

COMMUNITY HEALTH AT NEMEA, GREECE: A BIOARCHAEOLOGICAL APPROACH
TO THE IMPACT OF SOCIOPOLITICAL CHANGE IN BYZANTIUM

By

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ABSTRACT

COMMUNITY HEALTH AT NEMEA, GREECE: A BIOARCHAEOLOGICAL APPROACH TO THE IMPACT OF SOCIOPOLITICAL CHANGE IN BYZANTIUM

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This dissertation investigates the biological consequences of sociopolitical transformation in Byzantine Greece using a comparative analysis of two human skeletal samples ($N=259$) from the site of ancient Nemea. The skeletal samples from Nemea represent agricultural communities that lived at the site during the Early Christian (5th-6th centuries AD) and Middle to Late Byzantine (12th-13th centuries AD) periods. In the latter period, southern Greece was invaded by western Europeans and the Byzantine Empire experienced changes in political administration that had lasting, disruptive effects. Such events tend to dominate historical narratives and have influenced the interpretation of archaeological patterns, yet few studies have utilized human skeletal remains as an independent line of evidence to explore their impact on local Greek communities.

The bioarchaeological approach employed in this research integrates osteological, archaeological, and historical datasets in the reconstruction of patterns of physiological stress and activity in order to test the following hypotheses related to the biological and social consequences of alterations to Byzantine Greek society: (1) political instability and invasions diminished the quality of life of the Middle to Late Byzantine community at Nemea; (2) different spheres of activity for men and women resulted in sex-based differences in health within the Early Christian and Byzantine communities; and (3) burial location at Nemea was influenced by the social hierarchy.

The results of the skeletal analysis demonstrate that, despite living through a period of administrative problems and Frankish conquest, the individuals from the Middle to Late Byzantine period exhibit prevalence rates of paleopathological conditions and mortality patterns that are markedly similar to those of their Early Christian counterparts. While few skeletal health disparities were found between males and females, significant differences in the prevalence rates of cribra orbitalia and osteoarthritis in the Early Christian sample lend support to arguments concerning gendered expectations of behavior and a gendered division of labor in Byzantium. Finally, analyses of the spatial distribution of paleopathological conditions across the mortuary space of Nemea reveal limited evidence of patterns consistent with the organization of burials according to the social hierarchy. Instead, the organizing principles of the cemeteries of each period can be linked to changes in Byzantine socioreligious notions of the community and the family. With few exceptions, the results of this research demonstrate that the health and well-being of each community at Nemea was more dependent on local conditions than on the state-level sociopolitical changes that figure prominently in Byzantine historical narratives.

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To my parents, Mark and Jonelle, and my grandmother, Virginia

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collected in her dissertation research for comparative purposes in my own. It is my hope that the present research can serve as a jumping off point for future interdisciplinary investigations of health and burial practices in Byzantine Greece.

Inevitably the goals of a dissertation demand that one work to acquire new skills, however successfully. I am indebted to Sarah AcMoody and Dr. Jon Frey for their assistance building a functional GIS for the analysis of the burials at Nemea. It is impossible to estimate the number of frustrated hours, late nights, and cups of coffee that were associated with this task. It would also have been impossible for me to complete it without you.

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CHAPTER 1: INTRODUCTION

Sociopolitical Change and the Byzantine Greek Countryside

A desire on the part of scholars to investigate the daily lives of all members of Byzantine society has come slowly and even reluctantly. From the perspective of archaeology, the study of the post-Roman eastern Mediterranean in general developed more slowly than that of the Classical period as a result of intellectual traditions in the field of classical archaeology. In Greece, the Byzantine period has in the past been viewed as an unfortunate chapter in the nation's history, separating modern Greece from its rich classical heritage (Athanassopoulos 2008; Bowden 2009). Even when archaeologists began to pay greater attention to the Byzantine components of classical sites during the 20th century, their focus was firmly on the study of art and architecture rather than on the study of the daily lives of ordinary people (Athanassopoulos 2008). Only through recent efforts involving regional archaeological survey has a clearer picture of the Byzantine Greek countryside begun to take shape (Athanassopoulos 1993, 2008, 2010; Kardulias 1997).

Achieving an understanding of daily life for average people in the Byzantine Empire through written sources has also proven difficult. Byzantine historians, both ancient and modern, tend to place considerable emphasis on emperors, imperial politics, wars, and the effects of such events on Constantinople or other major urban centers. The problem for modern historians is that the voices that have survived in the historical record are often those of the privileged, who wrote in many cases to promote particular interests. The details that emerge from those sources are, unsurprisingly, largely concerned with elite life. Even broad chronicles of the Byzantine period are typically focused on large-scale political and military events (Athanassopoulos 1993). This myopic view of Byzantine society is somewhat paradoxical given that peasants formed the

backbone of Byzantium. It was, in fact, individuals residing in the countryside who made up the greatest proportion of the Byzantine Empire's population, workforce, and tax base (Kazhdan 1997).

In Greece human skeletal remains and, to a much greater degree, their mortuary contexts have been underutilized as sources of evidence capable of shedding light on the health, living conditions, and social organization of this neglected segment of Byzantine society. This dissertation aims to contribute to our current understanding of life and death in the Early Christian and Byzantine Greek countryside through a bioarchaeological analysis of the burials and human skeletal samples from the site of ancient Nemea. The individuals buried within the Sanctuary of Zeus at Nemea represent members of two distinct farming communities that occupied the site during the Early Christian (5th-6th centuries AD) and Middle to Late Byzantine (12th-13th centuries AD) periods. Each of those communities existed during periods of significant sociopolitical change in the Byzantine Empire. This dissertation, however, explores the possibility that the events of the Middle to Late Byzantine period had significant, negative consequences for the living conditions of the inhabitants of the Nemea Valley.

During the late 12th century AD, marginal areas of the empire such as the countryside of southern Greece experienced a deterioration of the provincial administration that exposed local populations to excessive taxation and a lack of services (Herrin 1975, 1985). Even more serious, however, were the results of the Fourth Crusade, which abandoned the goal of conquering the Holy Land and sacked Constantinople, the capital of the Byzantine Empire in 1204 AD. This disaster ushered in a period of political fragmentation and social transformation under western powers. The population of the Peloponnese experienced some of the most direct consequences of

the Fourth Crusade when Frankish knights invaded and conquered territory from Corinth to Monemvasia during the first half of the 13th century. In the years that followed this conquest, the Franks imposed a western-style feudal system on the local Greek population and, as a result, the position of local peasants at the bottom of the social hierarchy became both legal and hereditary (Jacoby 1973, 1989, 2008; Lock 1995).

A number of questions related to the events of the Middle to Late Byzantine transition lend themselves to further investigation. Some of those questions are related to the possibility that living conditions were affected. For example, in what ways (if any) did the strained relationships between the central and provincial administrations during the late 12th century impact individuals living in the Greek countryside? Did the imposition of a western-style feudal system following Frankish conquest worsen living conditions and increase workload for the local Greek population? Did dietary practices change with western influence? Other questions are more focused on what the material evidence, such as information obtained from burials, can reveal about social structure and sociocultural change. For example, what do differences in burial practices suggest about diachronic changes in the nature of Byzantine Christianity? Can western influence be detected among those burial practices? What is the significance of the spatial organization of Byzantine burials? What can burial practices tell us about diachronic changes in the structure of the Byzantine family? Were gender roles and gender relationships affected? While it is beyond the scope of this dissertation to answer all of these questions in a complete manner, it is possible to address many of them in a general way using a multidimensional bioarchaeological approach.

The Contribution of Bioarchaeology

Bioarchaeologists are uniquely positioned to use skeletal analysis in conjunction with archaeological and historical data to test hypotheses about ancient communities. The human skeleton is dynamic in that it is capable of responding to changing biomechanical demands and physiological stressors. If episodes of stress are not mitigated by factors such as an individual's biological resistance and/or cultural mechanisms, they may trigger a response observable in skeletal and dental tissue (Goodman et al. 1984, 1988). In this way, the prevalence rates of skeletal indicators of physiological disruption such as enamel defects, porotic cranial lesions, and reactive bone formation in ancient skeletal samples may be extremely informative about health and living conditions in the past.

Analyses of skeletal indicators of health and disease become even more powerful when combined with a thorough understanding of the archaeological and historical context of human remains. This was demonstrated by Jane Buikstra in the 1970s when she outlined a "bio-archaeological" research program that focused on the integration of archaeological and osteological datasets in the examination of biocultural change in the Illinois River valley during the Middle to Late Woodland transition (1977:69). Buikstra recognized the advantages of an interdisciplinary study of cemeteries and their contexts, such as controlling (at least to the extent possible) for sampling bias resulting from the mortuary program and identifying examples of differential susceptibility to disease.

Goldstein (1976, 1981) has argued convincingly that spatial organization is one of the most important aspects of the archaeological context to consider in the analysis of mortuary sites. The arrangement and ultimate form of cemeteries are the result of conscious choices made by groups of people and are therefore unlikely to be random. For example, spatial relationships

between burials or groups of burials may reflect social relationships during life. With this in mind, the investigation of the spatial component of cemeteries can potentially provide information on status distinctions, the organization of the family, and other characteristics of the social structure of a society (Goldstein 1981:57). The incorporation of skeletal analysis offers an independent line of evidence that can be used to test hypotheses about status differentiation or family groupings made based on the spatial data.

Bioarchaeology can make similar contributions when applied to mortuary sites dating to historical periods. In this case, data on skeletal health can be carefully integrated with archaeological and textual data to fill in gaps in the historical record and test commonly held assumptions about historical processes and events (Perry 2002, 2007). In this way, combining skeletal data with archaeological and historical context in an interdisciplinary bioarchaeological approach results in a richer analysis—one that is capable of addressing the types of broader questions concerning the living conditions of Greek populations under Frankish rule.

Bioarchaeological Research in the Eastern Mediterranean

Until relatively recently, it has been uncommon for studies of human skeletal samples recovered from archaeological sites in the eastern Mediterranean to employ an integrative bioarchaeological approach. The disconnect between the study of human skeletons and the analysis of their contexts in this region can be traced to the excavations of classical sites during the 19th and early 20th century, which were generally unconcerned with human remains. If skeletons were analyzed at all, they were typically subjected to craniometric assessments for the purposes of establishing racial typologies or tracing population origins (MacKinnon 2007;

Roberts et al. 2005).¹ The emphasis on “race” was characteristic of physical anthropology at the time and the incentive to demonstrate biological relationships between ancient and modern populations in Europe was driven by the culture historical approach and colonialist ideas (Armelagos 2003; Armelagos and Van Gerven 2003; MacKinnon 2007). The sole emphasis on osteological measurements and extended descriptions also meant that a large amount of data was collected without substantial reference to the archaeological and historical contexts of the remains (Buikstra and Lagia 2009). This not only minimized communication between physical anthropologists and other researchers, but also created a model in which skeletal analysis was viewed as a “post-excavation” specialization (MacKinnon 2007:496) and osteological findings were routinely relegated to site report appendices (Larsen 2006; Roberts et al. 2005).

Around the mid-20th century, studies of skeletal samples from the ancient Mediterranean began to address health-related questions more frequently. The work of J. Lawrence Angel figured most prominently in this transition. While some of Angel’s early research did focus on “race,” his major contributions were in the areas of health, disease, and adaptation. For example, Angel’s work in Greece and Turkey was focused on the relationships between porotic hyperostosis, inherited anemias, and *falciparum* malaria. He observed that the geographical distributions of malaria and genes for abnormal hemoglobin overlapped. Furthermore, he demonstrated ancient populations living in marshy areas within malarial regions and during periods when agricultural techniques were poor tended to exhibit greater frequencies of porotic hyperostosis. Based on this evidence, Angel argued that porotic hyperostosis in the eastern

¹ Unfortunately it was also common in this period to discard both human and animal bone discovered during excavation. Nemea is a case in point as the 1920s excavations recorded a number of burials, mostly in and around the Early Christian basilica, containing human remains that were not saved. Burials containing poorly preserved skeletons were likewise discarded in the 1960s excavations.

Mediterranean was probably a skeletal manifestation of one of the genetic anemias, which provided heterozygous individuals with a degree of protection against malaria (Angel 1966, 1967, 1978). His conclusions remain relevant to studies of health in the region as the precise etiology of cranial lesions continues to be an area of active research and debate.

Angel's emphasis on health in the eastern Mediterranean has expanded in a number of directions in recent years. In Greece, numerous studies that employ a paleopathological methodology emphasizing multiple indicators of stress and disease have been carried out on skeletal samples from a variety of time periods (e.g., Agelarakis 1997; Barnes 2003; Bourbou 2003; Bourbou and Tsilipakou 2009; Fox-Leonard 1997; Fox 2005; Papageorgopoulou and Xiotiris 2009; Papathanasiou et al. 2000, 2009). Many of these publications have taken into account the historical context of the remains and the possible effects of historical events on the overall health of the represented communities. For example, Fox's (2005) comparative assessment of Hellenistic and Roman samples from Paphos and Corinth found that the latter was characterized by greater childhood mortality, an elevated prevalence rate of enamel hypoplasias, and shorter stature. She suggests that those differences may have been related to more unstable living conditions at Corinth, which followed its sack by the Romans in 146 BC.

