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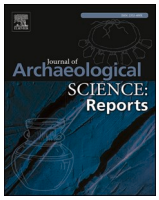

Mortuary practices in Late Bronze Age Cyprus: Demographic and taphonomic insights from two tombs in Limassol☆

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ABSTRACT

This paper explores mortuary practices of the Late Bronze Age (Late Cypriot), focusing on the demographic and taphonomic analysis of human skeletal remains discovered in two tombs in Limassol, Cyprus. These tombs featured multiple burials and a variety of grave goods that suggest an elite status for the deceased. The results supported inclusive burial practices, whereby all age groups and both sexes shared the burial space. Although tentative, these results also appear to support that infants and young children were initially buried in separate parts of the chamber tombs before being relocated within the tomb. In contrast, older children and adolescents received the same treatment as adults, sometimes being secondarily relocated inside the tombs and others left undisturbed. Information from the excavation diaries shows the repeated use of the tombs and the interaction between the deceased and the living in the form of piling the bodies from earlier interments to make room for new ones, as well as arranging selected crania in certain ways. However, the taphonomic study has not identified any other evidence of intentional post-mortem body manipulation. In addition, the good representation of all skeletal elements, which largely matches anticipated patterns from undisturbed contexts, supports that neither were bodies and/or body parts removed from the tomb after their initial burial, nor were bodies/body parts initially deposited elsewhere being transported into these tombs. The observed secondary treatment of the bodies inside the chamber tombs reveals a complex relationship between the living and the dead, fostering a connection with the ancestors and possibly highlighting a lineage-based collective identity. Future research of the grave goods and additional bioarchaeological parameters (diet, mechanical and physiological stress, biological kinship), coupled with a refined dating of the different strata of each tomb, should yield further important insights.

1. Introduction

This paper focuses on the mortuary practices of the Late Bronze Age (Late Cypriot, 1550–1050 BC) period, as revealed through the demographic and taphonomic study of human skeletal remains from two tombs unearthed in Limassol. Little is known about Late Cypriots in Limassol as urban development has significantly impeded the study of settlement and mortuary archaeology in the region (Violaris, 2012). Nonetheless, the Late Cypriot was a period marked by significant social and economic changes. Substantial population increases and rearrangements in the hierarchical structures of the society transformed the island's character. Settlements expanded and unoccupied territories on the island's south coast now became occupied, creating new urban centers (Steel, 2014). Cyprus' involvement in maritime trade led to the establishment of the island as the main trading route between Egypt, Anatolia, and other Mediterranean countries. As the island's economy evolved, elite groups started controlling surplus wealth, trade and access to prestige and luxury goods, while they formalized copper production to meet increased foreign demand. These changes transformed the island from a village-based to an international, urbanized society (Knapp, 2013; Steel, 2014). Foreigners migrated and integrated into the Cypriot society, giving rise to new social connections. Consequently, the concept of identity became more fluid as exchanges with outside groups led to cultural hybridisation, and a dynamic reshaping of the social landscape (Osterholtz, 2020).

Funerary customs also attest to the above changes. Towards the 3rd

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millennium BC, Cyprus followed a broad trend seen across various cultures in Central Europe, the Balkans, the Aegean, and the Levant, which established visually open cemeteries, replacing domestic burials (Baxevani, 1997). Keswani (2004) postulated that, during this period, certain groups' establishment of dominance could be attributed to their territorial control through the association with ancestors' burials. Specifically, in Cyprus the transition from intra-settlement inhumations to well-organized cemeteries may have been driven by each community's desire to assert ownership of the land, while an additional focus may have been to highlight the inter-familial relationships of specific elite groups within society, rather than emphasizing connections between different communities (Keswani, 2004). Tomb typologies also became more complex, evolving from simple intra-mural pit interments in the Early Chalcolithic to more formal, hierarchical mortuary customs, highlighted by the introduction of chamber tombs. The new burial landscape signified the growing social hierarchy of this period and could serve as a competitive display of wealth and cultural identity, aiming to impress internal and external audiences (Osterholtz, 2020).

Integrating osteological data with archaeological evidence and social theory allows researchers to explore past beliefs surrounding death and its negotiation by the living (Knüsel and Schotsmans, 2021). In this context, it is interesting to explore the mortuary information that may be extrapolated from Late Cypriot tombs in potential association with patterns of social transformation witnessed during this period. The two tombs under study in this paper were unearthed during a recent rescue excavation, thus there is limited contextual information at the moment. However, grave goods imply that the deceased belonged to a social elite, rendering them particularly pertinent to the study of issues of status and control for this period on the island.

2. Material and methods

2.1. Material

The human skeletal remains examined in this study come from two Late Cypriot tombs unearthed during rescue excavations by the Department of Antiquities of Cyprus in modern Limassol. Tomb 376 (Ellados and Navarinou Street) and Tomb 382 (Ellados Street) were excavated in 2023 close to the city centre (Fig. 1); they contained multiple burials in articulated, partially articulated, and commingled state. The settlement associated with these tombs remains unknown, and detailed information about the material culture accompanying the deceased is lacking as the relevant study is ongoing. An initial assessment of the context, particularly the pottery and tomb typology, has dated the tombs to the Late Cypriot, circa 1550–1050 BC.

Both tombs followed a common typology for Bronze Age Cyprus, namely a bedrock-cut chamber in *havara*, the geological layer of the ground. Tomb 376 consisted of one antechamber and one main chamber. Human remains were discovered in both spaces. Three articulated skeletons were found in the antechamber and seven in the main chamber. Forty-one skulls and multiple commingled loose bones were excavated in the main chamber. Many of these skulls had been placed meticulously along the chamber's circumference (Fig. 2). Tomb 382 consisted of two chambers on either side of the entrance, one towards the northeast and the second towards the southwest. One articulated skeleton and commingled skulls with postcranial bones were excavated in the northeast chamber. In the southwest chamber, two articulated and one partially articulated (lower limbs only) skeletons were found, while one skull with postcranial bones had been compiled on the southeast end of the chamber (Fig. 3).

According to the field records, Tomb 376 produced many grave goods; among those, there were some alabaster and chlorite jugs. Alabaster jugs during the Late Bronze Age were also excavated at Pyla-*Kokkinokremos*, where they were considered a unique discovery supporting a close connection between Cyprus, or some wealthy merchant from Cyprus, with the royal court of Egypt (Crabbé and Bretschneider, 2021). Other grave goods included carnelian, chlorite, and glass beads used as decorative necklaces, metal objects such as hairpins, brooches, and bronze rings placed on the toes of the dead. An important finding was a cylinder seal made of chlorite, depicting plants, birds, fish and reptiles. Tomb 382, located northeast of Tomb 376, was filled with pottery typologically matching the Late Bronze Age and two unique baby bottles associated with juvenile burials. Other findings included seashell, metal objects like daggers, bracelets and a silver gold plated clothing pin. An important finding was an animal-shaped jug depicting a sheep, which, according to the excavator, was used mainly in Anatolia and has probably been imported to Cyprus. Taken together, these grave goods imply a high status for those interred in Tombs 376 and 382.

