custom—which was allegedly able to liberate the psyche from the body of the diseased for the endeavors of the afterlife, while also aspiring to reconstruct, in a deductive manner, facets of the demographic dynamics and palaeopathological profiles of past populations (2, 3, 4, 5, 6, 7).

In trying to provide comprehensive understandings relative to aspects of the human condition through cremated anthropological remains, it is necessary to critically consider that the osseous record reflects on a mosaic of inherited circumstances often originating from but not limited to: a) an anthropogenic filter of cultural/behavioral mortuary conduct of the ancients; b) the morphologic, anatomic and volumetric changes of skeletal structures resulting from the varied degrees of sustained thermal exposure in the pyre; c) the digenesis processes affecting mainly the organic components, at the cellular and molecular levels, of bones and teeth during cremation; d) a multitude of contributing factors originating from the abiotic environmental conditions before, during and shortly after the event of cremation; e) subsequent changes affecting bone preservation augmented by the geomorphologic and sedimentologic attributes/properties at the burial site—components of the encompassing theme of taphonomic impacts including aspects of the biotic environment for example the activities of flora and soil fauna; and f) the applicability of improved excavation techniques— "sensitive" to the osseous record, post excavation handling, and repository circumstances (8).

Such factors contributing to the further deterioration and fragmentation of cremated skeletal remains could present a difficult predicament for methodological and theoretical applications used for deriving Physical Anthropological/Forensic assessments via inspectional, mensurational, and statistical discriminatory function analyses of the osseous record. This paper examining the cases of two archaeological sites, both of which yielded a very rich record of human cremations, namely the Geometric-Archaic burial ground at Orthi Petra in Eleutherna, Crete (9), and the Classical Period necropolis of ancient Abdera in Thrace (10), presents in a paradigmatic way a platform based on which some of these central issues concerning cremations are identified and discussed, compared at both intra-, and inter-site contexts.

Introduction

Archaeologists, anthropologists, and prehistorians have the opportunity to reconstruct diachronic aspects of the human condition, through analytical studies of the archaeological, anthropological, and palaeoenvironmental records (8). Activities of anthropogenic nature, reflecting on the varieties and complexity of human behavioral conduct are detectable in the archaeo-anthropological record. In fact, the human skeletal record, including cremations, enduring the weathering of time and the austere processes of taphonomy[1] (12, 13, 14, 15, 16), contains an entire universe of unique and non-renewable information which once discovered must be excavated, documented, studied and interpreted by colleagues preferably working in an team effort through inter-, and cross-disciplinary fields.

Being privileged with the opportunities to work in such environments, archaeologists and physical anthropologists function as ambassadors not only for the protection and preservation of archaeological sites and their records, but equally importantly for the sharing of scholarly information with other colleagues and the diffusion of knowledge to the public (11). Having assumed the task-oriented responsibility for deriving deductive assessments relative to the human condition in antiquity, archaeo-anthropologists are immersed in a multitude of pertinent processes, one of which is characterized by the aim to minimize the potential for the relative margin of error concerning any archaeo-anthropological interpretations. Such objectives are considered to be of significant practical importance especially for the retrieval of bio-anthropological information from the study of human cremated tissues, given the fact that they systematically present a complex epistemological challenge for the Physical Anthropologists and Forensic specialists alike, based on the disposition of numerous implicated issues of intricate nature. In trying to provide comprehensive understandings, through cremated anthropological remains, relative to aspects of the human condition in antiquity, it is necessary to critically consider that the osseous record reflects a mosaic of primarily inherited pre-mitigation circumstances, however often coupled by the results of applications of research methodologies and techniques, both during and after the excavation of archaeological contexts. Hence, cremations in addition to their significant contributions for deciphering archaeo-anthropological issues, also reflect on a variety of complex problematic conditions, some of which, at least to date, might not always be resolved, presenting therefore the potential for challenges of interpretation to facets of our proclaimed understandings. Consequently, the ability to appreciate the limitations of our methodological and procedural conduct, and possibly the inertia provided through conceptual biases, which affect, or might affect, the ways by which we perceive and interpret data retrieved from cremations must be a recognizable integral component in the framework of such inter-disciplinary interpretative endeavors.

It is in light of these perceptions that the objectives of this paper are twofold: **I)** in its earlier segment to identify and describe the essentials which might affect the nature and composition of cremated skeletal collections; conditions that both pre-, and post-date the excavation processes, and **II)** using the examples of two different sites to discuss and juxtapose understandings derived from their respective cremated skeletal records, highlighting when pertinent some of the conditions presented above.