Approaches that combine more traditional bioarchaeological methods with new analytical techniques represent another research trend in the bioarchaeological analysis of Greek skeletal material. For example, trace element and stable isotope studies have provided new insights into ancient dietary practices (Bourbou and Richards 2007; Bourbou et al. 2011; Garvie-Lok 2001; Papageorgopoulou and Xiotiris 2009; Papathanasiou et al. 2000, 2009; Petrousa et al. 2009) as well as population migration (Garvie-Lok 2009). Garvie-Lok's (2001) work is particularly relevant to the present research as she included twenty-nine Early Christian and twenty-five

Middle to Late Byzantine individuals from Nemea in her isotopic study of diet in Medieval Greece. Her results suggest that dietary composition in both periods was quite similar and focused on grains and terrestrial animal proteins. Millet may also have been consumed at Nemea—an interesting finding given that Byzantine dieticians viewed it unfavorably (Kazhdan 1997). Garvie-Lok (2009) has also provided confirmation of immigration to the northeastern Peloponnese during the Frankish period through an analysis of stable oxygen isotope ratios from 17 individuals buried at Corinth.

Perhaps in response to the recent call for researchers to use osteological data as an independent line of evidence with which to evaluate historical narratives (e.g., Perry 2002, 2007), studies of skeletal paleopathology in Greece are increasingly focused on examining the ability of ancient communities to adapt to cultural and environmental change. For example, the effects of natural disasters and invasions have been evaluated for proto-Byzantine samples from Crete and the southern Peloponnese (Bourbou 2003, 2010), as well as from northern Greece (Bourbou and Tsilipakou 2009). Bourbou (2003) found that those external factors had a greater impact on health at Eleutherna, Crete than at Messene in southern Greece during the 6th-7th centuries AD. Children at Eleutherna seem to have been particularly affected by a decline in nutrition and living conditions and display greater mortality along with elevated prevalence rates of anemia and scurvy. Bourbou and Tsilipakou's (2009) assessment of a contemporaneous skeletal sample from Sourtara in northern Greece reveals low levels of infections and general good health and nutritional status. Together these studies suggest that the health consequences of disruptive events for Greek communities during this period depended largely upon local conditions.

The present study contributes to this body of research an investigation of the impact of sociopolitical changes suggested by traditional historical narratives of Late Antiquity and the Middle to Late Byzantine transition on small-scale agricultural communities in the northeastern Peloponnese. It is also an overarching goal of this dissertation to expand upon recent research models by using an approach that explicitly tests hypotheses about mortuary practice in Byzantium. In this way, I follow Buikstra and Lagia (2009) in their recommendation of a problem-oriented approach to the study of cemeteries and human remains. As discussed above, the analysis of human skeletons in conjunction with their archaeological context represents an important break with tradition—one that is now being pursued more frequently (see, for example, Morris [1992], Paine et al. [2007], Perry [2002, 2007], Schepartz et al. [2009], Triantaphyllou [2001], Tritsaroli [2006], and Tritsaroli and Valentin [2008]). Recognition of the interdependence of osteological and archaeological datasets is crucial for the continued development of our understanding of cemetery organization in the Byzantine eastern Mediterranean.

The burials and samples of human skeletons from Nemea, which will be presented in detail in Chapter Six, are in many ways ideal for the examination of the impact of sociopolitical transformation in southern Greece during the Byzantine period. Although they represent two different communities from distinct periods of time, the similarities between those communities are marked. Based on the archaeological evidence, which is outlined in detail in Chapter Three, each community at Nemea was agricultural in character and neither was particularly wealthy. Because both groups of people lived and worked at the same site, it is unlikely that they experienced dramatic contrasts in environmental conditions or access to local resources. The

communities at Nemea also generally shared a Christian worldview.² The fact that these basic features of the two communities held more or less constant through time makes any apparent differences, such as diachronic changes in burial practices, all the more revealing. Variability in the prevalence rates of paleopathological conditions and in the mortuary domain provides perhaps the best sources of data with which to evaluate the effects of cultural transformation at Nemea.

Nemea and its Environs

Ancient Nemea is located near the southern end of a narrow valley in the northeastern Peloponnese to the southwest of Corinth and north of Mycenae and Argos (Figure 1.1). At roughly 330 m above sea level, the site is also the point of origin for the Nemea River, which drains northward out of the valley toward the Corinthian Gulf (Miller 1990). The contours of the valley along the river's course are well defined by the surrounding hills. To the southeast is Evangelistria Hill, on which a modern church and the remains of an Early Christian basilica are located. The ridge that forms the eastern boundary of the valley culminates at Mount Phoukas, while the western hills give rise to Mount Prophitis Ilias closer to the middle of the valley's north-south length (Wright et al. 1990).

Access to neighboring valleys and the maintenance of connections with settlements in adjacent areas have played a significant role in Nemea's history. The Nemea Valley is located near to various passes linking ancient cities and facilitating travel in the northeastern Peloponnese (Wright 1982). A minor pass in the southeast corner of the valley near the sanctuary

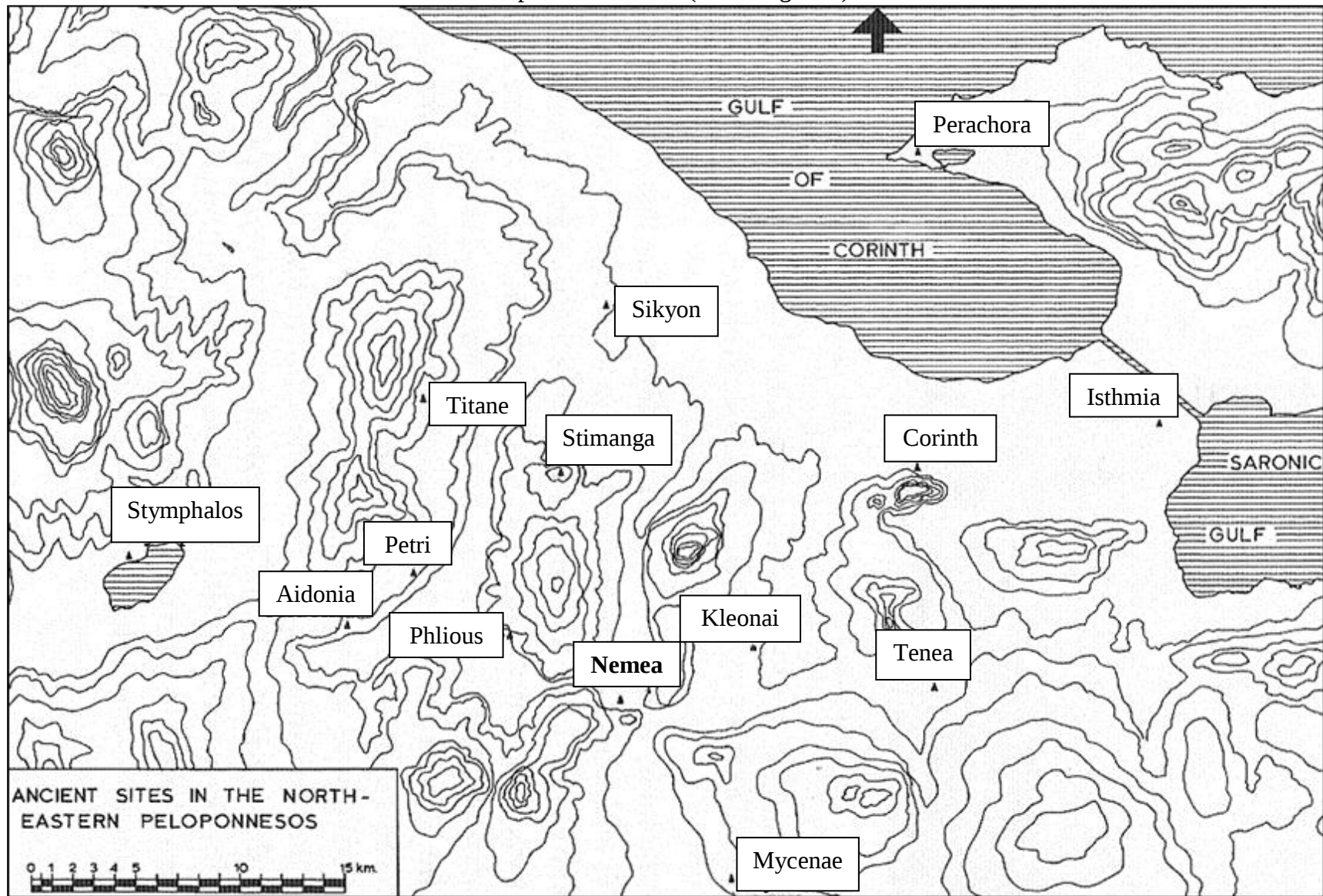
² Each community at Nemea utilized at least one Christian basilica, albeit in different ways. The Middle to Late Byzantine community buried its dead within and outside of the ruins of the basilica constructed in the former athletic sanctuary. There are very few examples of burials that exhibited non-Christian features or perhaps a mix of Christian and pagan themes. These exceptions are discussed in Chapters Eight and Nine.

of Zeus leads east into the Longopotamos Valley, in which lies ancient Kleonai. From there one gains access south to the Tretos pass connecting the Corinthia and the Argolid. Exiting the Nemea Valley to the west, one enters the Phliasian Plain, which contains the modern town of New Nemea and the ancient city-state of Phlius. Another important route south into the Argive Plain, the Kelossa Pass, is accessible from this point as well. The significance of the location of Nemea and its neighbors has recently been demonstrated by Marchand (2009), who points out that the Corinth-Argos road, which passed by Kleonai and utilized the Tretos pass, functioned not only as the major north-south link between those two cities, but also as an access point to other routes heading in various directions through the northeastern Peloponnese in antiquity. Nemea's location is thus probably one of the major reasons for which periods of occupation of the site have consistently coincided with periods of higher population and settlement densities throughout the region (Wright et al. 1990).

The unique geographical and geological conditions that characterize the Nemea Valley make it ideal for agriculture when properly drained. Alluvium from the encircling hills has accumulated on the valley floor since the Neolithic period and the excellent fertility of this fill is illustrated by the presence of numerous vineyards, olive groves, and fruit trees in addition to crops such as wheat and barley (Miller 1990; Wright 1982; Wright et al. 1990). Nemea's height above sea level and exposure to mountain winds also provide it with a unique microclimate. Summers tend to be somewhat cooler than in other areas of Greece, while winters bring a significant amount of moisture and precipitation that tapers off by early summer (Miller 1990). Water is also available locally in the form of springs located along the margins of the valley and aquifers underneath the valley floor (Wright 1982). The flow of the Nemea River has always been crucial to drainage of the valley for agricultural purposes and the promotion of more

habitable conditions in general. Early modern travelers visiting Nemea in the 19th century characterized the Nemea Valley, which was blocked at the time, as a sparsely occupied and unhealthy marshland (Athanasopoulos 1993). The challenge of maintaining adequate drainage is such that Wright et al. (1990) suggest adequate manpower has been a prerequisite to permanent settlement at Nemea.

Figure 1.1: Location of Nemea in the Northeastern Peloponnese.
Adapted from Miller (1990: Figure 1).



Phases of Occupation and Activity

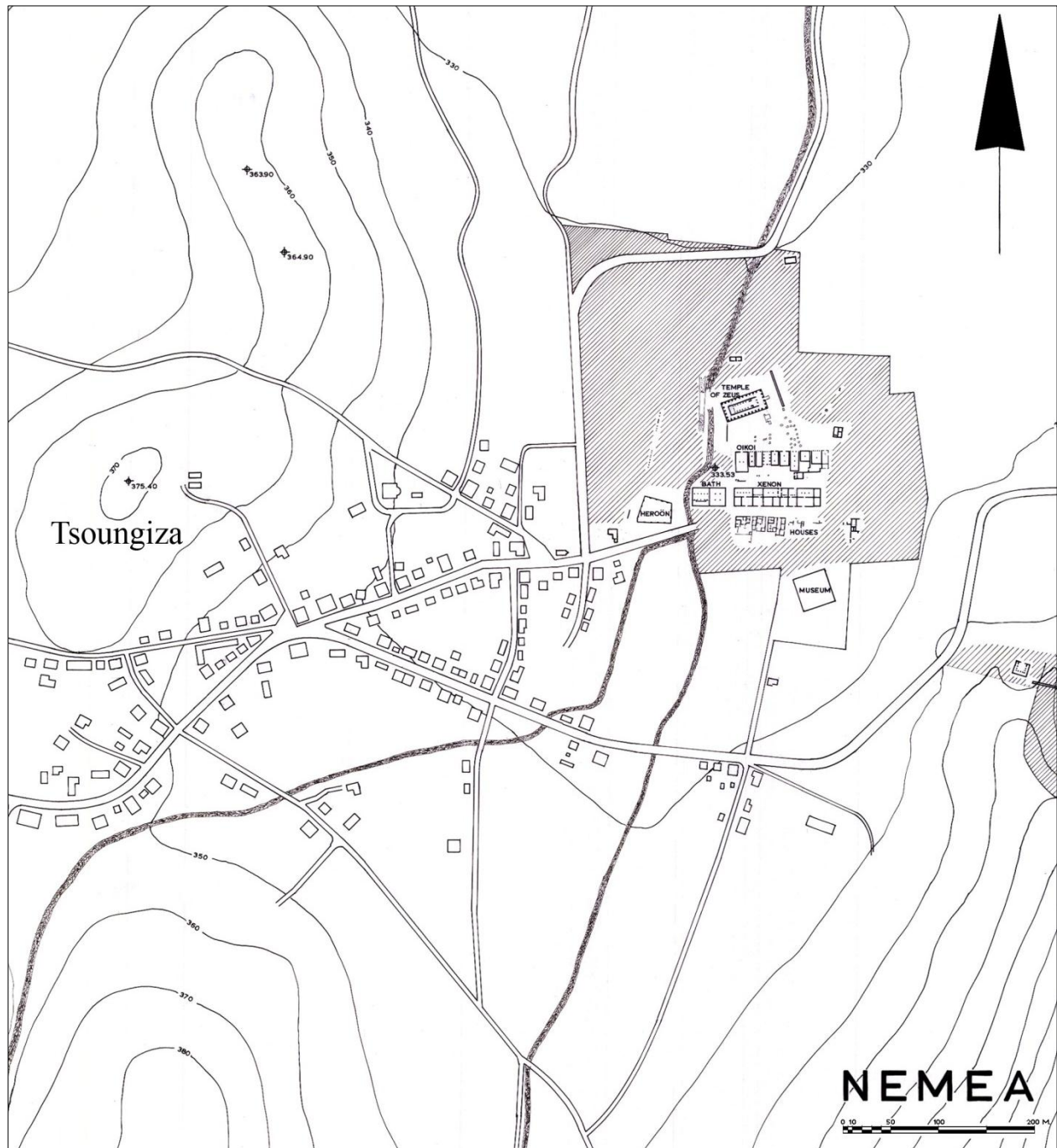
The earliest clear evidence of habitation in the Nemea Valley comes from the Tsoungiza Hill located west of the Sanctuary of Zeus (Figure 1.2). A number of refuse pits containing, among other finds, substantial quantities of Early Neolithic pottery, obsidian and stone tools, and animal bone fragments have been excavated by Blegen (1927) and Miller (1975, 1976, 1980). Although the precise location of the Early Neolithic settlement has not been determined, the quantity of material recovered from various areas on the hill suggests that it must have been extensive (Wright et al. 1990).