2.2. Methods

For the recording of the human remains, STARC OSTEOARCH was utilised, an open-access tool created for recording macroscopic human skeletal data (Caruso et al., 2023). STARC OSTEOARCH can accommodate both complete, articulated, skeletons as well as loose bones from commingled remains, thus it was suitable for the human remains under

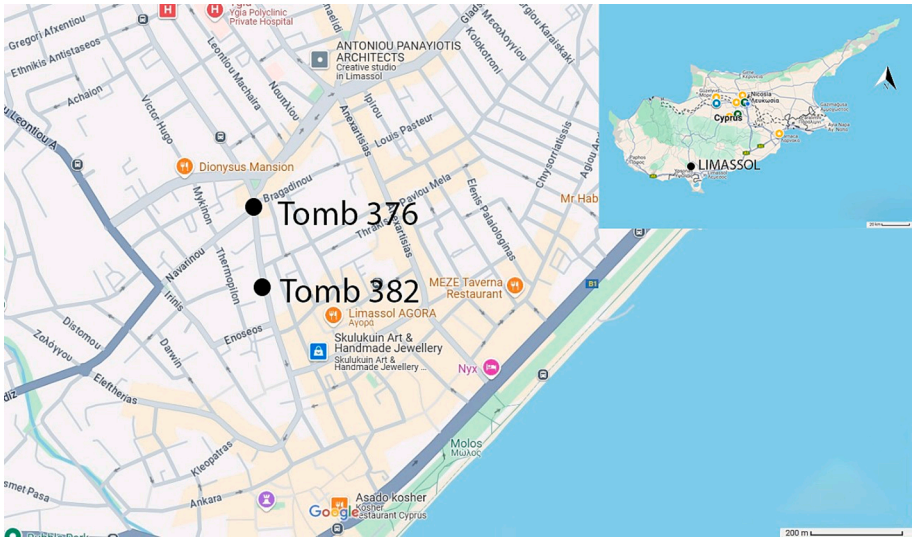

Fig. 1. Map of Limassol city with the location of Tomb 376 and Tomb 382. Source: Google maps.

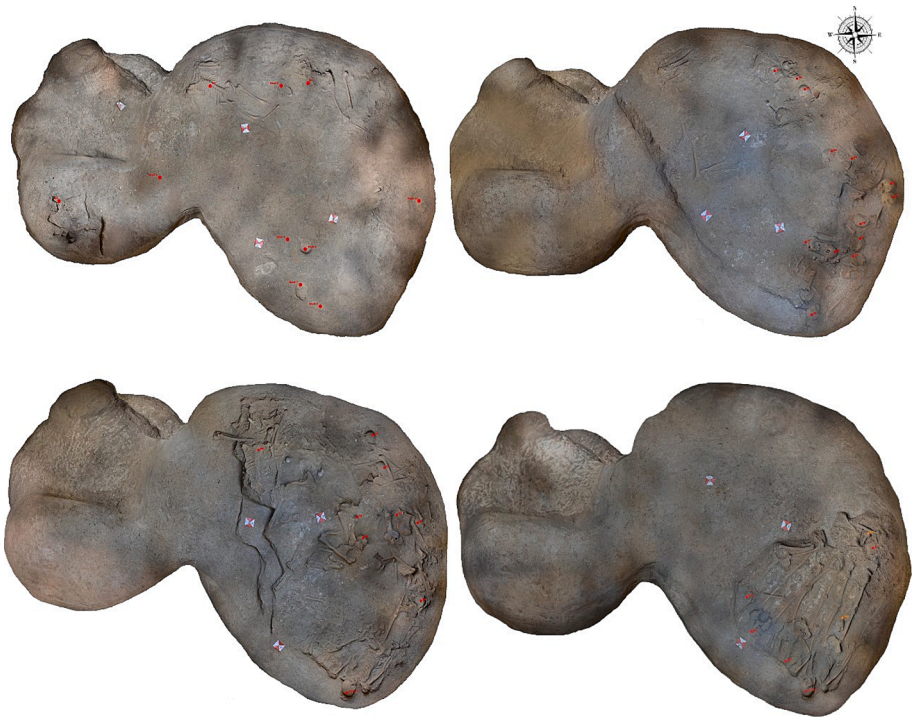

Fig. 2. Photogrammetry images from the excavation showing some representative layers (top left to bottom right): Tomb 376 layer 4; Tomb 376 layer 5; Tomb 376 layer 6-part 1; Tomb 376 layer 6-part 2. Source: Department of Antiquities of Cyprus.

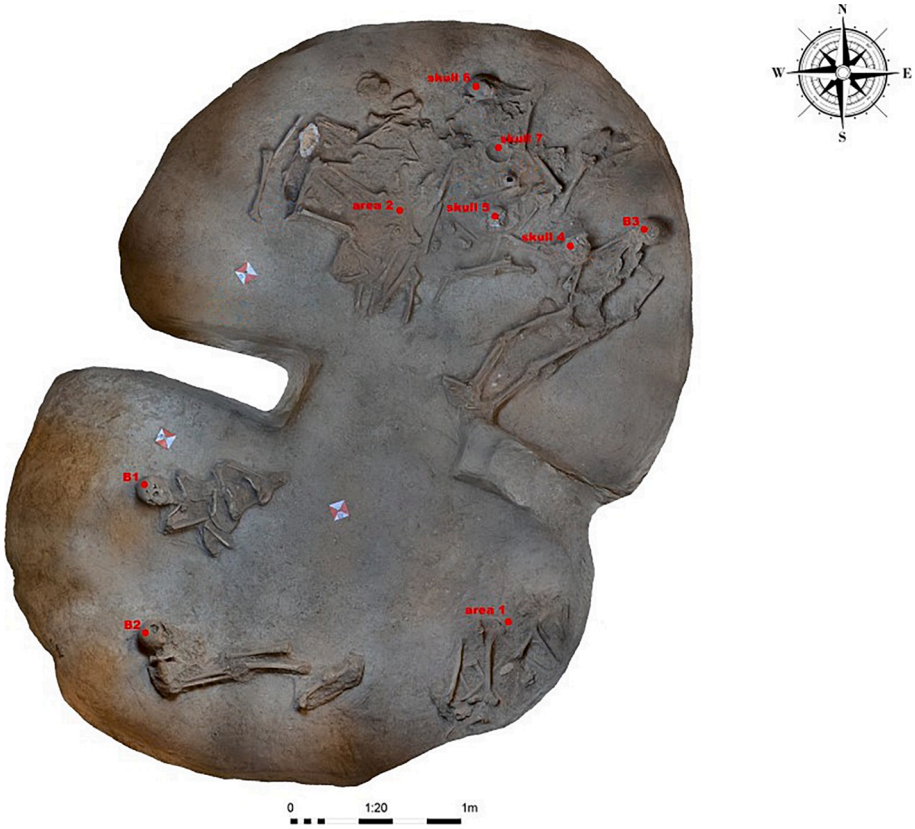

Fig. 3. Photogrammetry image from the excavation showing the burial layer of Tomb 382. Source: Department of Antiquities of Cyprus.

study.