I. Essentials which might affect the nature, kind, and composition of cremated skeletal collections: conditions that both predate (Ia), and postdate (Ib) the excavation processes

Pre-excavation circumstances which have the capacity to affect the composition and preservation of cremated human tissues include but are not limited to the following groupings:

Ia. 1) The multifarious cultural and behavioral conduct, a so-called anthropogenic "filter", relative to the expression of mortuary customs and funerary habits of the ancients (17). Of interest would be to consider: a] the condition of the interment especially as it pertains to the possibility that bones might have been void of soft tissues (dry bones "behave" differently compared to fresh or "green" bones when cremated) for any number of reasons (as for example in the case of an intentional secondary cremation, or under unintentional circumstances of i.e. a fire which in the process of consuming a dwelling would have cremated a predating inhumation of an

[1] The laws of burial processes.

adult or infant which had been interred in its floor or walls [2]); b] the specific preparations of the body of the diseased (i.e. if smeared with floral and/or faunal extracts—including fatty liquids/tissues, honey, and/or wrapped in textiles, skins or leather all of which would further contribute, as fuel, to the intensity of the fire); c] the diurnal or crepuscular timing of the event (relative to sun light penetration, air temperature and moisture—contributing factors to the intensity of the fire); d] the specific placement of the body on the pyre (i.e. supine, prone, extended, or crouched possibly resulting to differential thermal alterations sustained by cranial and post cranial components, or anterior versus posterior and superior versus inferior body surfaces in reference to pyre exposure); and e] the possibility of the extinguishing of the hot charcoals using liquids—also affecting the already hot and deteriorated bone and dental fragments with sudden contractions, perilous to bone preservation. Of further importance would be to know aspects of the burial custom which the archaeo-anthropologist often only scantily perceives *in situ* but which would greatly affect preservation as well as the nature of composition of the osseous cremated collections one retrieves archaeologically. Such notions might relate to: a] the lapse of time between the termination of the firing activities and the collection of the cremated bones; b] the experience of the individual(s)—professionals, or friends/relatives, who collected the cremated tissues of the diseased (an issue relative to the degree of detail with which bones could have been recognized and collected, and/or the patterns of bones left at the pyre bed, as detected archaeologically at most cremation features); c] the question as to if stepping on the cremation bed was considered appropriate and/or allowed for purposes of bone collection—especially for larger cremations of multiple individuals, coupled by the means used to search for bones—by visual means or through a minor/major cleaning process through the ashes and charcoals, and with bare hands or with the use of a specific toll(s)?; d] the thoroughness and duration of the handling and treatment of bones selected from the cremation before their deposit to urns?; and e] were urns subsequently interred—and after what temporal hiatus, or stored in a designated area for further burial custom related activities and/or as mandated by the specific social environmental circumstances or the foresight of the relatives and friends of the departed?

Considering the possible implication of such anthropogenic circumstances it would be tentatively pertinent to anticipate that there could have been some variations, even if minor, while Hellenes used cremation as a burial custom over many hundreds of years across the contexts of their geographically and geomorphologically varied cities and settlements;

2) The nature, size and shape of the constructed pyre-bed or substrate, such as a pit, earth platform or wooden log structure, including the level of preparation and gamut of geomorphologic and sedimentologic characteristics, especially in the case of a pit or earth platform for the provisioning of adequate air flow, through the pyre, during cremation;

3) Aspects of the fiery process such as the duration and intensity of the fire and degrees of temperatures reached which directly affect the level of changes sustained by skeletal tissues at their molecular, cellular and structural levels. Of further importance are the quality and quantity of the wooden fuels used and the possibly of fatty and/or additional combustive substances used during the cremation process (some provided as offerings), the presence or absence of a reduced environment, and a select number of abiotic environmental climatologic circumstances which should be entertained as contributing factors, although again very difficult to assess (i.e. wind, relative humidity, due point and rainfall, as well as sediment humidity);

4) The anatomic disarticulation, fragmentation, and translocation of bone structures during cremation (caused by checking, splintering, warping and bursting of compact/lamellar bone surfaces, and teeth, due to overblown organic liquids of the endosteal components of "green" bones), coupled by the ensuing morphologic deformations, and volumetric changes (up to approximately 30% reductions of osseous mass by volume at considerable exposures of about 800° C) resulting from an anisometric degree of sustained thermal exposure—as observed among skeletal tissues of cremations involving "green" bones (2, 18, 19, 20, 21, 17);

[2] As for example in the case of Individual No. 1, stratification level D of the early Neolithic component, at the site of Ganj-Dareh Tepe, Iran, see p:200, In Agelarakis, A., *The Palaeopathological Evidence, Indicators of Stress of The Shanidar Proto-Neolithic and Ganj-Dareh Tepe Early Neolithic Human Skeletal Collections*, Ph.D. Dissertation, Columbia University, Bell and Howell Co., University Microfilms International, 1989.

5) The imminent digenetic processes destroying the organic components (at parameters relevant to the degree of thermal exposure) of bones and teeth during cremation (ibid.); and

6) Subsequent taphonomic impacts following interment processes affecting bone preservation primarily in pyre beds, and in a lesser degree cremated bones deposited in urns, augmented by the geomorphologic nature and location of the burial site and its sedimentologic attributes and properties as well as of the soil flora and fauna of the burial site (22, 13, 23, 24, 25, 8). These are coupled by site formation/destruction processes due to diachronic natural processes and anthropogenic activities (8, 17, 22).

