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EXCAVATIONS AT POLYSTYLON (ABDERA) GREECE: ASPECTS OF MORTUARY PRACTICES AND SKELETAL BIOLOGY

ΑΝΑΤΥΠΟ

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EXCAVATIONS AT POLYSTYLON (ABDERA) GREECE: ASPECTS OF MORTUARY PRACTICES AND SKELETAL BIOLOGY

Abstract

The present study examines bioarchaeological data affecting two human skeletal series excavated from the archaeological sites, of ΞA1 and ΞA2, at Polystylon-Abdera, Greece. The two collections were dated between the 6th to 9th century AD, and 12th to 13th century AD, respectively.

Explanations for several conditions are offered, derived from analyses of the skeletal record, with the intention to decipher the anthropological manifestations and the bio-archaeological differences observed at an intra- and intersite level concerning the two populations.

The purpose of this report is twofold, to reflect primarily on issues of palaeopathology and palaeodemography, and subsequently to elucidate parts of the undocumented history of these people.

A Historical Overview

Archaeological investigations were launched at Abdera (Fig. 1) in 1950 by archaeologist Dim. Lazaridis. References reflecting on the archaeological record of Abdera during the ancient and Byzantine time periods have been published in the Πϱαϰτιϰά Αϱχαιολογιϰής Εταιϱείας (Prakt), and in the Αϱχαιολογιϰά Χϱονιϰά του Αϱχαιολογιϰού Δελτίου (ADelt), see (Prakt 1954, 169, ADelt 17 (1961/2), 245-248, ADelt 20 (1965), 453, Prakt 1966, 61, ADelt 22 (1967), 433, Prakt 1971, 63-71, Prakt 1976, A′, 134, Prakt 1978, 77-79, Prakt 1979, 101-105, Θϱαϰιϰά Χϱονιϰά 36 (1980/81), 58-60, Prakt 1982, 18-26, Prakt 1983-A′, 13-19, Prakt 1984).

Starting from the 9th century AD, Abdera was referred to as Polystylon (Πολύστυλον), see Bakirtzis (1982), a name it carried during the Middle Ages. Polystylon became an important city and center of Christianity in Thrace during the Byzantine period (Lazaridis 1961, 1965, 1975; Bakirtzis 1982, 1983).

Today, the cities of ancient Abdera and Byzantine Polystylon are represented by an archaeological area exceeding 2.5 Km^2 and by the historic village of Abdera located approximately 6 Km inland from the seashore, due north.

Archaeological excavations of sites ΞA1, and ΞA2 were directed by Prof. Ch. Bakirtzis, under the auspices of the Ephorate of Byzantine Antiquities of Eastern Macedonia and Thrace, sponsored by the Greek Archaeological Service, the Greek Ministry of Macedonia and Thrace, and the Archaeological Society of Athens. The project was conducted by a crew of the Ephorate of Byzantine Antiquities of Eastern Macedonia and Thrace supervised by archaeologist Nicholas Zikos. The author was responsible for the excavation of the burials, the documentation of the mortuary practices, the *in situ* inspectional, and the laboratory mensurational and statistical studies of the human skeletal remains.

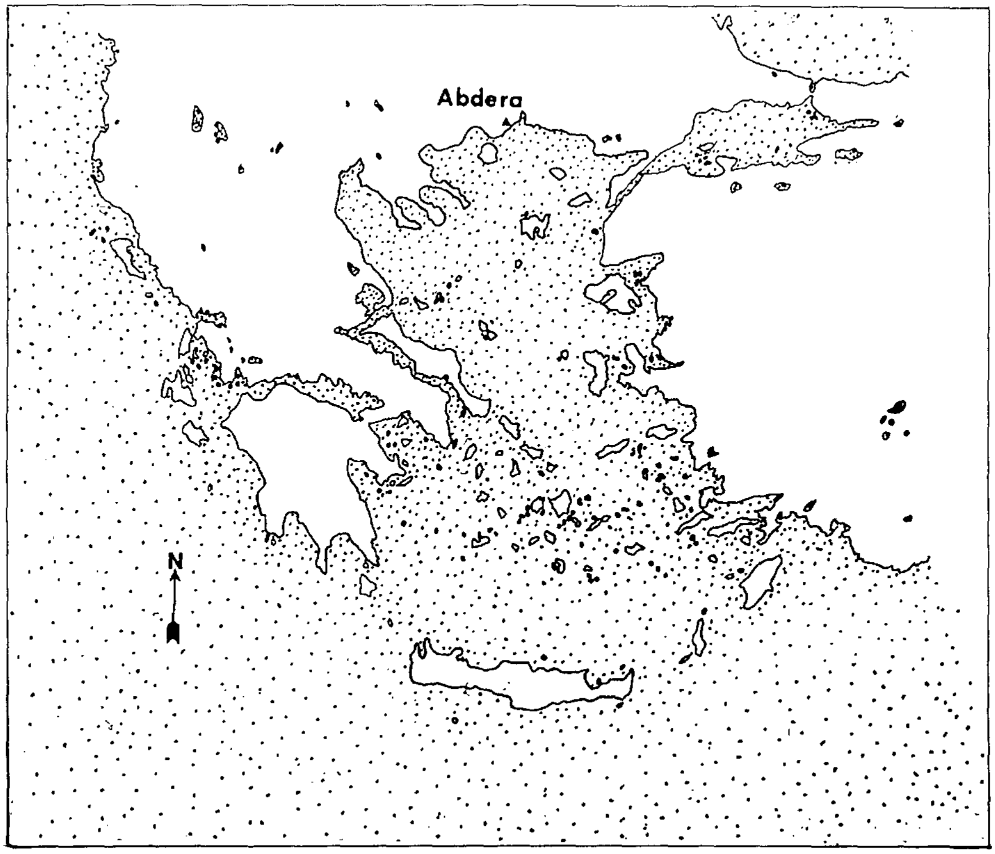


Fig. 1. Map showing location of site Abdera-Polystylon.

Site Locations, Burial Customs, Sample Size

The provenances of the two cemeteries were independent.The ΞA1 cemetery site was located at the peripheries of the three-aisled Basilica church (Fig. 2) by the western entrance of the ancient city of Abdera. The cemetery involved thirty well built and well defined graves. The graves were classified as boxed-shaped. They were constructed by the utilization of well carved marble and crystalline limestone slabs, and/or stone materials selectively collected from earlier architectural structures, hence, indicating secondary use-related associations. Out of the thirty graves excavated, eight represented collective burials consisting of both primary and secondary burials. Forty individuals comprised this skeletal collection (Table 1).

