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Intra-group dynamics, glimpses of labor diversity and specialization, and evidence of incipient social stratification in Neolithic Crete: Reflections from the Aposelemis Burial Ground

ABSTRACT

This paper presents bioarchaeological data retrieved from the study of anthropological remains excavated from the formal Neolithic burial ground discovered in the area of the Aposelemis dam in central Crete.

Archaeological documentation of the Aposelemis site revealed that it was a well-structured burial ground, yielding ca. sixty archaeological features, with specific tomb forms and indications of burial rites. The human skeletal record preserved in dry form and representing primary burials was recovered from 47 burial contexts which involved either individual or multiple interments. The rest of the features involved hearths and pits with faunal remains and pottery deposits.

Laboratory analyses based on methodological approaches and research protocols of Forensic Anthropology and Bioarchaeology revealed that the human skeletal population sample examined comprised 53 individuals of both biological sex subgroups and a range of age cohorts ranging from “Infancy I” (Birth to 6 years of age) to “Older or *Senilis*” (55+ years). Further, inspectional and mensurational studies of the dental and skeletal materials discerned a plethora of conditions relative to anatomic morphology and epigenetic variability, biological growth and physiology, aspects of dietary intake, facets of skeletomuscular system adaptations with a focus on *ante mortem* kinetics and trajectory forces of load stress, as well as manifestations of disease and trauma impact; the latter mainly caused by injuries afforded by external, non-pathological causative agents.

Consequently, this paper based on bioarchaeological data of the Neolithic Aposelemis anthropological remains offers glimpses and assessments of aspects of the human prehistoric condition as these relate to the population sample’s demographic and paleopathological profiles. Traces, markers, and changes permanently recorded on dental and skeletal surfaces reflect intra-group dynamics relevant to anatomic morphologic variability, inter- and intra-gender labor diversity suggesting specialization, as well as lines of evidence in support of incipient social stratification.

KEYWORDS: Neolithic Aposelemis Burial Ground, Bioarchaeology, Skeletal Forensics, Dental Anthropology, Palaeopathology, Demographic Dynamics, Incipient Social Stratification

Archaeological investigations and methodical excavations under the directorship of Dr. Athanasia Kanta, in preparations for the construction of the Aposelemis dam in the endoplains of Herakleion

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Fig. 1.
Aposelemis burial
ground, funerary
contexts in situ:
Courtesy of Dr.
Athanasia Kanta.

*(Images and graphs
are by the author
unless otherwise
stated, i.e. Figs 1
and 2)*

prefecture, unearthed among other significant finds a formal Neolithic period burial ground at the site of “Kefali” near the village of Sfendyli Pediados.

Archaeological documentation of the site revealed a well-structured burial ground with specific tomb forms and indications of burial rites. There were ca. 60 funerary features, the vast majority of them comprising tombs, some containing more than one burial, while the remaining features involved hearths and pits with faunal remains and pottery deposits (Fig. 1). While the archaeological materials are currently under study in preparation of the final publication, this paper focuses on the osteological/bio-anthropological study of the human remains (Fig. 2)



Fig. 2. Primary burial
context of human
interment in situ:
Courtesy of Dr.
Athanasia Kanta.



Fig. 3. Human skeletal component in sediment conglomerate as retrieved from excavation.



Fig. 4. Human skeletal component featured in Fig. 3, following processing by conservators.

recovered, aiming to elucidate in conjunction with the rest of the archaeological record unknown facets of the human condition during the Neolithic period in the Aposelemis endoplains of Crete.

As provided by physical anthropological analyses and archaeological forensic assessments* the human skeletal population sample examined so far comprised 53 individuals¹, along with an associated assembly of faunal remains associated with funerary rituals. The human skeletal record was recovered in dry form, from 47 burial contexts involving either individual or multiple interments.

While a considerable number of the human skeletal individuals had been retrieved from their burial contexts in a fragmentary and incomplete state of preservation, due to diachronic taphonomic processes, it was nevertheless possible with the valuable help of specialized conservation processes to retrieve diagnostic bioarchaeological data from the skeletal population sample of 53 human individuals (Fig. 3, and 4); hence the unit of analysis of this project was based on the single skeletal individual. Analyses of the human skeletal record were carried out through the interdisciplinary methodological processes of Physical/Forensic Anthropology.²

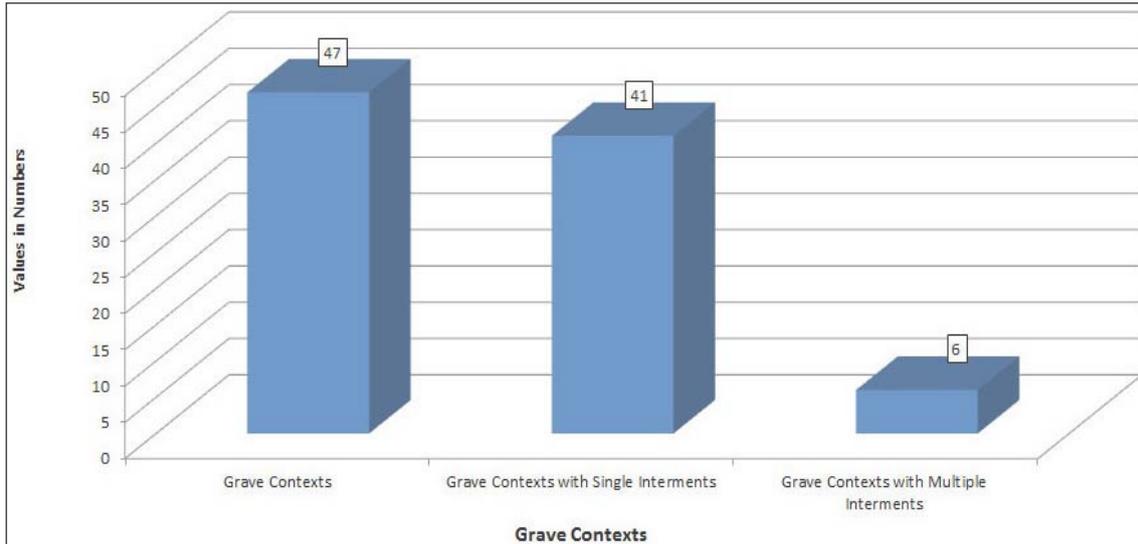
Laboratory analyses of the anthropological record determined that 41 of the 47 burial contexts had involved single interments, while 6 had contained multiple interments (Graph 1). Each of

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¹ An additional number of skeletal individuals having sustained significant compaction/truncation effects from superimposing deposits and embedded into hardy sedimentological conglomerates, given the diachronic effects of multifactorial taphonomic conditions, are currently under the care of specialized conservators.

² For a number of selected references see Bibliography.