Ib. In reference to mitigation processes and post excavation conditions which affect the nature of composition and preservation of cremated osseous units, a sample of important issues are recognized and referred to here (8). These concepts could possibly be lumped, without being limited, however, to the following groupings:

1) Subsequent to the identification of burial sites and their individual grave features, preferably via remote sensing, careful excavation techniques must be implemented, "sensitive" to the visual detection, recognition and manual recovery, by the trained excavator (also supported by auxiliary processing and recovery methods from unearthed sediments) of macro organic materials, which include the osseous record (recognizing, however that cremated human bones, especially these that have been thermally altered to a calcined degree, are mostly derived inorganic materials following the corruption of organic-|collagenous| components at the pyre);

2) A protocol should be available for post excavation handling of cremated osseous materials (compiled by collaborating conservators and archaeo-anthropologists), guiding a range of cleaning and consolidation procedures through the steering of laboratory analyses by the Physical Anthropologist/Forensic specialist;

3) All site and laboratory specific factors with the potential to affect preservation, allowing for further deterioration of osseous tissues, should be considered by the research design of the project, and curtailed. Needless to say that such a forethought is mandatory since a range of in-the-field preparatory activities coupled by during and after excavation procedures—i.e. handling, packing and transportation to the laboratory of these very fragile materials, could otherwise result in a number of limitations which would impede detailed analysis and in depth study of cremated tissues for both inspectional macroscopic evaluations, and metric studies implicating as a minimum the following: a) age assessments especially in cases of premature versus delayed cranial suturaleal ossification, avoidance of further fragmentation of dental clinico-anatomical surfaces, and of anatomical loci relative to variation from normal bone growth due to genetic, congenital, and developmental conditions; b) sex determinations especially for allowing the critical establishment of differentiation between females versus subadults or young adult males; and c) palaeopathologic analysis especially for distinguishing pseudopathologic and pseudo-traumatic manifestations, as well as quasi-epigenetic variations caused by thermal alteration and/or taphonomic processes (13, 23, 24, 25, 26); and

4) Stipulations should be required for appropriate repository circumstances, both before and after analysis (8).

II. Archaeological sites and their cremated skeletal records used as examples for discussing and highlighting pertinent issues

Two archaeological sites and their human cremated skeletal remains are introduced, set apart by temporal and geographic distance. The first site is the Geometric-Archaic burial ground at Orthi Petra in Eleutherna, Crete, excavated by Professor Nikolaos Ch. Stampolidis of the University of Crete at Rethymnon (7, 27, 28, 29, 30, 31) whereas the second site is the necropolis of the Classical component of the city of Abdera, in Thrace, excavated by Ms. Ntina Kallintzi[3] of the ΙΘ΄ Ephoreia of the Greek Archaeological Service, in Komotini, Thrace (10, 32, 33, 34, 35, 36, 37, 38, 39).

The purpose for selecting these two sites originates from the fact that they represent, as documented through the archaeo-anthropological record, both commonalities and differences in certain facets of the cultural

[3] Only a limited sample of publications submitted by Nt. Kallintzi to *ΑΕΜΘ* and *ΑΔ* are presented here.

"filter" as it pertains to the practice of cremation as a funerary ritual and the subsequent preservation of cremated osseous remains. Eleutherna is a mountainous site with considerable elevation, of approximately 700 meters from sea level, with different geomorphology and climatic circumstances and ample availability of lumber when compared to Abdera which is situated in an alluvial coastal plain, basically at sea level elevation.

The Homeric descriptions of the burial custom indicate that once a human body had been cremated on a pyre, and following the subsiding of the fire, the human cremated remains were removed from their primary context. Following certain preparations bones were deposited in an urn and were translocated from the pyre for interment into a new burial location (1), considered as it might in strict archaeo-anthropological terms as a secondary burial location. Although these descriptions present an exact illustration of the Eleutherna context (9, 28, 30) which yielded both the pyre beds as well as the burial tomb which contained the urns with relative bones, to date, Abdera yielded the pyre beds alone—considering that extensive systematic excavations have been conducted at Abdera since the 1950s. Hence, a Homeric kind of procedural conditions of this funerary custom could not be verified through the archaeo-anthropological record, at least to data, in Classical Abdera (35). This could reveal a variation of the Homeric version of the burial custom possibly indicative of the pyre features also serving as the final burial locations for the individuals involved.

