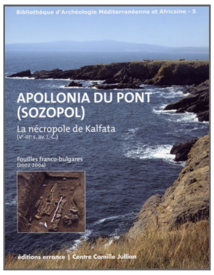

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Appendice

A Bioarchaeological Study of the Kalfata Necropolis

Anne Keenleyside

1. Introduction

Bioarchaeology, the study of human remains from archaeological contexts, can yield a wealth of information on the health, diet, and activity patterns of past populations. Numerous studies have been conducted on ancient Greek skeletal remains, but few have focused on remains from Greek colonial sites, and most of these have been restricted to skeletal samples from southern Italy. These include the analysis of nearly 700 skeletons from Metaponto (7th-2nd century BC ; Henneberg and Henneberg 1990, 1994, 1998, 2003 ; Henneberg *et al*. 1992), 129 burials from Pithekoussai (8th-7th century BC ; Becker and Donadio 1992 ; Becker 1995), and 16 skeletons from Morgantina (8th-5th century BC ; Becker 1996). With a few exceptions, there have been no bioarchaeological studies of skeletal remains from the Black Sea region. As a result, little is known about the biological and behavioural adaptations of the ancient Greeks who inhabited this region. This chapter presents the results of a demographic and palaeopathological analysis of human remains recovered from the Kalfata necropolis at Apollonia[1].

2. Materials and Methods

A total of 240 skeletons were examined in this study. The majority of these skeletons were fairly well preserved and relatively complete. Sex determination of the adult skeletons was done using standard morphological criteria of the crania and pelvic bones (Bass 1987 ; Ubelaker 1989). With the exception of late adolescents (15-18 years of age), no attempt was made to determine the sex of the subadults in the sample due to the difficulty of accurately sexing such individuals (Ubelaker 1989). Subadult age-at-death was estimated using dental formation (Moorrees *et al*. 1963a, 1963b), dental eruption, diaphyseal length, and degree of epiphyseal union (Ubelaker 1989). Subadults were assigned to one of five age categories : fetal, birth to 5 years, 5 to 10 years, 10 to 15 years, and 15 to 18 years. Adult age estimation was based on pubic symphysis morphology (Brooks and Suchey 1990), auricular surface morphology (Lovejoy *et al*. 1985), and ectocranial suture closure (Meindl and Lovejoy 1985), and adults were assigned to one of three age categories : 18 to 35 years, 36 to 50 years, and 50+ years.

The health and nutritional status of the individuals in the sample was assessed using a number of skeletal and dental indicators. All crania were visually examined for cribra orbitalia and porotic hyperostosis, conditions characterized by porosity and thickening of the superior orbital plates and cranial vault respectively. Cribra orbitalia was recorded for all individuals with at least one orbital roof preserved. The severity of the condition was categorized following the scale utilized by Stuart-Macadam (1991), and lesions were classified as active or healed based on the criteria outlined in Mensforth *et al*. (1978). Porotic hyperostosis was scored as present if the affected crania exhibited both pitting and thickening of the bone. Traumatic lesions were classified by type (e.g. fracture, dislocation), location in the skeleton, size and location on each affected bone, and stage of healing. Elements exhibiting evidence of infection secondary to a traumatic injury were included under the category of trauma. Infectious lesions were classified by type (e.g. bone formation, bone loss, or both), location in the skeleton, size and location on each affected bone, and stage of healing. Long bones that were less than two thirds complete were eliminated from the calculation of trauma and infection frequencies unless they exhibited evidence of these conditions.

Dental caries, antemortem tooth loss, abscesses, and calculus were recorded by individual and by tooth/tooth socket following the methodology outlined in Buikstra and Ubelaker (1994). Carious lesions were recorded as present only if they had penetrated the enamel surface. The number and location of lesions per tooth were also

1 I would like to thank Dr. Kristina Panayotova for inviting me to work on the skeletal material from Kalfata, and Dr. Dimitar Nedev, Director of the Archaeological Museum in Sozopol, for providing permission and facilities to study these remains. Financial support from the Leverhulme Foundation (A.K.) and the Social Sciences and Humanities Research Council of Canada (A.K.) is gratefully acknowledged.

noted. Teeth were scored as being lost antemortem if their sockets exhibited evidence of resorption. Dental abscesses were identified by the presence of a drainage channel through the alveolar bone at the apex of the tooth root, and their number and location was recorded for each affected tooth. Teeth were examined for the presence of dental calculus, and the location and degree of calculus were documented for each tooth involved. The degree of tooth wear was recorded using Smith's (1984) 8-stage system for the incisors, canines, and premolars, and Scott's (1979) 10-stage system for the molars. Enamel hypoplasia was classified according to the Developmental Defects of Enamel (DDE) Index (Commission on Oral Health 1982). Hypoplastic defects were identified by visual examination and were scored as present or absent for each of the six anterior maxillary and mandibular teeth. All observed defects were classified as either linear arrangements of pits, horizontal grooves, or both, and the total number of defects was recorded for each affected tooth. Those teeth that exhibited severe wear resulting in the loss of more than one third of the tooth crown, heavy calculus deposits, severe caries, or trauma were excluded from the analysis.

Osteoarthritis, or degenerative joint disease, was not systematically scored in the skeletal sample. The condition was, however, recorded when observed in the remains. Similarly, other pathological conditions were documented if they were present.

Fig. 67. Porotic hyperostosis in a subadult.

Fig. 68. Abnormal porosity on the left coronoid process of a subadult mandible.

3. Results

3.1. Age and Sex Distribution

The sex and age distribution of the sample are illustrated in Table 1. Of the 240 skeletons examined, 69 were male, 87 were female, and 84 were individuals of indeterminate sex. Eighty-two individuals were subadults (<18 years of age), and the majority of these (84 %) were under the age of ten at the time of their death. Of the 158 adults for whom age-at-death could be estimated, 60 (38 %) were young adults (18-35 years), 60 (38 %) were middle-aged adults (36-50 years), and 38 (24 %) were older adults (50+ years).

3.2. Skeletal Pathology

A complete list of all individuals in the sample with skeletal pathology is provided at the end of this chapter (**Table 21**). Fifty-one out of 156 crania (32.7 %) with preserved orbits had cribra orbitalia (**Table 16**). There was no statistically significant difference between males and females; however, a significantly greater proportion of subadults were affected than adults (x^2= 10.315, p= 0.0013). The majority of the observed lesions were categorized as mild to moderate. Of the 25 affected adults, 24 had lesions that were partly or completely healed at the time of their death, while 18 of the 26 affected subadults had active lesions.

Only 8 of the 158 crania (5.1 %) with observable frontal, parietal, and occipital bones showed evidence of porotic hyperostosis (**fig. 67**). Six of these specimens also exhibited cribra orbitalia. Significantly more subadults were affected than adults (x^2= 4.278, p= 0.0386), and four of the six affected subadults had active lesions.