Regardless of the location of the Neolithic settlement, Tsoungiza was certainly occupied by the Early Bronze Age. Blegen (1927) identified house foundations along with associated pottery and storage vessels dating to the Early, Middle, and Late Helladic periods. A re-excavation of the area explored by Blegen and Harland (unpublished) in the 1920s revealed additional Early Helladic ceramics and architectural remains (Pullen 1986; Wright et al. 1990). The Early Helladic settlement appears to have been concentrated on the crest of the hill.

While the Middle Bronze Age is not well represented, Miller's (1975, 1976, 1980) excavations produced significant amounts of high quality Late Helladic as well as Middle Helladic pottery. Adding to this evidence, Wright (1982) identified a burned structure containing domestic pottery and a hearth dating to the end of the Middle Helladic or Early Late Helladic period. The Nemea Valley Archaeological Project survey has since also identified a number of sites including Tsoungiza as well as areas within the Sanctuary of Zeus that contained Late Bronze Age finds (Cherry et al. 2000; Wright et al. 1990). The distribution and quantity of material recovered suggests that the Mycenaean settlement on and associated with Tsoungiza

was the dominant site within a hierarchy of settlements in the survey area and must have been of some regional importance.

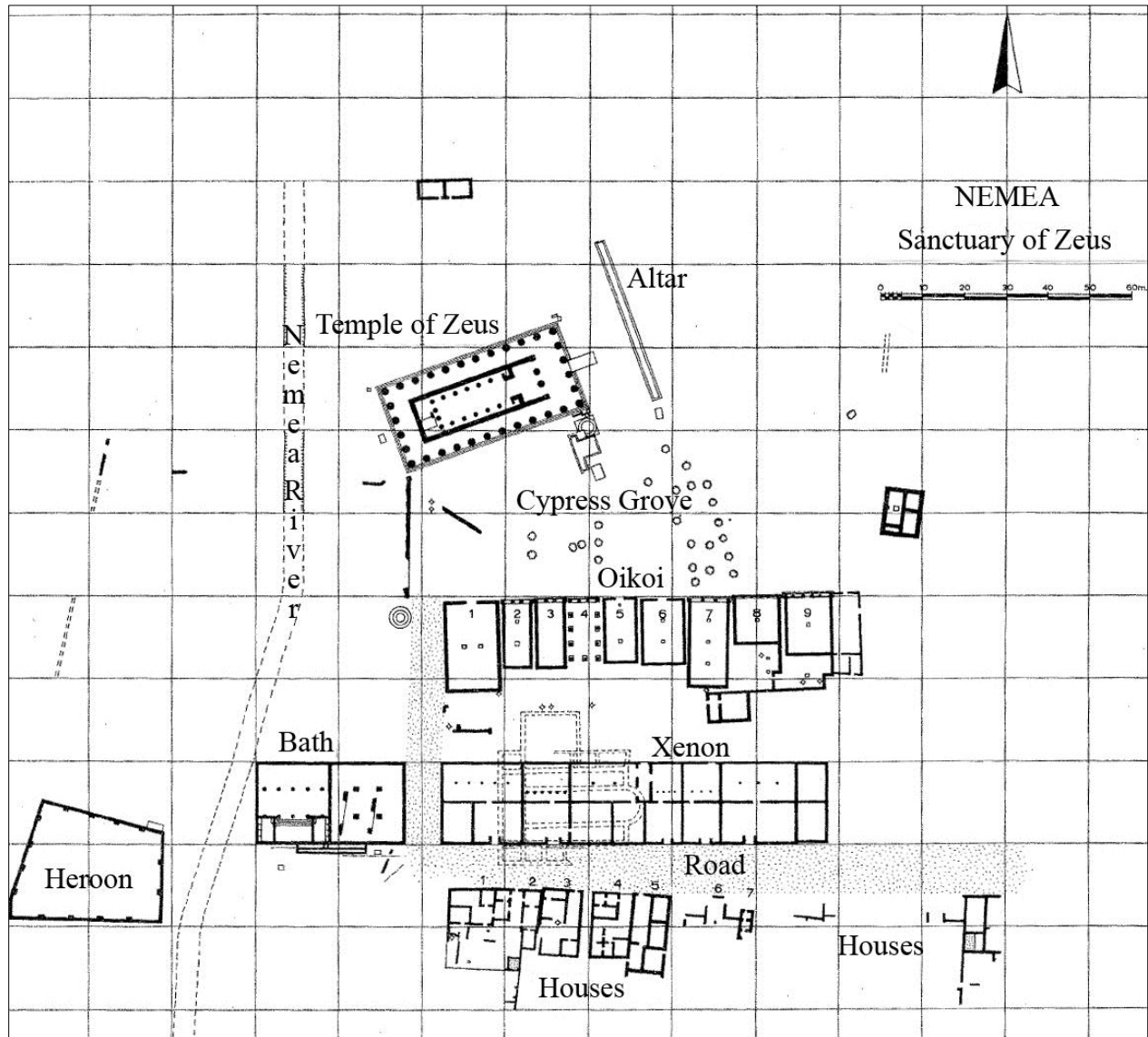
Figure 1.2: Site Plan of Nemea Showing the Sanctuary of Zeus and the Tsoungiza Hill.
Courtesy Kim Shelton.



Significant human presence in the Nemea Valley following the Bronze Age took on a very different character as permanent settlement at Nemea was replaced by the sporadic habitation of an athletic sanctuary. The Nemean Games were established in 573 BC, joining those held at Olympia, Delphi, and Isthmia in the pan-Hellenic cycle. While the schedule of the games operated on a four-year cycle, those held at Nemea took place every two years. It was only during perhaps the weeks leading up to the games and during the festival itself that the Nemea Valley would have seen great activity as athletes and visitors arrived at the site. At all other times, only a small group of caretakers and priests would have been present (Frey 1998; Miller 1990).

Nemea functioned as an athletic sanctuary into the 3rd century BC. However, the games were moved to Argos around 400 BC following a violent conflict that resulted in damage throughout the sanctuary and destruction of the Archaic Temple of Zeus (Miller 1977, 1979, 1990, 2006). A period of new construction in the last third of the 4th century BC marked the return of the games to Nemea, although they continued to be held periodically at Argos depending on the political situation between the Argives and the Macedonians (Miller 1978, 1982). Much of the architecture that can be observed at the site today including the Temple of Zeus, the Bath, the Xenon, and the Stadium (Figure 1.3) dates to that time (Birge et al. 1992; Miller 1977). The games moved permanently to Argos by 271 BC (Miller 2006).

Figure 1.3: Detail of the Sanctuary of Nemean Zeus. Adapted from Miller (1988: Figure 1).



It is with the next two phases of activity at Nemea that the present study is primarily concerned. In the 5th and then again in the 12th century AD, Nemea was occupied on a permanent basis by agricultural communities. In each case, the area of the former athletic sanctuary was converted to farming plots and, especially during the 5th-6th century, portions of its classical buildings were reused in the construction of ecclesiastical and domestic architecture. Importantly, the sanctuary served as the focal point of religious activity for the Early Christian

and Byzantine communities. A basilica constructed around the 6th century AD (Miller 1981) on top of the Xenon that centuries earlier housed competitors in the games would have been the most prominent artificial component of the landscape. It was within and adjacent to this basilica that many of the nearly 300 burials at Nemea were placed during the 5th-6th and 12th-13th centuries AD.³

Research Goals

The aim of this research is to examine the ways in which sociopolitical transformations affected the health, living conditions, and socioreligious behavior of rural Greek communities during the Byzantine period. This is achieved through a multidimensional bioarchaeological approach that considers evidence of skeletal stress in conjunction with mortuary archaeology and historical data. While the research hypotheses and expectations presented in subsequent chapters are based on arguments presented by historians as well as by archaeologists whose interpretations relied on written evidence, my research has been conducted independently of traditional historical narratives and, in this way, my results also serve as a means of evaluating those narratives. The possibility that the impact of sociopolitical changes and disruptive events has been exaggerated in the historical record is always considered.

The following are the principal goals of this research:

1. This study compares the prevalence rates of skeletal indicators of physiological stress and activity between the Early Christian and Middle to Late Byzantine communities at Nemea. The purpose of this research component is to determine whether or not the dramatic events of the

³ This figure represents the number of Early Christian and Byzantine burials that have been excavated to date at Nemea. It is possible that additional burials exist in unexcavated areas of the site.

latter period, such as the Frankish conquest of southern Greece during the Fourth Crusade, created living conditions that were comparatively worse than those of the Early Christian community.

2. This study compares the prevalence rates of skeletal indicators of physiological stress and activity between males and females within each period. Historical data suggests that women were a marginalized group in Byzantine society. The extent to which sex-based health disparities during this period have been examined using biological data, however, is limited. The results of this research shed light on gender roles and relationships in the Byzantine Greek countryside.

3. This study compares the prevalence rates of skeletal indicators of physiological stress and activity between the skeletal samples from Nemea and contemporaneous samples from central Greece. This research component places the results from Nemea into a broader, regional context and also allows for an examination of differences in health status between rural and urban sites.

4. This study tests archaeologically derived hypotheses about the relationship between burial location and social status in the Byzantine Empire. The mortuary space at Nemea is examined both visually and using statistical analysis for spatial concentrations of the presence or absence of physiological stress indicators that might be indicative of status or group differentiation expressed in burial location.

The specific research questions, hypotheses, and expectations of this research are outlined in Chapter Five.

Outline of the Dissertation

The remaining chapters of this dissertation are organized in the following manner:

Chapter Two outlines the theoretical perspectives and models that I draw upon in my analysis of physiological stress and mortuary practice at Nemea. Chapter Three places the site of Nemea into the larger context of Greece and the eastern Mediterranean in both Late Antiquity and the Middle to Late Byzantine period. It also provides a brief overview of the archaeology of Nemea with an emphasis on its settlements and on the organization and character of the burials within the Sanctuary of Zeus. Funerary ritual and burial practices in Late Antiquity and Byzantium are the subjects of Chapter Four. In chapters Five and Six I set forth my research design. There I outline the research questions and hypotheses tested, introduce the samples of burials and human skeletons from Nemea, and review the paleopathological variables and recording system used in the assessment of physiological stress. The results of the skeletal and mortuary analyses are outlined in chapters Seven and Eight, respectively. Chapter Nine synthesizes the results of this research and discusses their implications for health and living conditions, mortuary behavior, and the effects of sociopolitical change in the Byzantine Greek countryside. My conclusions and the directions for future research at Nemea and in the broader region of Greece are presented in Chapter Ten.

CHAPTER 2: BIOARCHAEOLOGY AND MORTUARY ANALYSIS

This chapter introduces the concept of physiological stress and discusses the biological mechanisms responsible for producing the skeletal and dental paleopathologies analyzed in this research. I also provide theoretical background necessary for the study and interpretation of aspects of burial customs that may be observable in the archaeological record. Although fundamental principles of skeletal and mortuary analysis are treated separately here, I argue for and later employ an approach that integrates the two datasets. When osteological data on stress is studied in conjunction with archaeological evidence from burials, the results are uniquely informative about fundamental aspects of past societies such as changes in the nature of religious practice through time, status differences, patterns of kinship and descent, and even patterns of gender.

Physiological Stress and the Skeleton

Bioarchaeologists generally conceptualize stress as a “biobehavioral response” to external stimuli that are either perceived or part of the physical environment (Goodman et al. 1988:173). Because skeletal tissue is dynamic and continuously responds to changing physiological demands, episodes of physiological stress often leave characteristic indicators on both skeletal and dental tissues (Martin et al. 1998). In this way, human skeletons recovered from ancient burials may provide a record of the life stresses experienced by the individuals they represent.