Excavations of the archaeological contexts of the pyres, at both sites, recovered a significant amount of cremated human remains left behind on those primary contexts. And if it is assumed that a lack of bone collection from the pyre for subsequent interment was in accord with the Abdera context, then why was such an activity—the leaving behind of bones at the pyre, observed in the Homeric-like version of the burial custom in Eleutherna? Was this a deliberate, conscious, cultural conduct relative to cremation process—demarcating for example a physical location in space which following the cremation process had acquired sacred characteristics, or were bones left *in situ* undetected because of the ashes, the charcoal, the rest of the debitage from burial artifacts, and the relative homogeneous discoloration of bones mimicking other materials—the result of the firing process during cremation? How can archaeological science assess in a quantitative manner such a complex esoteric handling of the burial custom—namely the specifics of the collection of bones from the pyre for deposit in urns and reburial as it applies to intra-site, and subsequently at inter-site environments and in fact, coupled with the ability to segregate between anthropogenic conscious conduct versus taphonomic conditions which might encompass site formation/destruction processes? Perhaps only under ideal conditions would it be possible to find out. Had one discovered within the same site the location of all the urns and the location of all the pyre beds (as is simulated in Eleutherna), coupled by forensic leads that would link a probable identification of who is who between the individuals involved, then possibly one could be enlightened. However, under nearly no circumstances (not even in Eleutherna) would this be a pragmatic scenario under current archaeo-anthropological know-how, considering that there are so many parameters and factors that are involved in the further fragmentation and deterioration of possibly mending osseous surfaces—and especially in light of the near impossibility to conduct DNA probing (40) through well cremated bones due to the effects of thermal alteration. Further, even if under a hypothetical scenario one would be able to implement such methods within the same site (i.e. Eleutherna), fortunate enough to make such forensic identifications, it could be argued that the specifics of that particular site would not have probabilities for setting statistical implications, as a precedent, for all other sites (41) yielding cremated human remains. The latter is of particular importance when considering the long term use of cremations as a burial custom in the Hellenic areas and when contemplating on the spectra of temporal distance between relative sites, their varied eco-niches and geographic settings coupled by cultural adaptation processes and variation according to population numbers, burial grounds' spatial availability, socio-economic horizons, and civic regulations.

Hence, as explained above, given that an intra-site scientifically secured judgment for the lumping of cremated bones from the pyres to those in urns is rare, it is then usually the case that a limited, if not selective, portion of any archaeologically recovered cremated skeletal body might be studied by the Physical / Forensic Anthropologist. That is, either through the case of an archaeological recovery of cremated human bones which had been left on the pyre bed—intentionally and/or unintentionally, or through the archaeological retrieval of cremated bones which had been placed inside the urns. Such issues implicating facets of the burial customs and practices also carry significant bearings for the reconstruction of aspects of the demographic profiles of the pop-

ulations involved through physical anthropologic/forensic research. What is the feasible measure, let alone extreme caution and care, under which the likelihood for minimizing the possibility of inflating and/or decreasing the numbers of individuals of population samples represented through the recovery of cremated bones (from pyres beds and urns) could be administered? However cautious a researcher might be, he/she would have to face in absence of a set standard of measures, guided by experience alone, circumstantial conditions where clarifications and clearer understandings would be needed for explaining the possible associations of what bones should belong to whom, recovered as they might from lets say pyre beds, versus these of possible "ectopic" (stratigraphically speaking) cremated bones at certain contexts of the site, to these of several intrusive(?) cremated bones in adjacent burial features containing dry bones, and of course to these unearthed from burial urns? Recognizing that occasionally there may be certain limitations to the possibilities of providing answers to such archaeo-anthropological questions there are often further concerns. The fact that in most cases, as explained above, only a limited sample of the cremated human skeletal body might be represented—unearthed either from a pyre bed or urn, as to allow a forensic evaluation relative to sex and age, (i.e. by volume, weight, morphological observations of anatomical loci, metric study, in addition to possible pathologic/traumatic manifestations) underlines the restrictive boundaries faced by the Physical Anthropologist / Forensic specialist and the extremely cautious environment he/she must work under in order to minimize the ever lingering possibility for margins of error. How does one discriminate for biological sex between the cremated remains of a male versus a female that might border each others mensurational index averages and in absence of discernible morphological characteristics? How does one distinguish, while working with incomplete and severely fragmented skeletal remains, between a female and a male of the subadult age subgroup? (See endnote*). It might possibly suffice to underline at this juncture that when diagnostic physical anthropological/anatomical loci are not preserved, no deductive assessments could be derived—especially since inductive determinations extracted through cremated human skeletal remains are neither befitting for archaeological science, nor for physical and forensic anthropology.

Considering the aforementioned reflections pertinent to certain arguments and areas of possible problematic nature for forensic evaluations of skeletal cremated structures, it was possible, in both sites, for most of the skeletal individuals to identify and assess either an adequate or sufficient number of anatomically identifiable bone loci. In the cases of less well preserved skeletal individuals site specific data bases of information on morphological variation (42) and statistical discriminatory function analyses (43) derived from both dry and cremated skeletal collections—again preferably specific to each site component[4] for minimizing subjective interpretations, which had been generated by the author (26, 44, 45, 46, 47, 48, 49, 50, 51) were used excessively in order to retrieve indicia deterministic at least for sex, and age evaluations, as well as for morphologic variation—when appropriate indicative of certain bio-physiological stimuli relative to acclimatization or adaptation, and/or manifestations of labor diversity. Basic laboratory analyses of cremated bones involved their segregation into subdivisions of the cranial, dental, and infra-cranial skeleton by subcategories of axial and appendicular remains and in correlation with the form and function of the osteological components (i.e. articular surfaces, anatomical loci of muscular origins and insertions, short, irregular, flat and tubular bone structures). Measurements of all possible thickness and length dimensions were recorded, for most bone fragments, coupled by estimations of volume and weight. Evaluations of all taphonomic features were then recorded, combined with the detection and identification of bone epigenetic traits, developmental changes, and acquired manifestations—pathogenic and traumatic.