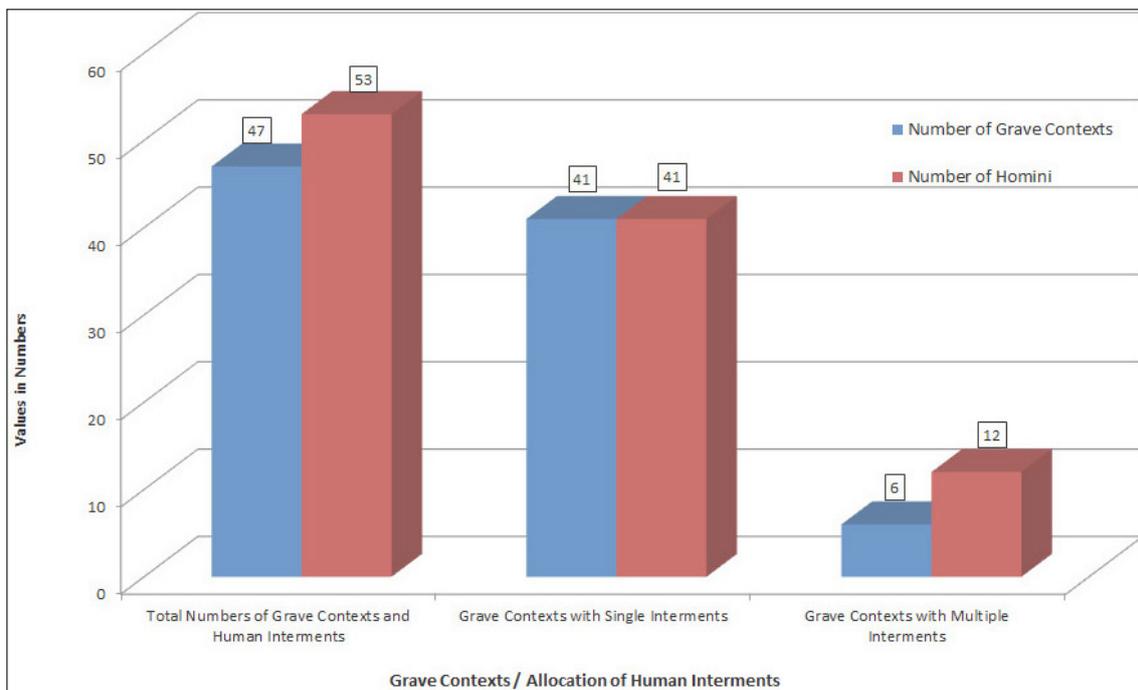
4 ΠΕΠΡΑΓΜΕΝΑ ΙΒ' ΔΙΕΘΝΟΥΣ ΚΡΗΤΟΛΟΓΙΚΟΥ ΣΥΝΕΔΡΙΟΥ



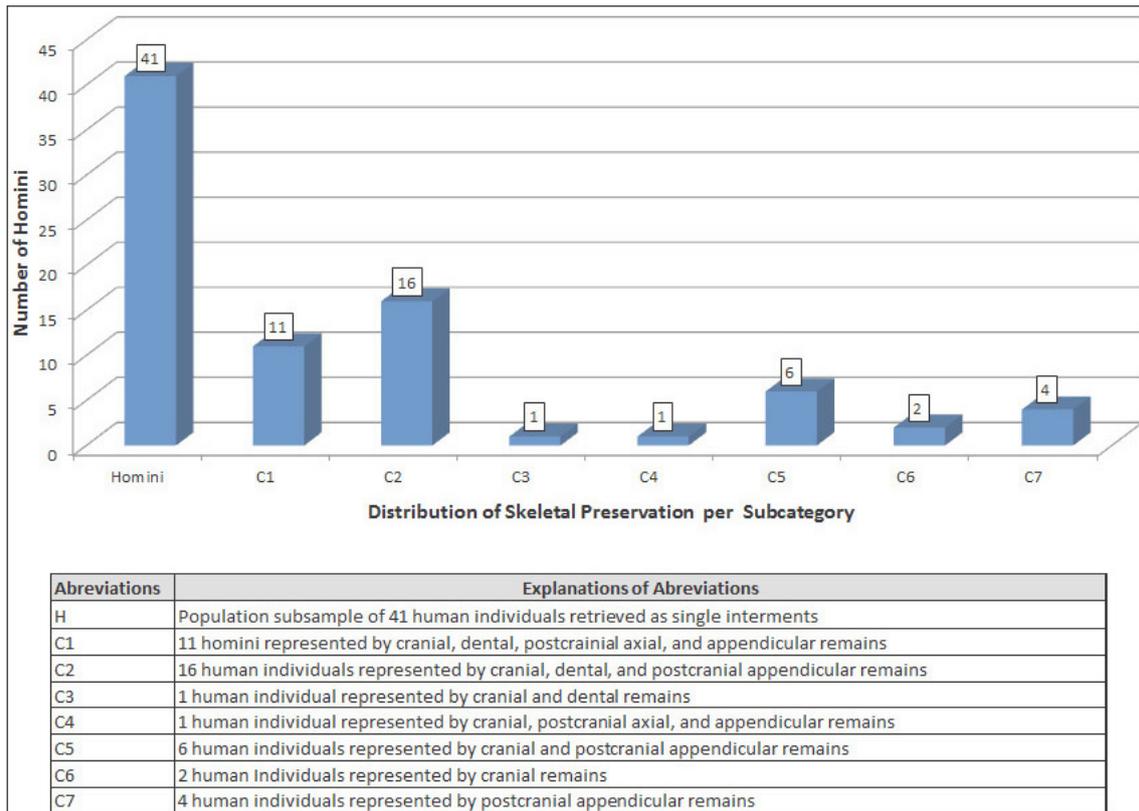
Graph 1. Distribution of 47 Grave Contexts involving Single versus Multiple Interments.

the latter contained 2 interments (Graph 2), hence the anthropological sample studied was comprised of 53 individuals.

A range of 7 prescribed subcategories was designated to characterize the site-specific nature of skeleto-anatomic composition of the collection, reflective of parameters inclusive of burial customs, diachronic bioturbation, and taphonomic processes. Addressing skeletal preservation among the 41 individuals retrieved and identified as single interments, the



Graph 2. Distribution of 53 Homini Retrieved from within 47 Grave Contexts.

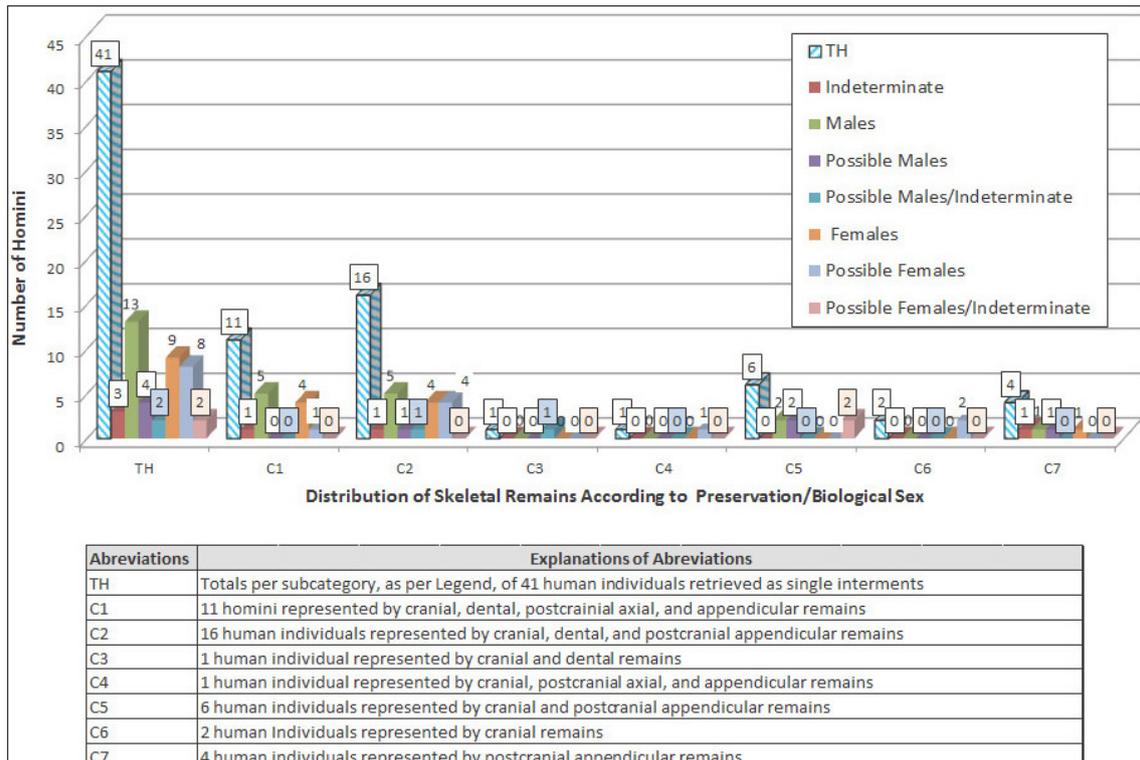


Graph 3. Distribution of Skeletal Preservation per Homo of 41 Homini Recovered as Single Interments from 41 of 47 Grave Contexts.