Three subadults, two with cribra orbitalia and one with porotic hyperostosis, displayed abnormal porosity on other cranial bones as well. Individual #314 had porosity on the right sphenoid bone, the palatine process of the left and right maxillary bones, and the medial surface of the left and right coronoid processes of the mandible (**fig. 68**). Individual #413 had porosity on the

Fig. 69. Healed fracture to the left clavicle of an older adult male (bottom). The normal right clavicle is shown above it for comparison.

Fig. 71. Endocranial lesions in a subadult.

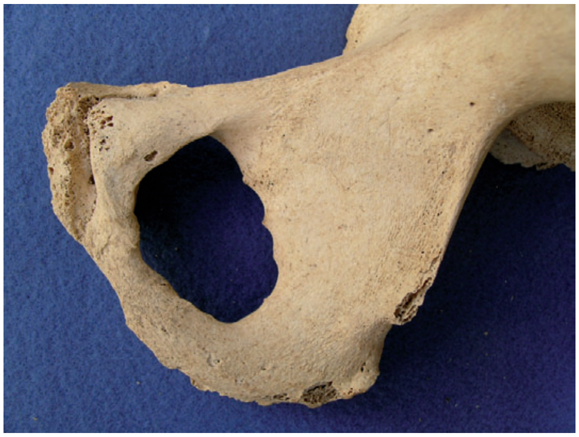

Fig. 70. Healed fracture to the right pubic bone of an older adult female.

Fig. 72. Osteoarthritis, as indicated by the presence of eburnation, on the distal femur of an older adult female.

greater wing of the sphenoid bone, and individual #431 had porosity on the right maxillary bone and on the left and right zygomatic bones.

Seven out of 159 observable crania (4.4 %), all of them adult, displayed evidence of trauma (**Table 16**). A higher proportion of males had cranial trauma than females (8.9 % compared to 4.9 %) but the difference was not statistically significant. Four of the affected individuals were males and three were females. Four individuals, all of them middle-aged or older, had well-healed depression fractures involving the left frontal bone (#10 and #215) or the left parietal bone (#112 and #164). In three of these cases, the depression fracture was shallow and affected only the outer table of bone. In the fourth case (#10), however, the fracture extended through the inner table of the frontal bone. Three individuals, a young adult male (#63a) and two older adult females (#140 and 179), had possible perimortem trauma involving the frontal, parietal, temporal, and/or maxillary bones. The

Fig. 73. The maxillary dentition of this individual displays dental abscessing, antemortem tooth loss, calculus, and tooth wear.

male had a large, radiating fracture line extending from the right temporal bone to the right frontal bone, and one of the females (#179) displayed a circular depression fracture through the right frontal bone, with several fracture lines extending from the depression and several fracture lines radiating through the right parietal bone directly posterior to the coronal suture, and through the anterior half of the left parietal bone. The other female (#140) had a possible perimortem fracture to the left frontal bone and maxilla, with a fracture line radiating from the superior margin of the left orbit and another one extending from the inferior margin of the left orbit through the left maxilla. This individual also exhibited a well-healed fracture of the nasal bones, and a healed Colles fracture to the right radius.

Twenty-eight out of 205 individuals (13.7 %) with preserved infracranial remains, 14 adult females and 14 adult males, exhibited evidence of infracranial trauma (**Table 16**). A slightly higher proportion of males had infracranial trauma than females (21.9 % compared to 17.3 %) but the difference was not statistically significant. Twenty-three of the affected individuals had sustained an injury to only one bone, while the remaining five individuals displayed trauma to multiple elements. In all cases, the injuries were well-healed at the time of death. Four of the affected individuals (#50, 140, 176, 277), three of them females, had a Colles fracture of the distal radius. One of these females (#176) had also sustained a fracture to the distal end of the right ulna and to the shaft of the right clavicle. One middle-aged male (#349) had a fracture of the distal right ulna, and two individuals, a young adult female (#46a) and an older adult male (#352), displayed a fracture through the shaft of the left clavicle (**fig. 69**). The latter individual also showed evidence of healed trauma to the anterior midshaft of the right humerus. One older female (#347) had myositis ossificans on the midshaft of the left ulna, a condition characterized by ossification in the muscle tissue resulting from trauma to the muscle. One older adult female (#112) had a possible healed fracture of the left 2nd metacarpal, and two individuals, a middle-aged female (#250) and an older male (#249), had fractures to the shaft of the right first metacarpal. Six individuals, two middle-aged males (#67 and #374), two older males (#46b and an individual of unknown provenience), and two older females (#198 and #347) had rib fractures involving one or more ribs. One older male (#63b) had a compression fracture of an unidentified lumbar vertebra. Four individuals had suffered traumatic injuries to their lower limbs. An older adult female (#189) had sustained a fracture to the distal left fibula, a middle-aged male (#209) had a fracture to the distal shaft of a left tibia, an older male (#249) had a fracture of the distal right fibula, and an older adult female (#338) had possible healed trauma to the antero-medial shaft of the right femur. Two individuals (#347 and #456), both of them older females, displayed well-healed fractures of the left ischio-pubic ramus and right pubic bone respectively (**fig. 70**). One adult (#257) had osteochondritis dissecans on the left talus, femoral condyle, and the left and right radius. This condition results from the death of bone tissue due to a trauma-related disruption in the blood supply (Roberts and Manchester 2005). Finally, four individuals (#63a, #135, #154, #447) had spondylolysis, a condition characterized by the separation of the neural arch from the vertebral body at the pars interarticularis. In two of the cases, the fourth lumbar vertebra was affected, and in the other two cases, the fifth lumbar vertebra was involved.

When analysed by element, infracranial trauma was recorded in only 13 out of 1308 (1 %) long bones in the sample (**Table 17**). Of the six major long bones, the ulna was most frequently affected (2.6 %), followed by the radius (1.9 %), fibula (1.2 %), tibia (0.4 %), and femur (0.4 %). Individuals over the age of 50 exhibited a significantly higher frequency of infracranial trauma than individuals under the age of 50 (x^2= 7.435, p= 0.0064).

Six out of 159 (3.8 %) observable crania in the sample exhibited evidence of possible infection (**Table 16**). One individual (#25), an older adult male, had a small lytic (i.e. destructive) lesion in the left parietal bone. The lesion had destroyed the inner table of bone, leaving the outer table unaffected. No new bone formation was associated with the lesion. The remaining five individuals (#199, 266, 273, 372, 413), all of whom were subadults, had endocranial lesions on the frontal, parietal, occipital, sphenoid and/or temporal bones (**fig. 71**).

Nineteen of the 150 individuals (12.7 %) whose infracranial remains were sufficiently preserved to allow for examination displayed evidence of infracranial infection (**Table 16**). A slightly higher proportion of females had infracranial infection than males (19 % compared to 15.4 %) but the difference was not statistically significant. Significantly more adults had infracranial infection than subadults (x^2=4.927, p=0.0264). Periostitis, inflammation of the periosteum, was the most common type of infectious lesion recorded in the sample, affected primarily the lower limb bones. Multiple bones were affected in ten individuals, suggesting some type of systemic infection, while single bones were affected in the remaining individuals. In all but one case (#307) the lesions were healed at the time of death. Three individuals (#70, #140, and #182), two males and one female, had lytic lesions involving the tibia, fibula, and humerus, respectively.