In addition, since bones of females and immature individuals usually do not preserve as well, compared to those of adult males, especially when lacking most diagnostic morpho-anatomical features and yielded osseous metric values bordered the lower average indexes of males versus the higher of females, caution was taken to avoid the danger of inflating aspects of the respective demographic profiles, by discriminating against the less well preserved skeletal individuals. In such cases, instead of using subjective criteria for lumping these "indeterminate" individuals to either of the two sex subgroups, a consensus of morphological characteristics and metric data was used within the context of skeletal morphologic variations provided within the specific site, through a population approach, to assign "possible", or "probable" females or males, and/or of individuals of "indeterminate" sex assessment.

[4] Although a diachronic view of skeletal biology and ecology of disease distribution, coupled by the dynamics of the demographic profiles of subsequent populations at intra-site environments are very important.

It could be further mentioned that bones from both sites showed similar color, chroma and hues on their surfaces ranging from the charcoal-like colors of the slightly thermally-altered bones that escaped higher temperatures, to the whitish chalk-like colors of the nearly calcined bones. Further observations between the osseous collections of the two sites revealed similarities as far as the sizes of bones left behind in the pyre beds, ranging from a few millimeters to several centimeters, and indiscriminately of the subcategories and/or subgroups of sex or age. Nevertheless, the weight of bone fragments representing individuals recovered from pyre beds discerned dissimilar values between the two sites when comparing individuals of same sex and age subgroups. In Eleutherna there were consistently much fewer cremated bones left on the pyre beds when compared to the Abdera context—seemingly confirming with the characteristics of the burial custom at each site. Yet, a vast amount of specific cremated bone structures were consistently missing from the Abdera pyre beds. Further, when comparing inter-site bone volumetric shrinkage, due to thermal alterations, it was in Eleutherna that the maximum degree of about 1/3 volume reduction was observed, with nearly a consistent prevalence, indicating that osseous components had been exposed to more intensive and possibly lengthy firing activities during the cremation process, reaching temperatures around and or slightly excessive of 800° Celsius. Consequently, based on the previous argument the question could be begged as to how a lesser in strength and stamina fire used at pyres in Abdera could invariably eliminate a specific segment of the human skeletal structures?

When making references to the osseous remains recovered from the urns in Eleutherna it was on a consistent basis that both very small (and not necessarily fragmented in a post depositional environment) and larger bone fragments had been collected, and deposited in the urns. Hence, it was assessed that both smaller (difficult to identify and select from the pyre bed), as well as larger bones (readily visible at the pyre beds) had been sought for collection. Short of a more engaging excavation process, which could have very well been culturally inappropriate, it would have been very difficult to select the total bone mass for the urns. Hence, urns yielded axial segments of skeletons represented by larger bone fragments of the facial cranium—including dentitions, the cervical vertebrae, the ventral (or anterior) segment of the thoracic region and very rarely the fragments of the bodies of the ventral areas of the lower thoracic and lumbar vertebrae. The appendicular segment of the skeletons were represented by fragments of the pubic bones from the pelvic area, the long- tubular and short-tubular bones of the upper and lower extremities including samples of the carpals and tarsals. Strangely enough, the collections of bones gathered for deposit in urns and reburial in Eleutherna, simulate the absence of similar bone structures from the Abdera pyres. That is, bones removed and/or being absent, respectively, mainly pertained to bones from the entire ventral anatomic map of the cremated human bodies. Consequently, bones recovered from the pyre beds, both in Eleutherna and Abdera contained the osseous structures of the back and base of the crania, the dorsal (or posterior) segments of the thorax regions, often including the majority of the thoracic and lumbar vertebral components, the dorsal segments of the pelvic bones, and samples of the smaller fragments of the short and tubular bones of the extremities.

From an archaeological/forensic point of view, such a consistent pattern of bones collected from the pyres for deposit in urns, representing ventral bone anatomical maps on the long axis of the skeletal bodies, nearly discriminatory against dorsally located bones, indicated that the placement of the interments on the pyres must have assumed, in both sites, supine and extended positionings. Based on the *in situ* location of the dorsal supero-inferior segments of the skeletal bodies at the pyres, with relatively well-preserved bone density and composition and slight to moderate thermal alteration as well as dark-grayish color discolorations (specifically of the facies dorsalis of the vertebral column, ribs, and ilio-sacral segments of the pelvis), it is assessed that the interments in both sites were not always placed on top of wooden log substrates, as might be illustrated on ancient depictions (i.e. on vase paintings) of the burial custom. In case the bodies had been placed on a log substrate, the fire would have fast consumed the relatively thin soft tissues locally and subsequently the vertebral structures and their cancellous components, very rich in endosteal fluids and thus with the imminent potential to burst . Instead, the vertebrae preserved larger fragments of their bodies and of their spinal processes, recovered archaeologically and as assessed forensically in relative anatomical position and contained within sediment pockets—as a stratigraphic layer, which upon examination consistently revealed hardened qualities similar to those observed with fired mud-bricks. A taphonomic process of vertebral vertical settling within the post-cremation hardened sediment of the burial bed, and in fact in relative anatomical sequence, is rendered relatively difficult since at a minimum the high temperatures would have backed the bur-