Goodman et al. (1984, 1988) have proposed a generalized model of the potential for physiological disruption to produce skeletal changes. The skeletal manifestation of stress is dependent upon three factors: (1) environmental constraints, (2) cultural systems, and (3) host resistance or individual susceptibility. Environmental constraints include external stressors as

well as the availability of resources. Human cultural systems, such as agriculture, may act as buffering mechanisms against problems with the living environment, but are also capable of creating additional stressors. Bush (1991), for example, points out that an unstable social environment is an important potential source of psychological stress. The impact of stressors that are not alleviated through external means depends on the biological resistance of the individual. Prolonged episodes of stress that are unmitigated by cultural mechanisms or individual biological resistance have functional consequences that can impact quality and duration of life (Larsen 1997). Such episodes are the most likely to disrupt normal processes of growth and development and leave indicators on the skeleton.

Recent large-scale projects have used multiple stress indicators in conjunction to standardize the assessment of health from a skeletal sample. Steckel et al. (2002a, 2002b, 2006) have even developed a health index that attempts to quantify quality of life, a generally agreed upon component of health. In this method, an index value for a skeletal sample is calculated based on the presence and expression of certain paleopathological variables as well as on the estimated duration for which those conditions were experienced. The variables chosen for the index are aimed at identifying physiological stress during all life stages. In the health index approach, health is viewed as a composite of an individual's life experience with factors such as nutrition, disease, and occupational stress. However, there is some debate among physical anthropologists and paleopathologists as to whether the analysis of physiological stress indicators actually measures the "health" of individuals or groups. In particular, it is unclear whether or not combining variables that each measure something different into a singular value representing health is a useful approach for understanding or reconstructing the experiences of a given community in the past. Furthermore, defining health is problematic in the first place. Most

definitions, whether ancient or modern, include components related to mental and social well-being that cannot be measured from skeletal remains (King 2005; Waldron 2009).

Because of the shortcomings of the health index approach, especially given the goals of this dissertation, this research uses indicators of physiological stress suggested by Steckel et al. (2002a, 2002b, 2006) independently as opposed to calculating composite values representative of the health of the two communities from Nemea. This approach makes possible general statements regarding the health status of the Nemea communities but, more importantly, allows detailed conclusions about specific aspects of health to be drawn from the prevalence and expression of each independent skeletal marker of stress. The paleopathological conditions examined in this study include linear enamel hypoplasias, porotic hyperostosis, cribra orbitalia, osteoarthritis, periosteal reactions, and trauma. The following sections examine each of those conditions in turn.

Enamel Hypoplasias

Enamel hypoplasias are areas of reduced enamel thickness that appear as horizontal lines, pits, or patches on the teeth. They are created when physiological stressors such as nutritional deficiencies and infections interrupt the formation of the enamel (Goodman and Rose 1990; Rose 1977; Steckel et al. 2002b). Tooth enamel is laid down incrementally by cells called ameloblasts that secrete a protein matrix. The progress of enamel layering is recorded within the tooth by internal structures called brown striae of Retzius. Brown striae that run along the sides of tooth crowns also have surface manifestations that take the form of circumferential grooves called perikymata. Most macroscopic defects that appear on the external surfaces of the teeth are linear enamel hypoplasias, which are essentially an abnormal spacing of successive perikyma grooves resulting from premature cessation of ameloblast activity (Hillson 1992, 1996; Hillson and Bond

1997). The activity of ameloblasts is particularly sensitive to metabolic disturbances, making enamel hypoplasias excellent indicators of physiological stress (Larsen 1997). Furthermore, because enamel is not remodeled after being laid down, hypoplastic defects constitute a permanent record of stresses experienced during childhood.

Enamel hypoplasias have been associated with a wide variety of physiological disturbances and must be considered generalized indicators of stress. Roberts and Manchester (2005:75) suggest that the etiologies of dental enamel defects may fall into the categories of systemic metabolic stress, congenital anomalies, and localized trauma. In most cases, enamel hypoplasias visible in archaeologically derived human teeth are interpreted as reflecting acute episodes of disease or malnutrition from which individuals recovered and subsequently continued normal development.

Differences have been demonstrated in the susceptibility of specific teeth to hypoplasia formation (Larsen 1997). In general, anterior teeth are affected more frequently than posterior teeth. Goodman and Rose (1990) further suggest that the permanent maxillary central incisors and the mandibular canines are most susceptible.

Porotic Hyperostosis

Porotic hyperostosis refers to porous lesions appearing on the external surface of the cranial vault. Angel (1966, 1967) suggested this term as a more accurate description of the condition “osteoporosis symmetrica,” previously offered by Hrdlička. The lesions of porotic hyperostosis appear most commonly on the parietal and occipital bones and range in expression from isolated, pinpoint pores to large, coalescing apertures (Stuart-Macadam 1989). It is usually assumed that porotic hyperostosis is associated primarily with stress experienced during

childhood, as lesions characterized as active at the time of death are found more frequently in children than adults (Larsen 1997; Stuart-Macadam 1985; Walker et al. 2009).

Traditionally, porotic hyperostosis and cribra orbitalia (similar lesions appearing in the superior portions of the eye orbits) were viewed as having a common etiology, each being a manifestation of iron-deficiency anemia (e.g., Larsen 1997; Roberts 2005; Stuart-Macadam 1989). The appearance of the condition was normally explained as an expansion of the diploë or marrow containing layer of the skull with concomitant thinning of the outer table in response to the increased need for red blood cell production. While hypotheses on the precise etiology of porotic hyperostosis included such factors as diet (El-Najjar et al. 1982), parasites (Ubelaker 1992), and response to pathogen load (Stuart-Macadam 1992), iron deficiency was understood to be the underlying mechanism.

More recently, however, the link with iron deficiency has been called into question, as has the relationship between porotic hyperostosis and cribra orbitalia. Walker et al. (2009) have argued persuasively that iron deficiency inhibits rather than facilitates the hypertrophic marrow response that may at times be responsible for the appearance of porotic hyperostosis.⁴ However, it should be noted that other researchers have previously argued for the abandonment of an association between iron-deficiency anemia and porotic hyperostosis (e.g., Rothschild 2002a, 2002b; Rothschild and Martin 2006; Waldron 2009). Current research suggests that marrow hypertrophy is likely caused by one of two mechanisms. The first is a hemolytic anemia, such as thalassemia or sickle cell anemia, whereby the destruction of red blood cells occurs at a faster rate than they can be produced by hemopoietic marrow. The second possibility is a megaloblastic

⁴ It is increasingly being recognized that other conditions such as scurvy, rickets, scalp infections, etc. may result in porous cranial lesions that appear similar to those produced by diploic expansion and thinning of the outer table traditionally associated with porotic hyperostosis.

anemia, which is characterized by an enlargement of hemopoietic cells resulting in dyserythropoiesis and subsequent destruction of poorly formed red blood cells. Megaloblastic anemia is commonly caused by deficiencies in folate and/or vitamin B₁₂ (Allen and Casterline-Sabel 2001; Walker et al. 2009; Weatherall and Kwiatkowski 2003).

Based on those findings, Angel's (1966, 1967, 1978) attribution of porotic hyperostosis to a genetic anemia may be correct in some cases. When evaluating porotic hyperostosis in human skeletal samples, especially in the eastern Mediterranean, it is important to distinguish between genetic anemias and those that are related to either problems with nutritional quality or malabsorption. Congenital anemias such as thalassemia have additional skeletal manifestations that include hypertrophy of the facial bones and displacement of dental structures, generalized osteopenia, enlargement of vascular foramina, and premature fusion of epiphyses (Lagia et al. 2007; Tayles 1996; Ortner 2003). Sickle cell anemia has its own unique features such as a relative lack of involvement of the facial bones, depression of vertebral endplates resulting in a "fish vertebra appearance," calcaneal and metacarpal lesions, and localized cranial expansion or "ballooning" (Hershkovitz et al. 1997; Ortner 2003:368).

Cribra Orbitalia

Porous lesions appearing in the eye orbits (cribra orbitalia) have traditionally been given similar treatment as porotic hyperostosis. It has been argued that the two conditions share a common etiology (usually iron-deficiency anemia) and that cribra orbitalia may represent an earlier manifestation of the disease process (Stuart-Macadam 1989). Both parts of this argument are problematic. As discussed above, the link between porous hypertrophic lesions and iron deficiency has been called into question through a better understanding of hematologic

processes. Furthermore, crania often exhibit porotic hyperostosis independently of cribra orbitalia (Walker et al. 2009).

The idea that cribra orbitalia may in fact be caused by a number of different mechanisms, some of which have no necessary association with porotic hyperostosis, is not new (see Ortner and Erickson 1997; Ortner et al. 1999; Schultz 2001). However, this view has gained due attention only quite recently. Of the conditions capable of producing orbital lesions, scurvy (vitamin C deficiency) deserves special mention. Vitamin C must be obtained from the diet in humans and prolonged deficiency impairs collagen formation, leading to weakened blood vessels (Brown and Ortner 2011; Fain 2005). Hemorrhaging can result from even normal movement and may stimulate an osteogenic response if it occurs in vessels located either adjacent to bone or within the periosteum (Ortner and Erickson 1997). Especially in children, among whom the periosteum is less firmly attached to bone and tissue formation is more rapid, subperiosteal hemorrhages ossify and appear as deposited layers of vascular bone (Brickley and Ives 2006; Brown and Ortner 2011; Schultz 2001; Walker et al. 2009). Walker et al. (2009) demonstrate that this scenario often occurs in the eye orbits and that the resultant lesions may appear similar to those produced by marrow hypertrophy associated with an entirely different process (anemia).

It remains possible that the cause of some orbital lesions is anemia of either megaloblastic or hemolytic origin (Walker et al. 2009). However, differential diagnosis should also include scurvy, rickets, infectious diseases, and eye infections along with potentially associated inflammatory processes affecting the sinuses and lacrimal glands (Brickley and Ives 2008; Schultz 2001; Wapler et al. 2004). It is often overlooked but certainly worth noting here that eye problems make up a sizeable portion of the complaints cited in ancient medical treatises and inscriptions at healing shrines (Edelstein and Edelstein 1945a, 1945b; Cruse 2004; Jackson

2000; LiDonnici 1995). It is even possible that some cases of cribra orbitalia are due to taphonomic factors such as erosion (Wapler et al. 2004). It may be not be possible to suggest a specific etiology for orbital lesions, although a pattern of porous lesions throughout the skeleton may be suggestive of a systemic disease such as scurvy. In the absence of a clear pattern of skeletal involvement, however, cribra orbitalia should be viewed more generally as an indicator of nutritional problems, infections, and their synergistic interaction.

Periosteal Reactions

Periosteal reactions are areas of irregular new bone formation that are often present on the long bones of archaeologically derived human skeletons. They are produced when osteoblasts in the inner layer of the periosteum are stimulated by factors such as systemic disease or trauma (Larsen 1997; Ortner 2003). During the active phase of the inflammatory response, the deposited bone is woven in appearance. It is gradually remodeled during the healing process and will take on a sclerotic appearance as the new bone is incorporated into the original cortex.

While periosteal reactions are considered non-specific indicators of stress, they are often interpreted as evidence for infection (Goodman et al. 1984, 1988; Steckel et al. 2002a, 2002b). In some cases, it may be possible to link reactive bone with specific diseases or disease syndromes. For example, treponemal infections may result in characteristic alterations of the lower leg bones that include substantial deposition of periosteal new bone on the anterior and medial surfaces of the tibiae (Ortner 2003; Rothschild and Rothschild 1995). However, more typical periosteal reactions may reflect an osseous response to a variety of stimuli. Waldron (2009) includes infections, metabolic diseases, tumors, congenital anomalies, venous stasis, and soft tissue lesions among the causes of periosteal reactions.

Weston (2008) underscores the difficulty of attributing periosteal reactions to any specific etiology. The problem is due mainly to the fact that bone tissue responds in a similar way to a variety of insults. Despite this lack of diagnostic potential, periosteal reactions are useful as indicators of non-specific stress, as generalized interpretations can be made based on their skeletal distribution (Gladykowska-Rzeczycka 1998). Diffuse or bilaterally expressed changes are more likely manifestations of infection, while localized periosteal new bone formation is more suggestive of minor trauma. The tibia is the most common site for the appearance of periosteal reactions, perhaps because of its location close to the surface of the skin (Roberts and Manchester 2005; Steckel et al. 2002a).

Osteoarthritis

Osteoarthritis is characterized by the gradual breakdown of synovial joint surfaces subjected to repeated mechanical stress. Osteoarthritis is often referred to in the paleopathological literature as a degenerative process, although that description is not entirely accurate. As the articular cartilage of joint surfaces breaks down, the response of cartilage and the subchondral bone is actually proliferative and reparative in nature. The formation of osteophytes reflects adaptive remodeling in order to mitigate the stresses placed on the joint (Roberts and Manchester 2005; Rothschild and Martin 2006; Waldron 2009). In addition to the presence of osteophytes, eburnation is considered highly diagnostic of osteoarthritis and occurs when movement at the joint continues subsequent to the destruction of the articular cartilage (Roberts and Manchester 2005).

In the vertebral joints, both the process of aging and the impact of mechanical stresses over time cause degenerative changes in the intervertebral discs that lead to the production of osteophytes. Osteophytic lipping usually occurs along the anterior margins of the vertebral

bodies and, as in diarthrodial joints, the overgrowth of bone represents an attempt to adjust to modified and/or increased forces (Adler 2000; Roberts and Manchester 2005).