When analysed by element, infracranial infection was recorded in 30 out of 906 (3.3 %) long bones in the sample (**Table 17**), and an almost identical proportion of younger and older adults were affected. Of the six major long bones, the tibia was most frequently involved (12.6 %), followed by the fibula (4.9 %), femur (1.7 %), and humerus (0.6 %).

A number of other pathological conditions were also documented in the Kalfata remains. These included osteoarthritis, or degenerative joint disease, vertebral osteophytosis, and Schmorl's nodes. Among the most severe cases of osteoarthritis were individuals #198 and #286, both of whom exhibited eburnation on the articular facets of the right and/or left patella and the condyles of the corresponding femora (**fig. 72**). Five individuals exhibited fusion of two or more bones. Three of these individuals (#445, #447, and #456) had fused thoracic vertebrae, one (#274) displayed fused cervical vertebrae, and one (#438) had fused distal phalanges of the foot. Finally, one individual (#198) had a button osteoma on the frontal bone, and a second individual (#437) had a small osteoma on the distal shaft of the left tibia.

3.3. Dental Pathology

Dental calculus was the most common dental condition observed in the sample, affecting 63.7 % (128/201) of individuals (**Table 18**) and 45.8 % (1146/2502) of permanent teeth (**Table 19**). In contrast, only 6.2 % (34/546) of the deciduous teeth had calculus deposits (**Table 20**). There were no significant sex differences when comparisons were made by the number of affected individuals. When comparisons were made by the number of affected teeth, however, males had a significantly higher prevalence of calculus than females overall (x^2=29.022, p=.0001), and young adult males had a higher prevalence than females of the same age group (x^2=10.413, p=.0013). For both sexes, the prevalence of calculus increased with age.

When recorded by individual, dental caries was the second most common dental disease observed in the sample, affecting 45.5 % (92/202) of individuals (**Table 18**). In contrast, only 8.4 % (215/2543) of permanent teeth (**Table 19**), and 7.2 % (38/525) of deciduous teeth had carious lesions (**Table 20**). Of the four tooth types, the molars were most frequently involved, reflecting their more complex morphology. There were no significant sex differences when comparisons were made by the number of affected individuals. When comparisons were made by the number of affected teeth, however, middle-aged females had a significantly higher frequency of lesions than males of the same age (x^2=13.947, p=.0002). Both sexes showed an increased prevalence of carious lesions with age.

Antemortem tooth loss affected 35.1 % (72/205) of individuals (**Table 18**) and 11.3 % (408/3616) of permanent teeth (**Table 19**). Of the four tooth types, the molars were most frequently lost antemortem. There were no significant sex differences when comparisons were made by the number of affected individuals. When comparisons were made by the number of affected teeth, however, significantly more young adult males had lost teeth prior to death than females of the same age group (x^2=31.856, p=.0001), while a significantly higher number of middle-aged females had lost teeth compared to males of the same age (x^2=10.910, p=.0010). For both sexes, the prevalence of antemortem tooth loss increased with age.

Abscesses were the least common type of dental pathology observed in the sample, affecting only 16.4 % (32/195) of individuals (**Table 18**), 1.7 % (55/3161) of permanent teeth (**Table 19**), and 0.2 % (1/524) of deciduous teeth (**Table 20**). The molars were the most frequently involved teeth (**fig. 73**). There were no significant sex differences when comparisons were made by the number of affected individuals or teeth. For both sexes, however, the prevalence of abscesses increased with age.

Enamel hypoplasia involving the canines and/or incisors was recorded in 17.4 % (29/167) of individuals (**Table 18**) and 10 % (83/827) of permanent teeth (**Table 19**). There were no significant sex differences when comparisons were made by the number of affected individuals. When comparisons were made by the number of affected teeth, however, middle-aged males had a significantly higher frequency than females of the same group (x^2=7.755, p=.0054). For both sexes, young adults showed a higher prevalence of defects than older individuals.

4. Discussion

4.1. Demographic Profile

Seventy-eight of the 240 individuals (32.5 %) in the sample were under the age of 15, and thirty-nine individuals (16.2 %) were under the age of five. This high proportion of infants and children is comparable to that seen in other pre-industrial skeletal samples and suggests a high rate of infant and child mortality. The period from birth to three years is particularly critical for growth, and it is during this time that children are most sensitive to the effects of infectious disease and malnutrition.

In a recent study of infant feeding practices using stable nitrogen isotope analysis of the remains of 64 subadults from the Kalfata necropolis, Kwok and Keenleyside (n.d.) determined that weaning at Apollonia began between 6 months and 1 year of age and was completed between the ages of 2 and 4. Likely causes of morbidity in these young children included the use of solid foods low in nutrients and gastrointestinal infections resulting from the consumption of contaminated food and water.

4.2. Skeletal Pathology

The etiology of cribra orbitalia and porotic hyperostosis in past populations has received considerable attention in the literature. Among Mediterranean populations these lesions have typically been attributed to genetic anaemia, most notably thalassemia, due to the presumed presence of endemic malaria in the Mediterranean region in antiquity (Angel 1966). Similarly, cribra orbitalia and porotic hyperostosis in Greek colonial samples from Italy have been linked to thalassemia (Ascenzi and Balistreri 1977 ; Becker 1995 ; Benassi and Toti 1958; Henneberg and Henneberg 1998). Other disorders can also cause these lesions, however, and the significance of cribra orbitalia and porotic hyperostosis must therefore be interpreted with caution. The most common of these disorders is iron deficiency anaemia, a condition that results from a low dietary intake of iron, poor intestinal absorption of iron, and/or excess loss of iron due to parasitic and other infections. Other conditions such as scurvy, eye infections, and osteoporosis can also produce these lesions (Wapler *et al*. 2004).

Examination of the remains from the Kalfata necropolis revealed no evidence of infracranial lesions characteristic of thalassemia. In addition, the lack of severe lesions typically seen in individuals, especially children, with this form of anaemia, the decreasing prevalence of lesions from younger to older age groups, and the presence of primarily healed lesions in adults suggest that the cases of cribra orbitalia and porotic hyperostosis recorded in the sample more likely reflect iron deficiency anaemia (Keenleyside and Panayotova 2006). This is consistent with a previously conducted stable isotopic analysis of the remains of 54 individuals from the necropolis (Keenleyside, Schwarcz, Panayotova 2006), which revealed a heavy reliance on plant foods such as wheat and barley, both of which contain compounds known to inhibit the intestinal absorption of iron. Other factors that may also have contributed to the development of iron deficiency anaemia in these individuals include malnutrition and parasitic and other infections (Keenleyside and Panayotova 2006).