The burial customs and practices concerning the collective burials involved the respectful and careful removal of the earlier interments toward the long-side (north and south), and the short-side (east and west) walls of the graves in order for the main burial to the interred. All individuals were positioned in an extended, supine position with flexed forearms superimposing the thoracic region. They were placed in an east-west orientation, facing east (Fig. 3). The respectful removal and repositioning of earlier interments, as welll as the placement and orientation of the main burials should be noted conform with the contemporary burial customs and practices observed among family owned graves of the Hellenic culture area. Based on the microstratigraphic interrelations affecting the secondary and primary burials, it was possible to argue that the remov-

TABLE 1. POLYSTYLON, ΞA1 AND ΞA2 SITES: Age and Sex Assessments

Age Groups in Years	ΞA1 Site Individuals			ΞA2 Site Individuals		
Infancy I: 0 to 6	16			13		
Infancy II: 6+ to 12	2			10		
Juvenilis: 12+ to 18					3 (♂)	1 (♀)
Adults: 18/19 to 45	1 (*)	13 (♂)	3 (♀)		17 (♂)	7 (♀)
Maturus: 45 to <60		3 (♂)	2 (♀)		9 (♂)	
Senilis: >60						

Note: (*) Indeterminate sex assessment, (♂)= Male, (♀)= Female

al and repositioning of the initial interments was conducted according to the state of bodily decomposition of the earlier interments. As a rule, however, the cranial remains of the preceding interments were placed adjacently, and in analogous anatomical associations with the crania of all primary burials, resting at the western short sides of the graves and facing east (Fig. 4).

The ΞA2 cemetery site was located at the peripheries of the aisles domed Byzantine church at the north-western esoteric area of Polystylon (Fig. 5). Forty five graves were excavated yielding a collection of sixty individuals (Table 1). Ten out of the forty five graves implicated primary and secondary burials. The burial customs concerning the practice of inhumations, placement and orientation of the interments, as well as the burial offerings were similar to these of the ΞA1 site. What differed, however, were the materials used for the construction of the graves, coupled by dissimilarities of the spatial distribution of the interments. Here (ΞA2 cemetery), wooden coffins appeared to have been introduced (Fig. 6) and widely used (Bakirtzis 1983). In addition, ample burials were intrusive, truncating and/or overlapping earlier, and adjacently located interments from the same cultural component. Furthermore, stratigraphic correlations indicated that during the processes of placement of new interments, human skeletal remains of unrelated graves were either partially, or entirely removed to undefined areas (Fig. 7).

Stratigraphy and Taphonomy

It was plausible to demonstrate by means of an integrated stratigraphic perspective, that the ΞA2 site was distinguished as a human activity area of long duration, allocated as a cemetery. Seen from a bio-archaeological viewpoint, however, it was apparent that this activity area was subjected to significant constraints affecting accessible space. These conditions of restricted spatial availability augmented to unconventional variations of the taphonomic conditions pertaining to the preservation of the human skeletal remains. From an anthropological perspective these disturbances and impactions of the human burials observed at the ΞA2 site, revealed contrasting deviations to what was documented at the antedating ΞA1 cemetery.

Ensuing the dissimilar cultural manifestations observed in the archaeological record it was necessary to decipher possible causative agents which underlay these variations, recognizing that burial customs and practices reflect on cultural and behavioral modes and versions through time. Additionally, preliminary archaeological forensic studies of the human skeletal remains indicated significant intrasite palaeopathological and palaeoepidemiological differences.

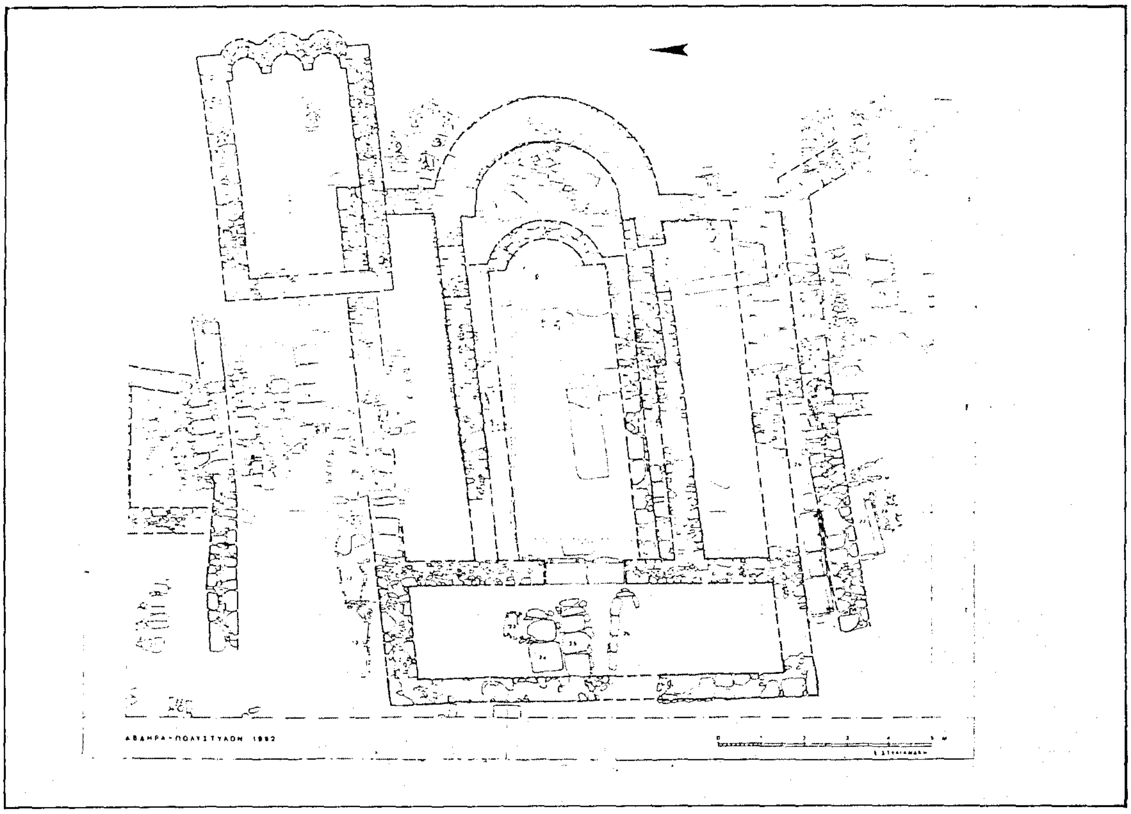


Fig. 2. Plan view of ΞΑ1 site.

Objectives

The overall objective was to use skeletal forensics and palaeopathology to comprehend and elucidate processes and conditions which underlie manifestations of skeletal changes and disease patterns observed in the archaeological record. It was anticipated that results from the bioarchaeological studies would enhance our understandings, by providing information on past physical and social environmental conditions pertaining to the subject study for purposes of anthropological reconstructions. Using a deductive approach, conditional probabilities could therefore be calculated for competing explanatory hypotheses.