The development of osteoarthritis is not straightforward. The breakdown of joint surfaces is dependent upon multiple factors such as sex, age, weight, genetics, nutrition, disease, trauma, and movement (Roberts and Manchester 2005; Waldron 2009; Weiss and Jurmain 2007). Of all of those factors, movement and associated “biomechanical wear and tear” have traditionally been considered to have the greatest influence on the expression of osteoarthritis (Goodman et al. 1984:35; Larsen 1997). In a recent review, Weiss and Jurmain (2007) point out that, at present, evidence indicates that high levels of activity beginning early in life seem to play a significant role. Weight-bearing joints such as the hip and knee are the most commonly affected, although joints of the upper limbs may be more frequently affected in ancient skeletal samples, presumably due to differences in activity patterns (Roberts and Manchester 2005).

The specificity with which osteoarthritis may be used to reconstruct patterns of activity in past human populations has been debated. Jurmain and Kilgore (1995) argue that the lack of consistent patterns of expression among ancient groups suggests that assigning specific etiologies to the appearance of the condition is inappropriate. The most consistent patterns are found in the vertebral column, where alterations to the intervertebral and apophyseal joints probably in large part reflect biomechanical factors associated with normal spinal curvature and bipedal locomotion (Knüsel et al. 1997; Weiss and Jurmain 2007). This complicates the interpretation of osteoarthritis in the spine and it has been suggested that appendicular joints—especially the non-weight-bearing joints of the upper limbs—should be preferred in assessments of past activity (Knüsel et al. 1997). Another consideration is the argument that the factors contributing to osteoarthritis act on different areas of joint surfaces. For example, Jurmain (1991)

has suggested that certain changes such as pitting and eburnation are more associated with biomechanical stress, while age may play a larger role in the development of marginal osteophytes (Jurmain 1991). With these caveats in mind, the severity and skeletal distribution of osteoarthritis should be understood as providing only general measurements of levels and patterns of activity (Bridges 1994; Jurmain and Kilgore 1995; Steckel et al. 2002a, 2002b).

Trauma

The analysis of trauma provides a measurement of activity patterns that is informative about the interaction between a population and its physical and social environments. In most cases, trauma observed in archaeological human skeletal samples is the result of either accidents or interpersonal violence (Larsen 1997). Regardless of the etiology, even relatively minor traumatic episodes from which individuals recover have the potential to impair normal functioning and reduce quality of life. More serious injuries such as open fractures that penetrate soft tissue may become infected and lead to complications with healing and even death.

A fracture can be defined as “an incomplete or complete break in the continuity of a bone” (Lovell 1997:141). Goodman et al. (1984) point out that fractures are the most common type of injury seen in ancient skeletal samples. When a discontinuity occurs in bone, ruptured blood vessels result in the formation of a hematoma. This process stimulates osteoblasts in the periosteum and endosteal space, which lay down woven bone to form the periosteal and medullary callus, respectively (Martin 1998). In dry bone, the presence of an osteogenic reaction demonstrates that healing had begun to take place and allows one to distinguish between injuries that occurred before the time of death (antemortem) from those occurring either around (perimortem) or after death (postmortem) (Sauer 1998). If healing continues, the primary callus of woven bone is gradually replaced by lamellar bone. Remodeling may ultimately restore

marrow activity and normal bone contour, but the process can take years (Roberts and Manchester 2005; Waldron 2009). Healing is likely to proceed regularly provided the broken ends remain in contact, immobile, and retain an adequate blood supply (Adler 2000). The healing process is also largely dependent on factors such as age, nutritional status, and the anatomical location of the fracture.

While trauma associated with accidents and violence account for most fractures in the archaeological record, it is important to distinguish between those very different etiologies. In this regard, it is critical in any assessment of trauma to note the type of observed fracture. Lovell (1997) provides a review of common types of fractures and the forces with which each is associated. Understanding the underlying mechanism of injury helps accurately reconstruct activity patterns on both an individual and a population level. It is also important to record the location of the fracture both in the skeleton (bone and side affected) and on the individual bone or bones affected (position of the fracture on the bone) (Judd and Roberts 1999; Roberts 1991).

Certain patterns of fractures are more typical of injuries sustained as a result of occupational hazards or accidental trauma. For example, frequent travel or work carried out over difficult terrain is likely to result in a high incidence of fractures due to falls. Colles' fractures (distal radius) are often cited in this regard as they are frequently produced by forces involved with a fall onto an outstretched hand (Mays 2006). Fractures of the ulna and clavicle may result from similar indirect forces (Lovell 1997). The tibia and fibula are also frequently affected in populations that engage in intensive agricultural activities (Larsen 1997). Relatively high frequencies of these types of fractures have been observed in studies of ancient farming communities (e.g., Judd and Roberts 1999) and provide support for the notion that agriculture was a dangerous activity in the past. It should be noted here that fractures sustained while

carrying out activities such as farming not only have immediate health implications, but may also preclude an individual from normal participation in occupational and social activities within his or her community.

The presence of other forms of skeletal trauma such as parry fractures (occurring on the distal third of an isolated ulna) and cranial depressed fractures are more likely to reflect interpersonal violence (Lovell 1997; Milner 1995; Steckel et al. 2002a). Once again, noting the type and location of the fracture is critical because it allows for the assessment of the direction of force and may provide clues as to the position of the assailant in violent confrontations. However, as Judd (2008) points out, the circumstances surrounding even injuries that likely resulted from direct blows such as parry fractures can never be completely known. The possibility exists that the individual who received the injury could have been an attacker, a victim, or even a participant in an agreed upon activity.

The assessment of trauma across age categories may shed light on differences in the treatment of adults and subadults in a society. For example, the identification of trauma in children and adolescents can potentially be suggestive of the age at which they begin to participate in adult occupational and social roles. Certain patterns of childhood trauma such as multiple injuries exhibiting different stages of healing may be indicative of abuse (Walker et al. 1997). Evidence of trauma occurring during the subadult years may be impossible to discern in adult remains due to the process of remodeling. However, this is not always the case. Glencross and Stuart-Macadam (2000) point out that healed trauma discernible as subtle alterations of normal bone morphology can be diagnosed more confidently with the help of clinical data on age-based patterns of injury types and locations.

Issues of Interpretation: “The Osteological Paradox”

In an important critical paper, Wood et al. (1992) caution that using frequencies of skeletal lesions to estimate the health of past populations may be much less straightforward than is usually assumed. They outline three factors—changes in demographic patterns, problems with the representativeness of samples, and individual variation in susceptibility to disease—that cannot generally be known and thus potentially confound the interpretation of lesion prevalence rates and age at death distributions. As a result of those factors, paleopathological and paleodemographic data are open to opposing yet equally plausible interpretations. For example, a community represented by a skeletal sample exhibiting high lesion prevalence rates and a low mean age at death might be interpreted as having experienced high levels of frailty and mortality. Alternatively, this pattern may reflect a community characterized by high fertility and long-term survival of stressful episodes such that skeletal changes were frequently manifest.

The arguments set forth by Wood et al. (1992) strongly suggest that the assessment of health from human skeletal remains presents unique challenges. However, there are approaches and techniques that may help clarify the relationship between lesion frequency and health in a given sample. For example, Goodman (1993) and Cohen (1994, 1997) have pointed out that differential survival has less influence on the appearance of skeletal indicators that reflect chronic stress, such as osteoarthritis, periosteal reactions, and porotic hyperostosis, than on acute conditions such as infections. The former indicators, then, can be interpreted in a more straightforward manner. The use of multiple indicators of stress in conjunction and comparisons of their prevalence rates across age classes can also assist in the interpretation of observed lesion patterns (Pechenkina and Delgado 2006). Finally, the incorporation of contextual evidence is critical. In most cases, ethnographic and epidemiological data support the association of higher

levels of physiological stress indicators such as enamel hypoplasias with disadvantaged groups rather than with advantaged groups (Cohen 1994, 1997; Goodman 1993). The analysis of the burial context is also valuable for the identification of differences in status, gender relationships, or kin groups that may direct hypotheses about differential susceptibility to disease (Wright and Yoder 2003).

Mortuary Analysis: Historical Development and Theoretical Background

The development of bioarchaeology in the second half of the twentieth century involved a process of recognizing the advantages of integrating techniques and data from both skeletal biology and archaeology (Armstrong 2003; Zuckerman and Armstrong 2011). More recently, however, there has been a tendency to emphasize one side of the discipline or the other in research approaches and trajectories. At present the most popular definition of bioarchaeology follows Larsen (1997) and conceptualizes the field as the study of human skeletons from archaeological sites. Jane Buikstra's (1977) original definition was more encompassing, emphasizing the study of human skeletons *and* their contexts. Although the implementation of Buikstra's original model is not always practical, its major principles should not be abandoned. Goldstein (2006) has demonstrated that, while the complete integration of data from skeletal biology and archaeology presents significant challenges, ignoring data from one perspective or the other presents inherent problems. It is difficult, for example, to draw conclusions about the impact of cultural change in a community if features of the burial program are unknown.

The analysis of human burials therefore offers important opportunities for collaboration between physical anthropologists and archaeologists. While not all aspects of funerary rituals are represented in the archaeological record, the mortuary domain may contain a wealth of information about the religious beliefs, cultural practices, and social organization of a group of

people. When utilized in bioarchaeological studies, this type of data allows anthropologists to move beyond descriptive studies and test broader hypotheses about the relationship between cultural behavior and health in the past (Armelagos 2003).

Rakita and Buikstra (2005) point out that intensive cross-cultural study of mortuary practices in American anthropology was generated primarily by two publications: Arnold van Gennep's *The Rites of Passage* and Robert Hertz's "A Contribution to the Study of the Collective Representation of Death." In his work, van Gennep (1960 [1908]) explored an underlying structure common to ceremonies marking life transitions such as birth, marriage, and death. Passages from one life stage to another, he argued, usually involve a process characterized by rites of separation, rites of liminality, and rites of reintegration. Van Gennep's study is useful for understanding particular aspects of rituals and the reasons for which certain themes such as birth and death commonly appear together (Metcalf and Huntington 1991). Hertz (1960 [1907]) also stressed the idea of liminality in his paper focusing on secondary burial in Indonesia. He suggested that the act of allowing the flesh of a body to decay parallels the transitional state of the soul. Moving the bones to a final, family burial location represents the soul's integration into the world of his or her ancestors.

Burial and Social Organization

Mortuary studies subsequent to the contributions of Hertz and van Gennep were increasingly guided by the principles of the New Archaeology, popularized by Binford in the 1960s. With the emphasis of processualism on understanding culture as a system and on a more scientific approach, archaeology became more rigorous in the search for models that explained cultural processes (Johnson 1999; Trigger 1989). It was during this period that Arthur Saxe completed his dissertation research, which proved to be an extremely important contribution to

the analysis of mortuary practices. Saxe (1970) developed and tested eight hypotheses which together aimed to reconstruct social organization from aspects of burial practice. While most of those hypotheses focused on the relationship between mortuary variables and social identity, Hypothesis 8 dealt with the spatial component of burials and has since been given the most attention. Saxe's (1970:199) original hypothesis states that groups will reserve formal areas for the burial of the dead based on the degree to which control over restricted resources is derived from lineal descent from the dead. Goldstein (1976, 1981) has reformulated that hypothesis to include related sub-hypotheses, arguing that permanent, bounded burial areas are *likely* to represent corporate groups and that the maintenance of those areas are one way in which corporate groups may legitimize rights to restricted resources.

The association between burial practices and status differentiation was a significant emphasis of mortuary studies in the New Archaeology. Binford (1971) used ethnographic data to demonstrate that the number of social dimensions related to status increased with the development of settled agriculture. Working from that data, he argued that burial practices should increase in complexity with agricultural intensification and sociopolitical complexity. Looking more specifically at grave contents, Brown (1971:101) related the presence of "important and precious" mortuary artifacts to higher rank in his formal analysis of aspects of the burial program at the Mississippian site of Spiro.

The ideas of Saxe, Binford, and Brown regarding the elaboration of the mortuary domain figure prominently in later studies concerned with developing models to identify certain forms of sociopolitical organization using archaeological evidence (e.g., Peebles and Kus 1977; O'Shea 1981; Tainter 1977, 1978). Those studies, however, had important contributions of their own. Peebles and Kus (1977:431) explored two different dimensions of the social persona:

“subordinate,” based on age, sex, and life achievement, and “superordinate,” which cannot be attributed to those factors. They argued that ranked societies can be identified by a burial program that includes both dimensions. Tainter (1977, 1978) focused on the role of energy expenditure in funerary ritual and the construction of the interment facility. He argued that energy expenditure can to a degree act as an independent source of data on rank because it can be evaluated across a cemetery even in situations where associations between graves are unclear. Tainter’s work suggested that there is a relatively direct correlation between the amount of energy expended in the mortuary ritual and the social rank of the individual.

While continuing to work within the framework of the “Saxe-Binford research program” (Brown 1995), archaeologists studying funerary remains in the 1980s were increasingly cognizant of the fact that reconstructing social organization from burial evidence is not as straightforward as it had been made to appear. O’Shea’s (1981) study of the effects of formation processes on funerary remains among the Arikara, Pawnee, and Omaha achieved a more nuanced picture of vertical and horizontal differentiation as well as energy expenditure. In his case studies, vertical social distinctions (rank-based) were found to be more visible in the archaeological record than horizontal social distinctions (kin-based). O’Shea attributed this to the fact that vertical distinctions were symbolized in the mortuary ritual by features such as elaborate grave construction, while horizontal distinctions tended to be expressed using organic materials, such as clothing and furniture, that are less likely to be preserved.

