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Exploring the Efficacy of Comparative Bioarchaeological Approaches in Providing Answers on Marginality and Networking: The Example of Late Bronze Age Achlada in Florina, Northern Greece

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ABSTRACT: This paper investigates the efficacy of comparative bioarchaeological approaches in exploring the impact of economic marginality on human lifeways. Skeletal remains from the Late Bronze Age cemetery of Achlada in Northern Greece were chosen to address this, as this specific community was probably less well networked, evident in its location away from major communication routes and the paucity of grave goods at the site. A biocultural methodology combining comparative data on funerary practices and lifestyle was implemented. Sex differences were found within the community and seem to agree with the differential burial placement of the sexes possibly representing the different roles that society symbolically attributed to men and women in deathways. Comparative intercemetery data did not reveal poorer health and diet, or more intense physical activity, compared to well-networked sites. Nonetheless, Achlada, as well as numerous, mostly north communities of the wider context, probably faced more physiological challenges during growth, at least of a mild to moderate level, compared to a number of populations connected by major communication routes. The current study highlights the importance of implementing comparative bioarchaeological approaches as a means of identifying the impact of marginality on human lifeways, particularly in settings with limited material culture information. Limitations linked to preservation issues and the multifactorial nature of lifestyle indicators could be dealt with by future biomolecular and isotopic analyses.

Keywords: lifeways; palaeopathology; prehistory

Η παρούσα εργασία έχει στόχο να διερευνήσει το κατά πόσο οι συγκριτικές βιοαρχαιολογικές προσεγγίσεις είναι εφικτό να δώσουν απαντήσεις ως προς την επίδραση της οικονομικής περιθωριοποίησης στον ανθρώπινο τρόπο διαβίωσης. Επιλέχθηκαν σκελετικά κατάλοιπα της Ύστερης Εποχής Χαλκού από το νεκροταφείο της

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Αχλάδας στη Βόρεια Ελλάδα ώστε να απαντηθεί το εν λόγω ερώτημα, καθώς η συγκεκριμένη κοινωνία -βάσει της θέσης της μακριά από τα μεγάλα δίκτυα επικοινωνίας και της παρουσίας πολύ λίγων ταφικών ευρημάτων- ήταν πιθανώς λιγότερο καλά δικτυωμένη. Ακολουθήθηκε μια συνδυαστική βιοπολιτισμική προσέγγιση συγκριτικών ταφικών δεδομένων και συγκριτικών αποτελεσμάτων δεικτών τρόπου διαβίωσης. Βρέθηκαν διαφορές μεταξύ των δύο φύλων στον εν λόγω πληθυσμό οι οποίες φαίνεται να συμφωνούν με την διαφορετική πλευρά κατάκλισής τους, η οποία πιθανώς να συμβόλιζε τη διαφορετικότητα των ρόλων που η κοινωνία απέδιδε σε άντρες και γυναίκες στο ταφικό περιβάλλον. Συγκριτικά αποτελέσματα μεταξύ νεκροταφείων δεν φανέρωσαν χαμηλότερο επίπεδο υγείας και διατροφής, ούτε πιο έντονη εργασιακή καταπόνηση, σε σχέση με καλά δικτυωμένες θέσεις. Παρόλα αυτά, η Αχλάδα, όπως και μια σειρά –κυρίως βόρειων- κοινωνιών του ευρύτερου πλαισίου, πιθανότητα αντιμετώπισαν περισσότερα φαινόμενα καταπόνησης (στρες) κατά τη διάρκεια της ανάπτυξης, τουλάχιστον ήπιου και μετρίου επιπέδου, συγκριτικά με καλύτερα δικτυωμένους πληθυσμούς. Η παρούσα εργασία τονίζει τη σημασία της εφαρμογής συγκριτικών βιοαρχαιολογικών προσεγγίσεων ως μέσο μελέτης της επίδρασης της περιθωριοποίησης στους ανθρώπινους πληθυσμούς, ιδιαιτέρως σε θέσεις με περιορισμένες πληροφορίες υλικού πολιτισμού. Μεθοδολογικοί περιορισμοί οι οποίοι συνδέονται με ζητήματα διατήρησης αλλά και με τον πολυπαραγοντικό χαρακτήρα των δεικτών τρόπου διαβίωσης, ενδεχομένως να αντιμετωπιστούν μέσω των επερχόμενων βιομοριακών και ισοτοπικών αναλύσεων.

Λέξεις κλειδιά: τρόποι διαβίωσης; παλαιοπαθολογία; προϊστορία

The Late Bronze Age (LBA) of the Eastern Mediterranean was a highly networked hub of intercultural interaction. Reaching a zenith in the fourteenth to thirteenth centuries B.C., social upheavals in the decades around 1200 B.C. led to a collapse of elite political and economic networks (Cline 2014; Middleton 2010, 2017, 2020). Since the time of shaft graves at Mycenae in the seventeenth to fifteenth centuries B.C., strong links to the north and west in the form of imported amber, Wellenband ornamentation, chariot styles, and horse trappings demonstrate that modern bias plays a role in how we contextualize Mycenaean networks (Blake 2008; Bouzek 1994, 1985; Harding 1984, 2007; Iacono 2019; Jung and Mehofer 2013; Maran 2013; Molloy 2016). In reality, manifestations of pottery, burial monuments, placement of the body, use of grave goods, and size of cemeteries display a certain fluidity, indicating that communities of the wider context were choosing from a "menu" of practices and material culture, based on their own perspectives. Fundamentally, if we seek to better understand the cultural context of Mycenaean societies within the landmass they occupy and comprehend the complex cultural interactions between communities of the north, west, and south, improving our knowledge of societies at the margin of Mycenaean influence is essential (Andreou 2001, 2010; Gimatzidis and Pieniążek 2018). Therefore, bioarchaeological comparative analyses of cemeteries that lie within the wider geographical and cultural context of the LBA eastern Mediterranean have the potential to provide enlightening information on cultural exchange and mobility.

The cemetery of Achlada lies south of the historic region called the Pelagonia Valley, a region of *ca*. 2,000 km^2. This was a region which at once provided good alluvial land for settling and an opportune place to trade both north and south. Finds of amber from the Achlada cemetery (Ziota 2019) suggest that the community of this valley participated to some extent in the Morava-Vardar/Axios routeway trade network. To best explore the context of Achlada, we evaluate data from the Balkans and Greece together. Looking initially to the north, at the site of Dubac in central Serbia, we find well-furnished burials in a mound which is located toward the southern limit of the Tumulus Culture tradition. The distribution of ceramics common to the Vardar/Axios region, and found at Achlada, finds its northernmost limit around this cemetery (Bulatović 2011; Dmitrović 2016). Following the pottery traditions south, there is a distinct concentration along the Morava-Vardar/Axios corridor, which demonstrates the importance of this north–south routeway. Achlada lies to the west of this route, possibly placing the community at the margins of a prosperous zone (Fig. 1). Well-furnished burials with bronze finds and abundant ceramics have been found along the Vardar River in the cemeteries at Ulanci and Mali Dol (e.g., Mitrevski 1997; Papazovska Sanev 2014) where the ceramic forms demonstrate close links with the Achlada community (Ziota 2019). Moving southeast to Macedonian Pieria, a number of well-studied cemeteries present features of Vardar-style pottery, as well as moderate to intense use of Mycenaean imports and imitations, while the use of tumuli burials is also practiced (e.g., Koulidou et al. 2017; Triantaphyllou 2001; Triantaphyllou and Andreou 2020). Achlada was connected to Pieria and material culture parallels were found at Trimbina (Ziota, 2020, personal communication), but without displaying key cultural features of this region. Moving southwest to Epirus, connections with the Mycenaean world through ceramic imports are evident and the metalwork demonstrates some shared practices with other parts of Greece. Epirus's communities also shared ceramic styles with Albania and displayed similarities in the interpretation and use of Mycenaean influences and objects (Papadopoulos et al. 2014; Tartaron 2004). Therefore, Achlada could also be considered marginal to Epirus.

Figure 1. The Site of Achlada in relation to Florina, Bitola, Thessaloniki, Pieria, and Axios River.

Even though social differentiation through the character and disposition of grave goods was commonly practiced in communities of the wider study context, in Achlada it was not deployed to a significant degree to differentiate the interred in a highly structured manner (Ziota 2019: Table 1). There are fall-off zones of the major cultural ambits and these overlap with the fall-off zone of the minor Vardar tradition. These groups in the Pelagonia Valley are arguably benefitting from some limited, and as yet poorly defined, trade or communication link. It could be argued that the dearth of prestige goods is indicative of a community not engaging strongly with major networks, either on the basis of the dearth of material from the networks or their lack of intense participation in using metal and other traded materials to construct identity, indicating local practices are dominant. So our questions arise. How marginal may we predict Achlada to be? What does it mean to be marginal in this world? When material culture evidence is limited, are comparative bioarchaeological approaches able to provide answers on marginality?

If a given community is poorly networked and thus poorly buffered in times of hardship through reciprocal intercommunity exchange networks (Halstead and O'Shea 1989:4), poorer health and diet might be expected. If people were more dependent on their land to survive and prosper, as a result of reduced trading actions and their associated wealth, higher levels of physical activity might also be expected. If, finally, we consider the lack of grave goods in the mortuary environment to indicate that they were not used as a means of expressing social differentiation in death, a lack of intra-cemetery lifestyle differentiations would be expected.

The limited archaeological information and lack of settlement data restricts what can be suggested for the relative prosperity of this LBA community. It is therefore imperative to use comparative and contextualized bioarchaeological data to explore marginality and its potential impact on lifeways. The main objective of this study is to examine the efficacy of comparative bioarchaeological approaches in providing answers on marginality and networking, particularly in cases of limited material culture information. The following specific hypotheses are formed:

1) If the lack of material culture differentiation displayed in the mortuary practices of the current community reflects lack of social differentiations in lived reality, significant age or gender differences within the community—not related to biological factors—should be absent.
2) If the Achlada community was economically marginal and poorly networked, higher levels of physiological stress and poorer diet compared to well-networked populations would be expected as a consequence of poor economic buffering. Similarly, as a result of reduced trading activities and associated wealth, individuals at Achlada would probably be involved in more strenuous physical activities when compared to populations connected to major routes.