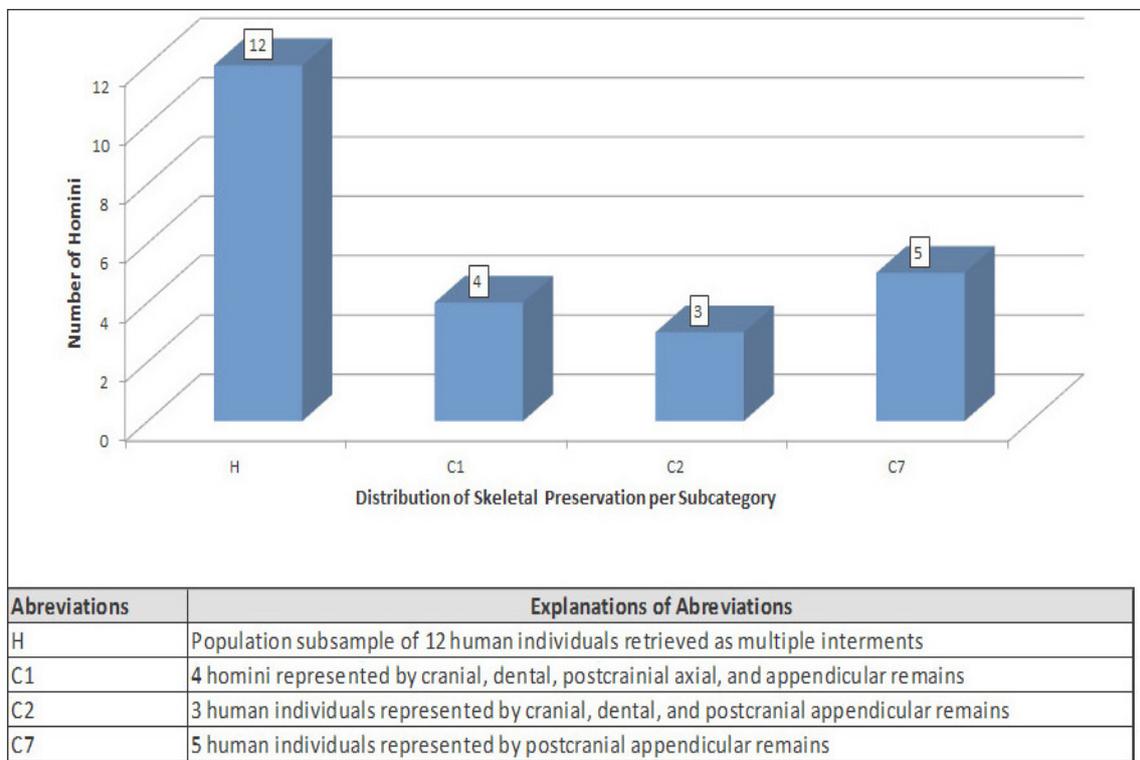
majority cluster comprised individuals represented by cranio-dental, post cranial axial, and post cranial appendicular remains, along with individuals which retained cranial, dental, and postcranial appendicular remains (Graph 3). Comparison of skeletal preservation by biological sex indicated that both female and male individuals retained comparative skeletal structures nearly isometrically, considering that forensic identification showed Males were more prevalent than Females (Graph 4).

A significantly diminished variety of preservation subcategories characterized the condition of the 12 individuals retrieved as multiple interments, compared to single interments, (Graph 5) with the highest score held by individuals who only preserved postcranial appendicular remains. Both female and male individuals of the multiple interments had been affected by comparative taphonomic parameters across the three designated subcategories (C1, C2, and C7) of skeletal preservation (Graph 6).

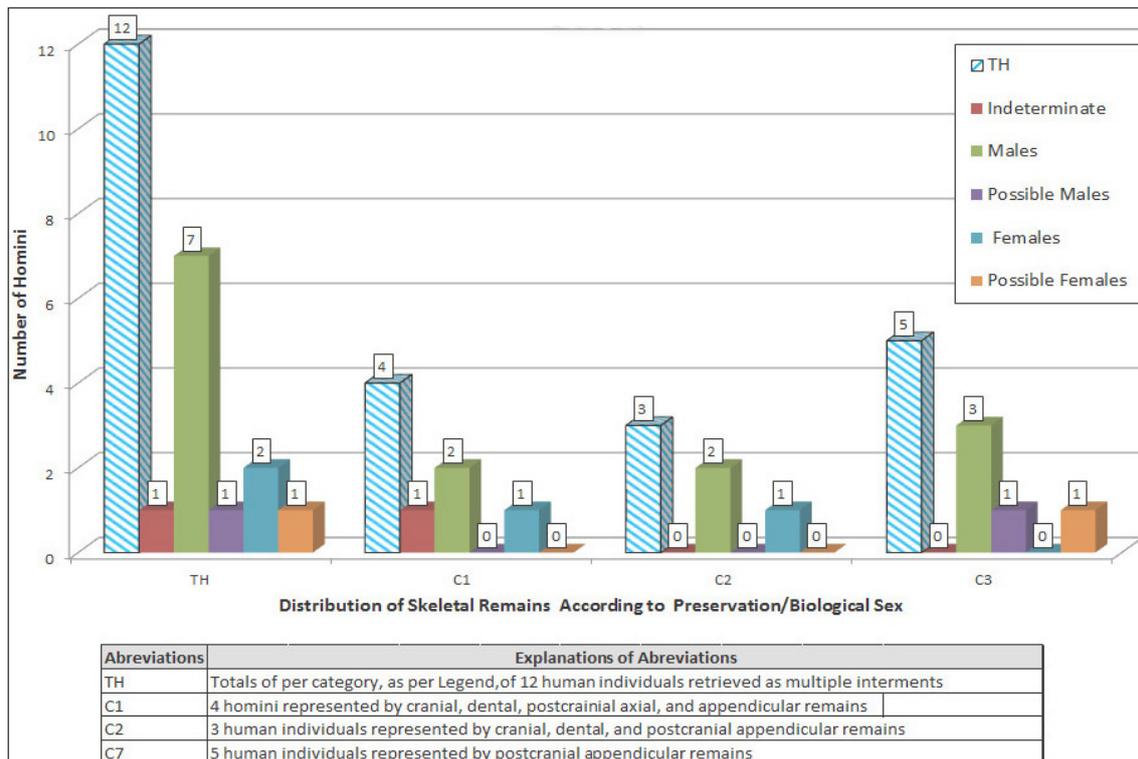
In juxtaposing the measures of skeletal preservation and anatomic representation of dental and skeletal surfaces between burial contexts which yielded single versus multiple interments, it appears that the former fared better in this regard; 41.67% of the multiple interments were represented only by postcranial appendicular remains (Graph 5: C7) compared to 9.76% of the single interments (Graph 4: C7). While considering a range of taphonomic parameters the diachronic effects of which could provide explanatory arguments on the specific prevalence



Graph 4. Biological Sex Distribution in Relation to Skeletal Preservation, per Homo, of 41 Homini Recovered as Single Interments from 41 of 47 Grave Contexts.



Graph 5. Distribution of Skeletal Preservation per Homo of 12 Homini Recovered as Multiple Interments from 6 of 47 Grave Contexts.