Brown (1981) pointed out that distinctions can be made between rank, power, and authority and that those distinctions might be represented in different ways in the mortuary domain. Prehistoric societies may also demonstrate gradations of social ranking (e.g., ranking without centralized leadership) that further complicate the interpretation of burial data. Brown

also called attention to the fact that the ritual process preceding burial needs to be carefully considered. This is because complicated, multiphase rituals may give the appearance of groups having different statuses. Outlining these potential difficulties, Brown stressed the importance of developing site-specific models for the interpretation of social behavior from mortuary data.

The Saxe-Binford approach has not been without its critics though. Responding mostly to the research of Tainter (1977, 1978), which focused on social change in the Middle to Late Woodland transition, Braun (1981) demonstrated how compounding error during data manipulation procedures may bias results of analyses that associate features of a burial program with social rank. Braun argued that Tainter's analyses were problematic first on the basis of his choice and execution of statistical tests. He also pointed out inconsistencies in the classification of locally produced and imported grave goods that biased the final assessments of complexity for each period in question. Finally, Braun identified flaws in Tainter's theoretical assumptions. For example, in his argument that differences in energy expenditure indicate differences in social rank, Tainter fails to address the possibility that differences in energy expenditure may occur between individuals *of the same* rank. Rakita and Buikstra (2005) add to Braun's critique of the processual approach the idea that certain elements of a burial program, such as spatial relationships, are not easily quantified.

Postprocessual Approaches

Reactions to processual studies on both methodological and theoretical grounds gradually coalesced into a new paradigm. In contrast to the major assumptions of the Saxe-Binford program, postprocessual approaches maintain that funerary rituals and their material remains need not be a direct reflection of the social hierarchy or of any other aspect of sociopolitical organization. For example, there is no necessary connection in postprocessual models between

social status and factors such as energy expenditure and the presence and type of grave goods. Instead, funerary rituals and burials themselves are viewed as areas of active contestation and negotiation by the living (Parker Pearson 1999). Rather than reproducing the social hierarchy, funerary rituals can be employed as mechanisms to manipulate or even transform it (Rakita and Buikstra 2005). While postprocessual studies are similar in their criticism of the Saxe-Binford approach, they represent a diversification of research perspectives which consider the roles of gender, agency, and emotion in the formation of the mortuary domain. They have also added to preexisting analytical frameworks. For example, analyses of the spatial component of cemeteries have expanded to include investigations of the relationship between cemeteries and their associated regional landscapes.

A critical point of emphasis in these postprocessual critiques is that care must be taken to examine the larger social and historical context in the interpretation of material remains. Hodder (1982) pointed out that reconstructing the functional relationships of past societies addresses only part of a larger problem. This is because those relationships are based on symbolic rules that are presented in ways that may change as individuals or groups negotiate statuses and roles. As the act of burial is one arena in which negotiation may occur, burial patterns cannot be taken as direct reflections of social differentiation. Furthermore, because material remains are imbued with symbolic meaning that is unfixed, objects may have different meanings in different contexts. This is a fundamental obstacle to the development of models that attempt to translate material remains or energy expenditure into social rank.

Similarly, Shanks and Tilley (1982:132) argued that the social order is legitimized using ideology, which is meant to “conceal real social relations”. Like Hodder, they underscored the fact that material culture is created within a symbolic context and, when used in mortuary rituals,

may function to maintain the social order through the misrepresentation of social divisions. Shanks and Tilley also demonstrated that the human body and its manipulation have great symbolic significance. In their analysis of English and Swedish Neolithic barrows, they point to the arrangement of disarticulated skeletal elements during secondary burial as an indication of the denial of structured social differences and the assertion of collective identity.

The practice of exhumation and reburial in village ossuaries is common today in areas of rural Greece. In this modern context, secondary rituals have been interpreted in a manner consistent with van Gennep's (1960 [1908]) rites of passage. They mark the end of the liminal mourning period and the incorporation of the deceased into the world of the dead. Storage of the remains in an ossuary also emphasizes the collective identity of the village dead (Alexiou 2002; Danforth and Tsiraras 1982).

Brown (2003) argued that ossuary burials can be understood as expressing collective identity when disarticulation is consistent across all individuals. In such cases, the treatment of each of the deceased in the same manner is likely carried out in an effort to replace individual identities with those of a community or group. His analysis of the Cahokia Mound 72-Sub 1 burials makes clear that interpretations involving collective representation are possible even in instances where there appear to be obvious status differences. For example, burials might be arranged as a performance in which certain individuals are given symbolic roles that could resemble status differences.

Secondary burial involving mortuary ceremonies may also have political objectives. Chesson (1999) has pointed out that the visibility of secondary ceremonies, which may involve the transportation or alteration of the remains and/or the grave structure, provides an ideal opportunity to either reinforce or renegotiate social and political associations. At Bab edh-Dhra',

secondary burial in large charnel houses is suggestive of an expansion of formal kinship relations and probably served to strengthen the connections between kin groups and their ancestors. The use of secondary funerary rituals to create and reinforce ancestral ties in order to legitimize the status of the living has also been suggested for the Classic Maya (Gillespie 2001) and at Cahokia (Goldstein 2000; Porubcan 2000).

Although there is certainly utility in being able to identify aspects of social organization using mortuary data, postprocessual studies emphasize that burial patterns are influenced by other factors. Decisions regulating the burial of adults versus non-adults, for example, might be influenced by factors other than age or status such as beliefs about attaining a state of humanness or the development of the soul. The need to examine belief systems is emphasized by Carr (1995) in his analysis of ethnographic data from the Human Relations Area Files. Although he found associations between social organization and both the form of cemeteries and energy expenditure, he demonstrated that aspects of mortuary treatment such as body position and orientation were more likely to reflect philosophical-religious beliefs.

Cannon (1989) has argued that mortuary expression is largely influenced by competitive display and changes through time in a similar manner as fashion in dress. In this model, increasing elaboration by elites is gradually adopted by lower status groups. To maintain their social distinction, elites subsequently scale back the intensity of their funerary expression. Using cross-cultural examples, Cannon showed how historical cycles of elaboration and restraint in mortuary behavior might be explained by competitive display. The implication of Cannon's hypothesis is that changes in mortuary expression do not necessarily correspond with changes in social structure. They may instead signal only changes in context-specific patterns of display and emulation.

Gender and Mortuary Analysis

The archaeological study of gender as a social construction is another important development associated largely with postprocessual approaches (Parker Pearson 1999). In 1984 Conkey and Spector forcefully demonstrated that assumptions about gender were pervasive in the archaeological literature. Especially prior to their work, there was a widespread tendency to impose modern, western cultural ideas about gender on past societies during the interpretation of archaeological deposits. This was especially apparent when mortuary remains were considered. Conkey and Spector's critical review identified instances in which the same objects found in the burials of males and females had been interpreted differently to conform to western gender stereotypes. For example, trade items found in the burials of males were assumed to indicate active participation in trade, whereas similar items found in female burials were suggested only to have been acquired.

O'Gorman (2001) points out that mortuary studies in particular are important for the investigation of gender in the past because they may incorporate skeletal analysis, which can provide reliable estimates of biological sex. The use of osteological techniques is critical in the avoidance of traditional approaches in which sex identifications were made based on associated mortuary artifacts (Weglian 2001). A large body of research demonstrates clearly that associations between males and females and the presence of certain types of adornment or artifacts are variable both cross-culturally and within a single society (Conkey and Spector 1984; Crass 2000, 2001; Crown and Fish 1996; Doucette 2001; Hamlin 2001; Hollimon 2011; Parker Pearson 1999; Weglian 2001). At the same time, Hollimon (2011) points out that bioarchaeologists using techniques from mortuary analysis and skeletal biology are in an

exceptional position to identify third gender categories in the archaeological record, although this must be done carefully using multiple lines of evidence from both approaches.

Mortuary analyses that focus on gender may be informative about the roles of men and women in past societies as well as changes in divisions of labor through time (Crass 2000, 2001; Hamlin 2001). O’Gorman’s (2001) examination of Oneota domestic and mortuary contexts suggests that women exerted control over household production and storage, in addition to having a diversity of inter- and intra-household social relationships that were reflected in greater variability in their mortuary patterns relative to men. In an analysis of the Pre-Classic to Classic transition among the Hohokam, Crown and Fish (1996) argue that women’s workload increased through time while their public presence declined. However, they suggest that women derived prestige at the level of the household or household group from their productive activities, which became increasingly important as social differentiation increased. Reconstruction of the activities of men and women is another area in which osteological data may be successfully integrated. Indicators of occupational stress such as osteoarthritis, enthesopathies, and variation in bone cross-sectional geometry are especially useful in the identification of sex-based patterns of activity (Hollimon 2000, 2011; Larsen 1997; Peterson 2000).

Joyce (2001) offered a unique approach to the analysis of gender in mortuary studies. She argued that burials represent sites at which social memories of the dead are constructed by the living. While the statistical analysis of mortuary data can identify certain patterns, they cannot capture the emotions involved in the performance of burial rites and in the reactions of those connected to deceased. To the extent possible, it is useful to combine more traditional analyses with more personal, biographical accounts of individual burials. Joyce’s approach to the burials at Tlatilco allowed her to focus on subtleties that make each woman’s grave distinctive.

Spatial Analysis

The analysis of the organization of burial space is critical because the use of space is often meaningful on a number of levels. Decisions about the location of the dead are important and are usually made very deliberately (Parker Pearson 1999). Ashmore and Geller (2005) have pointed out that spatial patterns in cemeteries may contain information about the relationships between individuals and groups of individuals, as well as insight into the broader cosmological concerns of past societies. The multidimensional nature of spatial patterns has also been discussed by Goldstein (1981). She demonstrated that many ideas can be expressed simultaneously in the location of burials and in the relationships within the grave between mortuary artifacts and the body. Ideally, spatial analysis should include assessments of the arrangement of burials relative to each other, their relationship with the surrounding landscape, and their individual contexts (e.g., aspects of grave construction, internal organization, and biological attributes of the deceased) (Goldstein 1981:59).

As discussed previously, Saxe's (1970) Hypothesis 8, which has been modified by Goldstein (1976) and later Charles (1995), has generated much discussion concerning the association between spatially bounded cemeteries and control over access to resources by corporate groups. Hypothesis 8 has been criticized on the grounds that it reduces the treatment of the dead and the creation of cemeteries to economic considerations and ignores other ideas that social groups might have been attempting to communicate (Morris 1991; Parker Pearson 1999). However, keeping in mind that the presence and form of cemeteries may be the result of processes other than attempts to establish control over property, the connection between spatially distinct disposal areas and corporate groups is still a useful concept in many contexts (Brown 1995; Morris 1991; Parker Pearson 1999).

Buikstra and Charles (1999), for example, relied on the Saxe/Goldstein hypothesis in their analysis of mortuary sites in the lower Illinois valley. They showed how landscapes, both natural and constructed, were utilized over millennia for negotiating relationships between kin groups. The monumental structures of Mississippian elites drew upon but also transformed the much earlier Archaic tradition of placing burials strategically in the landscape. Buikstra and Charles also demonstrated that it may be possible to correlate changes in the location of competitive mortuary rituals and the burial of the dead with changing sociopolitical conditions (Buikstra and Charles 1990; Charles and Buikstra 2002). The idea that the mortuary landscape is constructed within and thus influenced by a dynamic social context has also been illustrated using modern cemeteries, for example in Peru (Silverman 2002) and Greece (Tzortzopoulou-Gregory 2008).

In some cases, interpretations of the meaning of mortuary sites can be reached only through their analysis within a larger regional context. For example, Goldstein (1995) expanded upon a number of previous interpretations of Effigy Mound sites in southeastern Wisconsin by examining their locations relative to the distribution of regional resources. Since diverse forms of Effigy Mounds concentrated in areas of diverse resources, she argued that, in addition to places of burial, the mounds functioned as symbolic maps indicating directions to group resources.

Recent studies of the organization of cemeteries have demonstrated the utility of incorporating more sophisticated spatial-analytic techniques such as GIS. The mapping of burials and human remains accurately in space has been successfully applied to diverse goals such as illustrating changes in patterns of commemoration through time (Tzortzopoulou-Gregory 2008), elucidating spatial relationships in ossuaries and commingled burials (Herrmann 2002), investigating artifact distributions in graves and patterns of grave construction, and identifying

spatial patterns in the distribution of skeletal paleopathologies that may be suggestive of social differentiation reflected in burial location (Jenny 2011; Soler 2011). Building on these studies, GIS is employed in the present research in order to test hypotheses about the organization of the mortuary space at Early Christian and Byzantine Nemea.

As Goldstein (2006) demonstrates, the spatial component of mortuary sites is one of many areas in which increased collaboration between archaeologists and physical anthropologists would prove fruitful. There is additional room for collaboration with historians as well. Working with periods for which written evidence is available presents its own opportunities and challenges. While firsthand or at least contemporary accounts of historical processes and events are invaluable, it must be recognized that they are subjective and produced by people who often had agendas other than the faithful recording of those events. Morris (1992) has underscored the importance of using mortuary evidence in the study of sociopolitical change in the complex societies of the classical ancient world. The analysis of burials gives access to a much broader segment of society than written sources, which were produced primarily by and were directed mainly toward the elite. In this way, mortuary analysis and the bioarchaeological study of human skeletal remains can provide much more than conformational evidence set against an historical record that is taken to be accurate. Instead, they can function as independent sources of information that can be used to supplement and even challenge traditional historical narratives (Morris 1992; Perry 2002, 2007).