Table 1. Archaeological and anthropological information for Achlada prehistoric assemblage (CAR: dental caries, LEH: linear enamel hypoplasia, AMTL: antemortem tooth loss, CAL: calculus, S.DJD: spinal degenerative joint disease (DJD), P.DJD: postcranial degenerative joint disease (DJD), PF: postcranial fracture, SF: skull fracture, CO: cribra orbitalia, PH: porotic hyperostosis, ID: infectious disease).

N.Burial	Sex	Age	Placement of the body (slightly contracted)	Artifacts	Pathologies
T.466	M	25–45	Right	Kantharos-shaped amphora	CAR, AMTL, CAL, S.DJD, P.DJD, PF, ID
T.393	F?	Adult	Left	One-handled cup	PF
T.617	?/F?	25–35	Left	—	CAR, LEH, CAL
T.329	?	25–35?	Left	One-handled cup	CAR, AMTL, CAL
T.302	M	Adult	Right	—	CAR, LEH, CAL
T.479	M	25–35	Right	Kantharos-shaped amphora, bronze dagger and knife	CAR, LEH, AMTL, CAL
T.476	M	17–25?	Right	Kantharos	CAR, LEH, CAL
T.346	?	Adolescent/Adult	Right	—	none
T.344	?	17–25	Right	—	LEH, CAL
T.654	?/M?	25–45	Left	Bowl	CAR, CAL
T.469	F?	25–35	Left	—	CAR, LEH, CAL
T.336	?	Adult	Right	One-handled cup	none
T.510	?	Adult	Left?	?	LEH
T.337	M	20–25?	?	?	CAR, LEH, AMTL, CAL
T.379	?	2–3	Left	—	CAR
T.405	?/F?	25–35	Left	—	LEH
T.364	M	Adult	?	—	CAL
T.388	F?	25–34?	?	?	none
T.391	?	Adult	Left	?	none
T.394	?	20–35	Left	—	CAR, LEH, AMTL, CAL
T.432	?/F?	25–34	Left	One-handled cup	none
T.365	F?	17–25	Right	Kantharos	LEH, CAL
T.360	F?	33–45	Left	—	CAR, LEH, AMTL, CAL, S.DJD
T.384	?	5–6.5	?	?	LEH
T.324	?/F?	25–45	Left	—	CAL, CO
T.303	M?	25–30	?	?	LEH, CAL
T.387	M	25–44	Right	—	CAR, LEH, AMTL, CAL, S.DJD, P.DJD
T.338	M	33–45/45+	Right	Handleless	P.DJD
T.390	M	Adult	Left	—	PF
T.389	F	30–45	Supine	One-handled cup	LEH, CAL, PH

(*Continued*)

Table 1. (*continued*)

N.Burial	Sex	Age	Placement of the body (slightly contracted)	Artifacts	Pathologies
T.316	F?	17–25	Left	Kantharos	CAR, LEH, CAL, PH
T.345	M	33–45/45+	Right	—	LEH, S.DJD
T.308	?/F?	Adult	?	?	PH
T.352	M	25–35	Right	"Mycenaeanizing" matt-painted vessel	CAR, LEH, CAL
T.351	?/F?	17–25?	Left	Bowl	CAR, LEH, CAL
T.415	?	12–15	Right	One-handled cup	CAR, LEH, CAL
T.414	?/M?	Adult	Right	Kantharos-shaped amphora	P.DJD, SF
T.340	M	25–35	Right	—	CAR, LEH
T.342	?	8–12	?	?	CAR, LEH
T.350	?	5–6.5	Right	—	none
T.465	?/M?	Adult	Right	—	none
T.457	?/F?	Adult	?	Kantharos-shaped amphora	none
T.487	?	3–4	Left	Beads of amber and glass, stone tool	CAR, LEH, CO
T.472	?	Adult	Left	One-handled cup	none
T.356	M?	20–29	Right	Kantharos-shaped amphora, bronze pin	CAR, LEH, AMTL
T.374	M	25–35	Right	Kantharos-shaped amphora	CAR, LEH, CAL, S.DJD
T.367	M	25–35	Right	—	CAR, LEH, PF
T.444	F	17–25	Left	"Mycenaeanizing" painted vessel	LEH, CAL
T.378	?/M?	30–35	Right	—	CAR, LEH, CAL, S.DJD
T.362	?/M?	25–35?	Right	—	CAR
T.326	F?	25–35	Right	Kantharos-shaped amphora, bronze dagger and pin	LEH, AMTL, CAL
T.553	?	17–25	Left	Two-handled cup	CAR
T.370	?	Adolescent/Adult	Left?	One-handled cup	CAR, PF
T.371	?	12 ± 30 months	Left	—	CAR, LEH
T.458	F?	17–25	Left	Kantharos	CAR

Human remains from Achlada will be analyzed following a biocultural methodology, combining funerary practices with indicators of health and lifestyle. In order to understand the manner in which the communities in Pelagonia (Fig. 1) were connected to major cultural constellations to the north and/or south, comparative data on type of tombs/burials, placement of the dead, grave goods, and demography will be presented. Lifeways will be investigated through dental diseases (caries, antemortem tooth loss (AMTL), and calculus), stress and lifestyle indicators (stature, trauma, cribra orbitalia, porotic hyperostosis, and enamel hypoplasia), and degenerative joint diseases (DJD, including Schmorl's nodes).

Materials and Methods

The cemetery of Achlada

Since 2014 the Ephorate of Antiquities of Florina has been conducting rescue excavations at a lignite mine in the region of Achlada, where a 20-acre archaeological site has been defined. The excavation, which is still in progress, has revealed a cemetery dating from the LBA to Byzantine times (Ziota 2019). This study focuses on the prehistoric cemetery of Achlada near to the modern town of Florina in Macedonia in the north of Greece (Fig. 1).

The prehistoric cemetery (Fig. 2) consists of 74 pit burials and according to initial radiocarbon results it was used between 1400 and 1100 B.C. (Ziota 2019). Artifacts recovered from 32 tombs consisted primarily of pottery. Apart from ceramic vessels, the remaining finds include jewelry, weapons, and tools (Table 1). Despite this limited number of prestige objects, the general pattern in the mortuary assemblage is for few objects to have been used in the final burial rites (Ziota 2019).

Out of the 74 prehistoric burials, 17 are partially or completely disturbed by later burials or foundations of Roman buildings. The cemetery consists of single burials with the exception of a couple of cases. There is no indication of a tumulus, nor could this be supported based on the inclination of the ground. Tombs in Achlada are usually oriented along the southwest–northeast axis. The burials are contained and the deceased were placed with their bodies lying on their side, their lower limbs slightly contracted and their upper limbs flexed in front of the torso (Ziota 2019). A total of 54 adult/possible adult individuals, five juveniles, and three adolescents were identified. No infants (up to 1 year) were found. Sex estimation was conducted only in adult cases and 22 males/possible males and 17 females/possible females were recognized, as well as 32 individuals that could not be confidently sexed. The demographic information of Achlada prehistoric cemetery is presented in Fig. 3 (the 55 better preserved individuals). Interestingly, males are buried on their right side, whereas females are buried on their left. There are few exceptions to this, indicating a clear distinction between the sexes in terms of their placement (Ziota 2019; see Table 1).

Adult burials are found with artifacts with a frequency of 46%, while non-adult ones include artifacts at a much lower percentage (i.e., 25% or 2 out of 8). All burials that were recovered with artifacts include at least one vessel, with the exception of one juvenile inhumation found solely with beads and a stone tool (T.487). All ceramic vessels, which were usually placed close to the lower limbs, were handmade and belonged to specific types, intended for transport, offering, and consumption of liquids. Out of the 32 vessels only two were found with matt-painted decoration. Apart from pottery, the 13 remaining associated finds recovered in six tombs include three bronze fibulae, one glass and three amber beads (juvenile burial stated above), two bronze daggers, as well as one knife. A unique phallic object, most likely from sandstone, was also recovered (Ziota 2019). The ceramic vessels suggest a dynamic local production, without excluding foreign cultural characteristics that have been adapted to the local social and symbolic environment. No Mycenaean imports were recovered, even though pottery influenced by or imitating Mycenaean patterns was found (Ziota 2019).

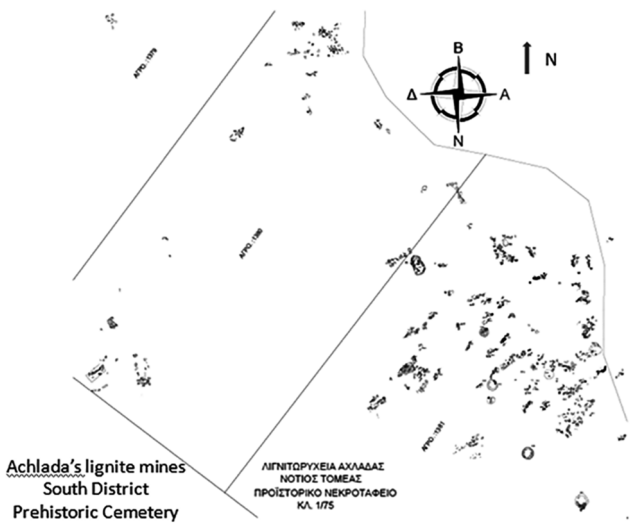

Figure 2. Topographic plan of the prehistoric burials of Achlada.

Methods

Biological profiling. Sex and age determination of the skeletons was conducted using the morphological criteria of the skull, pelvis, and ribs (Bass 1987; Brooks and Suchey 1990; Brothwell 1981; Buikstra and Ubelaker 1994; İşcan et al. 1984, 1985). Measurements were also used for sex estimation. Adults were categorized as females/possible females, males/possible males, or indeterminate.