Methods

In studying human skeletal remains, with a look at archaeological forensic implications, bone was considered a flexible organ responding to constitutional and/or localized physiological and pathological stress, which, in turn, affects the general health and vitality of an individual. Hence, stress is thought to be a dynamic factor activating and orienting human populations towards adaptive processes in respect to their biocultural environmental settings, which might need to be changed through selective processes for more favorable conditions. However, when stress is long

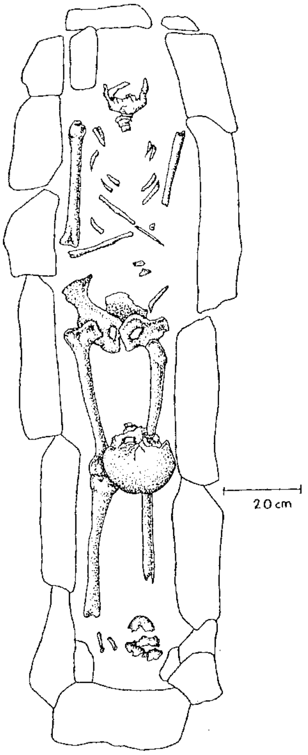


Fig. 3. Interment placement and orientation.

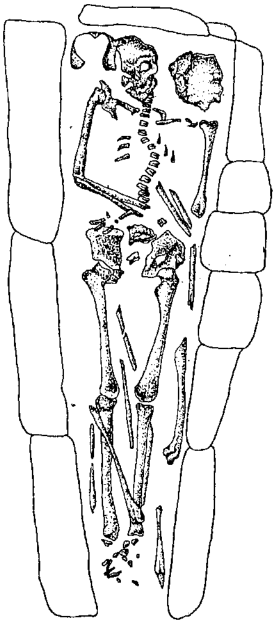


Fig. 4. Primary and secondary burials.

lasting and uncontrolled, it usually has a devastating effect on individuals and the groups or populations to which they belong (Selye 1971). Individual physiological changes, resulting from stress may increase morbidity and mortality within a population contributing to decreases of its productive and reproductive capacities (Christian 1968) affecting the gene pool, and regulating the composition of the genetic structure of the next generations.

A derivative of stress is the disruption of growth (Park 1964; Vahlquist 1975; Angel and Olney 1981). Disruptions severe enough to prove morbid, or conditions of arrested and improved growth usually leave permanent markers on skeletal tissues. Such markers are often the only means for the general reconstructions of stress frequencies in prehistoric and past historic populations.

Skeletal metrics, macroscopic investigations of cranial and post cranial pathologies enhanced by microscopic, as well as bone isotopic analyses were used in this study, in order to understand the adjustments and biocultural adaptations of these two series, and hopefully the processes which underlay the manifestations of stress and disease patterns seen in the archaeological record.

Various methods were employed for the determination of sex and age for each individual. The pelvic bones were the main criteria for sex assessments (Brooks 1955; Phenice 1969; Stewart 1968; Washburn 1949), although, robusticity, cranial and post cranial features were considered (Krogman

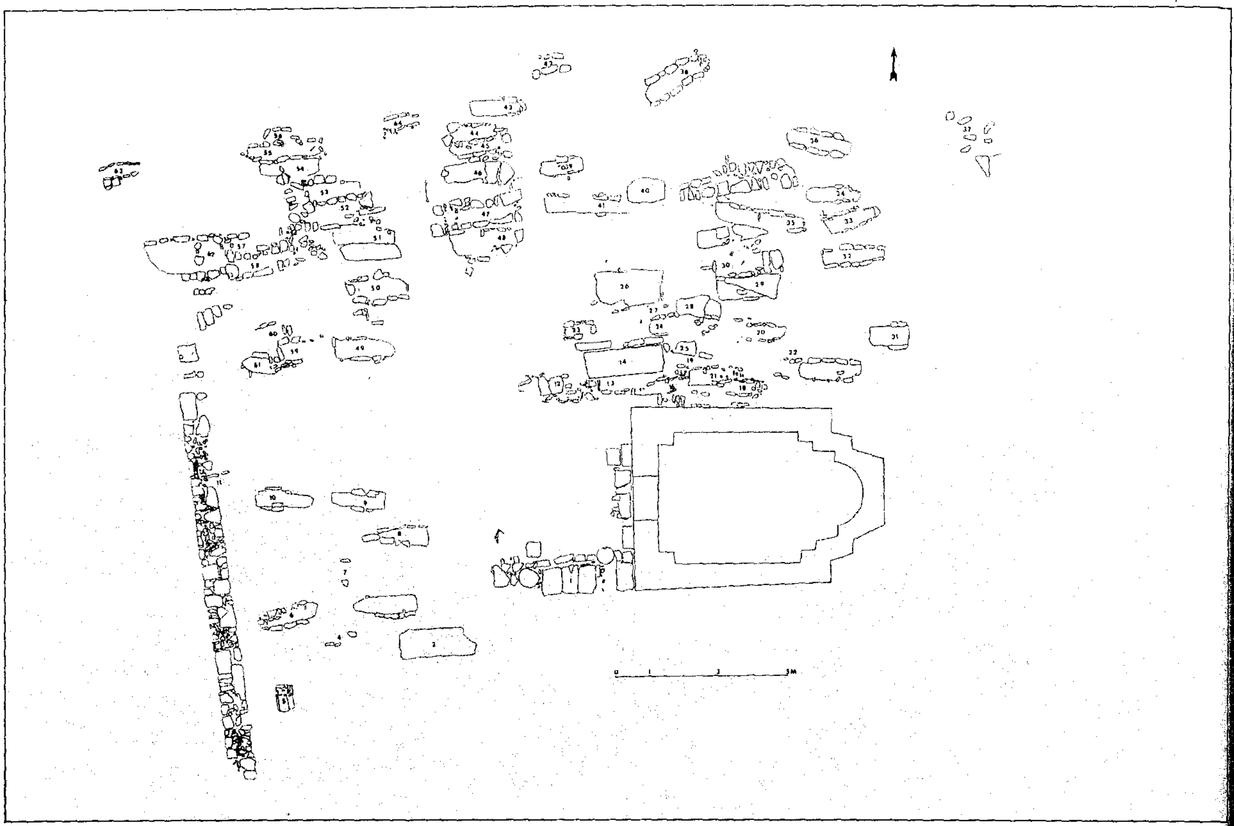


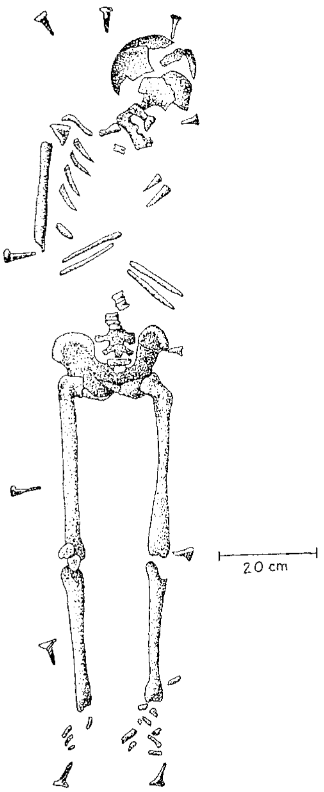
Fig. 5. Plan view of ΞA2 site.