Summary

This chapter has focused on two related approaches that are employed together in this research: bioarchaeology and mortuary analysis. In the first section, I discussed the concept of physiological stress as commonly used in the assessment of health from human skeletal remains

recovered from archaeological contexts. The skeletal indicators of stress introduced in this chapter, while generally understood as non-specific, each provide a different perspective on stress in past populations. For example, linear enamel hypoplasias are informative about acute episodes of stress experienced during early childhood, while periosteal reactions may be present at any age. Porotic hyperostosis and cribra orbitalia are likely to reflect physiological disruption caused by nutritional or metabolic disturbances, while osteoarthritis is due largely to activity-related stress. The assessment of multiple stress indicators increases the likelihood of avoiding the pitfalls described by Wood et al. (1992) in reference to the interpretation of skeletal lesions.

In the second section, I traced the historical development of the analysis mortuary sites and, in so doing, introduced multiple theoretical approaches for their interpretation. I placed particular emphasis on considerations of the expression of status differentiation and gender in the archaeological record, as well as on the investigation of the spatial component of cemeteries. Those areas are the most pertinent to the present research at Nemea. I argue that the evidence from skeletal biology should be used in conjunction with archaeological and historical data not only to place the biological evidence in context, but also so that assumptions about the other two datasets may be tested. The historical and archaeological contexts of the Early Christian and Middle to Late Byzantine communities at Nemea are the subject of the next chapter.

CHAPTER 3: GREECE IN THE EARLY CHRISTIAN AND MIDDLE TO LATE BYZANTINE PERIODS: PLACING THE NEMEA COMMUNITIES IN CONTEXT

Central to a bioarchaeological approach, as conceived by Buikstra (1977), is the idea that human remains cannot be studied in isolation. By themselves, skeletal remains have the potential to shed light on patterns of biological factors such as stress, disease, and activity. However, it is only when those biological datasets are combined with the archaeological and cultural context of the remains that they may contribute in a meaningful way to anthropological investigations of past societies. Thus, the most effective anthropological study of the human skeletal remains from Nemea first requires a careful examination of the social and political context of each community that permanently occupied the site.

The Early Christian and Middle to Late Byzantine inhabitants of Nemea lived and died during periods characterized by major social and cultural transformations. In Late Antiquity (around 200-700 AD) the transition from paganism to Christianity and a shift in the political center of power from Rome to Constantinople altered the social and political structures that had previously dominated the Mediterranean. During the 6th century AD, the impact of wars, invasions, disease, and even climactic shifts resulted in a period of relative decline that lasted for centuries in parts of southeastern Europe including Greece (Gregory 2010). While the Middle Byzantine period (717-1204 AD) saw renewed prosperity in the Byzantine Empire, conditions in the countryside gradually deteriorated in the second half of the 12th century as a result of increasingly dysfunctional provincial administration. This seems to have been a precursor to the disaster of the Fourth Crusade and the Frankish invasion of the Peloponnese. This chapter considers in detail the nature of the post-classical communities at Nemea and situates them within the broader context of sociopolitical change in Greece and the Byzantine world.

Greece and its Place in the Mediterranean World of Late Antiquity

Cities, Towns, and the Countryside

For Greece and, indeed for most of the Mediterranean world, the post-classical period was characterized by transition. While scholars continue to debate the competing influences of continuity and change, there can be little doubt that both processes were at work in the shaping of the social and physical landscapes of the late antique Mediterranean.⁵ In Greece cities continued to be the centers of population and cultural life, but a noticeable transformation of their character gradually took place (Gregory 1984). Cameron (1985) observes that traditional elements of classical cities such as open marketplaces and baths were frequently replaced by shops and other spaces that were more confined. It was also at this time that burials began to be placed in the fora of urban sites like Corinth, a practice forbidden during the Roman period (Iverson 1996; Sanders 2002). These developments together demonstrate that late antique cities were functioning in a manner that differed from their classical past.

The alterations to the physical appearance of cities have been attributed to a number of factors. Saradi-Mendelovici (1988) has pointed out that those changes should be attributed more to Christianization and administrative processes than to natural disasters or external threats. By the 5th-6th centuries, the influence of Christianity was becoming increasingly apparent as basilicas were constructed in cities and towns throughout the Greek East (Cameron 1985; Gregory 2010; Sanders 2002). Christian attitudes and ways of life in some ways contrasted greatly with those of pagans—a fact that resulted in the open criticism and avoidance of a

⁵ The concept of “modified continuity” is a useful way to understand how a middle ground may exist between the extreme views of continuity and discontinuity of classical ways of life into Late Antiquity. In this perspective, cultural change is understood as the result of a pragmatic selection process in which certain cultural elements are changed and others are maintained. For more detailed discussions of this concept see Kardulias (1995) and Frey (2006).

number of classical institutions such as the theatre, public baths, and the agora. Christianity also fundamentally changed the classical system of wealth redistribution. While affluent citizens traditionally supported the construction of public monuments, they began to redirect their wealth toward the Church instead (Leyerle 1994; Spieser 2001a, 2001b). This ideological shift and its consequent economic effects explain patterns visible in the late antique phases of sites such as Thessalonike and Butrint, where impressive ecclesiastical architecture was constructed and maintained at the same time as classical urban spaces were neglected (Bowden 1997, 1999; Spieser 2001b). Another outcome of this process was that local administrative elites, finding their posts increasingly less fruitful, began to abandon them for imperial or ecclesiastical positions (Curta 2006, Saradi-Mendelovici 1988, Spieser 2001a, 2001b). The power and influence of the clergy in local communities grew substantially as a result.

At least some of the changes to the form of towns and cities across southeastern Europe around the 5th-6th century AD can also be explained as a result of the growing insecurity of the Early Byzantine State and the execution of a new and ambitious defensive strategy. Curta (2001a, 2006) has demonstrated, for example, that the contraction and, in many cases, abandonment of Roman rural sites in the Balkans in favor of sites that were largely hilltop fortifications was related in large part to the emperor Justinian's efforts to protect the Empire against barbarian incursions. Justinian was nearly successful in an attempt to reunite the Roman Empire by reconquering Italy. However, the drawn out war in the West along with his building program, which included both the refurbishment of old fortifications and the construction of new ones, placed a great deal of financial and logistical strain on the Empire (Cameron 1985; Curta 2001a).

In the period immediately following Justinian's reign, invasions became more difficult to control. The collapse of the Danube frontier in the late 6th century allowed groups of Bulgars and Slavs to enter Greece, the latter group managing to cross the isthmus of Corinth and invade the Peloponnese in the 580s (Gregory 2010; Herrin 1985; Whitby 2000). Archaeological evidence reveals a further decline in the use of public buildings, the contraction of major cities, and the abandonment of many rural sites at that time (Cameron 1985; Curta 2001a; Herrin 1985; Whitby 2000).

The exact nature and impact of the so-called "Slavic invasions" of Greece during the late 6th century has been the subject of considerable debate. In the traditional narrative, which is based on written sources such as the *Miracles of St. Demetrios* and the *Chronicle of Monemvasia*, groups of Slavs migrated south across the Danube and carried out massive, sustained invasions of Byzantine territory in the Balkans and Greece. In many cases, archaeological evidence of destruction and abandonment of settlements dating to this period has been linked to those activities. The Slavs are also suggested to have occupied southern Greece for more than two centuries (Gregory 2010).

Recent syntheses of historical and archaeological data, however, suggest that the accepted narrative paints an unrealistic picture of the Slavic presence in the Balkans. For example, Curta (2001b) has argued persuasively that the Slavs gained political and military relevance largely as a result of conditions created by Justinian's fortification program. In this way, the Slavic ethnicity and political identity were each created by the Byzantines (Curta 2008). Other groups such as the Goths and the Avars were implicated in raids of Greece and it is possible that groups of Slavs were operating under Avar control (Curta 2004; Heather 1996). In

fact, Curta (2001b, 2004) points out that there is a great deal of confusion even among contemporary sources as to the identity of those invading Greece in the late 6th century.

Another problem with the traditional narrative of the Slavic invasions concerns both their immediate and long-term ramifications. Not all evidence of Slavic presence in southern Greece is associated with devastation. For example, Gregory (1993) identifies a possible Slavic settlement at Isthmia based on ceramic deposits that are consistent with permanent habitation rather than destruction and conquest. The conception of Greece as overrun with Slavic invaders has also led some researchers to interpret the late antique occupation of small islands around the Greek mainland as evidence of groups of people fleeing for safety (Hood 1970). More recently, however, Kardulias et al. (1995) have presented alternatives to this model. They demonstrate that at least some of those island settlements were of a permanent nature and that daily life would have necessitated continuous interaction with the mainland. It is more likely, then, that such settlements reflect the exploitation of marginal areas as strategy of coping with a problem very different from continuous invasion: increasing population pressure.

The reconsideration of the Slavic invasions is only one line of evidence that has been used to question the extent to which the late antique countryside experienced universal decline (Kazhdan 1997). Archaeological surface surveys have produced surprising data that suggest at least some areas of Greece were experiencing population growth and expansion. For example, Bintliff (1996) has demonstrated that parts of central Greece in the 5th-7th centuries were not only more populated than contemporary accounts suggest, but appear to have been nearly as prosperous as they were during classical times. Increased activity and settlement density in the Greek countryside during Late Antiquity has also been noted generally by Alcock (1993) and, more specifically, in the southern Argolid (Runnels and van Andel 1987) and the Nemea Valley

(Wright et al. 1990). Runnels and van Andel (1987:319) go as far as to characterize the period of the 3rd through 6th centuries AD as “generally an era of prosperity and peace.”

While survey data at first glance clearly indicate a rise in the number of settlements during the Late Roman period, other interpretations are possible. Pettegrew (2007, 2010) cautions that the large number of settlements identified in the region of Corinth and elsewhere in Greece may be due to the ease with which Late Roman pottery is recognized in surface surveys when compared with Early Roman pottery. Adjusting for differential visibility, there is much less contrast between the two periods, suggesting more continuous economic activity as opposed to a pattern of boom and bust. This need not, however, mean that the late antique countryside of Greece was stagnating. Even if the model of marked settlement expansion is incorrect, the amount of identifiable Late Roman ceramics, especially imported pottery and fine ware in the case of the Corinthia, is much more consistent with prosperity than decline (Pettegrew 2007).

The ability of settlements to flourish in the Greek East during Late Antiquity was likely due in part to the strength of the Eastern Empire relative to the West during this period. Cameron (1985) reports that Constantinople was able to buy off invading groups at least temporarily. The location of Greece also probably played a role as it was, for the most part, buffered from the turbulent events in the northern Balkans until the late 6th century (Gregory 1984; Whitby 2000). The fact that settlements like Nemea were able to succeed in valleys as opposed to fortified hilltops is further evidence that the Early Christian period in southern Greece was perhaps not as turbulent as previously believed (Rautman 2006).

The most recent reassessments of the data from regional archaeological surveys in Greece suggest that it is not until the 7th century AD that the number of settlements drops off

significantly (Pettegrew 2007, 2010). Even this pattern, however, could be explained by a shift toward local pottery of relatively poor quality that was less likely to be preserved (Pettegrew 2010). In this way, the extent to which the countryside was actually abandoned remains open for debate. While the pattern of contracting settlements demonstrated by Curta (2001a, 2006) for most of the Balkans may be clearer, the survey data in Greece, together with a revised understanding of the Slavic presence, have produced a more optimistic view of the late antique countryside. As will be outlined in greater detail below, the Early Christian community which occupied Nemea during the 5th-6th centuries was an example of the flourishing of rural Greece up to the abandonment of the site in the 580s AD.

Religious Life

The rise of Christianity, visible in the physical landscape of late antique cities and towns in the form of religious architecture, was a reflection of what Brown (1989:49) describes as a “new mood” that developed in the later Roman Empire. The worldview of the Empire in Late Antiquity was increasingly personal. In contrast to the pagan emphasis on objects such as temples and oracles, attention was turned to individuals as intermediaries between God and human beings. The emperor Constantine, who famously converted to Christianity after his victory over Maxentius at the battle of the Milvian Bridge in 312 AD, was a relatively early example of this process (Brown 1989). The growth of monasticism and the prominence of holy men in Late Antiquity also attest to a need to fill the void created by the absence of classical institutions and the neglect of religious buildings such as temples, which were more often in a state of disrepair (Brown 1971).

Along with the shift in focus from things to people was a movement away from concern with religious *practice* toward concern with religious *belief*. Garnsey and Humfress (2001) point

out that there continued to be a psychological connection between the happiness of the gods and the prosperity of Roman society. What changed, however, was that the happiness of the Christian God was understood to depend on the correctness of the belief system as opposed to the precision with which rituals were carried out in the pagan tradition.