Age determination in juveniles/adolescents was conducted following the criteria outlined in Moorrees et al. (1963), Scheuer and Black (2000), and Ubelaker (1989). The age categories used in this study are: 1) infant (< 1 year); 2) juvenile (1–12 years); 3) adolescent (12–17 years); 4) young adult (18–25 years); 5) young middle adult (26–35 years); 6) old middle adult (36–45 years); 7) mature adult (45+ years); 8) adult; 9) adolescent/adult.

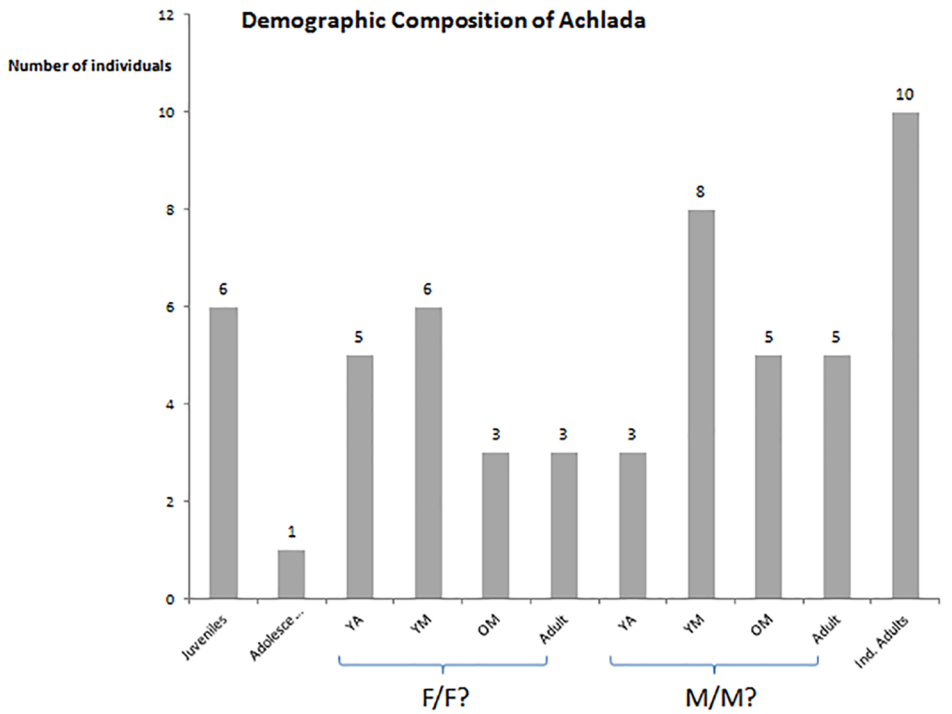

Figure 3. Demographic composition of Achlada's prehistoric assemblage. (YA: young adults, YM: young middle adults, OM: old middle adult, Ind. Adults: indeterminate adults.)

Stature is considered a marker of physical well-being, resource availability, economic and nutritional improvement, as well as social context (Tritsaroli and Michael 2020). Stature estimation was based on femoral length, as it is the largest element in the human skeleton and correlates best with human stature (Hauser et al. 2005). All measurements were performed using an osteometric board, and they were taken on the left side where possible, and on the right when the left side was not available (Buikstra and Ubelaker 1994; Martin 1914). The equations of Trotter for Whites (1970) were used.

Paleopathological diagnosis and recording. Degenerative joint diseases (DJD) are linked, among other factors (such as age), to strenuous physical activities. DJD was observed on all the joints of the human body, including the entire spine, according to the criteria of Rogers et al. (1987) (Fig. 4). In addition, a three-stage recording system for osteophytes and porosity (i.e., mild/moderate/severe) was implemented. Eburnation and Schmorl's nodes were recorded as present or absent. Schmorl's nodes mainly refer to the end result of the prolapsed disc, or the lesion that eventually is formed on the surface of the affected vertebral body (Faccia and Williams 2008:29). Even though congenital defects of the spine, age, and trauma are considered to be causative factors (Resnick and Niwayama 1978), a number of studies have tested Schmorl's nodes as markers of demanding physical activity (i.e., Angel et al. 1987; Baker 1997; Coughlan and Holst 2000; Manzon and Gualdi-Russo 2015).

Trauma frequencies are highly affected by lifestyle factors such as economy, living environment, occupation, and interpersonal violence (Roberts and Manchester 2005:84). Traumatic lesions were recorded on the entire skeleton, including healed fractures (antemortem trauma), unhealed fractures (perimortem trauma), sharp-force lesions, and projectile lesions.

Porotic hyperostosis (PH) and cribra orbitalia (CO) result from marrow hyperplasia. The etiology of their development has been highly debated and attributed to iron-deficiency anemia, inherited hemolytic anemias, acquired megaloblastic anemia due to B12 and/or folate deficiency, infectious disease, chronic scalp infections, respiratory infections, scurvy, and rickets (e.g., Camaschella 2015; Larsen 2015:31–32, 39; O'Donnell et al. 2020; Ortner 2003; Oxenham and Cavill 2010; Schultz 2002; Walker et al. 2009). When human remains are macroscopically analyzed, PH and CO are probably best regarded as stress indicators rather than markers of specific diseases (Steckel et al. 2005:13). PH and CO were recorded on four surfaces; orbits (CO) and parietal, frontal, and occipital bones (PH), according to a three-stage severity system: 1) porosity, 2) coalesce, 3) diploë expansion (Steckel et al. 2005). The stage of healing was also recorded (healed closed lesions or unremodeled lesions).

Enamel hypoplasia can occur only while the teeth are developing, thus remaining as a permanent record into adulthood. Many factors are relevant to enamel defect etiology but they can be categorized broadly into hereditary anomalies, localized trauma, and systemic metabolic stress such as a nutritional deficiency or childhood illness (Goodman and Rose 1991:279–294). Nevertheless, this condition is usually linked to systematic physiological stress in modern and archaeological skeletal human remains. Enamel hypoplasia was recorded on the buccal surface according to its morphology pit, line, or groove (Fig. 4).

Caries and calculus are considered to be mutually exclusive in terms of etiology, as the mechanisms that produce them are different. Comparing their frequencies in a population can give valuable information related to dietary patterns (Hillson 1979). Caries is a disease process characterized by the focal demineralization of dental hard tissues by organic acids produced by bacterial fermentation of dietary carbohydrates (Larsen et al. 1991). Apart from a cariogenic diet (i.e., sucrose), the etiology of dental caries is also related to poor dental hygiene, which leads to bacterial overgrowth, composition of the saliva, and susceptible tooth structure (Bourbou 2013:219). Dental calculus is mineralized bacterial plaque (Lukacs 1989:283) which consists of microorganisms that accumulate in the mouth, embedded in a matrix partly composed by the organisms themselves and partly derived from proteins in the saliva (i.e., Hillson 2005:289). It accumulates on the teeth faster when there is a high protein diet favoring an alkaline oral environment (i.e., Lukacs 1989:283), although the role of other factors such as individual variation, cultural practices, and the process of mineralization should not be overlooked (Lieverse 1999).

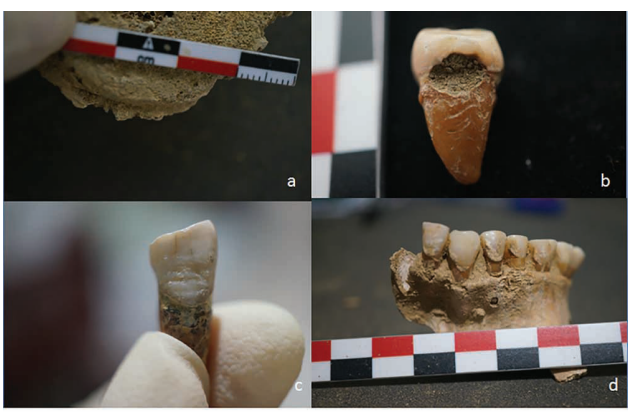

Figure 4. Examples of indicators recorded in LBA Achlada assemblage. a) T.374, male young middle adult, mild osteophytes on the superior body of 5th lumbar vertebra; b) T.340, male young middle adult, caries (medium expression) on the mesial/Cemento-Enamel junction surface on the 2nd lower left molar; c) T.326, female young middle adult, enamel hypoplasia (grooves) on the upper left canine; d) T.444, female young adult, slight and moderate calculus on right maxilla. Courtesy of the Hellenic Ministry of Culture and Sports.

Dental caries was recorded on the occlusal, mesial, distal, lingual, buccal, cemento-enamel junction (CEJ), and root, according to a four-stage system: 1) pinpoint, 2) small/< 1/2 crown, 3) medium/< 1/2 crown, and 4) large. Calculus was recorded according to Brothwell (1981) (Fig. 4). Teeth were recorded according to the FDI tooth numbering system.

Statistical analysis

As the data did not follow a normal distribution (Kolmogorov-Smirnov test), two nonparametric tests were performed: the Mann-Whitney U test ($p < 0.05$) and the Kruskal-Wallis test ($p < 0.05$). Spearman's rank correlation coefficient ($p < 0.05$, or $p < 0.01$) was also used in order to test how strongly the variables were associated with each other. The chi-square test was also used for comparative statistical analyses. All the analyses were carried out using SPSS (Statistical Package for the Social Sciences) version 21.

Results

A) Intra-cemetery variation

Out of the 74 prehistoric burials, the systematic study was applied on 55 of them as the poor skeletal representation of the remaining burials did not allow for a detailed osteological analysis and paleopathological investigation. Overall percentages of pathological conditions, nonspecific stress indicators, and fractures for the population of Achlada are presented in Table 2.

The overall frequency of DJD in the current sample is quite limited. All four cases of postcranial DJD were noted in males, three old middle adults and one adult. Overall, spinal DJD was observed on 25 vertebrae and 11 individuals. Apart from spinal DJD observed in one female old middle adult, all remaining cases (including Schmorl's nodes) involve males. As expected, DJD is mostly observed in older individuals. In cervical and thoracic vertebrae, age shows a positive correlation with osteophytes, although this is not statistically significant (Spearman's rho [age-cervical osteophytes]: 0.108, $p = 0.752$; Spearman's rho [age-thoracic osteophytes]: 0.230, $p = 0.495$).