ial bed hard. It is therefore suggested that the pyre bed in those cases reflects on burial beds which must have been prepared with unbound and unfastened soil, and as a consequence of this condition, the loose earth would allow the vertebral spines to "settle in" while the sediments were hardening through the firing activities. Such a scenario, however, necessitates the interments having being placed on the prepared earthen rampant or pyre pit and subsequently surrounded and/or superimposed by fire wood, the main fuel of the cremation process. It is suggested that it must be for this reason that the ventral skeletal remains are recovered from the Eleutherna urns cremated so thoroughly, in contrast to the dorsal segments of both the Eleutherna and especially of the Abdera pyres. What then of the ventral skeletal segments in Abdera? If such a strong and of considerable stamina fire, as documented in Eleutherna, did not completely consume them why should these be nearly consistently missing from Abdera? Should one assume that the Abdera pyres consumed the ventral skeletal structures because of a better quality of fuel or differential construction of the pyres? The anthropological evidence could not provide, so far, strong support for such an argument. Could it be possible that despite half a century's copious and systematic archaeological work at Abdera, urns with cremated human bones have yet to be recovered, or could it be speculated that there might have been a unknown facet of the burial custom which one should better comprehend with continued research?

Epilogue

It is therefore necessary to carry on such discussions in cross-disciplinary fora for better identifying the expectations as well as the limitations of archaeo-anthropological science in reference to cremations. It must be also underlined that continued research remains the best tool for further evaluating and reassessing the results of pertinent analyses, an imperative process for fine-tuning and advancement of concepts, doctrines, and theory building. In retrospect, workable resolutions can be reached, albeit with caution, out of multiple competing explanatory hypotheses for specific aspects of the larger subfield of studying cremations, even when there are no precedents or standards for comparisons, and even when adequate data might be unavailable for further testing.

* Parenthetically, for better illustrating this issue, a case study could be mentioned from the site of Pantanassa Amariou at Erimoklisies, Rethymnon, Crete. Burial No. 1, Bronze Amphoroid KraterBA10", excavated by archaeologist Ms. Eva Tegou of the Archaeological Museum at Rethymnon, (see publication by E. Tegou in this volume). This contextual unit involved a Male individual within Late Adulthood, represented by a collection of calcined cranial and infra cranial bone fragments. The tubular bones of the appendicular skeleton had been affected to such a degree of thermal alteration as to present concentrically exfoliated compact bone layers--on a transverse section from the endosteal ring toward the subperiosteal surfaces of compact bone components, hence simulating an onion layer peeled effect. Should preservation had been further limited, either due to anthropogenic activities and/or because of taphonomic deterioration, it would have been difficult and possibly under some circumstances of analysis misleading to retrieve mensurational data if one would attempt to perceive single exfoliated bone layers as representative fragments of the original--and certainly reduced through the cremation processes, thickness of the diaphyseal compact bone of the individual involved. In such a case of bone preservation one should selectively choose only the well preserved diaphyseal compact bone fragments for analysis, avoiding the rest--even if such fragments present considerable lengths on the long axes of bones. The table recording the post cranial diaphyseal bone thickness components for this individual--part of the metric study by which sex determinations might be assessed, presents three sequenced columns with metric values. Please consider that only column No. 1 presents appropriate anatomical bone thickness values, showing through columns No. 2, and No. 3 variation and progressive metric declination from the proper anatomical conditions. Calculating for metric averages between the three columns would still be misleading for forensic mensurational assessments, deviating from the Male indicia toward the Female border and mean of metric averages.