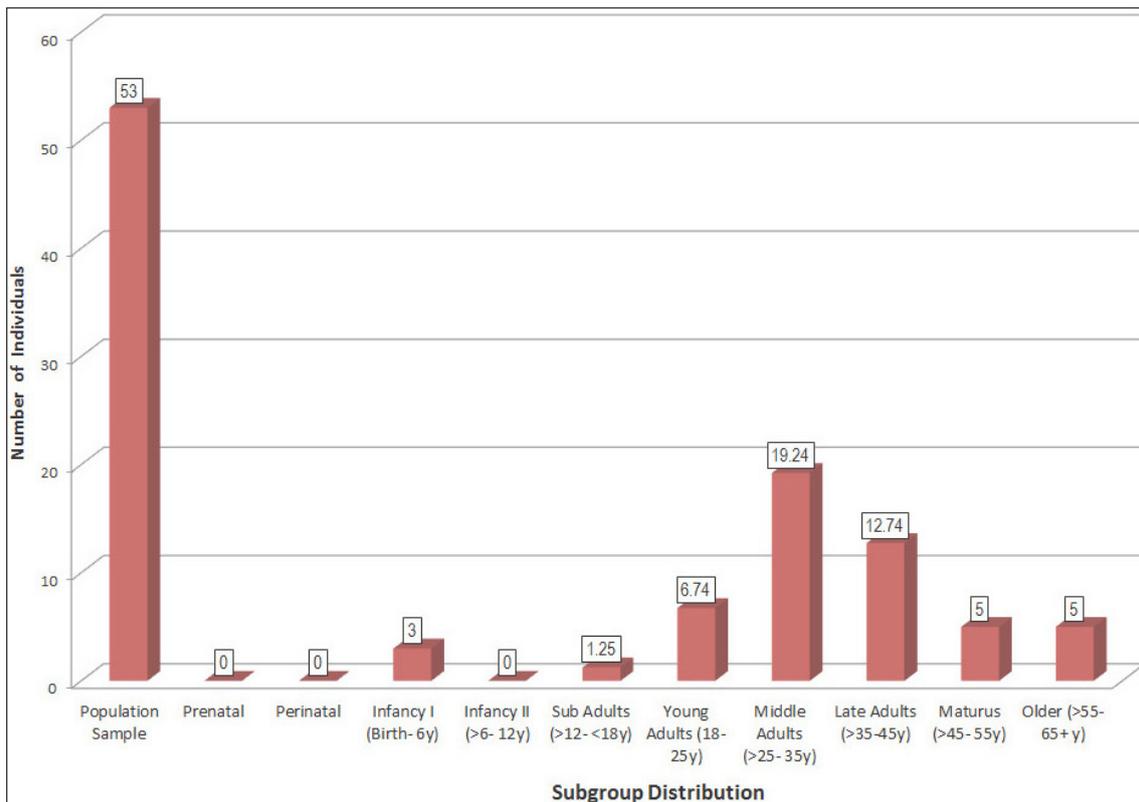


Graph 6. Biological Sex Distribution in Relation to Skeletal Preservation, per Homo, of 12 Homini Recovered as Multiple Interments from 6 of 47 Grave Contexts.

of skeletal preservation variables between single versus multiple interments, a competitive explanatory hypothesis could not be ruled out at this stage of project research, namely that the non-conterminous placement of interments in the graves containing multiple individuals could have also been a contributing factor to said skeletal preservation. Should additional evaluation processes through ongoing project-relative interdisciplinary research approaches, inclusive of burial artifactual assemblage analyses and demographic/palaeopathological profile investigations, prove unable to nullify the latter competitive explanatory hypothesis, it may yet offer a clue to the assessment of morbidity and mortality causative agents which could have affected the population sample, debating matters of epidemiology, and further on questions relating to the domain of the Aposelemis population mortuary and funerary organizational abilities, capacities and preparedness.

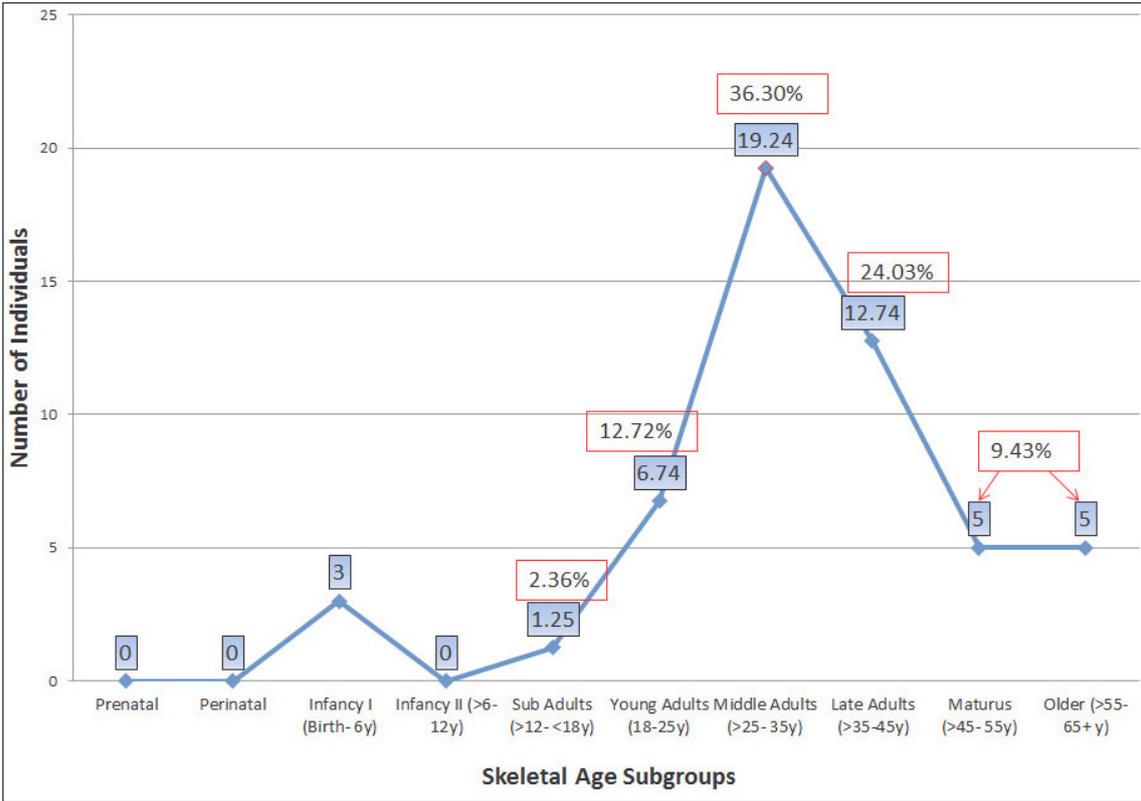
Abridged age at death assessments of the population sample depict a mortality curve initiating at early post-natal years within “Infancy I”, discontinuing till “SubAdulthood” and subsequently through a continued bell curve register a J-curving which crests within the domain of “Middle Adulthood”, declining during “Late Adulthood” and tapering off isometrically among the “*Maturus*” and the “Older” cohorts (Graph 7).