As noted earlier, three subadults, two with cribra orbitalia and one with porotic hyperostosis, also displayed porous lesions involving other cranial bones, including the sphenoid, mandible, and maxillary bones. Abnormal porosity of the greater wing of the sphenoid has been identified as a diagnostic feature of vitamin C deficiency, or scurvy (Ortner *et al*. 2001), and porosity of the coronoid process of the mandible, and the maxillary, zygomatic and temporal bones has also been linked to this disease. Lesions in these particular locations are believed to result from hemorrhages of the blood vessels associated with the use of the temporalis muscle in chewing (Ortner *et al*. 2001 ; Brickley and Ives 2006). Derived from fresh fruits and vegetables, vitamin C is essential for the synthesis of collagen and other connective tissues, and a deficiency leads to subperiosteal hemorrhaging that can result in new bone formation, and bleeding of the gums with subsequent tooth loss (Roberts and Manchester 2005). Based on the skeletal evidence noted above, the possibility exists that some of the children buried in the Kalfata necropolis suffered from scurvy.

Trauma to the skeleton can provide valuable insight into the activity patterns of past populations, as well as levels of interpersonal conflict within and between populations. Previous bioarchaeological studies have revealed that the ancient Greeks suffered from a variety of traumatic injuries (Angel 1971 ; Ortner and Theobald 1993 ; Papathanasiou *et al*. 2000). In the Kalfata sample, the age of the affected individuals (primarily older individuals), and the location and nature of the injuries suggest that they were primarily accidental. Cranial trauma, including perimortem fractures, can result from both accidents and interpersonal violence. Fractures of the clavicle and Colles fractures of the distal radius, which result when an individual extends their arm to break a fall, are both indicative of accidental falls (Lovejoy and Heiple 1981), and compression fractures of the vertebrae, such as that recorded in one male over the age of 50, are commonly seen in older adults with osteoporosis (Roberts and Manchester 2005). The fact that all of the infracranial fractures recorded in the sample were well-healed at the time of death indicates that the affected individuals survived their traumatic injuries with few, if any, complications.

Acute infectious diseases leave no evidence in bone and skeletal evidence of infection therefore represents chronic conditions which may or may not have been the immediate cause of death (Ortner 2003). Non-specific infections are more common in archaeological remains and include periostitis, an inflammation of the periosteum, and osteomyelitis, an inflammation of the marrow cavity (Roberts and Manchester 2005). Specific infections that can affect bone include tuberculosis, leprosy, and venereal syphilis. Determining the prevalence of infection in past populations is hindered by the fact that many diseases leave no evidence in bone, some affect the skeleton in only a small percentage of cases, and others affect the skeleton only years after the initial infection (Lovell 2000). Thus a low frequency of lesions in a skeletal sample does not necessarily indicate that infectious diseases were not a significant health problem among the population, as individuals with no skeletal lesions may have succumbed to infections before bone involvement occurred.

The majority of the infectious lesions documented in the Kalfata sample consisted of periostitis and were non-specific in nature, meaning that the specific pathogenic microorganism responsible cannot be identified. This condition may result from localized trauma or a chronic skin ulcer, or from a systemic infection, the latter often involving more than one bone, as seen in ten individuals in the sample. As noted earlier, endocranial lesions in the form of primarily reactive new bone on the frontal, parietal, occipital, and/or temporal bones were recorded in five subadults. While the etiology of the lesions seen in these individuals is uncertain, possible causes include meningitis, scurvy, rickets, and tuberculosis (Lewis 2004). Given that three of these individuals also had cribra orbitalia and/or porotic hyperostosis, and two of them had abnormal porosity on the greater wing of the sphenoid, it is possible that scurvy was the cause of the endocranial lesions seen in at least some of these individuals. No conclusive evidence of specific infectious diseases such as tuberculosis, brucellosis, treponemal infection or leprosy was found in any of the Kalfata remains. The presence of a single lytic lesion in three individuals (#70, #140, #182), may reflect a localized infection, but the causative agent is impossible to determine.

One individual in the sample (#46b), an older adult male, is particularly interesting as it manifests multiple lytic lesions throughout its skeleton (**fig. 74**). Affected elements include several cranial bones, the left clavicle, right scapula, left and right pelvic bones, humeri, and femora, a number of ribs, two cervical, nine thoracic, and four lumbar vertebrae, and the sacrum. While infectious diseases cannot be completely ruled out as the cause of these lesions, their appearance, size, shape, number, and distribution suggest the possibility of a malignant neoplasm, possibly multiple myeloma or metastatic carcinoma. A detailed macroscopic and radiographic examination would be required to confirm this diagnosis.

Fig. 74. Multiple lytic lesions throughout the skeleton of this older adult male may be indicative of a malignant neoplasm.

4.3. Dental Pathology

Dental pathology is commonly recorded in archaeological samples and can provide valuable insight into the general level of health and nutritional status of a population. Teeth can provide information on the type and nature of foods consumed and the level of oral hygiene. They can also provide evidence of nutritional and disease stress, as well as non-dietary functions i.e. their use as tools. Dental caries is an important indicator of diet, and high caries rates are associated with the consumption of carbohydrates, especially refined sugars. Antemortem tooth loss can result from the extraction of carious teeth, heavy tooth wear, trauma, or periodontal disease (Hillson 2005). Abscesses occur when bacteria invade a pulp cavity that has been exposed due to heavy tooth wear, caries, or trauma, and proceed down the root canal into the alveolar bone, causing an infection of the surrounding tissue (Hillson 2005). The formation of dental calculus, or mineralized plaque, has been linked to both high protein and high carbohydrate diets

(Meiklejohn and Zvelebil 1991 ; Lieverse 1999 ; Lillie and Richards 2000), but it is also influenced by a number of non-dietary factors, including oral hygiene, the mineral content of drinking water, the rate of salivary flow, and the use of the teeth as tools (Lieverse 1999). Enamel hypoplasia, a deficiency in enamel thickness caused by a disruption in the secretory phase of enamel formation, has been linked to more than a hundred different factors, most notably nutritional stress and childhood infections (Goodman and Rose 1990). Finally, high levels of tooth wear in past populations have been attributed to a diet of uncooked and unrefined food items such as coarse cereal grains, the consumption of poorly washed foods, and the use of grinding stones (Larsen 1997).

A review of dental pathology in a smaller sample of human remains from the Kalfata necropolis has previously been conducted (Keenleyside 2008), and the results obtained in that study closely match those gathered in the current study. The frequent occurrence of dental calculus in the sample resembles that of other agricultural populations and points to the consumption of a high carbohydrate diet and/or poor oral hygiene. The significantly higher prevalence of the condition in older individuals compared to younger ones has been observed in other populations as well, and reflects the progressive build-up of calculus with age.