REFERENCES

1. Homer. *Iliad*
2. Gejvall N.-G., "Cremations". In Brothwell, D., and E. Higgs (eds.) *Science in Archaeology*,Thames and Hudson, London 1969, 379-390.
3. Henderson J., "Factors Determining the State of Preservation of Human Remains". In Boddington A., Garland A.N., and Janaway R.C. (eds.) *Death, Decay and Reconstruction: Approaches to Archaeology and Forensic Science*, Manchester University Press, Manchester 1987, 43-53.
4. McKinley J.I., "Cremations: Expectations, Methodologies and Realities". In Roberts C.A., Lee F., and Bintliff J. (eds.) *Burial Archaeology: Current Research, Methods and Developments*, *BAR* 211 (1989), 65-76.
5. Burkert W., *Greek Religion*, Harvard University Press, Massachusetts 1985..
6. Garlant R., *The Greek Way of Death*, Cornell University Press, New York 1985.
7. Stampolidis N.Chr., *Reprisals. Contribution to the Study of Customs of the Geometric-Archaic Period*, Rethymnon 1996.
8. Αγελαράκης Α., «Εγχειρίδιο Φυσικής Ανθρωπολογίας για Αρχαιολόγους», *Αριάδνη* 8 (1996), 189-247.
9. Σταμπολίδης Ν.Χρ., *Αρχαία Ελεύθερνα. Το γεωμετρικό-αρχαϊκό νεκροταφείο της Ορθής Πέτρας*, Ρέθυμνο 1993.
10. Καλλιντζή Ντ., «Ανασκαφή ταφικού τύμβου στα Λιβδηρα», *ΑΕΜΘ* 4 (1990), 561-568.
11. Agelarakis A.,"Environments and Human Ecology: Dynamic Factors in Processual Equations of Human Adaptations as seen from Archaeological Perspectives". In Pantel, A.G., Schneider K.A., and G. Loyola-Black (eds.) *Proceedings of IV New World Conference Environment and Archaeology*. Organization of American States, USDA, Forest Service, in collaboration with the World Archaeological Congress.San Juan Puerto Rico, 1992, 112-118
12. Efremov I.A., "Taphonomy: A New Branch of Paleontology", *Pan American Geologist*, 74 (1940), 81-93.
13. Wells C., "Pseudopathology". In Brothwell, D., and Sandison A. (eds.) *Diseases in Antiquity*, Charles C. Thomas, Springfield Illinois, 1967, 5-19.
14. Shipman P., *Life History of a Fossil: An Introduction to Taphonomy and Paleoecology*, Harvard University Press, 1981, Cambridge, Massachusetts.
15. White T., and Folkens P., *Human Osteology*, Academic Press, San Fransisco 1991.
16. Turner II, C.G., and Turner J.A., "Perimortem Damage to Human Skeletal Remains from Wupatki National Monument, Northern Arizona", *The Kiva* 55 (1990), 187-212.
17. Agelarakis A., Kanta A., and Stampolidis N.Chr., "The Osseous Record in the Western Necropolis of Amathus: An Archaeo-Anthropological Investigation". In Karageorghis V., and Stampolidis N.Chr. (eds.) *Proceedings of the International Symposium on the Eastern Mediterranean: Cyprus-Dodecanese-Crete 16th-6th cent. B.C.*, Athens 1998, 217-229.
18. Binford L.R., "An Analysis of Cremations from Three Michigan Sites". In Binford L.R. (ed.) *An Archaeological Perspective*, Seminar Press, New York 1963, 373-382.
19. Αγελαράκης Α., «Ανάλυση οστεολογικού υλικού από τρεις τεφροδόχους στην πόλη της Χίου», *ΗΟΡΟΣ* 4 (1986), 145-153.
20. Shipman P., Foster G., and Schoeninger M.J., "Burned Bones and Teeth: An Experimental Study of Color, Morphology, Crystal Structure and Shrinkage", *Journal of Archaeological Science* 11 (1984), 307-325.
21. Buikstra J.E., and Swegle M., "Bone Modification Due to Burning: Experimental Evidence". In Bonnichsen R., and Sorg M. (eds.) *Bone Modification*, Center for the Study of the First Americans, Maine 1989, 247-258
22. Agelarakis A., "Archaeological Forensics and Paleopathology". In Grosman, J. (ed.) *The Excavation, Analysis, and Reconstruction of the Transitional Period, Late Woodland Period and Colonial Occupations at the Little Wood Creek Site, Fort Edward, Washington County, New York*, New York State Historic Preservation Office, the Advisory Council on Historic Preservation- Washington D.C., and U.S. EPA, 1990, Vol: IV.

23. Agelarakis A., Book Review on "Making Faces: Using Archaeological and Forensic Evidence". Prag J., and Neave R., 1997, Texas A&M University Press, College Station, Texas. *AJA*, 102 (1998).

24. Ortner D.J. and Putschar W.G.J., "Identification of Pathological Conditions in Human Skeletal Remains". Smithsonian Contributions to Anthropology, Smithsonian Inst. Press, City of Washington, 1985.

25. Agelarakis A., Paley S., Porath Y., and Winnick J., "The Chalcolithic Burial Cave in Ma'avarot, Israel, and its Paleoanthropological Implications", *International Journal of OsteoArchaeology* 8 (1998), 431-443.

26. Agelarakis A., "The Human Condition During the 7th c. B.C. in Abdera, as Revealed Through Physical and Forensic Anthropology". (forthcoming)

27. Stampolidis N. Chr., "Eleutherna on Crete: An Interim Report on the Geometric-Archaic Cemetery". *BSA* 85 (1990), 375-403.

28. Σταμπολίδης Ν.Χρ., «Γεωμετρική 'ομηρική' ταφική πυρά από την Ελεύθερνα», *Πεπραγμένα του ΣΤ' Διεθνούς Κρητολογικού Συνεδρίου*, Χανιά 1990, τ. Α:2, 289-298.

29. Σταμπολίδης Ν.Χρ., *Ελεύθερνα* ΙΙΙ.1, *Γεωμετρικά-αρχαϊκά χρόνια και Οδηγός στην Έκθεση «Το γεωμετρικό-αρχαϊκό νεκροταφείο της Ορθής Πέτρας»*, Ρέθυμνο 1993.