Since both tombs included large quantities of commingled remains, the zonation method (Knüsel and Outram, 2004) was utilised to determine the preservation of different elements and parts of elements, and estimate the minimum number of individuals (MNI). The Bone Representation Index (BRI), that is, the percentage of skeletal elements

that are present to the expected total number of elements based on the MNI, was also utilised to capture the degree of preservation of the assemblage more broadly (Bello and Andrews, 2006). Taphonomic alterations were recorded focusing on the Qualitative Bone Index (Bello et al., 2006), weathering (Behrensmeyer, 1978), tooth marks and root marks (Nikita, 2017), tool marks (Lewis, 2008; White et al., 2011), and thermal modification (Nikita, 2021). Finally, fragmentation was recorded in terms of extent and degree. For the extent of fragmentation, "minimal" indicated that 10–30 % of the bone was fragmented, "moderate" implied that 30–70 % of the bone was fragmented, and "extensive" suggested that over 70 % of the bone was fragmented. The degree of fragmentation was also classified as minimal (average bone fragment maximum length ≈ 5 cm), moderate (average bone fragment maximum length ≈ 3 cm) and extensive (average bone fragment maximum length ≈ 1 cm). Each entry in the database corresponds to individual bones (when preserved intact), reassociated bone fragments, or single fragments that could not be associated with others.

The biological sex of adult individuals was estimated using primarily pelvic traits and secondarily cranial characteristics. In any case, we acknowledge that estimated biological sex does not necessarily reflect social gender. Emphasis was given to the morphology of the greater sciatic notch, subpubic contour, ventral arch, medial aspect of the ischio-pubic ramus, and preauricular surface for the pelvis (Bruzek, 2002; Phenice, 1969), as well as the glabella, mastoid process, nuchal crest, supraorbital margin, mental eminence, chin shape, mandibular ramus flexure and gonial eversion for the cranium and mandible (Ferembach et al., 1980; Loth and Henneberg, 1996; Walker, 2008). For individuals whose sex could not be assessed using the pelvis or the cranium, metric methods based on the metacarpals, metatarsals and talus, developed on Greek populations, were utilised (Manolis et al., 2009; Mountrakis et al., 2010; Nathena et al., 2015; Peckmann et al., 2015). Sex estimation was not attempted for juveniles because sexually dimorphic traits are not fully developed yet and no broadly acceptable method exists for this purpose. Although we originally aspired to estimate sex at least for juveniles over 10 years old in order to examine how puberty evolved over time, following the example of Lewis et al. (2015), this approach could not be applied to the skeletal remains from Limassol because the assemblage constitutes mainly commingled and fragmented remains, and many of the skeletal markers examined by Lewis et al. (2015) were not preserved.

Depending on the preservation of each skeleton, age-at-death was also assessed using traits on the pelvis and the cranium. For adults, the morphology of the pubic symphysis (Brooks and Suchey, 1990) and the iliac auricular surface (Buckberry and Chamberlain, 2002) were utilised. If the pelvis was not preserved or the surfaces under examination were weathered, the closure of the cranial sutures was assessed (Meindl and Lovejoy, 1985), though acknowledging that this method shows low accuracy. For loose commingled bones, beyond the pelvis and cranium, a broad "adult" estimate was given if the secondary ossification centres had fully fused with the primary ones. For juveniles, age-at-death estimation was based on the appearance and degree of fusion of ossification centres on all available bones following Cunningham et al. (2016). When teeth were available, the formation and eruption stages of the deciduous and permanent teeth were considered based on the London Atlas (AlQahtani et al., 2010). When none of the above was available, age estimation was based on the size of the bones. The age groups adopted for this study were as follows: Fetus (before birth), Infant (0–3 years), Child (3–12 years), Adolescent (12–20 years), Young Adult (20–35 years), Middle Adult (35–50 years) and Old Adult (50 + years). Individuals who did not preserve any age diagnostic features were classified as Adults (over 20 years) or Juveniles (less than 20 years), broadly based on bone size.

3. Results

3.1. Taphonomy

The tombs under study were found intact, that is, no signs of looting or other major disturbance were evident. This is particularly important as it implies that these tombs are excellent for providing evidence regarding mortuary practices. With respect to the impact of natural agents on the human remains, no evidence of animal scavenging (e.g. tooth marks) was present, while root marks were visible on a few bones (see below). As for human-induced taphonomic alterations on the bones, no intentional modifications such as burning or cut marks were recorded. In what concerns fragmentation, almost half of the commingled assemblage (1705 entries) had a score of 1 (minimal fragmentation) and 2 (moderate fragmentation), while the other half showed extensive fragmentation. In contrast, 13 out of 14 articulated/partially articulated skeletons had a score of minimal fragmentation. The human bones presented mostly white, freshly fractured edges, indicating recent fragmentation, likely occurring during excavation, rather than as part of the mortuary practices (Lorentz, 2012).

The Qualitative Bone Index (QBI) and weathering stage indicated that the overall preservation of the bones was good, with minimal damage of the cortical bone surface. Eight of the 14 articulated/partially articulated skeletons exhibited 75–99 % cortical bone presence, five preserved 50–74 % of the cortical surface, and only one skeleton preserved 25–49 % of the cortical surface. Most commingled bones (3,055 entries) had 75–99 % of the cortical bone present, and only 61 entries displayed extensive damage, with merely 1–24 % of cortical bone present. The most common weathering damage was cracking on the bone surface (n = 3,009), followed by flaking and cracking of the outermost cortical surface (n = 540). However, there were cases with more extensive damage covering most of the bone surface and reaching as deep as 1–1.5 mm (n = 155), while the least recorded damage was weathering with splinters deeper than 1.5 mm (n = 25). No bones exhibited extensive weathering to the point of being unidentifiable. For the articulated/partially articulated skeletons, most (n = 8) showed prominent cracking on the bone surface and mosaic cracking on the articular surfaces, and several (n = 5) showed flaking and cracking of the outermost cortical surface. Only one skeleton exhibited extensive damage, covering most of the bone surface and reaching as deep as 1–1.5 mm. Evidence of root damage supports further the overall good state of preservation of the cortical bone surfaces. In the commingled assemblage, only 137 entries out of 3729 displayed root marks, while 11 out of 14 articulated/partially articulated skeletons exhibited root marks but only on a few elements, particularly the lower limbs.