Surpassing the early years of life during “Infancy I”, laden with the potential of increased morbidity and mortality from a range of conditions such as weanling diarrhea complications and infectious childhood diseases, the “Infancy II” age subgroup seems to have fared better

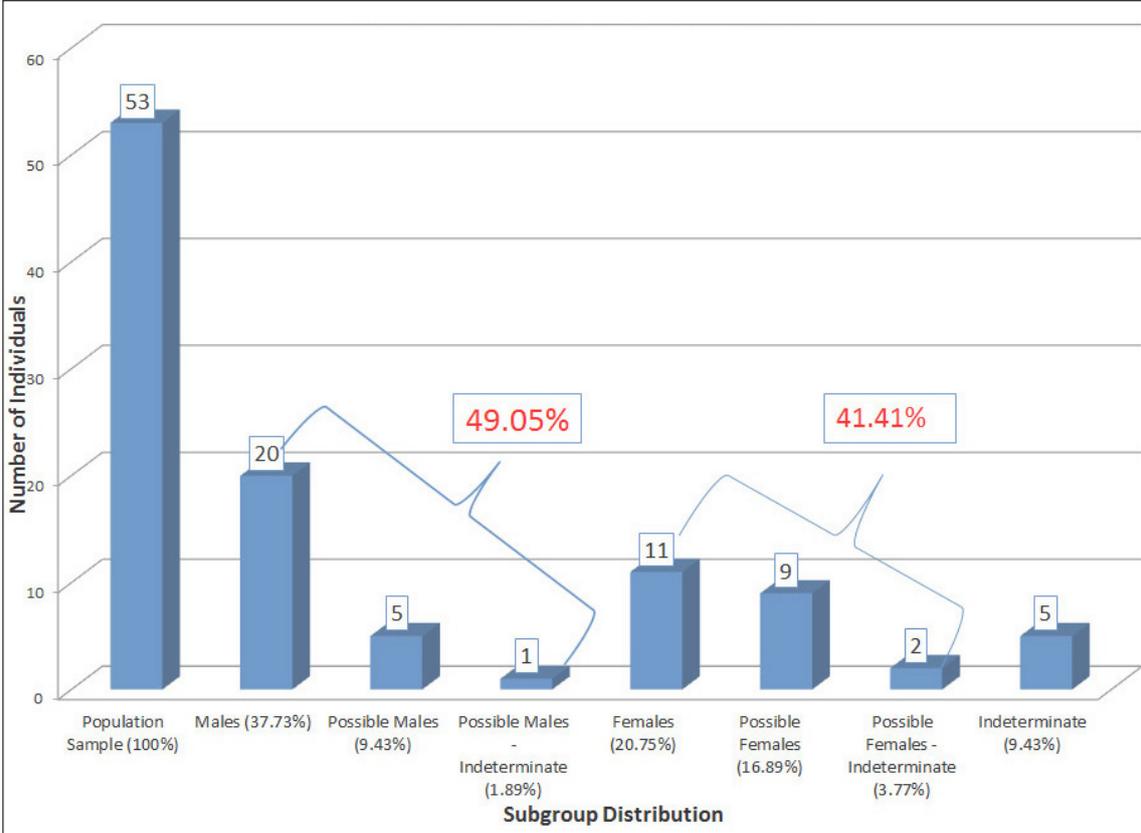


Graph 7. Abridged Skeletal Age Assessments.

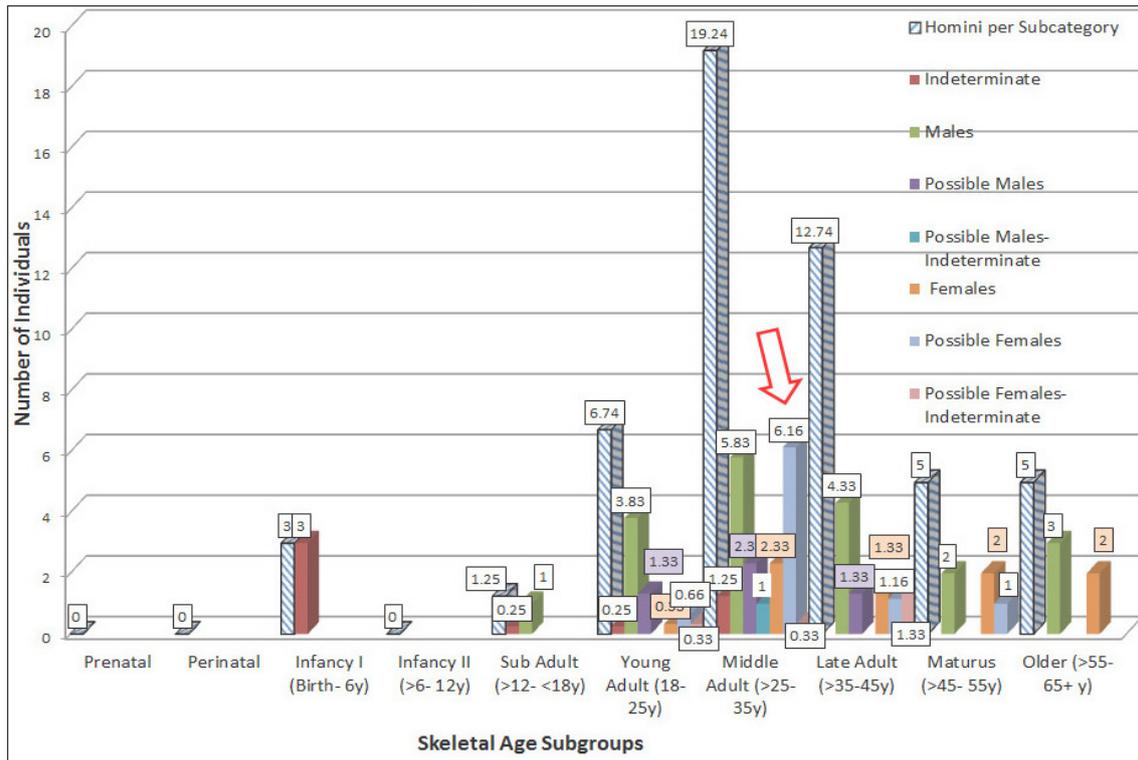
in survivorship ability than the “SubAdult” cohort; although the latter showed a better survivorship capacity than the “Infancy I” age subgroup. This, it is suggested, may reflect, among other conditions, matters of available cultural buffer mechanisms implemented to alleviate physiological and pathological stress during those critical years of biological growth and development. Thus, the sharply ascending mortality prevalence sustained past “SubAdulthood”, namely within “Young Adulthood” and successively cresting during “Middle Adulthood”, with still a considerable although somewhat abating prevalence within “Late Adulthood”, with the exception of a case of epidemic, could be revealing of the highly demanding and taxing anatomic and physiological burden placed on those age subgroups by life conditions and aspects of their perceived environments affecting both private matters-interests-and obligations, and of communal mandates required or exacted on the membership of the cohorts involved. Regarding the isomerous tapering off of mortality prevalence among the “Maturus” and “Older” cohorts, yet not significantly below the score observed among “Young Adults,” it is suggested it may reflect population attrition co-relevant to aging processes; although skeleto-muscularly both age subgroups showed a continued, relatively robust, involvement in the workings of their socio-cultural context. As far as the potential for the membership of the population involved in further extended longevity to old age is concerned, there were a number of individuals within the “Older” cohort who were age assessed at 65+ years at the occurrence of death (Graph 8).



Graph 8. Abridged Age Distribution.