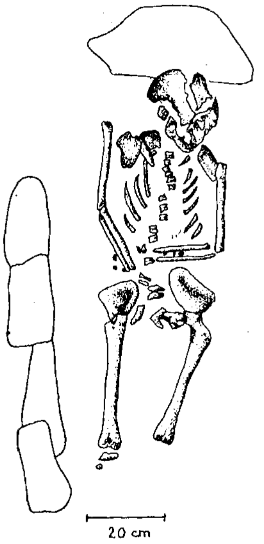
1962; Stewart 1968) as subjective assessments. For biological determinations of age among infants and juveniles, the main criteria used were dental development and eruption, as well as skeletal appendicular maturation. For the adults, *Maturus* and *Senilis*, the pubic symphysis was regarded as the main criterium for age assessments (Brooks 1955; Krogman and Iscan 1986; Gilbert and McKern 1973). Suturaleal fusion (Krogman 1962) and dental wear patterns (Brothwell 1989; Klatsky 1939; Molnar 1970; Tomenchuck 1979) provided supplementary data. Stature was calculated using the methods by Trotter and Glesser (1952, 1958) in conjunction with the correlation formula for individuals older than thirty years.

BIOARCHAEOLOGICAL RESULTS

Preface on the Assessments of Biological Distance and Pathology

Correlations of the skeletal morphometrics and traits of non metric epigenetic variation (Berry and Berry 1967; Brothwell 1963; Winder 1981) from both collections, revealed that each were inbred populations with no discernible evidence of biological distance between them. Forensic analyses of the ΞA1 and ΞA2 collections indicated there were significant differences in the skeletal record as reflected by the palaeopathological manifestations observed between the two series. The ΞA2 collection was the most severely affected by morbid manifestations.





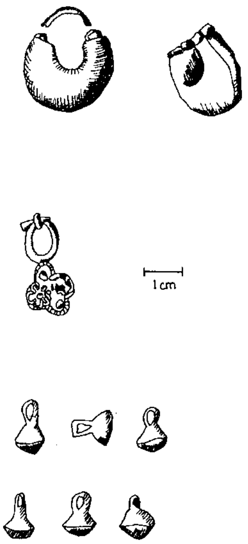


Fig. 6. Iron nails depicting the outlines of wooden coffin.

Fig. 7. Taphonomic impacts on human osseous remains.

Infant Morbidity

Throughout the developmental period of the individuals within the Infancy I age group (0-6 years) of the ΞA1 collection, three growth retardations were observed, notably between the first (1.0), second (2.0), and fifth (5.0) years of age. For the individuals of the Infancy I age group of the ΞA2 collection, two major growth retardations were detected, at the second (2.0) and fifth (5.0) years of age (Table 2).

The data derived from the skeletal analysis of the very young from Polystylon, especially the incidence of cessations of growth at the second (2.0) and fifth (5.0) year, observed among both skeletal collections, suggested these were particularly critical stages of the developmental processes and survival of the individuals within the Infancy I age groups.

Furthermore, it is inducted that the conditions of stress prevailing during these critical stages of growth and development were not successfully counteracted by anticipated cultural buffer mechanisms, and/or biocultural adaptations. It is therefore argued, that the causative agents of the morbid conditions critically affecting and inhibiting the vitality and survival of the very young individuals (within the Infancy I), were functioning as relatively early checking point mechanisms of the growth abilities and reproductive capacities of both populations. This statement specifically applies to the ΞA2 population .

TABLE 2. POLYSTYLON, ΞA1 AND ΞA2 SITES: Prevalence of Infant Mortality

Age groups in years	ΞA1 cessations of growth in years	ΞA2 cessations of growth in years
Infancy I: 0 to 6	At 1.0, 2.0, and 5.0 years	At 2.0 and 5.0 years
Infancy II: 6+ to 12	Limited number of individuals	At 8.0 and 10.0 years

Furthermore, the skeletal record of the ΞA2 site indicated, there were less survivors from Infancy I to the next age group, Infancy II(6+ to >6 years). Two growth retardation periods were observed with this latter age group, at the eighth (8.0) and tenth (10.0) years of age (Table 2).

Dental Pathologies and Manifestations of Stress

Inter- and intrasite dynamics of population demographics pertaining to the Infancy groups, relative to morbidity issues, were partially supported, when available, by dental hypoplasias, serving as permanent markers of stress. The latter (infancy stressors) coincides with the data derived from the dental enamel hypoplastic defects (Goodman 1984; Goodman and Armelagos 1985; Goodman et al. 1980; Pindborg 1982; Swardstedt 1966) of the older individuals who had survived severe and relatively long-lasting constitutional disturbances associated with a wide variety of diseases and nutritional deficiencies, the causative agent of the dental hypoplasias. These might include vitamin A (Wolbach 1947) and D, deficiencies (Nikiforok 1981), fevers (Kreshover and Clough 1953), maternal diabetes (Grahnen 1967), neonatal asphyxia (Grahnen 1969), neonatal jaundice, nephrotic syndrome (Schusterman 1969), and gastroenteritis (Smith 1979). Such conditions may disturb the enameloblastic activities serving as permanent markers of *ante mortem* disruptions and subsequent improvement of growth (Goodman 1984; Goodman et al. 1984).

It is remarkable to report that enamel hypoplasias were absent from the dental remains of the ΞA1 collection, whereas they were very frequent throughout the dental surfaces of the individuals of the ΞA2 site. Calculating the *intra vitam* chronological occurrence of enamel hypoplasias among the ΞA2 site's Infancy age groups, two major onset periods were scored: at the second (2.0) and fifth (5.0) years (Table 3). These chronological resolutions, onsets of enameloblastic defects, were in concurrence with the age at death assessments of the Infancy I group individuals that did not survive suspected morbid cessations of their growth. It should be underlined that infants that died within their first (1.0) year of life would have developed hypoplastic defects, had they not succumbed to conditions of stress which led to mortality.

In accordance with the ΞA2 Infancy I and II age groups, it is of particular interest to report that all ΞA2 female dentitions revealed multiple hypoplastic defects, calculated to have marked their enamel surfaces specifically at their second (2.0), fifth (5.0) and seventh (7.0) years of age. However, only 17.8% of the ΞA2 sites' male dentitions revealed hypoplastic defects which were

TABLE 3. POLYSTYLON, ΞA2 SITE: Enamel Hypoplasias as Permanent Markers of Stress in Years

Infancy groups I and II combined	Calculated hypoplastic onsets at 2.0, and 5.0 years
100% of the female individuals	Calculated hypoplastic onsets at 2.0, 5.0, and 7.0 y.
17.8% of the male individuals	Calculated hypoplastic onsets at 3.5, 5.0, and 7.0 y.

TABLE 4. POLYSTYLON, ΞA1 AND ΞA2 SITES: Prevalence of Porotic Hyperostosis as Cribra Orbitalia	
ΞA1 infancy groups combined	5.5%
ΞA2 infancy groups combined	39.1%

calculated to have occurred at three major periods of onset, notably at three and one half (3.5), fifth (5.0) and seventh (7.0) years of age (Table 3).