At 8.4 % of permanent teeth, the prevalence of carious lesions in the sample falls at the lower end of the range reported by Turner (1979) for agricultural populations (2.1-26.9 %, average = 10.43 %), and within the range reported for populations with a mixed economy (1.0-10.3 %, average = 4.84 %). The higher frequency of carious lesions in older individuals compared to younger ones is consistent with previous studies of caries in archaeological populations, and reflects the age-progressive nature of this disease (Hillson 2000, 2001). Sex differences in caries rates have been observed in both archaeological and modern populations, with females typically showing higher rates than males (Hillson 2001 : 253 ; Walker and Hewlett 1990). This has been attributed to a higher carbohydrate intake by females, earlier eruption of teeth, and behavioural differences in subsistence pursuits (Larsen 1997 ; Walker and Hewlett 1990). Changes in salivary composition during pregnancy and lactation have also been implicated in the development of caries in women (Laine 2002). In the Kalfata sample, middle-aged females had a significantly higher prevalence of caries by tooth count than males of the same age group, but rates were only slightly higher in females overall, suggesting that in general, males and females consumed foods with similar cariogenic properties.

The rate of antemortem tooth loss in the sample is similar to that seen in other agricultural populations and likely reflects, in part, the higher rate of caries typically seen in such populations. The significantly higher number of older individuals who had lost teeth prior to their death than younger individuals mirrors the age-related increase in antemortem tooth loss seen in modern populations. Periodontal disease was not scored in the sample, but may also have contributed to tooth loss among the colonists.

Calculating the prevalence of abscesses in archaeological samples is complicated by the fact that teeth may have been extracted prior to pulp exposure and infection. Alternatively, abscesses, if present, may not have penetrated the alveolar bone and are therefore not visible to the naked eye. Consequently, reported frequencies likely underestimate the actual prevalence of this condition in past populations. Nevertheless, the low frequency of abscessing in the sample parallels the low rate of caries by tooth count and the low to moderate rate of tooth wear recorded in the sample. The higher frequency of abscesses in older individuals compared to younger ones is seen in other archaeological samples as well, and reflects the higher rate of caries and tooth wear typically seen in this age group.

The presence of enamel hypoplasia in the sample, while relatively low, indicates that episodes of childhood stress occurred in some individuals. Hypoplastic defects in ancient Greek skeletal remains have been interpreted as evidence of nutritional stress, childhood infections and/or weaning stress (Angel 1984 ; Henneberg and Henneberg 1998, 2001), and it is likely that one or more of these factors contributed to the formation of defects in the Apollonians as well. As noted earlier, the presence of cribra orbitalia in 32.7 % of the individuals in the sample likely reflects iron deficiency anaemia resulting from a heavy reliance on a terrestrial plant diet, although other causes cannot be completely discounted (Keenleyside and Panayotova 2006). The higher frequency of enamel hypoplasia in younger adults compared to older ones has also been noted in other populations (Larsen 1997), and supports the hypothesis that individuals who experience stress during childhood are more likely to die at a younger age (Duray 1996).

Finally, the low to moderate levels of tooth wear recorded in the sample match those documented in other agricultural samples such as those from Pithekoussai (Becker 1995) and rural Metaponto (Henneberg and Henneberg 1998), and point to the consumption of a relatively soft diet.

5. Conclusions

Analyses of human skeletal remains can provide valuable insight into the health, diet, and activities of past populations. As the present study has illustrated, the individuals buried in the Kalfata necropolis suffered from a variety of health problems, including metabolic disorders such as iron deficiency anaemia and possibly scurvy, fractures, infections, osteoarthritis, and poor dental health. To what extent these individuals represent the entire population who lived at Apollonia during the 5th to 3rd centuries remains unknown. What is clear, however, is that these individuals experienced some of the same health challenges faced by modern populations. Future studies of additional skeletal remains recovered from the necropolis will hopefully provide a more complete picture of the health of this population and their dietary and behavioural adaptations, particularly when integrated with archaeological evidence derived from the site.

	Males	Females	Indeterminate	Total
Subadults				
Fetal	0	0	0	0
0-5	0	0	39	39
5-10	0	0	30	30
10-15	0	1	8	9
15-18	1	1	2	4
Total subadults	1	2	79	82
Adults				
18-35	21	35	4	60
36-50	33	26	1	60
50+	14	24	0	38
Total adults	68	85	5	158

Table 15. Age and sex distribution of the sample.

	Males		Females		Adults		Subadults		Total	
	A/O*	%	A/O	%	A/O	%	A/O	%	A/O	%
Cribra orbitalia	14/45	31.1	13/61	21.3	25/105	23.8	26/51	51.0**	51/156	32.7
Porotic hyperostosis	1/44	2.3	1/61	1.6	2/103	1.9	6/55	10.9**	8/158	5.1
Cranial trauma	4/45	8.9	3/61	4.9	7/104	6.7	0/55	0.0	7/159	4.4
Infracranial trauma	14/64	21.9	14/81	17.3	28/144	19.4**	0/61	0.0	28/205	13.7
Cranial infection	1/45	2.2	1/61	1.6	1/104	.96	5/55	9.1**	6/159	3.8
Infracranial infection	6/39	15.4	11/58	19.0	17/96	17.7**	2/54	3.7	19/150	12.7

*Affected/observed
** statistically significant difference

Table 16. Frequency of cribra orbitalia, porotic hyperostosis, trauma, and infection by individual.

	Humerus		Radius		Ulna		Femur		Tibia		Fibula		Total	
	A/O	%	A/O	%	A/O	%	A/O	%	A/O	%	A/O	%	A/O	%
Trauma														
Younger adults*	0/174	0.0	1/150	0.7	3/143	2.1	0/203	0.0	1/181	0.5	0/129	0.0	5/980	0.5
Older adults**	0/56	0.0	3/55	5.4	2/50	4.0	1/62	1.6	0/61	0.0	2/44	4.5	8/328	2.4***
Total	0/230	0.0	4/205	1.9	5/193	2.6	1/265	0.4	1/242	0.4	2/173	1.2	13/1308	1.0
Infection														
Younger adults	0/115	0.0	0/101	0.0	0/102	0.0	3/131	2.3	15/115	13.0	3/85	3.5	21/649	3.2
Older adults	1/41	2.4	0/43	0.0	0/43	0.0	0/48	0.0	5/44	11.4	3/38	7.9	9/257	3.5
Total	1/156	0.6	0/144	0.0	0/145	0.0	3/179	1.7	20/159	12.6	6/123	4.9	30/906	3.3

Table 17. Frequency of infracranial trauma and infection by element.