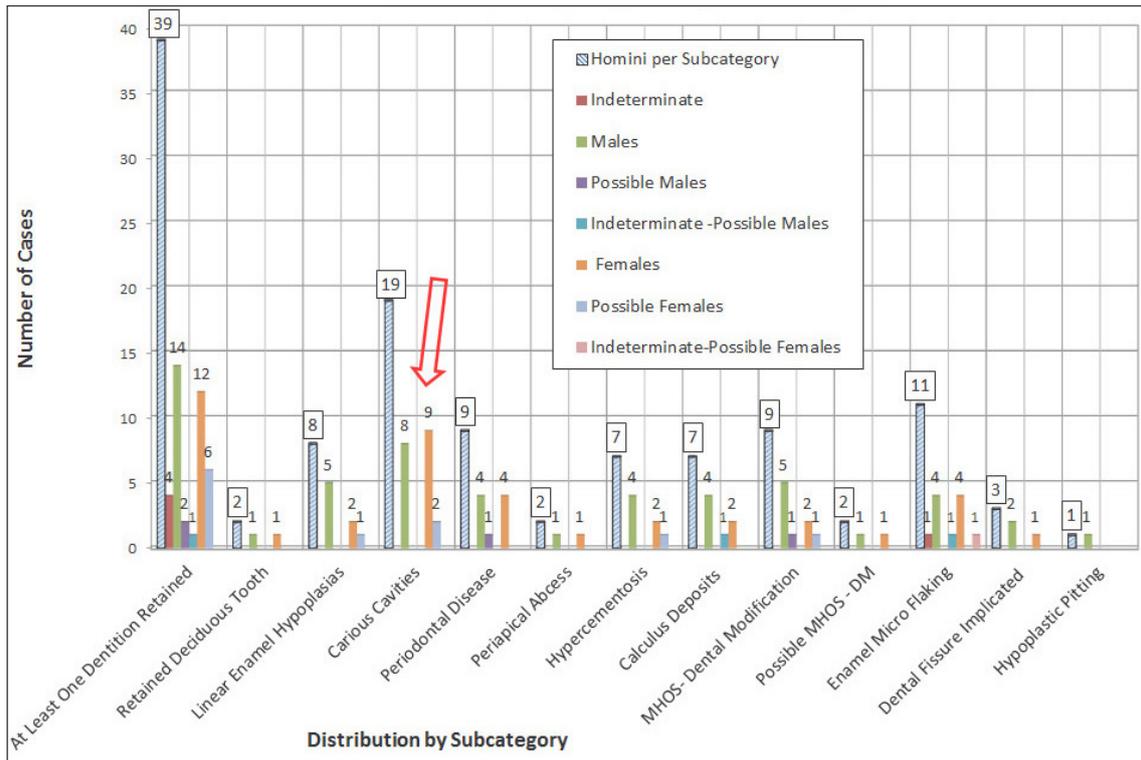
Graph 9. Biological Sex Assessments.



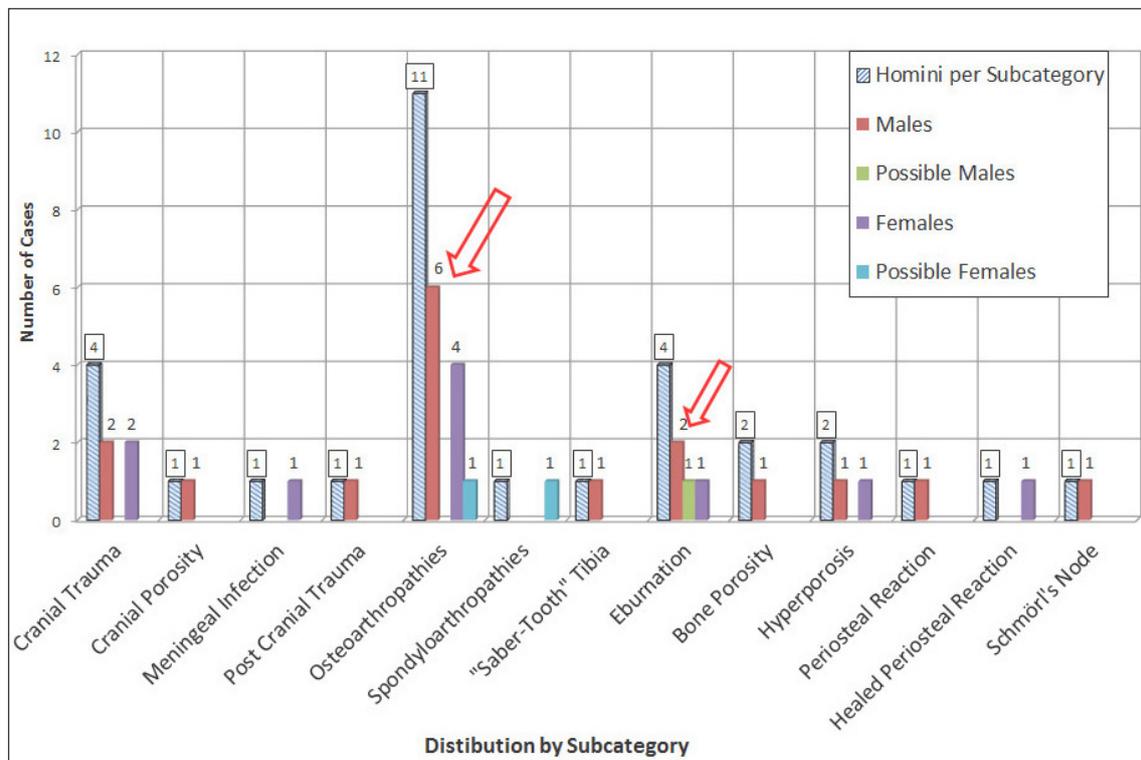
Graph 10. Abridged Skeletal Age and Biological Sex Distribution within the Skeletal Population Sample of 53 Individuals.

Addressing the composition of biological sex distribution within the population sample, based on the level of forensic assessment certainty, the combined Male cluster reached 49%, trailed by the respective Female cluster at 41.41% (Graph 9). The remaining ca. 10.0% comprised individuals who due to preservation issues and/or their very young age did not provide diagnostic criteria for biological sex assessments. Yet it appears that the distribution along the lines of biological sex diversity within the population sample was nearly isomerous (Graph 10), skewing any distinct variability-prevalence between male versus female individuals, while a combined evaluation of abridged age and biological sex assessments clearly indicated that only during “Middle Adulthood” a representative component of the Female cluster mentioned above, namely the “Possible Females”, surpassed 2.6-fold (see arrow in Graph 10) the relative mortality prevalence of comparable Males; it appears this was a heavily taxing age period for those individuals, affected among other parameters, it is suggested, by complications related to issues of fecundity and comorbidity.

Seeking to better decipher aspects of life conditions permanently recorded in the skeletal record of the population sample, dental and jaw pathologies of a population subgroup of 39 individuals (Graph 11) who had retained dentitions clearly indicated, with the exception of cariogenic lesions (see arrow in Graph 11), a greater prevalence of relevant oral cavity pathogenicity among Males compared to Females. Similar conditions prevailed in the non-pathological domain of dental modifications for non-masticatory purposes whereby jaws and teeth had been used



Graph 11. Distribution of 80 Dental Pathological Conditions & Manifestations of MHOS- Dental Modifications (DM) in Relation to Biological Sex among 39 (73.58%) of 53 Individuals comprising the Population Sample.