In evaluating the prevalence of hypoplastic defects among the two series, it was very significant to discover that hypoplasias were lacking from the ΞA1 site dentitions, indiscriminantly of sex and age group. On the contrary, the ΞA2 dental surfaces exclusively revealed multiple hypoplastic defects, owed to growth disruptions from suspected systemic disturbances. The dental hypoplastic data was consistent with the rest of the ΞA2 collection's palaeopathological record which revealed increased manifestations of stress, infectious and morbid conditions during this era at Polystylon. Further, it should not be overlooked that a clear differential pattern of growth disruptions by gender was discovered in the ΞA2 skeletal collection. These results, although reflected for the first time through the bioachaeological record in this geographic region, were not unexpected, for it could be predicted that males would have fewer growth disruptions, as observed among patrilineal peasant societies. Even though the growing male was more susceptible to stress, it was most probably better protected and buffered through «cultural filters», compared to female offspring.

Porotic Hyperostosis

The prevalence of porotic hyperostosis was mainly manifested in the form of *cribra orbitalia* affecting 5.5% of the ΞA1 Infant groups (combined Infancy I and II), while reaching 39.1% among the ΞA2 counterparts (Table 4). The presence of *cribra orbitalia* manifestations, observed most frequently among the Infancy I and II age groups of the ΞA2 collection (however, some of the cribrotic lesions observed were in the process of healing) were in accordance with the rest of the palaeopathological record indicating the very young of Polystylon during this time period were affected severely by stress conditions which more frequently (compared to ΞA1) had the potential to deploy their fatal capacities.

Based on the intra- and intersite comparative assessments and evaluations of the palaeoepidemiological record, concerning both skeletal collections, it is suggested that the occurrence of *cribra orbitalia* might not be interpreted as manifestations of hereditary hemopoietic disorders (Armelagos et al. 1967; Carlson et al. 1974). It should be noted that any anemia, hereditary such as sickle cell anemia, thalassemia (Angel 1964, 1966, 1967, 1978b) and/or nutritional anemia (Carlson et al. 1974; Lallo et al. 1977; Lukens 1975; Steinbock 1976), may cause porotic hyperostosis and cribrotic lesions in the roofs of the orbital cavities.

Suspected hereditary anemias (Cockburn 1963, 1967; Ortner and Putschar 1981; Steinbock 1976; Wells 1964), in both collections, were represented by three cases only. In these cases taphonomic conditions did not allow the preservation of appropriate diagnostic criteria for purposes of differential diagnosis. Hence, hereditary causative agents could not be excluded. However, judging from the overall pathogenetic profile of the rest of the individuals involved, manifesting cribrotic lesions in the orbital roofs, it is suggested that *cribra orbitalia* could be indicative of malnutrition and/or prolonged nutritional stress, debilitating infectious and/or opportunistic diseases especially in cases of constitutional disturbances, trauma or recovery from trauma, and conditions of aggregation (Huss-Ashmore et al. 1982; Martin et al. 1985; Mensforth et al. 1978).

A prolonged lactation period is suspected for the children of the ΞA2 site. After weaning, alternative foods were introduced to their dietary patterns. These foods, usually involving cereal grains, are deficient in nutrients when compared with the maternal milk, in addition they are very poor in iron. This, in a synergistic process with possible parasitic infestations (Lukens 1975), was most likely to have caused "weanling diarrhea", a general syndrome found in infants (Beher 1968; Gordon et al. 1963; Mensforth et al. 1978), which, if uncontrolled, could lead to morbid conditions. Hence, an iron deficiency anemia is highly suspected.

It should be of interest to mention that similar conditions of prolonged maternal lactation were common practice, as indicated by ethnographic interviews of elderly local informants conducted by the author in the historic village of Abdera. Such maternal offspring relations are explained here as a case of nutritional necessity in poor, low yield, dry farming, peasant cultural-economic environments, also reflecting cases of dependence training in extended family social arrangements.

Adult Females

The high prevalence of mortality observed among the Infancy age groups of the ΞA2 site (compared to the earlier site, ΞA1) was in accord with the palaeoepidemiological profile affecting the adult females of the ΞA2 site. The significant adult female mortality ratio at the ΞA2 site reflects a high prevalence of mortality for these females during their child bearing years, suggesting increased stress conditions during their reproductive years, the result of a variety of factors including multiparity.

All ΞA2 females revealed non-localized osteoporotic conditions, observed even among the young adult female individuals. In addition, 12.5% of this age/gender subgroup revealed skeletal manifestations indicative of iron deficiency anemias (Stuart-Macadam 1978). It should be of significant importance to juxtapose these morbid conditions to the female subgroup of the ΞA1 site, where such manifestations were practically absent.

Dental pathological manifestations (Brothwell 1963; Mandel 1979; Pindborg 1970, 1982; Powell 1985), reflecting, as they might, aspects of a general hygiene status, were diverse between the female individuals of the two collections. The females of the ΞA2 site, surprisingly, revealed less dental pathologies and a higher hygiene status than the ΞA1 site counterparts. Dental wear in the form of attrition, abrasion and acquired enamel micro-defects, owed to functional modification, suggested the foods consumed were better prepared in the dietary patterns of the ΞA2 sites' female individuals, when compared to the ΞA1, females, however, not necessarily richer in nutrients.

Based on the bioarchaeological evidence it seems that during the time period represented by the ΞA2 site a nexus of economic and socio-political changes occurred at Polystylon which must have affected certain aspects of the cultural environmental settings. This transformation of behavioral hues is reflected by the modified patterns of "savoir vivre" elucidated by the dental toiletry, and expected labor diversity between genders; specifically by the newly adopted restriction of strenuous work-related physical activities confined to the female individuals at the ΞA2 site. These adjusted actions were discerned through the manifestations of the stress bearing and trajectory points of their skeletal bodies. The skeletal structures of the females revealed emphasized sexual dimorphism (when compared to their counterparts of the time period represented by the ΞA1 site) with gracile skeletal bodies lacking any morphometrics indicative of robusticity and showing absence of degenerative osteoarthritic lesions or traumatic conditions. The absence of such manifestations and conditions of stress might be associated with a decrease in involvement to strenuous working activities, circumstances that were indeed "reversed" and indeed prominent among the female individuals of the ΞA1 site. The stature variable, however, remained stable for both ΞA1 and ΞA2 female individuals, measuring a mean value of approximately 156.0 cm.