Traumatic lesions were noted in five individuals (Tables 1 and 2 ; also see Supplemental Information), affecting seven postcranial elements and one cranium. With the exception of one possible adult

female, the remaining cases were noted in males/possible male individuals.

Cribra orbitalia and porotic hyperostosis were observed in five cases overall (Tables 1 and 2). Interestingly, with the exception of one juvenile presenting with porosity on the orbital roof, all remaining four cases were recorded in females. In the adult cases, the lesions were mostly healed. One young child, between three and four years old, presented with both active and healed lesions.

Prevalences of caries, calculus, AMTL, and enamel hypoplasia in relation to sex are presented in Table 3. When all age categories are combined, statistically significant differences were found between the sexes for enamel hypoplasia and calculus. More specifically, males and females do present statistically significant differences for the former indicator but not for the latter (Mann-Whitney U, Z = –0.216, $p = 0.829$). Statistical comparisons between males and females while controlling for age are also presented in Table 4. No statistically significant differences regarding caries and calculus location and severity were noted. In contrast, the sexes do present statistically significant differences in terms of hypoplasia type (Mann-Whitney U, Z = –4.538, $p < 0.001$).

The stated dental indicators were also examined in relation to age, regardless of sex (Table 5). No age differences were noted for enamel hypoplasia, contrary to the remaining indicators. AMTL and calculus present their highest rates in the old middle adult category. Both conditions present positive and significant correlations with age (Spearman's rho [age-calculus]: 0.193, $p = 0.000$; Spearman's rho [age-AMTL]: 0.137, $p = 0.000$). Dental caries on the other hand are presenting a negative correlation with age (Spearman's rho: –0.038, $p = 0.310$), although not significant. Caries were mostly noted in young adults (Table 5) and the difference between the adult age categories is significant (Kruskal-Wallis, chi-square: 10.221, df = 2, $p = 0.06$).

Table 2. Percentages of pathological conditions and fractures for the population of Achlada (Florina). (True Prevalence Rates for dental diseases and enamel hypoplasia are the number of teeth/alveoli exhibiting the condition divided by the number of teeth/alveoli examined; Crude Prevalence Rates for the remaining conditions and fracture cases are defined as the number of individuals exhibiting the condition/fracture divided by the number of individuals examined.)

Pathologies	Individuals affected	Crude prevalence rate %	Teeth/alveoli affected	True prevalance rate %
AMTL	9/55	16.4	26/816	3.2
Caries	29/55	52.7	70/709	9.9
Enamel hypoplasia	31/55	56.4	150/709	21.2
Calculus	26/55	47.3	159/709	22.4
Cribra orbitalia	2/55	3.6		
Porotic hyperostosis	3/55	5.5		
Spinal DJD	6/55	10.9		
Postcranial DJD	4/55	7.3		
Skull fractures*	1/55	1.8		
Postcranial fractures*	4/55	7.3		

***probable cases**

Table 3. Dental diseases and enamel hypoplasia in relation to sex (for all age categories combined).

	F/F?	M/M?	?	Kruskall-Wallis test
Dental caries	21/70 30%	34/70 48.6%	15/70 21.4%	chi-square = 2.371 df = 2 $p = 0.306$
AMTL	5/26 19.2%	16/26 61.5%	5/26 19.2%	chi-square = 0.000 df = 2 $p = 1.000$
Enamel hypoplasia	30/150 20%	84/150 56%	36/150 24%	chi-square = 27.418 df = 2 $p = 0.000$
Calculus	65/159 40.9%	75/159 47.2%	19/159 11.9%	chi-square = 16.612 df = 2 $p = 0.000$

Table 4. Statistical comparisons of dental diseases and enamel hypoplasia between sexes while controlling for age

	Young adults	Young middle	Old middle
	(F/F? vs. M/M?)	(F/F? vs. M/M?)	(F/F? vs. M/M?)
Dental caries	85.7% (18/21); 29.4% (10/34)	9.5% (2/21); 38.2% (13/34)	4.8% (1/21); 29.4% (10/34)
	Mann-Whitney: 4397.0	Mann-Whitney: 6031.5	**Mann-Whitney: 3641.0**
	Z = –0.082	Z = –1.857	**Z = –2.093**
	p = 0.934	p = 0.063	***p* = 0.036**
AMTL	0; 18.8% (3/16)	40% (2/5); 6.3% (1/16)	60% (3/5); 75% (12/16)
	Mann-Whitney: 4224.0	Mann-Whitney: 6321.0	Mann-Whitney: 3681.0
	Z = –2.371	Z = –1.211	Z = –1.571
	***p* = 0.018**	p = 0.226	p = 0.116
Enamel hypoplasia	43.3% (13/30); 20.2% (17/84)	46.7% (14/30); 56% (47/84)	10% (3/30); 22.6% (19/84)
	Mann-Whitney: 3776.5	**Mann-Whitney: 3554.0**	**Mann-Whitney: 3432.5**
	Z = –2.692	**Z = –2.281**	**Z = –2.595**
	***p* = 0.007**	***p* = 0.023**	***p* = 0.009**
Calculus	36.9% (24/65); 21.3% (16/75)	33.8% (22/65); 41.3% (31/75)	29.2% (19/65); 29.3% (22/75)
	Mann-Whitney: 4220.0	Mann-Whitney: 6025.5	Mann-Whitney: 3667.0
	Z = –0.737	Z = –1.141	Z = –1.090
	p = 0.461	p= 0.254	p = 0.276

Table 5. Prevalence of dental diseases and enamel hypoplasia by age groups

Age groups	Dental caries	AMTL	Calculus	Enamel hypoplasia
Juvenile (1–12 years)	5.8% (5/86)	absent	absent	20.9% (18/86)
Adolescent (12–18 years)	10% (2/20)	absent	10% (2/20)	40% (8/20)
Yound adult (18–25 years)	16.3% (30/184)	1.4% (3/207)	22.8% (42/184)	19.6% (36/184)
Young middle (25–35 years)	7.3% (20/273)	2.6% (8/302)	24.5% (67/273)	23.1% (63/273)
Old middle (36–45 years)	8.4% (11/131)	8.2% (15/182)	31.3% (41/131)	16.8% (22/131)
Kruskal-Wallis test	**chi-square = 12.519** **df = 4** ***p* = 0.014**	**chi-square = 20.598** **df = 4** ***p* = 0.00**	**chi-square = 33.691** **df = 4** ***p* = 0.00**	chi-square = 7.134 df = 4 p = 0.129

B) Intercemetery comparisons

Comparative mortuary data. Comparative funerary information on the LBA sites of the wider archaeological and geographical context is presented in Table 6. Single burial inhumations are mostly observed in populations north of Thessaly, while multiple burials are mostly noted in southern Mycenaean populations. The pattern of males being placed on their right side, with females on their left, is noted in the current sample as well as at Jančići Dubac (with a few exceptions) and at Pigi Artemidos. Artifacts, such as pottery and numerous bronze items (e.g., jewelry, weapons), are common among all sites of the wider study context. Elaborate burials are noted in the Grave Circle/Tholos Tombs of Pylos and Kazanaki Tholos Tomb in Thessaly. At numerous sites (e.g., Lofkënd Tumuli, Spathes, Korinos, Trimbina, Athens), prestigious objects were also found, with a proportion of the buried population (Table 6).

Table 6. Archaeological information of LBA sites of the wider study region

Sites of the wider context	Absolute chronology	Relative chronology	Type of tombs/burials	Grave orientation Burial placement	Brief information on grave goods
Achlada, Macedonia, Greece	1400–1100 B.C.		pit graves, single burials, all inhumations	SW–NE; males/right; females/left	one ceramic vessel per tomb (32 overall); 13 objects (e.g., amber beads, bronze fibulae, one knife)
Jančići Dubac, Serbia[1]		LBA	Tumuli, inhumations and cremations	multiple orientation (W–E and E–W), slightly crouched position observed in some cases, males/right; females/left	jewelry, numerous bronze items, ceramic vessels, in general well furnished
Manastir, Čaška–Veles, North Macedonia[2]		EBA–EIA	necropolis of the settlement, 12 skeletons, of which 10 with traces of burning-cremation not completed		part of the Ulanci group LBA tradition, North Balkan objects (e.g., battle axes—Celts, spears)
Kamenica Tumuli, Albania[3]	13th–12th c. B.C.		Tumuli, Great Circle, simple pits	flexed position	pottery, jewelery, weapons
Apollonia Tumulus 10, Albania[4]		LBA/EIA	Tumuli, simple pits, single burials	multiple orientation NW most prevalent sleeping/fetal position most prevalent	32% of burials with grave goods, remarkable variety of types (e.g., bronze pins, bronze knife, necklace of faience beads)
Lofkënd Tumuli, Albania[5]		LBA/EIA	Tumuli, pit burials, single and commingled burials (simultaneous and primary-secondary inhumations), two cremations present	multiple orientation (predominant orientation northeast and southeast), mostly supine position with legs flexed	less than half of 85 burials with goods, grave goods found more in female burials, mostly one artifact per person, six "wealthier" burials up to 11 items each, in general: pottery, bronze and iron ornaments (including weapons), beads of various materials (iron and glass), electrum objects
Epirus's sites, Greece (Elaphotopos, Konitsa, Skamneli)[6]		LBA	cist graves, inhumations		local pottery, bronze weapons and implements, bronze jewelry, lithics; significant number of beads and one matt-painted jug (Skamneli burials)
P. Athinas, Macedonia, Greece[7]	1650–1500 B.C.		5 Tumuli—16 single-pit graves—the 5 central of them deeper—possible examples of elaborate construction	SW–NE males/ right; females/left	one ceramic vessel per burial—very few other findings (e.g., jewelry)—most usual ceramic type "Thessaly Kantharos" with central channel decoration
P. Artemidos, Macedonia, Greece[8]	1600–1400 B.C.		Tumulus, 6 pit graves & 3 stone & 1 deposit of bones, all single burials	variously oriented males on both sides	clay vessels and bronze items (one bracelet, one spiral earring, two pins, and three knives); one vase of Mycenaean type
Valtos, Macedonia, Greece[9]		MBA–LBA	Tumulus—3 pit graves		bronze jewelry in one burial
Korinos, Macedonia, Greece[10]		EBA–LBA	Tumuli, pit graves, mainly single burials	contracted position, no specific orientation	large quantity of pottery (local and Mycenaean), clay, lithic and stone objects, numerous jewelry (bronze, silver, some gold beads)