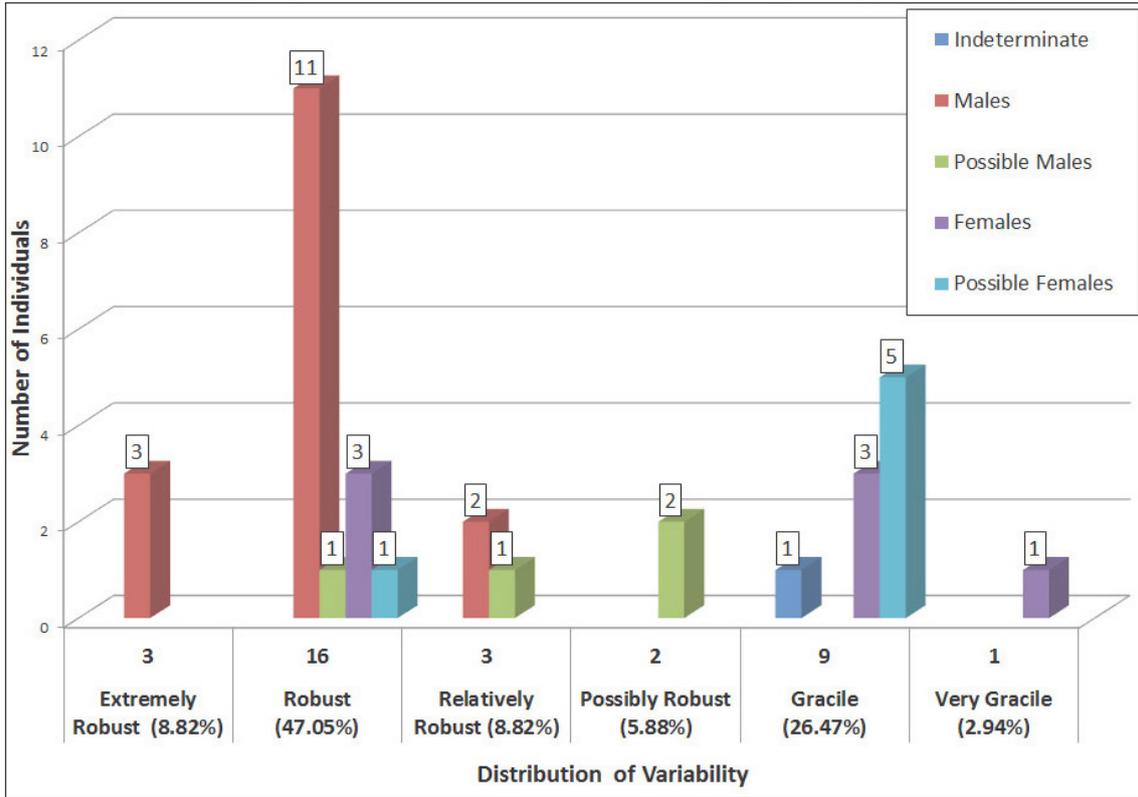
Graph 12. Distribution of 31 Skeletal Pathological Manifestations and Trauma Cases in relation to Biological Sex among 29 (54.72%) of the 53 Individuals comprising the Population Sample.

in “third hand” functions. Further, with the exception of a greater prevalence among Males in osteoarthropathies and articular surface eburnation (see arrows in Graph 12), cranio-infracranial pathological manifestations revealed a near isomeric distribution among Females and Males even in the cases of cranial trauma, all of which had been healed or were in the healing process, apparently following medical intervention. Cranial trauma cases were exclusively observed on antero-postero-lateral vault surfaces raising suspicions about their causative agents, given that in the sphere of anthropology of conflict such specificity of cranial *loci* impact may present trauma patterns sustained not necessarily exclusively accidentally, but possibly in the event of close encounter engagement, particularly of malicious intent; although no competitive explanatory hypotheses have been excluded in this ongoing investigation. Regarding the osteoarthropathic changes, these were the consequence of degenerative processes, combined with several cases of subchondral bone eburnation secondary to long-term hyperactivity and even focal micro-traumatism of synovial joints of the appendicular skeleton. With reference to the articular surface eburnation, this was chiefly observed among the subgroup of individuals who presented a robust skeletal build combined with specialized skeletomuscular changes designated as markers of habitual and/or occupational stress (MHOS).

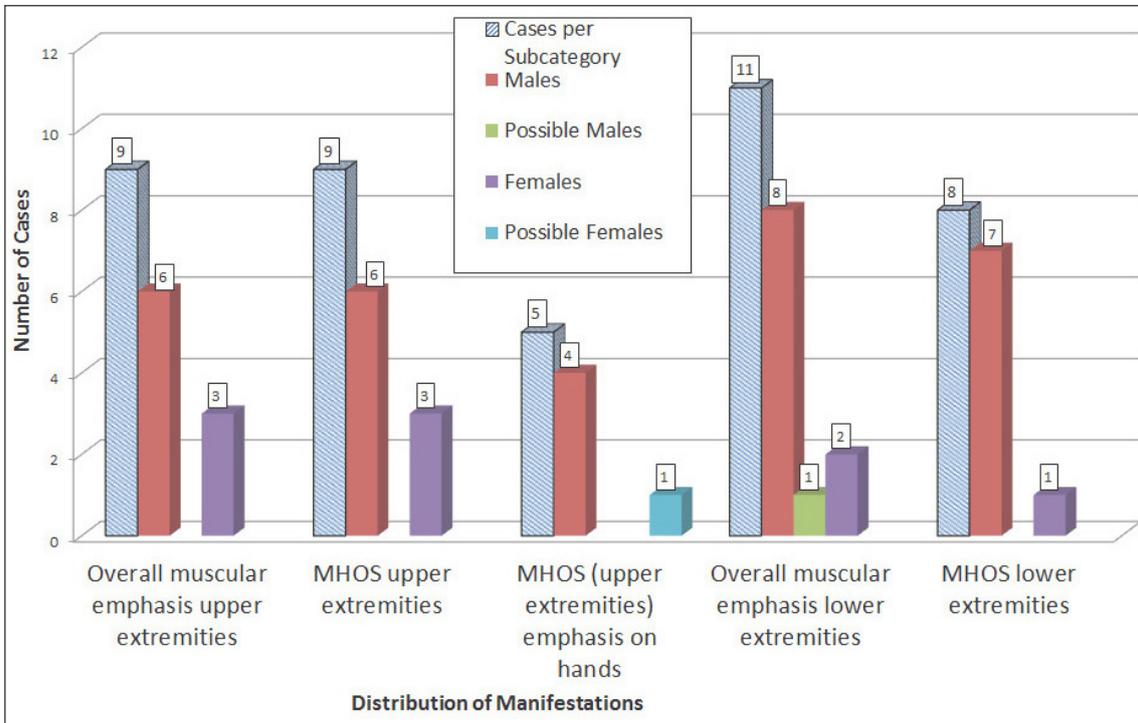
As an inherent component of the anthropological study, emphasis was placed on the identification of *in vivo* skeletal changes, as they may be reflective of intra-population variability on matters of skeletomuscular build and robustness, of labor diversity issues by age and biological sex subgroup, and of the realm of traceable kinetics in physical activities revealed by particular skeletomuscular changes such as MHOS. These last were mainly represented by changes in cranio-infracranial skeleto-anatomic *loci*, where ligamento-muscular attachments of origin and insertion, of muscles that functioned in synergistic and/or antagonistic ways, had left specific traces of emphasized skeletal imprints; consequences of *ante mortem* skeleto-muscular system actions which had caused localized modifications and enhancement of the bone substrate.

Hence, of the population sample of 53 individuals, 19 (35.85%) were either not adequately preserved or were represented, due to young age, by immaturely developed skeletal bodies for skeletomuscular analysis. Therefore, of the remaining 34 individuals (Graph 13), 3 Males showed manifestations of extremely emphasized skeletal build and particular features of infracranial accentuated skeletomuscular robustness, 16 individuals, of whom 12 belonged to the Male and four to the Female clusters, revealed robust skeletal build and features of skeleto-muscular emphasis, 3 individuals involved in the Male cluster showed relatively robust skeletal frames and muscular imprints, tapering off with 2 “Possible Male” individuals who showed possibilities of a robust skeletal build. Of the remaining 10 individuals, all within the Female cluster, 9 revealed gracile skeletal bodies while 1 was very gracile, yet not due to pathological reasons as far could be discerned skeletally.

Henceforth, of the subgroup of 34 individuals selected for detailed anatomic morphology evaluations (because of better skeletal preservation), a subgroup of 26 involving both Females and Males revealed 42 cases of tangible bone plasticity changes (Graph 14) in *loci* of muscular origins and insertions, particularly on appendicular skeletal structures relevant to *in vivo* actions designated as MHOS. Further, 20 (76.92%) of those 26 individuals revealed a combination of



Graph 13. Distribution of Skeletal Morphological Variability in Relation to Biological Sex among 34 (64.15%) of the 53 Individuals comprising the Population Sample.