30. Σταμπολίδης Ν.Χρ., *Ελεύθερνα* ΙΙΙ.2, *Από τη γεωμετρική και αρχαϊκή νεκρόπολη. Ταφικές πυρές και ομηρικά έπη*, Ρέθυμνο 1994.

31. Stampolidis N.Chr., "Imports and Amalgamata: the Eleuthernian Experience". In Karageorghis, V., and Stampolidis N.Chr. (eds.) *Proceedings of the International Symposium on the Eastern Mediterranean: Cyprus-Dodecanese- Crete 16th-6th cent. B.C.*, Athens 1998, 175-184.

32. Καλλιντζή Ντ., «Αρχαιολογικές εργασίες της ΙΘ' Εφορείας στα Άβδηρα κατά το 1991», *ΑΕΜΘ* 5, (1991), 456-469.

33. Καλλιντζή Ντ., *ΑΔ* 16 (1991), Β, 325.

34. Καλλιντζή Ντ., *ΑΔ* 1992 και 1993.

35. Καλλιντζή Ντ., «Έθιμα ταφής στα Άβδηρα», *Πρακτικά του 2ου Διεθνούς Συμποσίου Θρακικών Σπουδών, Αρχαία Θράκη*, 1997, τ. 2, 807-839.

36. Κουκούλη-Χρυσανθάκη Χ., ««Οι ανασκαφικές έρευνες στα αρχαία Άβδηρα», *Συμπόσιο Η Ιστορική, Αρχαιολογική και Λαογραφική έρευνα για τη Θράκη*, Θεσσαλονίκη 1988, 46-48.

37. Koukouli-Chrysanthaki, Ch., "The cemeteries of Abdera", *Necropoles et societes antiques*, 33-77.

38. Κρανιώτη Λ., «Τύμβος από τη ΒΑ. νεκρόπολη των Αβδήρων» *ΑΕΜΘ* 1 (1987),431-435.

39. Τριαντάφυλλος Δ., «Σαρκοφάγος κλαζομενικού τύπου από τα Άβδηρα της Θράκης», *Πρακτικά του 2ου Διεθνούς Συμποσίου Θρακικών Σπουδών, Αρχαία Θράκη*, 1997, τ. 2, 741-774.

40. Rogan K.P., and Salvo J.J. "Study of Nucleic Acids Isolated From Ancient Remains". *YearBook of Physical Anthropology* 33 (1990), 195-214.

41. Bordens K.S., and Abott B.B., "Research Design and Methods". 2nd Edition, Mayfield Publishing Company, Toronto 1991

42. Van Vark G.N., and Schaafsma W., In Saunders S.R. and Katzenberg M.A. (eds.) "Skeletal Biology of Past Peoples: Advances in the Quantitative Analysis of Skeletal Morphology". Willey-Liss, New York 1991, 225-257.

43. DiBennardo R., and Reichs K.J., "Forensic Osteology: The Use and Interpretation of Common Computer Implementations of Discriminant Function Analysis". C.C. Thomas, Springfield, Ill., 1986, 171.

44. Agelarakis A. "Social Hierarchy in a Classical Society at Abdera as Revealed by New Archaeological Perspectives of he Human Skeletal Record", *Πρακτικά του 2ου Διεθνούς Συμποσίου Θρακικών Σπουδών, Αρχαία Θράκη*, 1997, τ. 2, 849-866.

45. Agelarakis A. "Anthropological Investigations in Classical Abdera: Cremated and Dry Human Osseous

Materials". Archival Reports, Archaeological Museum of Abdera, 1996, 1997, 1999 (forthcoming).

46. Agelarakis A., and Agelarakis Ar., "The Palaeopathological Evidence, Indicators of Stress and Dietary Evaluations from two Skeletal Populations, a Middle and a Late Byzantine, from Polystylon Abdera, Greece", *Byzantinische Forschungen* 14 (1989), 9-

47. Agelarakis A. "Excavations at Polystylon (Abdera) Greece: Aspects of Mortuary Practices and Skeletal Biology". *AA* 47 (1997), 293-308.

48. Agelarakis A., and Bakirtzis Ch., "Cemeteries of Polystylon – Abdera". In *Burial Customs and Practices in the Rhodopes, Rhodopica*, 1998/1, 58-68.

49. Agelarakis A., "The Roman Skeletal Collection from Abdera". (Report in preparation).

50. Agelarakis A., Reports on the Dry and Cremated Human Skeletal Remains from Orthi Petra at Eleutherna, Archival Reports with the excavator of Orthi Petra – Prof. N.Ch. Stampolidis, 1995, 1996, 1997, 1998 & 1999 (forthcoming).

51. Agelarakis A., "A Letter to the Excavator Pertinent to Physical Anthropology & Paleopathology". In Stampolidis N.Chr., *Reprisals. Contributions to the Study of Customs of the Geometric-Archaic Period*, Rethymnon 1966, 204-207.