(*Continued*)

Table 6. (*Continued*)

Sites of the wider context	Absolute chronology	Relative chronology	Type of tombs/burials	Grave orientation Burial placement	Brief information on grave goods
Spathes, Macedonia, Greece[11]	1400–1200 B.C.		cist graves, 2–5 individuals per burial		sealstones (17), jewelry weaponry (e.g., sword type G of Sandars, C^3 dagger) and Mycenaean or "Mycenaeanising" pottery
Treis Elies, Macedonia, Greece[12]		LBA/EIA	cist and pit graves single burials		handmade Macedonian pottery and ceramics influenced by Mycenaean patterns, numerous metalwork findings, simple and "poor" necklaces
Trimbina, Macedonia, Greece [13]	1420–1150 B.C.		17 cist and pit burials (including one animal burial), single burials	NE–SW	all human burials with artifacts (pottery and metalwork)—intense Mycenaean presence, one "warrior" burial
Rema Xydias, Macedonia, Greece [14]	1390–1200 B.C.		mostly cist graves—multiple/collective inhumations in most cases		local production and Mycenaean-type artifacts
Faia Petra, Macedonia, Greece [15]	13th c. B.C.		five groups of single and multiple burials and a single grave, inhumations and one cremation, elaborate and time-consuming construction of burial enclosures	contracted and supine positions	plain clay pots (mainly incised decoration filled with white paste— typical of Eastern and Central Macedonia); two Mycenaean-type stirrup jars, several bronze items, amber beads, and two gold discs, funerary meals (remains of unburnt animal bones)
Velestino, Thessaly, Greece[16]		LHIIIA–B	five chamber tombs, one primary, and two to six secondary burials per tomb	contracted position	not very "rich" artifacts
Kazanaki, Thessaly, Greece[17]	14th c. B.C.		one tholos tomb, commingled, evidence of incomplete cremation		prestige items (e.g., golden jewelry, 1000 necklace tiles, glass beads), 42 pots (18 matt painted)
East Lokris, Phiotida, Greece[18]	1325–1100 B.C.		chamber tombs commingled burials		non-elite socioeconomic stratum
Athens, Attiki, Greece[19]		LBA	chamber tombs, pit graves, cist graves		weapons (swords, spears, knives), painted pottery, beads (e.g., gold, amber)
Pylos, Peloponnese, Greece[20]		Middle Helladic to LHIIIC	population from the Palace of Nestor and neighboring area, Grave Circle, elaborate tholos tombs, chamber tombs and pit (cist) grave, primary and secondary burials in all cases	extended and contracted	Grave Circle: multiple artifacts (e.g., bronze cauldrons, daggers, rapiers, boars' tusks, ornaments of gold, ivory, and silver); Tholos tombs: beads of amethyst, pottery, gold leaf; Chambers: pottery, beads, bronze and stone artifacts; pit grave: four pots
Ayia Sotira, Peloponnese, Greece[21]		LHIIIA1–IIIB2	chamber cemetery, primary and secondary burials, 24 out of 34 burials showed evidence for secondary treatment		pottery, plant, and food remains (meals for living or dead), residues of fatty lipids and wood, hundreds of miniature beads

(*Continued*)

Table 6. (*Continued*)

Sites of the wider context	Absolute chronology	Relative chronology	Type of tombs/burials	Grave orientation Burial placement	Brief information on grave goods
Achaea Clauss, Peloponnese, Greece[22]		LHIIIA1–IIIC	chamber tombs, primary and secondary burials, inhumations, only one cremation	Clauss Warrior 2: left placement, legs in contracted position	pottery, sealstones, impressive jewelry, toilet equipment, metal objects, weapons (e.g., Naue II long sword), two warrior burials, exotic knife of North Italian origin at Clauss Warrior 2
Voudeni, Peloponnese, Greece[23]	1400–1050 B.C.		chamber tombs, collective burials		numerous findings: pottery, weapons, tools, jewelry; connections with Messene, Laconia, Argolid/Corinth, Crete, Italy, Anatolia
Spaliareika Achaea, Peloponnese, Greece[24]		LHIIIA–C	four chamber tombs, primary and secondary inhumations	supine position ("local ruler" burial)	two bronze swords (burial of local ruler—most elaborate burial), pottery, bronze items, glass and stone beads
Sykia, Peloponnese, Greece[25]		LHIIIA–C	three chamber tombs		weapons (e.g., swords, knives, daggers), pottery

[1] Dmitrović 2016; [2] Veljanovska 2008; [3] Kline 2015:69; [4] Grazia Amore 2010; [5] Papadopoulos et al. 2014; Stapleton 2014; [6] Tartaron 2004; Vasileiou et al. 2018; Vokotopoulou 1967; [7] Poulaki-Pantermali 2008; Poulaki-Pantermali et al. 2010; Tritsaroli 2017; [8] Tritsaroli and Koulidou 2018; [9] Poulaki-Pantermali et al. 2010; [10] Bessios 1997; [11] Poulaki-Pantermali 1986a, 1986b, 1987a, 1987b, 1990, 1991; [12] Poulaki-Pantermali 1988, 1989, 1992; [13] Koulidou et al. 2017; [14] Koulidou 2005, 2009, 2020; Tritsaroli, 2020; [15] Valla et al. 2010; [16] Arachoviti 1994; Doulgeri-Intzesiloglou 1994; Papathanasiou et al. 2012a; [17] Adrimi-Sismani and Alexandrou 2008; [18] Iezzi 2005, 2009; [19] Camp 2003; Smith 2009; [20] Blegen et al. 1973; [21] Smith et al. 2017; [22] Paschalidis 2020; Paschalidis and McGeorge 2009; [23] Kolonas 1998, 2009a; Moutafi 2015; [24] Petropoulos 2000; [25] Eustathiou 1997, 1998.

The number of adults vs. non-adults found in cemeteries of the wider region is presented in Table 7. The highest adult–non-adult ratios are noted in LBA/EIA Treis Elies in Pieria (11:1 ratio), Mycenaean Pylos (8:1 ratio), the current sample (7:1 ratio), and Mycenaean Voudeni (6:1 ratio). A number of sites, (e.g., Kamenica Tumuli, Apollonia Tumulus 10, Lofkënd Tumuli, Spathes, Korinos, East Lokris, Athens, Ayia Sotira) present ratios between 4:1 and 2:1. In Pigi Athinas tumuli no non-adults were found, whereas Čaška–Veles and Faia Petra present almost an equal number of adults and non-adults. LBA Jančići Dubac is an exception, as the number of non-adults is slightly higher compared to adults.

Comparative data of lifestyle indicators. Comparative DJD data of LBA sites of the wider study context are presented in Table 8. The highest number of postcranial DJD cases is noted at Rema Xydias and Pigi Athinas in Macedonian Olympus. The spine is more affected than the rest of the skeleton in Achlada and Lofkënd tumuli, while in Velestino and Jančići Dubac DJD is absent from the postcranial elements. In LBA Spathes and LBA/EIA Treis Elies, the upper part of the body (upper limbs, cervical and thoracic segments, and thorax) is more affected than the lower one (lower limbs, lumbar, and sacral segments) (Table 8).

Comparative data on stature, trauma, CO, and PH are presented in Table 9. The highest adult stature is observed at Jančići Dubac and it is much higher compared to all the remaining sites of the wider study context. The two sites in Thessaly (Kazanaki and Velestino), Sykia in the Peloponnese, and Čaška–Veles in North Macedonia gave stature averages of around 165 cm, while the remaining samples have a stature range of between 158 cm and 162 cm. Apart from Rema Xydias in Macedonian Olympus exhibiting a very high number of trauma cases (per bone), the majority of the remaining sites present few trauma cases (below five), while Achlada cemetery and Lofkënd tumuli present six and nine cases of traumatic lesions, respectively. Likewise, the majority of sites present limited numbers of CO and PH cases, with the exception of Pigi Athinas and Rema Xydias (Table 9).

Finally, comparative results of enamel hypoplasia and dental diseases rates are presented in Table 10. Achlada has a statistically significantly higher rate of enamel hypoplasia than all the sites of Central and Southern Greece, as well all of Epirus's sites (Elaphotopos, Konitsa, and Skamneli). The only sites that present significantly higher rates of enamel hypoplasia than Achlada are Pigi Artemidos and Trimbina in Macedonian Olympus. Dental caries frequencies

Table 7. Number of adults and non-adults in LBA sites of the wider context

	Adults	Non-adults (< 18 years)
Achlada	48	7
Jančići Dubac[1]	8	10
Manastir, Čaška–Veles[2]	7	4
Kamenica Tumuli[3]	10	4
Apollonia Tumulus 10[4]	46	14
Lofkënd Tumuli[5]	86	43
P. Athinas[6]	17	0
P. Artemidos[7]	8	2
Valtos[8]	7	3
Korinos[9]	20	4
Spathes[9]	21	6
Treis Elies[9]	32	3
Trimbina[10]	18	8
Rema Xydias[10]	32	13
Faia Petra[11]	7	5
Velestino[12]	20	11
Kazanaki[13]	6	3
East Lokris[14]	142	43
Athens[15]	79	38
Pylos[16]	160	19
Ayia Sotira[17]	26	8
Achaea Clauss[18]	55	18
Voudeni, Achaea[19]	175	31
Spaliareika Achaea[20]	21	4
Sykia[21]	28	8

[1] Radović 2016:272–282; [2] Veljanovska 2008:431–438; [3] Kline 2015:69; [4] Schepartz 2010:52; [5] Schepartz 2014:140–141; [6] Tritsaroli 2017:238; [7] Tritsaroli and Koulidou 2018:Table 1, 12; [8] Tritsaroli 2007:Table 1, 192; [9] Triantaphyllou 2001:36; [10] Tritsaroli 2020:Table 2, 262; [11] Valla et al. 2010:Fig. 6, 236; [12] Papathanasiou et al. 2012a:215; [13] Papathanasiou 2009:153; [14] Iezzi 2005:219, 2009:Table 11.1; [15] Smith 1998; [16] Schepartz et al, 2009:Table 10.2, 2011; Papathanasiou et al., 2012b; [17] Triantaphyllou 2017:132; [18] Paschalidis and McGeorge 2009:102; [19] Moutafi 2015:428–429; [20] Papathanasiou 2005:Table 1, 192; [21] Papathanasiou 1999:1009–1101.

range from 0% to 24.2%, placing Achlada's rate (9.9%) in the middle of this range (Table 10). In contrast, the observed calculus rate of the current sample is significantly higher than most other compared collections (mostly in Macedonia) with the exception of Valtos and Pigi Artemidos. Regarding AMTL, Achlada's rate is one of the lowest compared to the sites of the wider study region (Table 10).