When comparing the QBI between Tomb 376 and 382, in both tombs the majority of the bones had 75–99 % intact cortical bone, though Tomb 382 had more bones with 25–49 % and 1–24 % intact cortical bone surface compared to Tomb 376. The most common weathering damage for both Tomb 376 and Tomb 382 was cracking on the bone surface followed by flaking and cracking of the cortical bone. The only difference between the two tombs is that in Tomb 382, more bones exhibited extensive damage, covering most of the bone surface and reaching as deep as 1–1.5 mm and damage with splinters deeper than 1.5 mm, compared to Tomb 376. Comparing the extent of fragmentation between the tombs, in both Tomb 376 and Tomb 382, almost half of the elements showed extensive fragmentation, and the other half had no to moderate fragmentation.

When estimating the minimum number of individuals represented by the pooled bone assemblage from both tombs, using the most basic approach of counting the most prevalent element, the MNI was 65 based on the occipital bone. In case of fragmentation, this was counted only once per individual based on the presence of the nuchal crest (Table 1). However, when estimating the MNI separately for each tomb, and also taking into account the age of the individuals, this number rose to 72 (55 individuals in Tomb 376 and 17 individuals in Tomb 382). Specifically,

Table 1
Minimum Number of Individuals by element and side based on pooled commingled and articulated individuals for Tomb 376 and Tomb 382.

	Tomb 376			Tomb 382		
Element	**Right**	**Left**	**Midline**	**Right**	**Left**	**Midline**
Occipital			51			14
Atlas			44			4
Axis			26			8
Mandible	36	42		10	13	
Scapula	33	27		11	6	
Humerus	37	41		14	11	
Radius	24	27		8	12	
Ulna	40	32		14	9	
Os coxa	47	40		13	9	
Femur	48	48		16	17	
Tibia	32	38		13	16	
Fibula	25	26		11	13	
Talus	23	26		3	4	
Calcaneus	27	28		7	3	

Note: The MNI for Tomb 376 based on the most prevalent element (occipital bone) in the above table is 51, but four juveniles were additionally identified in the assemblage, who did not preserve the occipital bone.

in Tomb 376, the most prevalent element, used for MNI estimation, was the occipital bone, which was present 51 times. In addition, four juveniles were added to the MNI as they were identified based on the postcranial elements and/or teeth but did not preserve occipital bones. In Tomb 382 the most prevalent element was the left femur and specifically zone 6 (middle diaphysis till bifurcation of linea aspera), which was present 17 times. This MNI was not further increased when factoring in the different age groups represented in the tomb because it appeared to already include all relevant individuals.

A Bone Representation Index was estimated for all individuals in the assemblage per tomb (Fig. 4). Bone representation in both tombs was very similar. In both cases, the scapula and the sacrum had among the lowest scores out of all the elements, whereas the occipital and the femur had the highest. Small differences were seen in the representation of other elements between tombs; for example, in Tomb 376 the radius and fibula were among the poorest represented elements, while in Tomb 382 these elements were well represented.

Bone representation for selected elements was compared to assemblages from Psematismenos-*Trelloukas* and Spitalfields as a means of identifying deviant patterns from the expected representation of different elements (Fig. 4). Psematismenos-*Trelloukas* is a Cypriot Early Bronze Age cemetery with articulated and commingled remains (Lorentz, 2016); it was selected for use in this study because it is the only Bronze Age Cypriot assemblage for which BRI data has been published. Spitalfields is a post-medieval assemblage from London, with single inhumations; it is considered to reflect what a standard skeletal assemblage should look like in terms of bone representation/preservation given the absence of selective human activity (Bello and Andrews, 2006). It is seen that all three assemblages exhibit similar curves, with certain elements less represented than others (e.g. sacra and scapulae). However, the composition of the Limassol assemblages is more similar to the Spitalfields assemblage than the Psematismenos-*Trelloukas* one. Firstly, the overall preservation of the Limassol human remains is much better than that in Psematismenos-*Trelloukas* in terms of the much higher BRI scores for all elements. In addition, the relative pattern of representation of different elements is similar between Spitalfields and Limassol, whereas there are striking differences in Psematismenos-*Trelloukas*. For example, the radius shows a poor representation in Limassol Tomb 376 and moderate in Tomb 382, while in the Psematismenos-*Trelloukas* assemblage it is among the best represented elements. Similarly, the representation of the os coxa in the Limassol assemblage is very good and comparable to the Spitalfields human remains, whereas it is poor in Psematismenos-*Trelloukas*. However, the differences between the Limassol and Psematismenos-*Trelloukas* assemblages must be approached cautiously because Psematismenos-*Trelloukas* is an Early Bronze Age assemblage, while the Limassol remains date to the Late Bronze Age. Similarly, the Spitalfields BRI estimate was based on articulated individuals and not on MNI. In any case, these comparative results support that although there was some secondary body manipulation taking place inside the tombs, there is no evidence of selected elements being removed or added to the tombs from some other location.

More detailed information regarding the preservation of individual bone parts using the zonation method is given as supplementary material (**Figs. S1-S25**), while representative results for the cranium are plotted in Fig. 5. For the cranium, it is seen that the parietal and occipital bones (zones 1–5) were the most frequently preserved. The lower limb long bones were better preserved than their upper counterparts, exhibiting a greater number of zones present. For the femur, the most frequently preserved zone was the middle part of the diaphysis until the

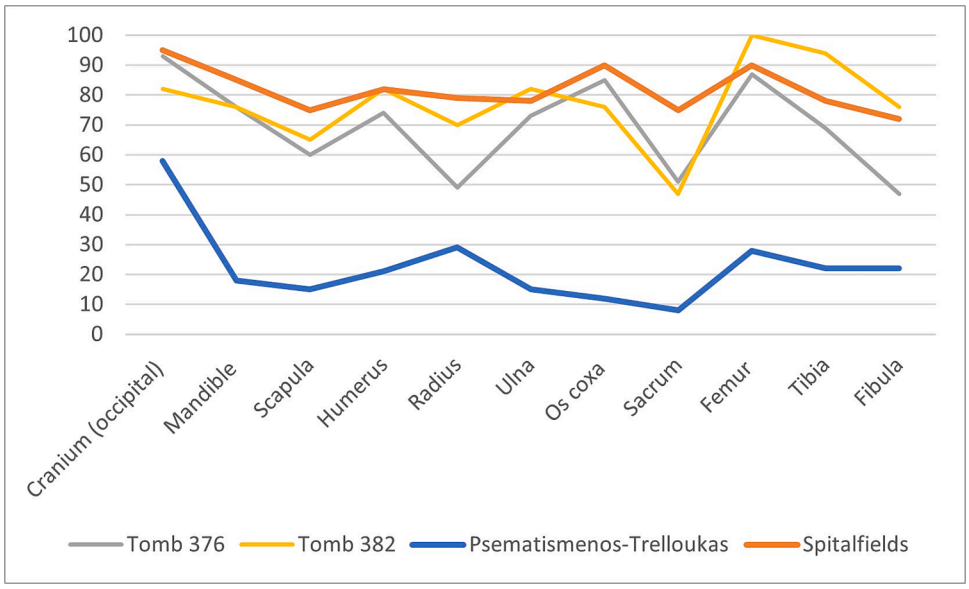

Fig. 4. BRI comparison per element for the assemblages from Limassol, Spitalfields and Psematismenos-Trelloukas (adapted from Bello and Andrews 2006, 3, fig. 1.1 and Lorentz 2016, 766, Fig. 5).