Adult Males

Comparing the skeletal morphometrics of both ΞA1 and ΞA2 male groups of Polystylon, the ΞA2 site's male individuals revealed a discernible decrease in robusticity, coupled with a reduction in stature by ca. 3.0 cm, hence, measuring a mean of 165.74 cm, when compared to the males of the ΞA1 site which measured a mean of 168.74 cm. Furthermore, the ΞA2 males revealed a degradation of the general hygiene status as revealed through assessments of their masticatory *apparatus*, coupled by the presence of severe cranial and post cranial pathologies when compared to all ΞA1 adults (indiscriminate of sex), as well as to the females of the ΞA2 site. Dental wear (Pindborg 1970), acquired enamel micro-defects (Pindborg 1982), cariogenic lesions (Mandel 1979), periodontal disease, *intra vitam* tooth loss fluctuated from moderate to severe for the ΞA2 sites' male individuals. Their post cranial pathological manifestations (Steinbock 1976) disclosed primary periostitis, degenerative osteoarthritis (Stewart 1958b, 1968), and traumatic conditions involving mainly the vertebrae (Schmorl 1971) and the lower extremities, particularly the tibiae. All manifestations were indicative of strenuous working activities (Zarek 1966). Post traumatic implications and secondary periostitis associated with specific infectious diseases, such as osteomyelitis (Ortner and Putschar 1981), revealed a harsh and strenuous physical and social environment for the male individuals of the ΞA2 site. Such conditions and manifestations were not observed among the males of the ΞA1 site.

Bone Isotopic Results

Results from bone isotopic analyses (Krueger and Sullivan 1984) from both collections, compared to samples from Archaic (7th century BC) and Lated Archaic/Early Classical (terminal 7th to third quarter of 6th century BC) populations from Abdera, indicated the ΞA1 site population had depended more on agricultural C3 plants, cereals like wheat (*frumentum*) and barley, than earlier cultural components. The minor sea food amounts consumed by the ΞA1 population included more fish than earlier cultural components, providing however 30-50% of the protein source but representing only an amount of ca. 10% on a weight basis. The ΞA2 population depended even more on agricultural products, and it seems that a C4 plant, such as millet, was introduced in their dietary patterns. It should be noted that the common millet (*milium*), was mainly grown as a fodder and emergency crop during the classical antiquity (Jasny 1994; Moritz 1958). The seafood input at ΞA2 was the lowest when compared diachronically, nevertheless comprising a very important source for the protein intake.

Conclusion

This paper has sought to demonstrate the significance of anthropological implications for the archaeological record through the physical anthropological and archaeological forensic study of the ΞA1, and ΞA2 skeletal collections. Osteological studies disclosed explicit palaeopathological differences at the intra- and intersite levels of analysis between the 6-9th centuries AD (ΞA1 site) and 12-13th centuries AD (ΞA2 site) at Polystylon, Abdera. The susceptibility to stress increased during the 12-13th c. AD, revealing increased morbidity and mortality for the Infant groups, Juveniles and Young Adult female individuals.

Although the causative agents of maladaptations to buffer stress cannot be specified through the skeletal record alone, from a bio-cultural perspective the growth and sustenance processes of an organism, and eventually of a population, do not only require a high input of nutrients, but a fine-tuned correlation between physical and cultural environments as well. Any factor(s) interfering with these requirements and fragile balance mechanisms can and will affect growth, healthiness and livelihood. Growth retardation and morbidity could thus be a consequence of a) decreased nutritional intake and/or unachieved increased nutrient requirements which accompany biological reparative processes in case of trauma or disease, and b) any unfavorable changes, by means of a "positive feedback" in systems models, altering conditions of socio-cultural equilibria for the subject population.

In light of the above it was expected to identify a general declination of health parameters and an ascending record of palaeopathological manifestations among all ΞA2 individuals. Surprisingly, however, it was discovered that the ΞA2 females revealed the highest dental hygiene status when compared to all other adult individuals (indiscriminate of sex) from both collections. Further, the ΞA2 females disclosed the greatest sexual dimorphism relative to robusticity, coupled by a lack of occupational and habitual, degenerative, lesions of the joints. It is suggested that these manifestations reflect a cultural buffer phenomenon, which must have restrained females from participating in strenuous working activities when compared to the female counterparts of the ΞA1 collection. Hence, it could be argued that a segment of the ΞA2 human population, in the midst of increased to conditions of stress from both physical and social environments, presented certain attributes of cultural resilience as recipient of diseases, responding with a "negative feedback mechanism" for the betterment of their health status (even if unintentionally) in the overvall palaeopathological picture of Polystylon between the 6-9th and 12-13th centuries AD.

The male individuals of ΞA2 conducted the bulk of the strenuous physical work required at Polystylon. Dental pathologies indicate they did not discriminate against consumption of non-well prepared foods. Their dietary patterns, as revealed through bone growth and isotopic analyses, must have included less nutritive foods. Furthermore, they exhibited a decreased dental hygiene status when compared to the rest of the adults (indiscriminate of sex) of both collections. Contrarily, the ΞA1 males were the most robust, well built, and more culturally buffered from early childhood conditions of stress.

It was further deducted that the individuals from both collections that had been exposed to growth retardations and had experienced early life conditions of stress, were more susceptible to later onsets of disruptions of growth and health by physiological and pathological stress inflictions and fell easier and earlier victims to death.

As Calvin Wells (1965) noted: "The patterns of disease or injury that affect any group are not a matter of chance. It is invariably the expression of stresses and strains to which they were exposed, a response to everything in their environment and behavior. It reflects their genetic inheritance, the climate in which they lived, the soil that gave them subsistence and the animals and plants that shared their homeland. It is influenced by their occupation, their choice of dwelling, and their clothes, their social structure, even their folklore and mythology".

However, from a social and/or an economic point of view, disease is conceived as a maladaptation to harsh or changing environments before any buffering systems are activated (Bean, 1981). And yet, a successful population could carry and buffer high frequencies of disease and asthenias, as long as interactions between environment and cultural, health, growth, reproduction, and longevity, could be kept in balance for cultural and biological success (Angel 1975, 1984).

Although the skeletal record alone could not explain the exact reasons and the complete panorama of historic circumstances responsible for the abrupt changes and decline of the quality of life and nearly marasmus of the ΞA2 population, it is nevertheless possible to conceptualize, and in fact it is asserted here that we are observing reflections of events and processes of a time period strictly related to the isolation, slow deterioration through warfare and polemic activities, and finally the decline of the Byzantine Empire and its provinces to the Ottoman forces.

It is anticipated that the bioarchaeological information will help elucidate viewpoints of the undocumented history of Polystylon during these Byzantine time periods, and in conjunction with the rest of the archaeological record to provide for a better understanding of the living conditions of these Hellens.