Discussion

A) Intra-cemetery variation

In terms of DJD, male individuals were more affected than females. Osteoarthritis, especially of the spine, is strongly linked to genetics and some studies have documented that this hereditary effect

Table 8. DJD in Late Bronze Age sites of the wider context

Sites (overall number of individuals)	Overall DJD	Postcranial DJD	Spinal DJD
Achlada (N = 55)	10 cases (per indiv.) 31 cases (per bone)	4 cases (per indiv.) 6 cases (per bone)	6 cases (per indiv.) 25 cases (per bone)
Jančići Dubac (N = 18)[1]	not available	not available	4 cases (per indiv.)
Lofkënd Tumulus (N = 136)[2]	not available	8 cases (per bone)	45 cases (per indiv.)
P. Athinas (N = 17)[3]	not available	46 cases (per bone)	18 cases (per bone)
P. Artemidos (N = 10)[4]	not available	2 cases per hip, knee, ankle; 1 case per foot (per indiv.)	4 cases (per indiv.)
Spathes (N = 27)[5]	11 cases (per bone)	upper body: 9 cases lower body: 2 cases (per bone)	
Treis Elies (N = 35)[5]	21 cases (per bone)	upper body: 13 cases lower body: 8 cases (per bone)	
Trimbina (N = 26)[6]	not available	shoulder (13.6%–37.5%) elbow (4.3%–23.5%) hands (2%–33.3%) hip (18.4%–23.8%) knee (15.9%–22.2%) ankle (7.9%–25%) foot (3.6%–7.3%)(per bone)	cervical: 30.4%, thoracic & lumbar: 33.3% (per bone)
Kazanaki (N = 9)[7]	9 cases (per bone)	not available	not available
Velestino (N = 31)[8]	not available	not available	12 cases (per bone)
Spaliareika (N = 25)[9]	10 cases (per bone)	not available	not available
Sykia (N = 36)[10]	8 cases (per bone)	not available	not available

Upper body: upper limbs, cervical and thoracic vertebrae, thorax; lower body: lower limbs, lumbar, and sacral vertebrae. For Trimbina and Rema Xydias DJD is presented for both sites combined.
[1] Radović 2016:272–282; [2] Schepartz 2014:148–149; [3] Tritsaroli 2017:Table 9.6, Table 9.7, 243–244; [4] Tritsaroli and Koulidou 2018:17; [5] Triantaphyllou 2001:Table 6.1, Table 6.4, 70, 74; [6] Tritsaroli 2020:258; [7] Papathanasiou 2009:154; [8] Papathanasiou et al. 2012a:218; [9] Papathanasiou 2005:195–196; [10] Papathanasiou 1999:1011.

is stronger in females than in males (Bergink et al. 2003; Sambrook et al. 1999; Spector and MacGregor 2004; Wilson et al. 1990). Therefore, even though the number of affected cases is very limited, it could be cautiously suggested that activity patterns differed between men and women. Regarding trauma, the pattern observed in the current sample follows the expected conventional model of males suffering more accidental injuries than females as a possible consequence of a greater exposure to trauma triggered by heavier workload (Angel 1974; Grauer and Roberts 1996; Merbs 1989). In particular, traumatic lesions of the foot observed mostly in male individuals of the wider context (Figs. S1 and S4) (e.g., Papathanasiou et al. 2012a:218–219; Triantaphyllou 2001:83; Tritsaroli and Koulidou 2018:16) may suggest activities such as farming (e.g., constructing and clearing fields, tilling, planting, and harvesting) and walking long distances (Triantaphyllou 2001:83).

In Achlada cemetery, with the exception of one juvenile, all cases of PH and CO were recorded on females. A number of studies have pointed out that females show higher frequencies of acquired anemia than men due to stresses and iron loss related to pregnancy, lactation, and menstruation (Larsen 1997; Miller 2016; Stuart-Macadam 1998). On the other hand, as lesions observed on females were mostly healed, it is most likely that they had been formed during childhood/adolescence (Stuart-Macadam 1985; Walker et al. 2009). Walker et al. (2009) have challenged the association of iron loss with such porosities, linking them instead to megaloblastic and hemolytic anemias. In any case, due to the limited number of observed cranial elements and the obscure etiology of these lesions, more detailed conclusions could not be drawn.

Regarding enamel hypoplasia, males overall present higher frequencies of enamel hypoplasia than females and this difference is statistically significant. It seems possible that males could have been more exposed to stress episodes during their developmental years than females. On the other hand, it is quite possible that females experienced the same stress but were physiologically more buffered and did not develop the same amount of defects (e.g., Trigunaite et al. 2015). Nevertheless, younger females present significantly higher rates than younger males (Table 4), possibly suggesting that females experiencing stress episodes during childhood underwent a significant risk of death in early adulthood (Triantaphyllou 2001:114). As a high prevalence of

Table 9. Comparative data of stature, trauma, cribra orbitalia, and porotic hyperostosis

Sites (overall number of individuals)	Stature	Trauma	Cribra orbitalia	Porotic hyperostosis
		6 cases (per indiv.)		
Achlada (N = 55)	162.5 cm	8 cases (per bone)	2 cases (per indiv.)	3 cases (per indiv.)
Jančići Dubac (N = 18)[1]	172.09 cm	absent	absent	absent
Manastir, Čaška–Veles (N = 12)[2]	165.3 cm	not available	not available	not available
Apollonia Tumulus 10 (N = 60)[3]	not available	not available	5 cases (per indiv.)	
Lofkënd Tumulus (N = 136)[4]	161.5 cm	9 cases (per indiv.)	5 cases (per indiv.)	1 case (per indiv.)
P. Athinas (N = 17)[5]	162 cm	2 cases (per bone)	none	17 cases (per bone)
P. Artemidos (N = 10)[6]	not available	2 cases (per indiv.)	3 cases (per indiv.)	1 case (per indiv.)
Valtos (N = 3)[7]	not available	2 cases (per bone)	absent	1 case (per indiv.)
Spathes (N = 27)[8]	157 cm	2 cases (per bone)	3 cases (per bone)	1 case (per bone)
Treis Elies (N = 35)[8]	not available	2 cases (per bone)	1 case (per bone)	absent
Trimbina (N = 26)[9]	160 cm	1 case (per bone)	2 cases (per indiv.)	5 cases (per indiv.)
Rema Xydias (N = 45)[9]	158 cm	15 cases (per bone)	7 cases (per indiv.)	17 cases (per indiv.)
Kazanaki (N = 9)[10]	165.5 cm	1 case (per bone)	2 cases (per indiv.)	absent
Velestino (N = 31)[11]	164.4 cm	2 cases (per indiv.)	absent	absent
Spaliareika (N = 25)[12]	158 cm	1 case (per indiv.)	1 case (per indiv.)	4 cases (per indiv.)
Achaea Clauss (N = 73)[13]	162.2 cm	not available	not available	not available
Sykia (N = 36)[14]	165.9 cm	4 cases (per indiv.)	absent	1 case (per indiv.)
Ayia Sotira (N = 34)[15]	not available	1 case (per indiv.)	not available	not available

[1] Radović 2016:272–282; [2] Veljanovska 2008:431–438; [3] Schepartz 2010:Fig. 3.20, 61; [4] Schepartz 2014:139–150; [5] Tritsaroli 2017:238, 246; [6] Tritsaroli and Koulidou 2018:15–16; [7] Tritsaroli 2007:192–193; [8] Triantaphyllou 2001:Table 6.5, Table 6.15, 79, 106; [9] Tritsaroli 2020:Table 4, 263; [10] Papathanasiou 2009:153–154; [11] Papathanasiou et al. 2012a:217–219; [12] Papathanasiou 2005:194–195; [13] Paschalidis and McGeorge 2009:103; [14] Papathanasiou 1999:1010–1011; [15] Triantaphyllou 2017:13.

physiological stress indicators in mature and old adults may indicate that affected individuals coped successfully with stress episodes during growth (DeWitte and Stojanowski 2015:407; Wood et al. 1992:352) current results could indicate that males coped more successfully with stress episodes during childhood compared to females, as defects are much more evident in the middle and old middle aged men than women. Could it be suggested then that males received better care, such as a better nutrition, during growth that helped them to cope with stresses more successfully? A dentine isotopic reconstruction could potentially shed light on sex dietary differences during childhood. On the other hand, it cannot be safely assumed that males and females buried in Achlada all grew up together under the same conditions. The challenges both sexes faced in their childhood do not of necessity reflect challenges faced in the same landscape or community setting.