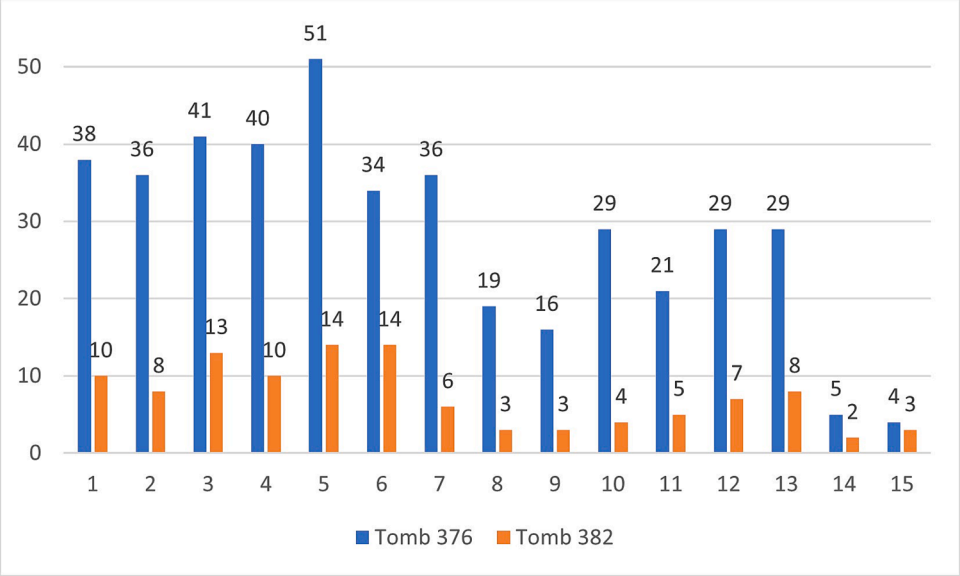

Fig. 5. Zone representation of cranial bones for pooled commingled and articulated individuals for Tomb 376 and Tomb 382.

bifurcation of the *linea aspera* (zone 6), for the tibia, the second quarter of the diaphysis (zone 8) and for the fibula, the middle and most distal quarter of the diaphysis (zones 3 and 4). The most prevalent zones for the humerus were the distal half of the diaphysis and the area of the deltoid tuberosity (zones 7, 9, 10). For the ulna, the proximal half of the diaphysis (zone E) was the most preserved part, and for the radius the proximal, middle and distal parts of the diaphysis (zones 5–10). For the scapula, the most frequently preserved zone was the axillary third of the squamous and spine (zone 5). The hand and foot bones were present in different degrees, depending on the specific element. However, the most frequent hand bones in Tomb 376 were the MC2 and MC3, which were present 16 times, corresponding to ~29 % of the expected bones, while in Tomb 382 the most frequent hand bone was the MC1, which was present 3 times, corresponding to ~18 %. Among the foot bones in Tomb 376, the most frequent was the calcaneus, which was present 28 times, corresponding to ~51 % of the expected elements, while in Tomb 382 the calcaneus was also the most frequent among the foot bones, and it was present 7 times, which corresponds to ~41 %.

3.2. Demography

All age groups were represented in the assemblage, from fetuses to old adults (Fig. 6**,** as well as **Figs. S26-S27** for separate data per tomb). In the entire assemblage, 51 adults and 21 juveniles were present. Most of the individuals were young adult or middle aged. Specifically, out of the 51 adults, 17 were identified as young, 19 as middle aged, and only four individuals reached old adulthood. Eleven individuals were broadly classified as adults (over 20 years of age) because they lacked more specific age-estimation traits. Concerning the juveniles, most did not survive beyond childhood. Specifically, out of the 21 juveniles, one was a fetus, four were identified as infants (0–3 years), twelve as children (3–12 years), and three as adolescents (12–20 years). One was broadly classified as juvenile (less than 20 years) based on bone size, but did not preserve any traits to estimate age more precisely.

Regarding the relative representation of males and females among the adults, the assemblage included 23 females/probable females and 19 males/probable males (Fig. 6). More females were present in the young adult age group (nine females and three probable females compared to

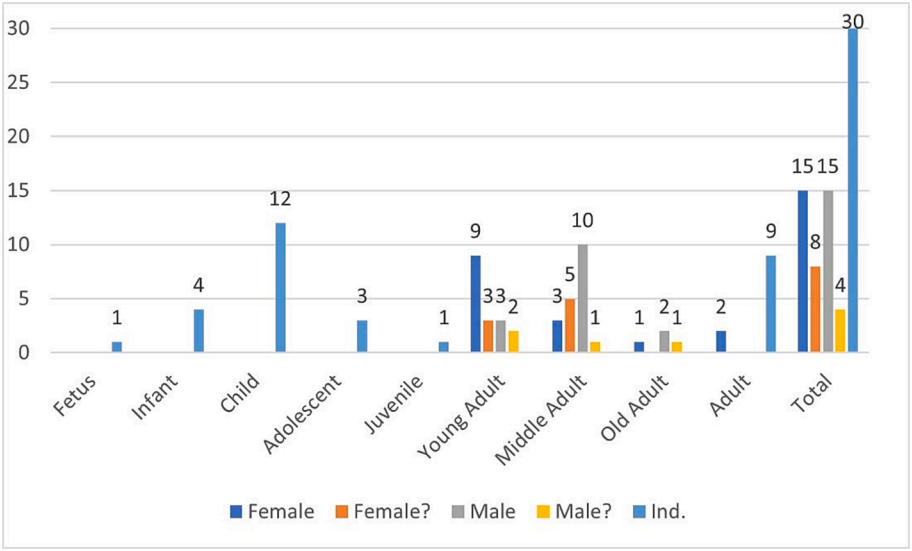

Fig. 6. Age and sex distribution for pooled commingled and articulated/partially articulated individuals.

three males and two probable males). In the middle adult age group, the sex distribution was the opposite of the young adult group, with ten males and one probable male, compared to three females and five probable females. The old adult age group included only two male individuals, one probable male and one female. Finally, the broad adult group included two females and nine individuals of indeterminate sex.