*18-50 years of age
**50+ years of age
*** statistically significant difference

Age (yrs)	Males	%	Females	%	Indeterminate	%	Total	%
Dental Caries								
<18	0/1	0.0	0/2	0.0	14/58	24.1	14/61	22.9
18-35	8/18	44.4	13/32	40.6	0/2	0.0	21/52	40.4
36-50	17/29	58.6	16/24	66.7	1/1	100.0	34/54	63.0
50+	9/13	69.2	14/22	63.6	0/0	0.0	23/35	65.7
Total	34/61	55.7	43/80	53.7	15/61	24.6	92/202	45.5
AMTL								
<18	0/1	0.0	0/2	0.0	1/58	1.7	1/61	1.6
18-35	5/18	27.8	4/33	12.1	0/2	0.0	9/53	17.0
36-50	11/29	37.9	16/24	66.7	0/1	0.0	27/54	50.0
50+	12/13	92.3	23/24	95.8	0/0	0.0	35/37	94.6
Total	28/61	45.9	43/83	51.8	1/61	1.6	72/205	35.1
Abscesses								
<18	0/0	0.0	0/2	0.0	0/53	0.0	1/55	1.8
18-35	1/15	6.7	3/33	9.1	0/2	0.0	4/50	8.0
36-50	8/29	27.6	6/24	25.0	1/1	100.0	15/54	27.8
50+	6/13	46.1	6/23	26.1	0/0	0.0	12/36	33.3
Total	15/57	26.3	15/82	18.3	2/56	3.6	32/195	16.4
Calculus								
<18	0/1	0.0	1/2	50.0	14/58	24.1	15/61	24.6
18-35	15/18	83.3	22/32	68.7	2/2	100.0	39/52	75.0
36-50	26/29	90.0	20/24	83.3	1/1	100.0	47/54	87.0
50+	10/12	83.3	17/22	77.3	0/0	0.0	27/34	79.4
Total	51/60	85.0	60/80	75.0	17/61	27.9	128/201	63.7
Enamel Hypoplasia								
<18	1/1	100.0	0/2	0.0	6/56	10.7	7/59	11.9
18-35	5/14	35.7	7/29	24.1	0/2	0.0	12/45	26.7
36-50	6/27	22.2	3/17	17.6	0/1	0.0	9/45	20.0
50+	0/6	0.0	1/12	8.3	0/0	0.0	1/18	5.5
Total	12/48	25.0	11/60	18.3	6/59	10.2	29/167	17.4

Table 18. Dental pathology by individual.

Age (yrs)	Males	%	Females	%	Indeterminate	%	Total	%
Dental Caries								
18-35	11/297	3.7	34/716	4.7	0/38	0.0	45/1051	4.3
36-50	42/620	6.8	61/440	13.9*	1/31	3.2	104/1091	9.5
50+	28/160	17.5	38/241	15.8	0/0	0.0	66/401	16.5
Total	81/1077	7.5	133/1397	9.5	1/69	1.4	215/2543	8.4
AMTL								
18-35	21/385	5.4*	4/876	0.5	0/45	0.0	25/1306	1.9
36-50	31/759	4.1	53/624	8.5*	0/31	0.0	84/1414	5.9
50+	124/360	34.4	175/536	32.6	0/0	0.0	299/896	33.4
Total	176/1504	11.7	232/2036	11.4	0/76	0.0	408/3616	11.3
Abscesses								
18-35	1/289	0.3	5/819	0.6	0/42	0.0	6/1150	0.5
36-50	12/643	1.9	10/551	1.8	2/30	6.7	24/1224	2.0
50+	12/302	4.0	13/485	2.7	0/0	0.0	25/787	3.2
Total	25/1234	2.0	28/1855	1.5	2/72	2.8	55/3161	1.7
Calculus								
18-35	127/294	43.2*	230/713	32.3	13/38	34.2	370/1045	35.4
36-50	343/615	55.8	203/430	47.2	5/31	16.1	551/1076	51.2
50+	90/156	57.7	135/225	60.0	0/0	0.0	225/381	59.0
Total	560/1065	52.6*	568/1368	41.5	18/69	26.1	1146/2502	45.8
Enamel Hypoplasia								
18-35	21/100	21.0	36/254	14.2	0/12	0.0	57/366	15.6
36-50	21/205	10.2*	2/126	1.6	0/10	0.0	23/341	6.7
50+	0/37	0.0	3/83	3.6	0/0	0.0	3/120	2.5
Total	42/342	12.3	41/463	8.8	0/22	0.0	83/827	10.0

Table 19. Dental pathology by tooth (permanent teeth).

* statistically significant difference between males and females

Dental Pathology	Affected/Observed	%
Dental Caries	38/525	7.2
Antemortem Tooth Loss	0/671	0.0
Dental Abscess	1/524	0.2
Calculus	34/546	6.2
Enamel Hypoplasia	0/261	0.0

Table 20. Dental pathology by tooth (deciduous teeth).

Skeleton #	Sex	Age (yrs)	Pathology
2a	male	21-35	Cribra orbitalia
9	female	36-50	Healed periostitis on the right tibia
10	male	36-50	Healed depression fracture to the left frontal bone
21	male	21-35	Cribra orbitalia, healed fracture to the acromial end of the right clavicle
25	male	50+	Cribra orbitalia, possible lytic lesion on the left parietal bone, heavy lipping on the dens of the second cervical vertebra
31	female?	50+	Moderate lipping around the lateral facet of the right patella
46a	female	21-35	Healed fracture to the shaft of the left clavicle
46b	male	50+	Cribra orbitalia, healed fracture to the shaft of an unidentified rib, moderate lipping of the left temporo-mandibular joint, osteophytosis on the 4th and 5th lumbar vertebrae, possible lytic lesions in the right temporal, right parietal, and sphenoid bones, left clavicle, right scapula, ribs, left and right pelvic bones, humeri, femora, 2 cervical vertebrae, 9 thoracic vertebrae, 4 lumbar vertebrae, and sacrum
50	male?	50+	Healed Colles fracture to the left radius, osteophytosis on several unidentified thoracic vertebrae
52	indeterminate	4-5	Cribra orbitalia
60	indeterminate	2.5-3	Cribra orbitalia
63a	male	21-35	Possible perimortem trauma to the right parietal, right frontal, and right temporal bones, spondylolysis of the 4th lumbar vertebra, lipping on the distal femora, proximal tibiae, distal humeri, proximal radii and ulnae, osteophytosis on the 4th and 5th lumbar vertebrae
63b	male	50+	Compression fracture of an unidentified lumbar vertebra, eburnation on the distal left and right humerus, lipping on the proximal right ulna, and on the articular facets of the 9th, 10th, and 11th thoracic vertebrae, osteophytosis on the 10th thoracic vertebra
67	male	36-50	Healed fracture to the shafts of three unidentified ribs, lipping and/or porosity on the articular facets of the 8th, 9th, 11th, and 12th thoracic vertebrae and the 3rd, 4th, and 5th lumbar vertebrae, osteophytosis on the cervical vertebrae, 10th, 11th, and 12th thoracic vertebrae, and 3rd to 5th lumbar vertebrae
69	female	36-50	Lipping and porosity on the articular facet and dens of the 1st and 2nd cervical vertebrae
70	male	21-35	Lytic lesion on the right distal tibia
78	female	50+	Ossification of costal cartilage of the 1st ribs, slight lipping around the acetabulum of the left and right pelvic bones, moderate lipping of the articular facets of the 5th lumbar and 1st sacral vertebrae, osteophytosis on the 3rd and 4th lumbar vertebrae and on four unidentified thoracic vertebrae
112	female	50+	Healed depression fracture to the left parietal bone, healed fracture to the left second metacarpal, osteophytosis on the 4th lumbar vertebra
135	female	36-50	Spondylolysis and osteophytosis of the 4th lumbar vertebra
140	female	50+	Possible perimortem trauma to the left frontal and left maxillary bones, healed fracture to the nasal bones, healed Colles fracture to the right radius, possible lytic lesion on the distal right fibula, osteophytosis on the middle to lower thoracic vertebrae
145	female	13-17	Cribra orbitalia
151a	male	21-35	Porotic hyperostosis, cribra orbitalia

Table 21. Summary of skeletal pathology in the Kalfata remains.