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BIBLIOGRAPHY

Angel 1964	J.L. Angel, Osteoporosis: Thalassemia?, Am. J. Phys. Anthropol. 22, 369-374.
Angel 1966	J.L. Angel, Porotic Hyperostosis, Anemias, Malarias, and the Marshes in Prehistoric Eastern Mediterranean, Science 153, 760-762.
Angel 1967	J.L. Angel, Porotic Hyperostosis or Osteoporosis Symmetrica, in D.R. Brothwell and A.T. Sandinson (eds): Diseases in Antiquity. Springfield, IL: Ch. C. Thomas, 378-379.
Angel 1975	J.L. Angel, Paleoecology, Paleodemography, and Health, in S. Polgar (ed): Population, Ecology, and Social Evolution. Mouton: The Hague, 167-190.
Angel 1978	J.L. Angel, Porotic Hyperostosis in the Eastern Mediterranean. Med. Coll. Virg. Quarterly. 14:10-16.
Angel 1984	J.L. Angel, Health as a Crucial Factor in the Changes from Hunting to Developed Farming in the Eastern Mediterranean, in M.N. Cohen and G.J. Armelagos (eds): Paleopathology at the Origins of Agriculture. New York, Academic Press, 51-69.
Angel and Olney 1981	J.L. Angel and L.M. Olny, Skull Base Height and Pelvic inlet Depth from Prehistoric to Modern Times. Am. J. Phys. Anthropol. 54, 197.
Armelagos, Huss-Ashmore - Martin 1967	G.L. Armelagos, R. Huss-Ashmore - D. Martin, Future Work in Paleopathology, in I.W.D. Wade (ed): Miscellaneous Papers in Paleopathology. Technical Series No. 7, Flagstaff, A.R: Northern Arizona Museum, 1-8.
Bakirtzis 1982	C. Bakirtzis, Excavations in Polystylon Abdera, Prakt 25, 18-26.
Bakirtzis 1983	C. Bakirtzis, Excavations in Polystylon Abdera, Prakt 26, 13-9.
Bean 1981	W.B. Bean, Changing Patterns of Ideas about Disease, in HR Rothchilde (ed): Biocultural Aspects of Disease. New York, Academic Press, 25-50.
Beher 1968	M. Beher, Prevalence of Malnutrition among Preschool Children of Developing Countries, in N.S. Scrimshaw and J.E. Gordon (eds): Malnutrition, Learning and Behavior, Cambridge, M.I.T. Press.

Berry and Berry 1967	R.J. Berry and A.C. Berry, Epigenetic variation in the Human Cranium. J. Anat. 101, 361-379.
Brooks 1955	S.T. Brooks, Skeletal Age at Death: Reliability of Cranial and Pubic Age Indicators. Am. J. Phys. Anthropol. 13, 567-597.
Brothwell 1959	D. Brothwell, The Use of non-metric Characters in the Skull in Differentiating Populations. Ber. 6 Tag Dtsch. Ges. Anthropol. Kel. 103, 103-109.
Brothwell 1963	D.R. Brothwell, The Macroscopic Dental Pathology of Some Earlier Populations. Dental Anthropology. New York: McMillan Co.
Brothwell 1989	D.R. Brothwell, The Relationship of Tooth Wear to Aging, in M.Y. Iscan (ed): Age Markers in the Human Skeleton. Springfield, IL: Charles C. Thomas.
Carlson, Armelagos and van Gerven 1974	D.S. Carlson, G. Armelagos D. van Gerven, Factors affecting the Etiology of Cribra Orbitalia in Prehistoric Nubia. J.Hum. Evol. 3, 405-410.
Christian 1968	J. Christian, Potential Role of the Adrenal Cortex as affected by Social Rank and Population Density on Experimental epidemics. Amer. J. Epid. 87, 255-264.
Cockburn 1963	T.A. Cockburn, The Evolution and Eradication of Infectious Diseases. Baltimore: Johns Hopkins U. Press.
Cockburn 1967	T.A. Cockburn, Infectious Diseases: Their Evolution and Eradication. Springfield, IL: Charles C. Thomas.
Diodorus	Diodorus Siculus of Agyrium (c.60-30 B.C.), World History.
Gaius Plinius	Gaius Plinius Secundus (23/24-79 A.D.), Naturalis Historia. Vol. Geography. Books 3-6.
Goodman 1984	A.H. Goodman, The Chronological Occurrence of Enamel Hypoplasias in an Industrial Sample. Am. J. Phys. Anthropol. 63, 164.
Goodman and Armelagos 1985	A.H. Goodman and G.J. Armelagos, Factors Affecting the Distribution of Enamel Hypoplasias within the Human Permanent Dentition. Am. J. Phys. Antrhopol. 68, 479-493.
Goodman, Armelagos and Rose 1980	A.H. Goodman, G.L. Armelagos and J.C. Rose, Enamel Hypoplasias as indicators of Stress in three Prehistoric Populations from Illinois. Hum. Biol. 52, 515-528.
Goodman, Martin, Armelagos and Clark 1984	A.H. Goodman, D.L. Martin, G.J. Armelagos and G. Clark, Indicators of Stress form Bones and Teeth, in M.N. Cohen and G.J. Armelagos (eds): Paleopathology at the Origins of Agriculture. New York: Academic Press, 13-39.
Gordon, Chitkara, and Wyon 1963	E. Gordon, I.D. Chitkara and J.B. Wyon, Weanling Diarrhea. Am.J. Med. Sci. 245, 345-377.
Grahnen 1967	H. Grahnen, Maternal Diabetes and Changes in the Hard Tissues of Primary Teeth I: A Clinical Study. Odont. Rev. 18, 257-162.
Grahnen 1969	H. Grahnen, Neonatal Asphyxia and Mineralization Defects of the Primary Teeth. Caries Res. 3, 301-307.
Herodotus	Herodotus son of Lyxes from Halicarnassus (c. 484-420 B.C.) History.
Himes 1978	J.B. Himes, Bone Growth and Development in Protein-Calorie Malnutrition. World Rev. Nutr. Diet 28, 143-187.
Huss-Ashmore 1981	R. Huss-Ashmore, Bone Growth and Remodeling as Measure of Nutritional Stress, in D.L. Martin, and M.P. Bumsted (eds): Biocultural Adaptation, Comprehensive Approaches to Skeletal Analysis. Research Report 20, 84-95. Amherst, University of Massachusetts Department of Anthropology.
Huss-Ashmore, Goodman and Armelagos 1982	R. Huss-Ashmore, A.H. Goodman and G.J. Armelagos, Nutritional Inference from Paleopathology, in M.B. Schiffer (ed): Advances in Archaeological Method and Theory. Vol. 5. New York, Academic Press, 395-474.
Jasny 1944	N. Jasny, The Wheats of Classical Antiquity. London, England: Evans Brothers, Ltd.
Klatsky 1939	N. Klatsky, Dental Attrition. J. Am. Dent. Ass. 26, 73-84.
Kreshover and Clough 1953	S. Kreshover and O. Clough, Prenatal Influences on Tooth Development: Artificially Induced Fever in Rats. J. Dent. Res. 32, 565, 577.