4. Discussion

The Late Cypriot period was characterized by significant social and economic changes, including population growth and the emergence of urban centres. Maritime trade established Cyprus as a key hub, leading to the rise of a political elite, the formalization of copper production, and the transformation of the island into an urban society (Steel, 2014). Additionally, during this time, funerary customs shifted from domestic burials to organized cemeteries, allowing communities to assert land ownership and emphasize elite inter-familial relationships (Keswani, 2004). Despite these well-studied trends in Late Cypriot archaeology, extensive modern urban development in Limassol has posed restrictions to systematic archaeological studies in this region (Violaris, 2012). The present paper focused on two tombs from the modern city of Limassol, which were found during rescue excavations accompanying anti-flood works in the city. The tombs date to the Late Cypriot and appear to have housed the remains of some local elite, thus they can provide important information on the hierarchical societies that emerged during this period and their mortuary practices.

4.1. Burial customs

The tombs examined belong to a Late Bronze Age cemetery located beneath the city of Limassol. Earlier excavations in the surrounding area, north and northeast of Tombs 376 and 382, have revealed Late Bronze Age tombs in Ayia Phylaxeos Street, Gladstonos Street, and Gladstonos and Mycenon (Violaris, 2012). In Ayia Phylaxeos Street, a group of Late Cypriot tombs was excavated, among which Tomb 128 yielded a significant number of findings along with seven skulls and some loose bones. The skulls were arranged around the periphery of the chamber, supporting the secondary treatment of the deceased. Tombs 130 and 131 yielded only bones with no other objects. Tomb 134 yielded a large number of human remains, while eight skulls were placed along the walls of the burial chamber, supporting a secondary treatment of the deceased. Tomb 135 contained only a single burial found *in situ* and a few loose bones. Unfortunately, none of the skeletal remains from the above tombs were kept after the excavation. Thus, no further conclusions can be drawn regarding the post-mortem treatment of the deceased. Tomb 100 was found at Gladstonos Street but it had been looted and used as a rubbish pit for the past 50 years before excavation. As a result, this tomb yielded very fragmentary and incomplete findings, and no human remains. Finally, Tomb 240 was found in Gladstonos and Mycenon Street; it yielded many burial offerings but no skeletal remains (Violaris, 2012).

Available contextual information for Tombs 376 and 382 is currently limited. The grave goods have not undergone systematic study yet, and the dating of the various layers within the tombs remains undetermined. Therefore, our analysis has to be constrained to the information gleaned from the macroscopic examination of the human remains and on key field notes.

Field notes highlight that most of the burials had been placed in the main chamber of Tomb 376. As there is limited standing area remaining in the main chamber, it is possible that when the main chamber reached its capacity, the antechamber was used for three additional articulated burials before the tomb was sealed. Additionally, based on the field notes, the initial burials in the lowest archaeological layer of the tomb had not been repositioned, unlike subsequent burials. Indeed, the excavation revealed a prevalence of commingled bones in the layers between the first and last burial instances. Another striking observation about Tomb 376 was the placement of certain skulls on the southeastern periphery of the main chamber. Overall, this tomb supports intermittent interments and periodic reorganization of the bones within the chamber.

Similarly, the Tomb 382 chambers were used for multiple burials, though they contained fewer deceased than Tomb 376. The northeast chamber housed more burials than the southwest chamber, and the arrangement of the bodies appeared less structured. Commingled remains predominated at the centre of the northeast chamber, while the only articulated burial was situated closer to the entrance. It is likely that the commingled remains represent the earlier inhabitants of this chamber while the articulated burial was the last one to take place there. Two articulated skeletons were identified on the northern and western sides of the southwest chamber, with commingled remains in the southeastern section of this chamber.

Based on available evidence during the excavation and skeletal analysis, it can be inferred that both Tomb 376 and Tomb 382 were utilised over an extended period, with instances of reopening to accommodate additional burials. In Tomb 376 the articulated skeletons formed the lower and upper strata of the burials in the main chamber, while they were placed separately from the commingled remains in the antechamber. In Tomb 382 articulated skeletons were found in different locations within the chambers compared to the commingled remains.

The above patterns support the existence of a secondary treatment of the deceased. However, the good representation of most skeletal elements, attested in the comparable BRI between the Limassol and Spitalfields assemblages (Fig. 4), but also in the limited weathering/cortical bone damage, and the absence of cut marks or other signs of excarnation or body manipulation, contradicts the presence of a ritual of secondary burials in our context, that is, it does not agree with the primary burial of these individuals in a different location and their placement in the chamber tombs at a later point. Instead, what we witness is likely repeated ‘reductions’ of individuals, that is, movement of the bones to the side in order to make space for additional bodies.

The above conclusion is further supported by the relatively good representation of hand and foot bones in the assemblage. If the bodies had been initially buried in a different location and then moved to Tombs 376 and 382 at a later stage, we would anticipate the hand and foot bones of the individuals to have been largely lost in the process. These bones are not ‘prominent’ like the crania or major long bones, so it is unlikely they would have been intentionally selected to be relocated; in contrast, they are very likely to be left behind intentionally or accidentally, if a different primary burial site was involved. In the tombs under study, the representation of hand bones in Tomb 376 is up to 29 % and in Tomb 382 is up to 18 %, while that of foot bones in Tomb 376 is up to 51 % and in Tomb 382 up to 41 % of the expected values for undisturbed contexts. The extensive loss of certain hand and foot bones (for example, phalanges) may well be attributed to the ease with which these may be overlooked during excavation, particularly in a rescue excavation context. Note that the only other context from Late Bronze Age Cyprus where hand/foot bone data is reported is from Tomb 1 in Hala Sultan Teke, where the anthropologist concluded that this tomb had been used as a primary burial site, largely on the basis of “the relatively high number of small hand and foot bones (the proximal foot phalanges have an approximately 12 % representation)” (Osterholtz, 2015, p. 87). Thus, even a percentage representation of 12 % was considered high enough to support a primary burial site.

Therefore, our analyses support that these chamber tombs were places of multiple primary inhumations where subsequent human activity focused on reorganizing the remains within the chambers. It is unlikely that secondary burials had originated outside these tombs as there is no evidence to suggest that the decomposition process had occurred at another location before the (partially) defleshed bodies had been interred in the chamber. Likewise, the study of the Early Bronze Age material from Psematismenos-*Trelloukas* also suggested that all recovered human remains from the pits and the chambers originated from primary, not secondary burials (Lorentz, 2016), despite the overall

much poorer representation of the different elements in that context compared to Limassol.