Osteological and isotopic data from mainland southern Greece (Papathanasiou et al. 2012b; Schepartz et al. 2009; Triantaphyllou et al. 2019) have indicated dietary differentiations related to sex, with females having poorer dental health than males, and the latter incorporating more animal protein in their diet. The concept of females consuming cariogenic foodstuffs and males more meat could be suggested for sites in Pieria such as Pigi Athinas (Tritsaroli 2017:250), Korinos, and Spathes (Triantaphyllou 2001:120–126), based on caries and calculus rates. The pattern observed at Achlada though is not that clear. Males present higher rates of caries and calculus than females; however, the differences are not statistically significant. Dental caries differences are significant between old middle adult males and females (Table 4). AMTL, which is associated with caries among other factors (Hillson 1996), is also more frequent in males than females and this difference is sta-

tistically significant (Mann-Whitney U: Z = –1.961, $p = 0.05$). Females tend to present higher frequencies of dental caries in both modern and archaeological samples (Hillson 2001; Walker and Hewlett 1990) due to biological, behavioral, and cultural factors (Laine 2002; Larsen 1997; Larsen et al. 1991; Walker and Hewlett 1990). Nevertheless, this is not a universal pattern. For example, in Lofkënd Tumuli, Mycenaean Athens, and Mycenaean Ayia Sotira, males present much higher carious lesions than females (Schepartz 2014:149–150; Smith 1998; Triantaphyllou 2017:136). Various cultural and behavioral factors have been proposed to explain this reverse pattern (i.e., more males than females affected), including the type and consistency of food preparation and cooking methods, gendered division of labor, and subsistence activity patterns that could potentially result in differential access to cariogenic food for men and women (Lukacs 1989:151–152; Walker and Erlandson 1986:380).

What is even more interesting and not associated with biological factors is the negative association of dental caries with age in the current sample. Even though the progressive nature of this condition leads to a developmental pattern that is strongly related to age (Manji et al. 1991; Thylstrup and Fejerskov 1994), the highest percentage of caries was noted in young adults (Table 5). Both sexes presented negative correlations with age, although the observed correlation was only statistically significant for females. It could be suggested that younger females might have been mostly responsible for specific tasks, such as food preparation, that could have possibly exposed them to a higher intake of cariogenic foodstuffs. These results could also represent selective mortality. It could be proposed that frailty was higher in younger females and thus they were more likely to die and be selected out of the population (DeWitte and Stojanowski 2015:407; Wood et al. 1992). Complications during pregnancy and childbirth could be possibly linked to female ill health and mortality. Selective mortality could also be proposed for juveniles exhibiting dental caries, even though their number is very limited and far-reaching interpretations should not be made.

B) Intercemetery comparisons

Comparative data on funerary practices. Comparative mortuary information is presented to better comprehend the different ways in which the communities in Pelagonia were connected to major cultural constellations to the north and/or south (Table 6). Starting from the northern part of the wider context, Jančići Dubac, in the Čačak region, is under the influence of the Tumulus tradition and belongs to the Western Serbian variant of the Vatin group (Dmitrović 2016:214). It is a very well-furnished mortuary assemblage (with widespread presence of vessels from Morava Valley) (Dmitrović 2016:218) and certain characteristics, such as differential burial treatment between the sexes and type of burials, are also evident in the Albanian and Ulanci mortuary tradition (Papadopoulos et al. 2014; Papazovska Sanev 2014). A significant difference between Achlada and Dubac is the prominent presence of cremations (common from 1350 B.C. onward) along with inhumation burials. Even though cremations are not absent in the remaining study region, they are much less frequent (Table 6). General features of the Tumuli Ulanci necropolises include inhumations in crouched positions and the body placed in cist/pit graves, while matt-painted pottery and local copies of Mycenaean vessels are also present (Papazovska Sanev 2014:9). Such features are very much evident in Macedonia, Northern Greece (e.g., Pigi Athinas, Pigi Artemidos, Valtos), while cist tombs and single inhumation burials are also the "rule" in LBA Epirus (e.g., Tartaron 2004). Tumuli, a tradition that appears on the Greek mainland in the Early Helladic II period probably as a consequence of influences from the north (Tritsaroli 2017:228), is much more evident in Pieria, especially before the "Mycenaeanization" of the area. Moving from the Middle Helladic period to the Late Helladic, especially in Central and Southern Greece, the reuse of graves and multiple inhumations appear. These multiple shaft graves are covered by chamber and tholos tombs (Stapleton, 2014:205; Tritsaroli 2017:227–228) (Table 6). The occurrence of multiple and/or secondary burials also appears in Macedonia, Northern Greece, during the Developed LBA (LHIIIA–LHIIIB) (e.g., Spathes, Rema Xydias) (Koulidou 2020; Triantaphyllou 2001:64–65; Triantaphyllou and Andreou 2020:183), and mostly during the Advanced LBA (LHIIIC) (e.g., Faia Petra, Methoni and Kastri in Thasos) (Triantaphyllou and Andreou 2020:183). Another important characteristic appearing in the mortuary environment during the LBA is the deposition of material wealth in burials (Tritsaroli 2017:228). The accumulation of distinct artifacts as manifestations of social identity is evident in numerous northern assemblages, such as Spathes and Lofkënd tumuli (Table 6) (Stapleton 2014; Triantaphyllou and Andreou 2020), as well as at Aeani and Rymnio in Western Macedonia (Karametrou-Mentesidi 1990:355; Poulaki-Pantermali 2013:45–62). Even in cases where prestige items were not found (e.g., Pigi Athinas) social intra-cemetery differentiation was attempted through differential investment in grave construction (Tritsaroli 2017:228–233: Table 6).

It is therefore characteristic that in Achlada there is no such differential investment in grave construction, while accumulation of distinct artifacts was very relatively modest (just 13 associated finds recovered in six tombs) (Ziota 2019).

In terms of demographic characteristics, the overall number of juveniles is very small in the community under study while no infants were found. The 7:1 ratio of adults vs. non-adults is similar to that found in Mycenaean assemblages, such as Voudeni and Pylos (Table 7). The pattern of a limited number of non-adults is also in agreement with neighboring sites in Southern Albania, such as the LBA Kamenica Tumulus (Kline 2015:69) and Lofkënd Tumuli (Schepartz 2014:144), but not at Čaška–Veles in North Macedonia (Veljanovska 2008:431–438) or Jančići Dubac (Radović 2016: 272–282). Normally, for preindustrial societies the expected percentage of juveniles and infants ranges between 30% and 50% (Coale and Demeney 1983; Weiss 1973). Non-adults were treated in a different way in the Mycenaean sphere and there is a significant variation in differential treatment of juvenile individuals in LBA Greece, not just in relation to their arithmetic presence, but also regarding the presence/absence of artifacts found in their tombs (Cavanagh and Mee 1998; Schepartz et al. 2009). Nevertheless, we cannot be certain of the limited non-adult presence in the Achlada community, as it is possible that a higher number of non-adults were buried in a part of the cemetery that was not preserved (due to disruptions by later burials or foundations of Roman buildings) (Ziota 2019). Additionally, it could also be hypothesized that if juvenile burials were shallower than adult ones, it would be more likely for them to get disrupted through later activity during the Roman period (Ziota 2019).

Based on the information presented above, it seems that features from different traditions were combined in the current mortuary environment. Differential burial treatment between sexes and burial types reflects traditions visible at Ulanci and Central Macedonia cemeteries. Material culture evidence reveals relations with sites of Central Macedonia and southeastern Albania (Ziota 2019). Mycenaean influence is also present, manifested by two "Mycenaeanizing" painted vessels (Ziota 2019:Table 1) and possibly also based on the adult:non-adult ratio. The comparative funerary analysis showed that Achlada was connected with minor and major cultural ambits, but in a limited way, as suggested by the lack of significant material culture differentiation within the community.

Comparative lifestyle data. In terms of DJD, the assemblage seems to be moderately affected when compared to other sites of the wider context (Table 8), even though spinal DJD is prominent. It is obvious that the current assemblage is more intensely affected compared to the well-networked sites at Spathes and Treis Elies, but less so compared to the Pigi Athinas assemblage (1650–1500 B.C.), with the latter predating Achlada as well as the extensive Mycenaean influence in the region around Mount Olympus (Tritsaroli 2017:225). Rema Xydias population in Pieria, a modestly furnished assemblage, is also a severely affected community with regard to DJD (Tritsaroli 2020:258). The cervical segment of the vertebra seems to be more affected in Achlada and this pattern is also noted at Pigi Athinas (Tritsaroli 2017:251) and Lofkënd tumuli (Schepartz 2014). The upper part of the body is also mostly affected in Spathes and Treis Elies (Triantaphyllou 2001) (Table 8), confirming that food acquisition, processing, preparation, and craft production, which have been linked to degenerative changes predominantly in the upper body (Triantaphyllou 2001:75), probably were important labor activities at these sites. Different methodologies and recording protocols make it difficult to directly compare DJD frequencies between sites, while at the same time age and weight have also been considered to be important causative factors leading to DJD (Sofaer-Derevenski 2000; Solano 2002; Waldron 1998; Weiss 2004, 2006). Therefore, interpretations should be treated with caution.

Injuries in the current sample and wider context are mostly of an accidental nature/origin. Cases of possible interpersonal violence are also present, although limited (e.g., scapular fracture [the severity of the lesion suggested a violent episode] at Pigi Artemidos [Tritsaroli and Koulidou 2018:20], one healed cranial trauma at Lofkënd Tumuli [Schepartz 2014], and three male individuals in the Mycenaean Athenian Agora found with wounds consistent with combat and interpersonal violence [Smith 2009]). In the current sample there is a possible case of a healed cranial depression that could be associated either with a violent attack or an accidental injury (Fig. S5); however, the poor preservation of the specific sample does not allow for a secure diagnosis. It is attractive to hypothesize that the dearth of violent cases could be associated with possible advantages related to marginality. If for example we think of competition and raiding, being marginal could have its advantages as there would be little to claim/steal. Nevertheless, the paucity of violent trauma cases in the vast majority of well-networked sites does not favor such bold assumptions.

Stature estimates from Achlada seem to fall within the range of well-networked LBA sites situated to the south, north, and east (Table 9). Even though stature is mainly affected by genetic factors (Lango et al. 2010; Wood et al. 2014), evidence from a wide range of osteological investigations (Steckel 1995, 2009) has demonstrated that adult height and environmental stress, usually nutritionally induced, are closely related. Stature estimates should be treated with caution though, as results from most of the sites in the comparative list (Table 9) are based on very few femoral bones. Regarding nonspecific stress indicators, PH and CO cases in Achlada are quite few, but this is similar to most other sites (see Table 9 for references).