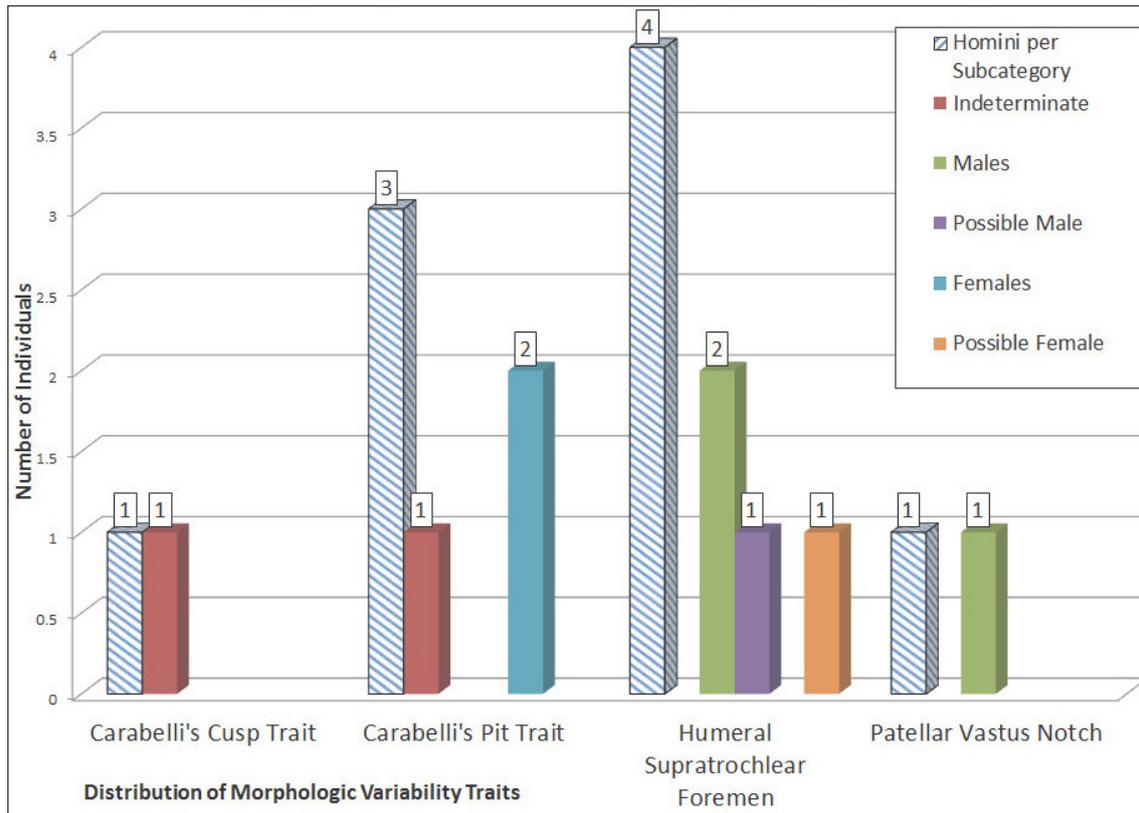


Graph 14. Distribution of 42 Cases of Unique Skeleto-Muscular Emphasis & Markers of Habitual-Occupational Stress (MHOS) by Biological Sex among 26 (76.5% of the 34 robust individuals) Individuals comprising 49.06% of the Population Sample of 53 Homini.

considerable manifestations of overall robustness in skeletal build in addition to significantly enhanced *loci* of muscular origins and insertions (assessed as 22 MHOS cases) in structures of the appendicular skeleton. Members of this latter subgroup offered a 100% observation ratio in combining robustly built skeletal systems with emphasized MHOS traces, whereas the lack of skeletal robustness and MHOS among the 10 skeleto-anatomically gracile Females provided no skeletal evidentiary data indicative of reduced mobility but rather revealed that they had been in good, physically active, bodily condition.

Such an apparent variability of skeleto-muscular morphology may offer ramifications in the eventual interpretation of aspects of behavioral conduct in the Aposelemis Neolithic cultural context, given that nearly all pre-“Young Adult” individuals, and certain post-“Young Adult” individuals, who lacked MHOS manifestations and robust skeletal build, did not seem to have been involved in carrying out heavy-impact, repetitive kinetics or to have been involved in heavy load-bearing activities that would most probably have left traces on axial and appendicular body structures. While it appears that an age factor may have been in effect, which excluded the pre-“Young Adult” individuals from tasks that would have caused them to acquire traceable MHOS, matters of community diversification in *specialization* among post-“Young Adult” individuals comes to mind, as it may have related to mandates concomitant to economic productivity and output. Given that there were no evidentiary skeletal data to reveal inactivity due to trauma, pathology, or aging effects, the possibility could be considered of at least a few variables regarding the subgroup of post-“Young Adult” individuals lacking robust skeletal structures and MHOS manifestations. This could have been, for example, a result of : a) conditions presented by a certain intra-population scaffolding in matters of social stratification that excluded said individuals from involvement in physical tasks which would have resulted in specific skeletal structures’ robustness and MHOS, and/or b) that said individuals were involved in important actions and responsibilities, essential components of cultural fabric mandates which nevertheless did not involve the taxing effects of repetitive kinetics and/or demanding load-bearing conditions. Of particular interest is the fact that the 10 individuals lacking robust skeletal build and manifestations of MHOS were exclusively observed among the Female cluster; conditions that were absent from the Male cohort. This may indicate that a larger ensemble of Female individuals, unlike a number of fewer Females from the same population, at a 10:4 ratio, had been persistently sheltered from involvement in heavy load impact activities that would otherwise have left their mark on their skeleto-muscular systems. Therefore, in addition to labor diversification between Males and Females, there were apparently well-defined intra-female labor diversity dynamics in play at Neolithic Aposelemis; this is suggested to reflect tesserae indicative of possibly non-incipient differences, in the expectations and responsibilities of life modes and of the social standing milieu among them.

Yet as far as the matter of *in vivo* physical mobility is concerned, it clearly appears that the 10 Female individuals who seem to have been buffered from exposure to excessively demanding physical activities, particularly concerning trajectory forces of stress during load-bearing activities, were not in fact lacking traces of skeleto-muscular changes on their lower extremities which were indicative of frequent *ante mortem* involvement in locomotory behavior in nearly precipitous



Graph 15. Traits of Morphological Variability in Relations to Biological Sex Distribution among 9 (16.98%) of 53 Individuals comprising the Population Sample.

substrates. Such skeleto-anatomic manifestations were shared with the Females of robust anatomic morphology and MHOS changes, given the unavoidable components of their perceived environment and catchment areas. Similarly, as afforded by skeletal preservation, the particular body posture of the squatting position with knee joint hyperflexion along with hyperextension of the hip joints was documented indiscriminately of biological sex or variability of skeletomuscular robustness and MHOS. Furthermore, it appears that the quality of preparation, the composition of dietary intake, and the palaeopathology of jaws and teeth was not variant among Female individuals.

In searching for independent lines of evidence in order to further integrate and elucidate aspects of this most interesting domain of population-sample-composition it was possible, despite the limitations imposed by preservation, to record a number of mainly non-metric traits of epigenetic variability, within the realm of population morphological variability. Hence, 9 (16.98%) of the population sample of 53 individuals showed dental and appendicular skeletal epigenetic traits (Graph 15) offering but an initial step into the investigation of population gene pool dynamics, which the project is in the process of advancing through molecular archaeometry based on ancient DNA (aDNA) analyses.

Continued research on the wealth of information that can be retrieved from the human skeletal collection promises to yield additional clues, in conjunction with the rest of the archaeological

record, for deciphering additional features of the human condition during this period which formed realities and expectations in this pivotal Eastern Mediterranean region between the sea routes of Southeast Europe, Western Asia, and North Africa.

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