Several Late Cypriot contexts have similarly given evidence of a secondary treatment of the deceased but not (necessarily) of secondary burials. In Hala Sultan Tekke, Tomb X contained undisturbed, slightly disturbed and disturbed burials, which had been swept away to the sides of the chamber (Fischer and Bürge, 2017). Similarly, in Tomb SS of Hala Sultan Tekke, the intentional positioning of some bones, where the left humerus had been paired with the right ulna and radius, and vice versa, suggests the intentional secondary treatment of the deceased but offers no data to support secondary burials in the tomb (Casa et al., 2021). Keswani (2004) offers a detailed account of the secondary treatments evidenced in assemblages from earlier excavations of Late Cypriot funerary contexts. Specifically, she lists the collective burials at a) Tomb 1 of Pendayia *Mandres* (Karageorghis, 1965a in Keswani, 2004), b) Tomb 12 at Myrtou *Stephania* (Hennessy, 1964 in Keswani, 2004), c) Tombs 20 and 21 at Ayia Irini *Palaeokastro* (Pecorella, 1977 in Keswani, 2004), and d) Tombs 8, 10 and 14 at Ayios Iakovos *Melia* (Gjerstad et al., 1934 in Keswani, 2004). Additional secondary treatments reported included squatting burials at Tomb 42 at Katydhata (Gjerstad, 1926 in Keswani, 2004) and at Swedish Tombs 2, 6 and 17 at Enkomi *Ayios Iakovos* (Gjerstad et al., 1934 in Keswani, 2004), as well as redeposited and disarticulated remains from Tombs 1–3 at Akhera *Chiftlik Paradisi* (Karageorghis, 1965b in Keswani, 2004), Tombs 3, 5 and part of 14 at Myrtou *Stephania* (Hennessy 1964 in Keswani 2004), Tombs 1 and 2 from Korovia *Nitovikla* (Gjerstad et al., 1934 in Keswani, 2004), Cypriot Tomb 24 at Enkomi *Ayios Iakovos* (Dikaios, 1969 in Keswani, 2004), Tombs 11 and 20 at Kalavasos *Ayios Dhimitrios* (South, 1997, 2000), Tomb 21 at Kourion *Bamboula* (Benson, 1972) and, finally, at Kouklia *Eliomylia* (Karageorghis, 1990 in Keswani, 2004).

Other contexts have revealed potential evidence for secondary burials. In Tomb 6 Morphou *Toumba tou Skourou* the presence of several commingled and incomplete skeletons and the concentration of more skulls than their counterpart post-cranial bones supports the secondary mortuary treatment of the bodies and may imply that the tomb had been used for secondary burials (Vermeule and Wolsky, 1990 in Robedizo et al., 2021). Similarly, in Tomb A in Hala Sultan Tekke, the authors mention that Skeleton 1 is missing most parts of the right side, and Skeleton 2 is missing one arm and both hands, which may suggest a secondary burial (Fischer and Satraki, 2013). Furthermore, in Tomb RR in Hala Sultan Tekke a concentration of commingled remains with more skulls than post-cranial bones and some heterogeneous charring in skeletal concentration areas was interpreted as the secondary manipulation of bodies after death and decomposition (Robedizo et al., 2021). This pattern is also consistent with a secondary burial that selectively focused on the crania. A predominance of crania also characterised Swedish Tomb 11 at Enkomi *Ayios Iakovos* (Gjerstad et al., 1934 in Keswani, 2004). Contexts with incomplete skeletal remains, potentially suggesting a secondary burial, have also been found in Tomb 6 at Politiko (Karageorghis, 1965c in Keswani, 2004), Tomb 11 at Milia *Vikla Trachonas* (Westholm 1939 in Keswani, 2004), Tomb 11 and 14 at Kalavasos *Ayios Dhimitrios* (South, 1997, 2000), Tomb 6 at Kourion *Bamboula* (Benson, 1972, Angel, 1972), as well as Swedish Tombs 8, 12, 15, Cypriot Tomb 4A and French Tomb 5? at Enkomi *Ayios Iakovos* (Gjerstad et al., 1934; Dikaios, 1969 and Schaeffer, 1952 in Keswani, 2004).

Within the modern city of Limassol but belonging to a different cemetery, Late Cypriot Tomb 357 has indicated a likelihood of secondary burials accompanied by post-depositional activity. The high degree of fragmentation, the lack of articulated burials *in situ* and the taphonomic alterations on some of the bones, which implied exposure of the skeleton to the environment outside the tomb, led to the suggestion that Tomb 357 housed secondary burials (Lee et al., 2020). In the Limassol area, there is another example of secondary burial treatment from a different cemetery; in the *Enaerios* area of the city, in Tomb LM 1328 the skeletons found in two burials had been disturbed and poorly represented, possibly due to the relocation of the bodies (Lorentz, 2012). However, compared to both of these contexts, Tombs 376 and 382 in the Limassol District produced a greater quantity of human remains, and in very good to excellent condition, especially considering the date of the remains.

The above patterns illustrate the variability that characterized the treatment of the deceased during the Late Cypriot across the island, whereby tombs even within the same cemetery reflected different associations with the deceased, manifesting as primary undisturbed burials, primary disturbed burials, as well as secondary burials, in variable combinations.

4.2. Demographic profile

With regard to the demographic composition of the assemblage, the results show that all age and sex groups were represented in Tombs 376 and 382. However, a closer look at the relative representation of males-females and different age groups is warranted. Most Late Cypriot tombs found across the island included all age groups, with the majority of the individuals representing young adults (20–35 years) (Angel, 1972; Douglas, 2021). In Tombs 376 and 382, the middle adult age group was the most prevalent but a large number of young adults was present as well. Two other Late Cypriot assemblages reflect a similar age distribution. In the Late Cypriot Tomb 1.76 of Idalion middle to old adults represented one-third of the adult population (Schulte-Campbell, 1989). A similar representation of young and middle adults was also seen in Hala Sultan Tekke Tomb X, where at least four individuals were estimated to be between the fourth and fifth decade of their lives, while another five individuals were estimated to be between the second and third decade (Fischer and Bürge, 2017). In contrast, in Late Cypriot assemblages across Cyprus, there is a notable limited presence of older adults (over 50 years old). This limited presence to some extent reflects the anticipated shorter life span during these early periods. However, it also characterizes bioarchaeological assemblages across the world from prehistory to recent periods and to some extent reflects inherent biases of skeletal age estimation methods (e.g. Wood et al., 2002). The presence of middle aged and older adults in the Limassol assemblage may be attributed to the fact that the occupants of these tombs belonged to an elite group, thus they should have enjoyed better health and overall life quality. However, this potential interpretation should be confirmed with further osteological analyses of mechanical and physiological stress, as well as dietary patterns. In any case, it should be remembered that the above demographic patterns have emerged from very small assemblages, especially in the case of the comparative groups, while age estimates for Tombs 376 and 382 may also be biased due to the methods employed, particularly the inaccuracy that characterizes cranial suture closure.