Krogman 1962	W.M. Krogman, The Human Skeleton in Forensic Medicine. Springfield, IL: Charles C. Thomas.
Krogman and Iscan 1986	W.M. Krogman and M.Y. Iscan, The Human Skeleton in Forensic Medicine. Springfield, IL.: Charles C Thomas.
Krueger and Sullivan 1984	H.W. Krueger and Ch. Sullivan, Models for Carbon Isotope Fractionation between Diet and Bone, in J.E. Turnlund, and P.E. Johnson (eds): Stable Isotopes and Nutrition. A.C.S. Symposium Series No. 258. Washington, D.C: American Chemical Society, 205-220.
Lazaridis 1961	D.I. Lazaridis, On Abdera, Prakt Vol. 139.
Lazaridis 1965	D.I. Lazaridis, On Abdera, ADelt 20, 453.
Lazaridis 1971	D.I. Lazaridis, Abdera and Dikaia, Ancient Greek Cities. Pantos. 6, 13.
Lallo, Armelagos and Mensforth 1977	J. Lallo, G.J. Armelagos and R.P. Mensforth, The Role of Diet, Disease and Physiology in the Origin of Porotic Hyperostosis. Hum. Biol. 49, 471-484.
Lukens 1975	J. Lukens, Iron Deficiency and Infection. Am. J. Dis. Child. 129, 160-162.
Mandel 1979	I.D. Mandel, Dental Caries. American Scientist. 67, 686-694.
Martin, Goodman and Armelagos 1985	D.L. Martin, A.H. Goodman, and G.J. Armelagos, Skeletal Pathologies as Indicators of Quality and Quantity of Diet, in R.I. Gilbert, and J.H. Mielke (eds):The Analysis of Prehistoric Diets. New York, Academic Press, 227-279.
Martin and Saller 1957	R. Martin and K. Saller, Lehrbuch der Anthropologie. Stuttgart: Fischer.
McKern, and Gilbert 1973	T.W. McKern and B.M. Gilbert, A Method for Aging the Female os Pubis. Am. J. Phys. Anthropol. 38, 31-38.
Mensforth, Lovejoy, Lallo and Armelagos 1978	R. Mensforth, C. Lovejoy, J. Lallo and G.L. Armelagos, The Role of Constitutional Factors, Diet, and Infectious Disease in the Etiology of Porotic Hyperostosis and Periosteal Reactions in Prehistoric Infants and Children. Med. Anthropol. 2, 1-59.
Nikiforok 1981	G. Nikiforok, The Etiology of Enamel Hypoplasias: A Unifying Concept. Pediatrics. 98, 888-893.
Molnar 1970	S. Molnar, Human Tooth Wear, Tooth Function, and Cultural Variability. Am. J. Phys. Anthropol. 34, 27-42.
Moritz 1958	L.A. Moritz, Grain-Mills and Flour in Classical Antiquity. Oxford, England: University Press.
Ortner and Putschar 1981	D.J. Ortner and W. Putschar, Identification of Pathological Conditions in Human Skeletal Remains. Washington, D C: Smithsonian Institution Press.
Park 1964	E.A. Park, The Imprinting of Nutritional Disturbances on the Growing Bone. Pediatrics. 38, 815-862.
Phenice 1969	T.W. Phenice, A Newly Developed Visual Method of Sexing the Os Pubis. Am. J. Phys. Anthropol. 30,. 297-301.
Pindborg 1970	J.J. Pindborg, Pathology of the Dental Hard Tissus, Copenhagen: Munksgaard.
Pindborg 1982	J.J. Pindborg, Aetiology of Developmental Enamel Defects not Related to Fluorosis. Int. Dent. J. Surg. 29, 171-192.
Powell 1985	M.L. Powell, The Analysis of Dental Wear and Caries for Dietary Reconstruction, in R.I. Gilbert, and J.H. Mielke (eds): The Analysis of Prehistoric Diets. Orlando, F.L.: Academic Press, 307-338.
Schmorl and Junghanns 1971	G. Schmorl and H. Junghanns, The Human Spine in Health and Disease. New York, Grune and Stratton.
Schusterman 1969	S. Schusterman, The Prevalence of Enamel Defects in Childhood Nephrotic Syndrome. J. Dent. Child. 36, 435-440.
Selye 1971	H. Selye, The Evaluation of the Stress Concept-Stress and Cardiovascular Disease, in L. Levi (ed): Society, Stress, and Disease. Vol I. London: Oxford Un. Press, 299-311.
Smith and Miller 1979	D.M. Smith and J. Miller, Gastro-Enteritis, Coelic Disease and Enamel Hypoplasia. Br. Dent J. 147-91-95.

Steinbock 1976	R.T. Steinbock, Paleopathological Diagnosis and Interpretation. Springfield IL: Charles C. Thomas.
Stewart 1958a	T.D. Stewart, The Rate of Development of Vertebral Osteoarthritis in American Whites and its Significance in Skeletal age Identification. Leech 28, 144-151.
Stewart 1968	T.D. Stewart, Identification by the Skeletal Structures, in F.E. Camps (ed): Gradwol's Legal Medicine. Bristol, England: J. Wright and Sons Ltd., 123-154.
Stini 1971	W.A. Stini, Evolutionary Implications of Changing Nutritional Patterns in Human Populations. Am. Anthropol. 73, 1019-1030.
Strabo	Strabo of Amaseia (64/3 B.C.-A.D. 21 at least), Geography. Book 7: North and East Europe, North Balkans.
Stuart 1987b	Macadam P. Stuart, Porotic Hyperostosis: New Evidence to Support the Anemia Theory. Am.J.Phys. Anthropol. 74, 521-526.
Swardstedt 1966	T. Swardstedt, Odontological Aspects of a Medieval Population in the Province of Jamtland/Mid-Sweden. Stockholm: Tiden-Barnangen AB.
Thucydides	Thucydides (c.455-400 B.C.), History of the Peloponnesian War (431-404 B.C.).
Tomenchuck and Mayhall 1979	J. Tomenchuck and J.T. Mayhall, A Correlation of Tooth Wear and Age among Modern Igloolik Eskimos. Am.J. Phys. Anthropol. 51, 67-68.
Trotter and Gleser 1952	M. Trotter and G.C. Gleser, Estimation of Stature from long Bones of American Whites and Negroes. Am. J. Phys. Anthropol. 10, 463-514.
Trotter and Gleser 1958	M. Trotter and G.C. Gleser, A Re-Evaluation of Estimation of Stature Based on Long Bones After Death. Am. J. Phys. Anthropol. 16, 79-123.
Vahlquist 1975	B. Vahlquist, Two Century Perspective on some Major Nutritional Deficiency Diseases of Childhood. Acta Paediatr. Scand. 64, 161-171.
Washburn 1949	S.L. Washburn, Sex Differences in the Pubic Bone. Am. J. Phys. Anthropol. 6, 199-207.
Wells 1964	C. Wells, Bones, Bodies and Disease. London, Thames and Hudson.
Winder 1981	S. Winder, Infracranial Nonmetric Variation: An Assessment of its Value for Biological Distance Analysis. Ph.D. Dissertation, Indiana University.
Wolbach 1947	S. B. Wolbach, Vitamin A Deficiency and Excess in Relation to Skeletal Growth. J. Bone Joint Diseas. 7, 34-57.
Zarek 1966	J.M. Zarek, Dynamic Considerations in load Bearing Bones with Special Reference to Osteosynthesis and Articular Cartilage, in F.G. Evans (ed): Studies on the Anatomy and Function of Bones and Joints. New York: Springer Verlag, 40-51.