Skeleton #	Sex	Age (yrs)	Pathology
154	male	36-50	Spondylolysis of the 5th lumbar vertebra, osteophytosis on the 4th and 5th lumbar vertebrae, moderate lipping of the acetabula of the left and right pelvic bones
156	female	50+	Moderate to heavy lipping and/or porosity on the articular facets of the 1st to 5th cervical vertebrae
158	female?	36-50	Slight lipping around the glenoid fossa of the right scapula
159	female	50+	Osteophytosis on the thoracic and lumbar vertebrae
162	female	18-20	Cribra orbitalia
164	male	36-50	Cribra orbitalia, healed depression fracture to the left parietal bone, moderate lipping of the right temporo-mandibular joint
165	indeterminate	1-2	Cribra orbitalia
170	female?	21-35	Healed periostitis on the shafts of the left and right tibiae and femora
172	indeterminate	6-8	Porotic hyperostosis, cribra orbitalia
176	female	50+	Healed fracture to the shaft of the right clavicle, healed Colles fracture to the right radius, healed fracture to the distal right ulna, osteophytosis on the thoracic, lumbar, and first sacral vertebrae, slight to moderate pitting and/or lipping on the glenoid fossa of the right scapula, the articular facets of the right trapezoid, right lunate, right patella, 2nd and 3rd thoracic vertebrae, and proximal facet of a proximal phalange
178	female	36-50	Healed periostitis on the proximal and midshaft of the right tibia, osteophytosis on one unidentified cervical vertebra
179	female	50+	Cribra orbitalia, possible perimortem trauma to the frontal bone and the left and right parietal bones, osteophytosis on the cervical, thoracic, and lumbar vertebrae
182	male	50+	Lytic lesion on the proximal right humerus, healed periostitis on the midshaft of the left fibula and the left and right tibiae, moderate to heavy lipping on the distal right ulna and radius, the distal articular facet of a proximal phalange, severe porosity and/or eburnation on the articular facets of the cervical vertebrae, osteophytosis on the thoracic and lumbar vertebrae
183	indeterminate	5-7	Porotic hyperostosis, cribra orbitalia
184	female	21-35	Healed periostitis on the midshaft of the left and right tibiae
186	male?	36-50	Osteophytosis on one unidentified cervical vertebra
189	female	50+	Healed fracture to the distal shaft of the left fibula, pitting and/or lipping on the articular facets of the 1st, 2nd and 12th thoracic vertebrae and the 1st to 5th lumbar vertebrae, osteophytosis on the 4th and 5th lumbar vertebrae and the 1st sacral vertebra
194	male	18-20	Cribra orbitalia
196	indeterminate	3-5	Cribra orbitalia
198	female	50+	Healed periostitis on the shafts of the left and right tibiae, button osteoma on the frontal bone, biparietal thinning, eburnation on the distal right femur and right patella, lipping and/or porosity on the right 1st to 3rd cuneiform, left 2nd cuneiform and the proximal articular facets of all metatarsals, healed fracture to the shaft of an unidentified rib, osteophytosis on one thoracic and one lumbar vertebra
199	indeterminate	6-18 months	Cribra orbitalia, endocranial lesions on the frontal and occipital bones
202	indeterminate	6-9	Cribra orbitalia
209	male	36-50	Healed fracture to the distal shaft of the left tibia, slight to moderate lipping on the distal femora, patellae, acetabulum of the left pelvic bone, Schmorl's nodes on the lumbar vertebrae
212	indeterminate	5-7	Healed periostitis on the midshaft of the left tibia

Table 21. Summary of skeletal pathology in the Kalfata remains.

Skeleton #	Sex	Age (yrs)	Pathology
215	male	36-50	Healed depression fracture to the frontal bone, healed periostitis on the midshaft of the left tibia, moderate to severe pitting and/or lipping on the articular facets of the right calcaneus, talus, navicular, and cuboid, the acetabulum and auricular surface of the right pelvic bone, and the auricular surface of the sacrum, osteophytosis on the lumbar vertebrae
216	indeterminate	11-13	Partially healed periostitis on shaft of right second metatarsal, left and right third metatarsals
219	male	36-50	Osteophytosis on one lumbar vertebra
222	female?	50+	Osteophytosis on two unidentified thoracic vertebrae, lipping and/or eburnation on the articular facets of several phalanges
229a	male	36-50	Osteophytosis on one unidentified thoracic vertebra and on the 12th thoracic vertebra, slight lipping on distal right humerus, glenoid fossa of right scapula, distal facets of one proximal and one middle phalange of the hand
229b	male?	36-50	Osteophytosis on an unidentified lumbar vertebra
241	indeterminate	4-6	Cribra orbitalia
246	female	21-35	Cribra orbitalia
249	male	50+	Possible healed fracture to distal shaft of right fibula, possible healed fracture to right 1st metacarpal, slight lipping around the glenoid fossa of the left and right scapula, the acetabulum of the left and right pelvic bones, and the articular facets of the right calcaneus, moderate to heavy lipping and/or porosity of the sternal end of the right clavicle and the articular facets of the 2nd to 5th cervical vertebrae, osteophytosis on 10th to 12th thoracic vertebrae and all lumbar vertebrae
250	female	36-50	Healed fracture to right 1st metacarpal, moderate lipping on the right inferior articular facet of an unidentified lumbar vertebra, osteophytosis on the 5th and 6th cervical vertebrae
254	female	36-50	Healed periostitis on distal shaft of right femur
257	female	36-50	Osteochondritis dissecans on left talus, femoral condyle, and head of left and right radius
266	indeterminate	1-2	Endocranial lesions on right and left temporal bones, and porosity on the sphenoid bone
268	indeterminate	5-7	Cribra orbitalia
273	indeterminate	4-6	Cribra orbitalia, porotic hyperostosis, endocranial lesions on unidentified cranial bone fragments
274	female	36-50	Fusion of 4th and 5th cervical vertebrae, osteophytosis on 4th and 5th cervical vertebrae, lipping and porosity on the articular facets of the 2nd and 3rd cervical vertebrae
277	female	36-50	Healed Colles fracture to left radius, slight lipping around the acetabulum of the left and right pelvic bones, osteophytosis on cervical vertebrae, 4th and 5th lumbar vertebrae, and 1st sacral vertebra
286	female	50+	Possible healed fracture to shaft of right second rib, heavy lipping, pitting, and eburnation of the articular facets of the left and right patella and the left and right distal femora, moderate lipping and porosity of the sternal end of the left clavicle, slight to moderate lipping around the glenoid fossa of the left and right scapulae, slight lipping around head of right humerus and the articular facets of 3 carpal bones and the 1st and 3rd metacarpals, heavy porosity on acromial end of right clavicle, slight to moderate lipping around the acetabulum of the left and right pelvic bones, osteophytosis on 4th to 6th cervical vertebrae, thoracic and lumbar vertebrae, 1st sacral vertebra
288	indeterminate	4-6	Cranial deformation
291	male	21-35	Schmorl's nodes on 5 thoracic and 4 lumber vertebrae
292	male	50+	Cribra orbitalia, slight lipping on distal right humerus, eburnation on proximal left radius

Table 21. Summary of skeletal pathology in the Kalfata remains.