The enamel hypoplasia rate at Achlada is significantly higher than at all the sites of Southern and Central Greece, as well as numerous northern assemblages (Table 10). Interestingly, with a few exceptions, there is a clear tendency of northern communities to display elevated frequencies of enamel defects, compared to those of Central and Southern Greece. This observation is statistically significant (Mann-Whitney U: $p = 0.008$). According to Papathanasiou (2005:196), the declining rates of enamel hypoplasia noted in Mycenaean populations may reflect an improvement in health status and living conditions, especially for children. When comparing these results with northern sites of the wider context, the current community presents significantly higher rates of

Table 10. Dental diseases and enamel hypoplasia in Late Bronze Age sites of the wider study region

	Dental caries	Calculus	AMTL	Enamel hypoplasia
Achlada	9.9%	22.4%	3.2%	21.2%
Jančići Dubac[1]	0%*	16.6%*	11.1%	11.1%*
Apollonia Tumulus 10[2]	17%*	Not available	4.2%	Not available
Lofkënd Tumulus[3]	9.8%	Not available	5.3%*	56.6%
Epirus's sites[4]	18.3%*	12.2%*	7.9%*	6.1%*
Pigi Athinas[5]	10%	14%*	3%	23%
Pigi Artemidos [6]	17.8%*	28.2%	3.1%	32%*
Valtos[7]	8%	53%*	4%	9%*
Spathes[8]	11.23%	7.86%*	26.14%*	14.04%*
Treis Elies[8]	13.88%	2.08%*	37.66%*	6.9%*
Korinos[8]	3.15%*	9.47%*	0%*	4.2%*
Trimbina[9]	24.2%*	15.8%*	10.4%*	36.1%*
Rema Xydias[9]	19%*	25.7%*		26%
Velestino[10]	5.1%*	6%*	64.3%*	6%*
Kazanaki[11]	0%*	Not available	0%	8%*
Pylos (Grave Circle/Tholos III)[12]	3.7%*	Not available	4.8%	4.4%*
Pylos (chambers)[12]	12%	Not available	14.5%*	10.6%*
Spaliareika[13]	3.3%*	Not available	26.1%*	10.8%*
Sykia[14]	7%	Not available	7.3%*	6.1%*
Ayia Sotira[15]	9.91%	Not available	7.29%*	1.22%*

*Statistically significant differences compared to Achlada (Pearson chi-square test [$p < 0.05$], df = 1 for all cases).
Enamel hypoplasia for Lofkënd Tumuli is given per number of dentitions and statistical comparison with Achlada was made based on crude prevalence; AMTL for Velestino is given per number of individuals and statistical comparison with Achlada was made based on crude prevalence; AMTL is given combined for Trimbina and Rema Xydias.
[1] Radović 2016:272–282; [2] Schepartz 2010:Table 3.2, Table 3.3, 62; [3] Schepartz 2014:139–150; [4] Michael, personal observations; [5] Tritsaroli 2017:239; [6] Tritsaroli and Koulidou 2018:14–15; [7] Tritsaroli 2007:193; [8] Triantaphyllou 2001:109, 120, 124, 128; [9] Tritsaroli 2020:Table 4, 263; [10] Papathanasiou et al. 2012a:227; [11] Papathanasiou 2009:154; [12] Schepartz et al. 2009:Table 10.5, 167 (retrieved from individual teeth); [13] Papathanasiou 2005:35–38, 191–198; [14] Papathanasiou 1999: 1009–1101; [15] Triantaphyllou 2017:135.

enamel hypoplasia compared to Treis Elies, Spathes, Korinos, and Jančići Dubac sites that were extensively connected to major routes. This is not an absolute pattern, though (e.g., Trimbina, Tables 6 and 10). It could, however, be suggested that enamel hypoplasia rates in Achlada suggest a poor growth environment, leading to multiple episodes of stress and growth arrest during the early years of these individuals.

On the other hand, significantly higher enamel hypoplasia rates may not necessarily indicate poorer health (Wood et al. 1992), as individuals who do not survive stressful events would not have had the chance to develop such hypoplastic defects. Ameloblasts are particularly sensitive to even minor physiological disruptions (Larsen 2015:44). In her attempt to interpret the elevated enamel hypoplasia rates in Lofkënd Tumuli contrary to the limited PH and CO cases (Tables 9 and 10), Schepartz (2014) suggested the possibility of stresses leading to enamel hypoplasia to be of a lower magnitude than those resulting in PH and CO, as the former indicator is much more sensitive to metabolic stresses. Preservation challenges affecting cranial segments, also noted in the current assemblage, should also be considered. Consequently, it could be cautiously suggested that the current sample, as well as a number of mostly northern communities of the wider context, faced more physiological challenges during growth, at least of a mild and moderate level, compared to a number of sites connected to major routes. This could be a result of participation in less extensive trading networks, and/or harsher environmental conditions (e.g., lower temperatures).

In terms of diet, the LBA in Northern Greece was marked by a specialized and extensive system of agriculture and stock raising. High juvenile mortality curves have been observed among sheep, goat, and cattle, suggesting a strategy of animal husbandry primarily targeted at meat consumption (Triantaphyllou 2015:58). Isotopic dietary reconstructions from several Aegean Bronze Age skeletal collections have revealed predominantly terrestrial subsistence strategies involving the intake of both plant and animal products (e.g., dairy products, eggs) without significant contributions of meat or marine protein (i.e., Lagia and Cavanagh 2010; Lagia et al. 2007; Papathanasiou 2015; Papathanasiou et al. 2012b; Petroutsa et al. 2009; Triantaphyllou et al. 2019). Heavy reliance on terrestrial food items was also found in LBA Kamenica Tumulus (Kline 2015:133). Combining dental with isotopic data, Spathes and Treis Elies displayed a low animal intake (Triantaphyllou 2015) (Table 10). The analogous relation of calculus and protein consumption was also found based on isotopic data, in EBA Koilada in Kozani, Western Macedonia (Triantaphyllou 2001; Triantaphyllou 2015; Ziota 2007), where the calculus rate was at 22.22% (almost identical to the Achlada sample—true prevalence). On the other hand, isotopic results also showed a heavy reliance on animal protein for Korinos (Triantaphyllou 2015:67), where calculus rates are less than 10%, reminding us that simplistic correlations should be avoided, as oral hygiene, water, and soil quality should also be taken into account when considering dental pathologies (Tritsaroli 2017:251). Nonetheless, based on the caries/AMTL-calculus pattern (Table 10), a reliance on animal proteins and thus pastoralism could be cautiously suggested for the current sample. Hunting could also be proposed as its practice was renewed by the end of the LBA in Macedonia (Triantaphyllou and Andreou 2020:174). Achlada's specific location on a fertile plateau, though, supports cultivating practice. What is certain is that dental diseases do not suggest a poorer diet in the Achlada community compared to other well-networked populations (Table 10). On the contrary, it could be suggested that the stated community had a good diet with adequate intake of animal proteins. Could we assume then that marginality for the specific community meant they had modest access to prestige goods, but adequate access to food sources? Even if reciprocal intercommunity exchange networks were less extensive, physical storage and/or diversification (Halstead and O'Shea 1989:4) could be the primary cultural practices of the Achlada community as a response to times of hardship, thus securing adequate food sources. Therefore, the dearth of material in graves could suggest a greater focus on basic subsistence or nominal surplus farming organization. It is obvious that the matter of marginality and its impact on human lifeways is highly complex.

Conclusions

In conclusion, it seems that a "menu" of practices was articulated by LBA populations presented in the current study. No specific formula existed and communities had the choice of following different funerary practices based on their perspectives. Different cultural nodes were being accessed, they were inspired by groups to the north and to the south, but this was selective, and local conventions also emerged, as seen at Achlada. Scarce deposition of precious materials in the Achlada burials (e.g., rare amber finds, occasional metal findings) points to a clear connection—probably not an extensive one, though—with cultural ambits.

Intra-cemetery lifestyle investigation revealed differentiations between the sexes. Males possibly managed to cope more successfully with stressful events during growth, possibly indicating better care during childhood. The analysis revealed that men were possibly more engaged in challenging physical activities than women. In addition, dental results suggest that young females were either a group of higher frailty and/or were more exposed to carbohydrates, perhaps as a consequence of their part in the community. The differential burial placement of the sexes in the preserved portion of the cemetery possibly represents symbolically the different roles that society attributed to men and women in deathways (Ziota 2019). It is possible that those different roles were associated with actual lifestyle differences. Whether these intra-community differentiations were associated with possible marginality remains unclear.

The comparative bioarchaeological analysis did not reveal significantly poorer health compared to well-networked populations. It is true, though, that the current community, as well as a number of mostly northern populations surrounding Achlada in the wider region, probably faced more physiological challenges during growth, at least of a mild and moderate level, compared to communities connected to major cultural ambits. In terms of diet and physical activity the analysis did not indicate an unprivileged marginal environment. In fact, dietary dental analysis revealed that the current community had potential access to animal protein. Combining mortuary and lifestyle data we find Achlada being closer to Pigi Athinas and Lofkënd Tumuli, but displaying more modest material culture in the mortuary environment. Therefore, it is possible that marginality in the current sample could mean modestly resourced in prestige finished goods rather than less access to food sources.

The main challenge at the Achlada LBA site was the dearth of material culture evidence related to networking and subsistence. For this reason a thorough contextualized and comparative bioarchaeological analysis was implemented. Even though preservation challenges and the multifactorial nature of lifestyle indicators hindered firm answers, bioarchaeological comparative approaches were able to offer insights into the priorities and lifeways of this community. Dietary isotopic reconstruction, biomolecular analysis, and mobility investigation will hopefully help us to form a more integrated picture. The quest of exploring the impact of marginality on human lifeways has just begun.

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