In what concerns juveniles, Tombs 376 and 382 included a rather small number of individuals ($n = 21$) younger than 20 years. This pattern might be attributed to excavation or preservation biases; however, this etiology is not supported by the presence of fetal and infant remains and their commendable state of preservation. Juveniles are present in numerous Late Cypriot cemeteries, and archaeological evidence suggests that they received treatment akin to that of adults. For example, in Tomb X in Hala Sultan Tekke, out of the 17 individuals, eight were juveniles: one 5–6 years old, one 6–8 years old, two 8–10 years old and four 6–9 years old (Fischer and Bürge, 2017). In the Idalion Tomb 1.76 out of the 21 individuals, nine were children ranging from newborn to 12 years old (Schulte-Campbell, 1989). Furthermore, in Limassol Tomb 323, out of the six individuals two were juveniles, one 8–10 years old and one approximately 5 years old (Lorentz, 2012). The relatively small number of juveniles in Tombs 376 and 382 cannot be explained at this point; it is important for additional tombs of the cemetery to be excavated and anthropologically studied before any conclusions can be drawn on the representation of juveniles in this population and the possibility of part of the population having been

buried elsewhere based on age or other criteria.

The sex distribution among the adult individuals in Tombs 376 and 382 conforms to a pattern observed in similar contexts. Specifically, in these two tombs both males and females were present; a slightly higher representation of females was noted, but given the small difference between the number of males and females in the assemblages, as well as the presence of individuals of unidentified sex, we are reluctant to place too much emphasis on this pattern. Across Cyprus, most tombs of the Late Cypriot housed both male and female occupants in comparable proportions. Notably, in Kalavasos *Ayios Dhimitrios,* males constituted 57 % of the individuals within the chambers, while females represented 43 % (Moyer, 1989). In Kalavasos *Mangia* Osterholtz (2020) identified 1 adult male, 1 adult female and 2 adults of indeterminate sex, along with many juveniles. A similar distribution of sexes can be observed in Idalion Tomb 1.76, where at least three males, two females, and six adults of undetermined sex were recovered (Schulte-Campbell, 1989). In Hala Sultan Tekke Tomb A, out of four skeletons, two were males, one was a female, and one was a juvenile (Fischer and Satraki, 2013). Among other Late Bronze Age tombs in the broader area of Limassol, one male was identified in Tomb 6 Kandou, one probable female in Tomb 322, one female among two adults in Tomb 323, and another female in Tomb 324 (Lorentz, 2012). These results are again based on small assemblages; thus, the demographic patterns may easily change if more skeletons become available for study. However, they clearly suggest the similar treatment of males and females after death and the lack of any distinct sex-driven segregation of the mortuary spaces.

Similarly, no particular association has been found between secondary treatment and demographic parameters in Tombs 376 and 382. In both tombs the articulated/semi-articulated skeletons, as well as the commingled ones included both males and females. In Tomb 376 both types of burial (articulated and commingled) included both adults and juveniles. In contrast, in Tomb 382 the articulated skeletons belonged exclusively to adults; however, their number was very small (only four skeletons).

According to Keswani (1989), juveniles, particularly infants and children, were customarily segregated from adults and positioned in niches or in the corridors of the chambers until they were prepared for interment in the main chamber. This could be the case for Tombs 376 and 382 since no fetuses, infants or young children burials were found *in situ*. The older children (over 10 years) and the adolescents were likely treated as adults and interred as primary burials since some of them were found articulated *in situ* during the excavations. Thus, the presence and distribution of juveniles within the assemblage suggest that younger juveniles may have been partially segregated from older individuals until passing a certain threshold, as Keswani (1989) supported. However, overall, juveniles received mortuary treatments similar to those afforded to adult members, supporting a societal structure that emphasised the inclusion and importance of younger individuals.

5. Conclusions

In summary, the taphonomic and demographic study of the human remains from Tombs 376 and 382 yielded significant information about Late Cypriot mortuary practices, complementing current knowledge on death-related beliefs for this period in Cyprus. The bioarchaeological data support inclusive burial practices, whereby all age groups, from fetuses to old adults, males and females shared the burial space. Although tentative, these results also appear to support that younger members of the society (fetuses, infants and young children) were initially buried in separate parts of the chamber tombs before being relocated, whereas older children and adolescents received the same treatment as adults, an observation previously made in other contexts of this period. Males and females were buried together and received similar post-mortem treatment. Information from the excavation diaries shows the repeated use of the tombs and the interaction between the deceased and the living in the form of piling the bodies from earlier interments to make room for new ones, as well as arranging specific elements (e.g. crania) in certain ways. However, the taphonomic study has not identified any other evidence of intentional post-mortem body manipulation (e.g. burning, cutting etc.). In addition, the good representation of all skeletal elements, which largely matches anticipated patterns from undisturbed contexts, supports that neither were bodies and/or body parts removed from the tomb after their initial burial, nor were bodies initially deposited elsewhere being transported into these tombs. These patterns are in agreement with other Late Cypriot contexts, but they also deviate from other cases, highlighting the variability that characterized funerary practices during this period of intense social transformations. The observed secondary treatment of the bodies inside the chamber tombs reveals a complex relationship between the living and the dead. Returning to graves and handling remains fosters a connection to ancestral grounds, potentially emphasizing a lineage-based collective identity. This reveals a mortuary landscape where community identity was intertwined with historical continuity and a shared perception of death, rather than focusing on individual identities (Lagia et al., 2016).

Future research will focus on a better contextualization of these findings in their mortuary context, as well as on a deeper understanding of the biocultural identity of these individuals. A systematic study of the material culture, including pottery and metal artefacts from the tombs, will soon commence. Additional bioarchaeological parameters focused on mechanical and physiological stress, along with dental diseases, are currently under examination and will shed light on the living conditions of these individuals in comparison to other Bronze Age Cypriot assemblages. Furthermore, isotopic analysis may reveal mobility and dietary patterns, and ancient DNA analysis could assess genetic kinship, although preservation conditions in Cyprus present significant challenges and limitations for the use of such destructive methods.

CRediT authorship contribution statement

Gkampriella Selempa: Writing – original draft. **Katerina Papanikolaou:** Writing – review & editing, Resources, Investigation, Data curation. **Rogiros Christodoulou:** Writing – review & editing, Resources, Investigation, Data curation. **Efthymia Nikita:** Writing – review & editing, Supervision, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jasrep.2025.105145.

Data availability

Data will be made available on request.

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