Skeleton #	Sex	Age (yrs)	Pathology
295	indeterminate	2-4.5	Cribra orbitalia
302	male	50+	Cribra orbitalia, healed periostitis of the left fibula and tibia, degenerative joint changes throughout the skeleton
307	female	18-20	Cribra orbitalia, active periostitis on proximal shaft of right fibula
310	female	50+	Osteophytosis, slight to moderate lipping around the proximal facets of the proximal phalanges of the big toe, osteophytosis on cervical, thoracic, and lumbar vertebrae, Schmorl's nodes on lumber vertebrae
311	female	17-19	Cribra orbitalia
313	indeterminate	6-8	Cribra orbitalia
314	indeterminate	3-5	Cribra orbitalia, porosity on the mandible, maxillary bones, and sphenoid bone
321	female	21-35	Cribra orbitalia
324	male	36-50	Hyperostosis frontalis interna, lipping on the left superior articular facets of the 3rd and 4th cervical vertebrae, osteophytosis on the 3rd and 4th cervical vertebrae
325	female	36-50	Healed fracture to distal shaft of left ulna
330	male	50+	Cribra orbitalia, moderate lipping around glenoid fossa of right scapula, acetabulum of left pelvic bone, osteophytosis on lower thoracic vertebrae, lower lumbar vertebrae, cervical vertebrae, Schmorl's nodes
335	male	36-50	Slight lipping on distal right ulna
336	female	36-50	Osteophytosis on 11th and 12th thoracic vertebrae and on lumbar vertebrae
338	female	50+	Possible healed periostitis on left and right tibiae, possible trauma to shaft of right femur, osteophytosis on lumbar vertebrae, Schmorl's nodes
344	female	21-30	Cribra orbitalia
346	female	21-35	Schmorl's nodes on 1 cervical, 3 thoracic, and 2 lumbar vertebrae
347	female	50+	Healed fractures to midshaft of left ulna with myositis ossificans, left ischio-pubic ramus, right 3rd metatarsal, two unidentified ribs, osteophytosis
348	indeterminate	2-4	Cribra orbitalia
349	male	36-50	Healed fracture to the distal right ulna
350	female	36-50	Partially healed periostitis on the proximal metaphysis of the left tibia
352	male	50+	Healed fracture to the shaft of the left clavicle, healed trauma to the midshaft of the right humerus
354	male	36-50	Osteophytosis on two unidentified thoracic vertebrae
357	male	36-50	Cribra orbitalia
358	indeterminate	5-7	Cribra orbitalia
360	male?	18-20	Cribra orbitalia, porotic hyperostosis
372	indeterminate	0-6 months	Endocranial lesions on parietal bone fragments
373	male	36-50	Healed periostitis on the shafts of the left and right tibiae and fibulae
374	male	36-50	Healed fracture to the shaft of one unidentified rib
380	indeterminate	3-5	Cribra orbitalia
391	male	21-35	Cribra orbitalia, healed periostitis on middle and distal shaft of left and right tibia, osteophytosis on cervical, thoracic, and lumbar vertebrae, lipping and/or porosity on the articular facets of the thoracic vertebrae
393	indeterminate	2-4	Porotic hyperostosis

Table 21. Summary of skeletal pathology in the Kalfata remains.

Skeleton #	Sex	Age (yrs)	Pathology
397	female	21-35	Cribra orbitalia
403	indeterminate	2-4	Cribra orbitalia
413	female	11-13	Cribra orbitalia, endocranial lesions on the frontal bone, porosity on the greater wings of the sphenoid bone
427	male	50+	Osteophytosis on cervical vertebrae and on the 1st sacral vertebra, Schmorl's nodes on lower thoracic vertebrae
431	indeterminate	6-7	Porotic hyperostosis, porosity on right maxillary and left and right zygomatic bones
436	male	21-35	Schmorl's nodes on the 5th to 12th thoracic vertebrae, the lumbar vertebrae, and the 1st sacral vertebra
437	female	36-50	Healed fracture to the distal shaft of left ulna, small osteoma on the distal shaft of the left tibia, Schmorl's nodes on the lumbar vertebrae, osteophytosis on five thoracic vertebrae
438	female	50+	Cribra orbitalia, Schmorl's nodes on thoracic and lumbar vertebrae, fusion of a middle and distal phalanx of the foot
440	indeterminate	6-8	Cribra orbitalia, porotic hyperostosis
442	female	36-50	Slight to moderate lipping around the glenoid fossa of the left and right scapulae and distal left humerus, osteophytosis on one cervical, 6 thoracic, and 4 lumbar vertebrae
443	indeterminate	9-11	Cribra orbitalia
445	female	36-50	Fusion of 3rd and 4th thoracic vertebrae, osteophytosis on 7th, 8th, and 9th thoracic vertebrae
447	male	36-50	Cribra orbitalia, osteophytosis on 8th, 9th, 10th, and 11th thoracic vertebrae and the 4th and 5th lumbar vertebrae, fusion of 9th and 10th thoracic vertebrae, spondylolysis of the 5th lumbar vertebra
448a	indeterminate	4-6	Cribra orbitalia
456	female	50+	Cribra orbitalia, healed fracture to the right pubic bone, fusion of 4 unidentified thoracic vertebrae, osteophytosis on the 3rd, 4th and 5th lumbar vertebrae
458	female	50+	Biparietal thinning, osteophytosis on 5th and 6th cervical vertebrae
?*	indeterminate	2-4	Cribra orbitalia
?	indeterminate	3-4	Cribra orbitalia
?	male	50+	Cribra orbitalia, healed fractures to the shafts of two rib fragments
?	female	21-35	Healed periostitis on midshaft of left and right tibia
?	indeterminate	11-13	Cribra orbitalia
?	female	<50	Lipping around the glenoid fossa of the right scapula, osteophytosis on 5th lumbar and 1st sacral vertebrae
?	male	36-50	Schmorl's node on an unidentified thoracic vertebra, osteophytosis on two unidentified thoracic vertebrae and on the lumbar vertebrae

* indicates individuals of unknown provenience

Table 21. Summary of skeletal pathology in the Kalfata remains.