Contemporary accounts of hostility between pagans and Christians and the persecution of the latter during the early Christian centuries give the impression that conflict between the two religious groups was the norm. While such opposition cannot be ignored in a discussion of the religious climate of Late Antiquity, there is plenty of evidence to suggest that the Early Christian period, perhaps especially in Greece, was replete with examples of coexistence and even syncretism. The utilization of pagan sacred space for religious activity by Christians was extremely common, albeit the motivations behind such examples are not always clear.⁶ The site of Nemea, which features a relatively large Early Christian basilica and Christian cemeteries placed directly within what would have remained an obvious former pagan sanctuary illustrates this scenario well.⁷ In addition to the continuity of religious space, Gregory (1986) points out that both religious traditions addressed broad life concerns such as healing, death, and the family. Selectively retaining elements of paganism would thus have been useful in understanding Christian concepts during conversion. Trombley (1985) echoes that sentiment and adds that the process of Christianization in the countryside of Greece and Anatolia was characterized by the integration of Christian themes as opposed to the wholesale elimination of pagan practice.

⁶ While constructing churches near the boundaries or at the former sites of pagan temples suggests continuity of religious practice, these actions may often have been deliberate attempts by Christians to intimidate pagans and/or eliminate cult activity.

⁷ Writing in the 2nd century AD, Pausanias (2.15.2) reports that the Hellenistic Temple at Nemea was still present, although its roof had collapsed and its cult-statue was missing.

By the late 4th century, legislation outlawing aspects of pagan worship such as public sacrifice was put into place. It was also around this time that many instances of the destruction of pagan temples and looting of shrines, especially in rural areas, were recorded (Caseau 2004; Garnsey and Humfress 2001). It is important to keep in mind, however, that there is no necessary connection between the destruction of temples and the end of paganism. In many cases, temples were destroyed only after they ceased to function as the sites of pagan ritual (Spieser 2001c). More importantly, Garnsey and Humfress (2001) point out that paganism was traditionally a flexible system and individuals could draw upon local cults, imported traditions, or simply employ alternative forms of worship in order to renegotiate their religious identities within a pagan framework. The many examples of syncretic cult activity in the historical and archaeological records illustrate a diversity of religious practice in Late Antiquity and confirm that paganism not only survived, but continued to evolve (Bowersock 1990; Garnsey and Humfress 2001; Trombley 1985).

Archaeological evidence suggests that, in southern Greece, pagan cult activity may have continued, perhaps alongside Christian worship, well into the 6th century AD Rothaus (2000) argues for this situation at Corinth, where votive lamps must have been offered during the 6th century at the site of the Temple of Asklepios, which had been destroyed perhaps a century earlier. Additionally, while Christian burials encroached upon the site of the former temple, they never occurred directly on it. This may indicate that Christians were using burial space to intimidate pagans, but in a manner that respected those still carrying out rituals. Rothaus (1996, 2000) also argues that an abandoned bath structure near the Asklepieion was the site of ritual deposition of votive lamps by both Christians and non-Christians during the 4th to 6th centuries.

If correct, this demonstrates that Christians and non-Christians interacted in ways that involved performing the same act at a site that had mutual ritual significance—the only difference was the deity worshipped.⁸ Examples of shared forms of religious behavior also show that the distinction between the categories “pagan” and “Christian” was in reality often ambiguous (Rothaus 1996).

It is clear that small pockets of pagan activity survived beyond the 6th century. Trombley (1985) identifies a number of minor pagan rituals from rural Greece and Anatolia between the 6th and the 10th century, recorded largely in hagiographic texts. However, the Byzantine Empire was, for the most part, thoroughly Christian in religious orientation (Rautman 2006). Based on the Christian architecture as well as on the burial practices that will be described later, the 5th-6th century community that developed at Nemea in plain view of the monuments of the former pagan athletic sanctuary shared this worldview.

Gender

The growth of the Christian Church had mixed results for the status of women, who were generally expected to have a lesser public presence than men in the Greco-Roman tradition. In the early Church, women were able to take on positions of leadership. Women had public speaking roles in churches at Corinth and at Kenchreai the church featured a female minister (Snyder 1999). As Christianity grew in popularity and worship became more public, however, women were more often marginalized. They were not permitted to join the priesthood and their roles in the church were usually limited. For example, women might serve as deaconesses,

⁸ Sanders (2005) has more recently argued that archaeological evidence for Hellenic worship at Corinth is difficult to discern after the 4th century AD. While he acknowledges that the presence of vessels appearing in apparent Christian graves in the Asklepieion cemetery is reminiscent of pre-Christian practice and may indicate syncretism, he favors a later date for the graves and disagrees with the assertion that Christian burial there was meant to discourage pagan ritual.

chosen from among virgins and widows to assist other women in the ritual of baptism and during times of illness (Alexandre 1992).

One option that offered significantly more freedom to women was participation in the monastic movement that increased greatly in popularity during Late Antiquity. In addition to the spiritual benefits, joining a female monastic house could provide intellectual stimulation, opportunities for travel, and a way to avoid the health risks associated with pregnancy and childbirth (Alexandre 1992; Garnsey and Humfress 2001). While widows were in a unique position to lead an ascetic lifestyle, this was also a possibility available to young women who chose to renounce marriage and sexuality (Elm 2000 [1994]).

Women's subordinate position in the Church extended to other facets of life. Views of women drew upon scriptural themes depicting them as both weak and prone to leading men into temptation (Garnsey and Humfress 2001). Ideas regarding the suppression of such supposedly innate qualities influenced early Christian texts, which included prescriptive recommendations even for such mundane activities as eating. Grimm (1995) points out that young Christian women in Late Antiquity were urged to maintain restricted diets in order to minimize physical desires such as sexuality. The extent to which such recommendations were followed is unclear but, if adopted, they may very well have had negative consequences for the nutritional status and overall health of women during this period.

The public/private dichotomy of men and women seems to have become stricter over time. Rautman (2006) describes a number of ways in which late antique women participated in public life. In addition to attending religious services and festivals, women frequented public institutions such as the theater and baths and played a crucial role in the fate of socio-religious movements such as iconoclasm. He suggests that later periods of Byzantine history were

characterized by greater restrictions on women's activities outside of the home, which may have been limited to the church. It should be noted that non-elite women, especially in the countryside, probably participated in a wider range of activities than their aristocratic urban counterparts.

Health and Health Care

A number of options were available in Late Antiquity to individuals suffering from medical problems, although access to treatment outside of the care of the family was not always easy and its quality varied tremendously. The treatment of the sick during this period still drew largely on the Hippocratic tradition (5th and 4th centuries BC) and, to an even greater degree, on the work of Galen of Pergamon, a prolific doctor practicing and writing in the 2nd century AD (Nutton 1984). The Christianization of the Empire also significantly influenced health care, perhaps even creating greater demand for it by focusing more attention on bodily suffering as well as on categories of people such as the sick and the poor (Horden 2008; Nutton 1984; Perkins 1995). Ultimately it was a Christian religious institution—the monastery—that created a new form of treatment center that would become the first hospitals.

In classical antiquity, cult sites dedicated to the god Asclepius were prominent centers of healing throughout the Mediterranean. The cult of Asclepius serves, however, as another example of the continuity of pagan traditions in the late antique world. Sanctuaries are reported to have functioned until around the 6th century AD (Edelstein and Edelstein 1945; Wickkiser 2008). Asclepius was held to have healed or advised his patients by visiting them in a dream as they slept in a particular part of the sanctuary. Inscriptions that record the work of Asclepius suggest that his cures were miraculous. However, it is interesting to note that he is described as

performing them in ways that often resembled the work of human physicians (Edelstein and Edelstein 1945; LiDonnici 1995).

Temple medicine had certain advantages. One of those was the cost. Individuals requesting the services of the god typically needed to make an offering, but this could be as little as whatever the poorest visitor could spare. Another benefit of the Asclepius cult was the possibility of receiving treatment for chronic illnesses for which Hippocratic physicians were reluctant to provide care (Wickkiser 2008). On the other hand, visiting a sanctuary of Asclepius could require one to travel great distances, especially in Late Antiquity when fewer temples were functioning. For many, including the very ill, visiting the site of a healing cult may not have been a reasonable option.

Doctors, like healing sanctuaries dedicated to Asclepius, continued to function in the traditional ways in Late Antiquity. Public physicians were appointed in towns and cities by the 2nd century AD and their status perhaps even rose in the 5th-6th centuries (Nutton 1984; Rosen 1958). Doctors of the Hippocratic tradition working during the Roman period had already expanded into a number of diverse specializations such as surgery and ophthalmology (Jackson 1988). As in the church, women were not given the full range of opportunities as men in medicine. They could not receive formal training, but they commonly acted as midwives and worked alongside doctors in that capacity (Clark 1993). While doctors were probably widely available, they could be expensive. Furthermore, there was a considerable range of variation in the training and expertise of individuals who claimed to be physicians. Nutton (1984) and Horden (2008) point out that ecclesiastical texts often express disdain for doctors and reference their ineptitude.

The dialectical relationship that developed between Christianity and other forms of medical care in Late Antiquity is noteworthy and created a lasting association. Nutton (1984) and Avalos (1999) have drawn attention to the fact that the conception of Jesus as a healer has not received due attention in discussions of Christianity's success. Christianity contained its own healing system, which provided a number of advantages, mostly related to access, over Greco-Roman medicine. The emphasis on faith, invoking the name of Jesus, and laying on of hands presented the sick with a system that avoided complex rituals and eliminated issues such as extended travel and expense. Interestingly, like the cult of Asclepius, Christianity was also able to draw upon a new demographic group created by the exclusion of the chronically ill from other healing services.

The Christian emphasis on charity also appears to have been responsible for the development of the hospital as a widely available health care institution. The origins of hospitals have been traced by Crislip (2005) to the surprisingly comprehensive and efficient health care systems that appeared in early Christian monasteries by the 4th century AD. Monasteries contained multiple components recognizable in modern health care such as infirmaries or inpatient facilities and professional staffs of doctors and nurses. In the late 4th century, prominent individuals such as Basil of Caesarea and John Chrysostom began the practice of extending the monastic health care system to the general population in what are viewed by some as the first true hospitals (Crislip 2005; Miller 1984).

Despite these positive developments, the possible effects of the collapse of earlier Roman infrastructure on health deserve some mention. Roman cities contained a number of institutions and services carefully designed to promote public health including aqueducts, baths, public latrines, and sewers (Rosen 1958; Scarborough 1981). As discussed previously, those institutions

were often neglected at the expense of ecclesiastical architecture in late antique urban areas, especially in the Balkans where cities also contracted into smaller, more fortified sites. The decline or absence of public health infrastructure, when combined with population aggregation in urban communities, was likely a frequent cause of problems related to sanitation, access to clean water, and disease transmission (Manchester 1992). Based on paleopathological data, there is good evidence that this scenario occurred at places like Butrint and the suburban Vrina Plain, Albania around the 6th-7th centuries AD (Beatrice et al. 2009, forthcoming; Fenton et al. forthcoming). The extent to which rural areas would have been affected by this process is unclear.

The Early Christian Community at Nemea

The conditions that allowed for continued prosperity in the Greek countryside during Late Antiquity led to the occupation of the site of ancient Nemea by a farming community during the 5th-6th centuries AD (Wright et al. 1990). Archaeological evidence for sustained activity during this time comes mainly from modifications made to the Sanctuary of Zeus. While modest in scale, the Early Christian community seems to have thrived until the site was abandoned abruptly in the last quarter of the 6th century.

Consistent with common alterations to classical cities and towns associated with Christianization, two main basilicas were constructed at Nemea. Only limited excavation has been carried out in the area of the basilica located atop the Evangelistria Hill southeast of the Sanctuary of Zeus. Landon (1990) points out that this structure is similar in both design and scale to the valley basilica, which has received much greater attention. The valley basilica was erected on top of the remains of the Xenon, a 4th century BC hotel that probably housed the athletes who

competed in the Nemean games (Kraynak 1990). The plan of this basilica is typical for Early Christian churches in the region and features two aisles, a central nave with an apse at the east end, and a narthex at the west (Landon 1990). It was constructed primarily with building materials reused from earlier sanctuary buildings including the Temple of Zeus. A baptistery and a structure identified as an Early Christian housing complex are associated with the basilica, the latter perhaps serving at least in part as the residence for the clergy (Miller 1983; Miller 1988). The valley basilica was likely the religious focal point for the community, as it would have dominated the modified landscape of the former sanctuary (Landon 1990).

Other evidence for activity at Nemea sheds additional light on the nature of the Early Christian community. Numerous farming trenches have been discovered across the sanctuary as well as in surrounding areas of the Nemea Valley (Landon 1990; Miller 1975, 1977, 1978, 1979, 1980, 1981, 1982; Miller 1983, 1984). These trenches typically appear in parallel rows and in many cases their construction caused considerable damage to underlying Classical and Hellenistic structures. The distribution of these farming trenches suggests that agricultural activity during the 5th-6th century AD must have been extensive. In fact, most of the areas within the sanctuary that have been found to be devoid of agricultural activity were later discovered to contain Early Christian burials (Landon 1990; Miller 1977).

Among the crops typically cultivated during the Late Roman and Byzantine periods, grain, beans, grapes, and olives were the most important (Bourbou et al. 2011; Kazhdan 1997; Rautman 2006; Stathakopoulos 2007a). The excavation reports do not speculate on exactly what was grown at Early Christian Nemea, but it was likely some combination of those foods. A dependence on grain and terrestrial animal products can be inferred from the results of Garvie-Lok (2001), who analyzed carbon and nitrogen isotope ratios in bone samples from 29

individuals from Early Christian graves. Archaeological data from regional sites corroborates the historical and isotopic evidence. The analysis of architectural and botanical remains from a late antique farmstead at Pyrgouthi in the Berbati Valley to the southeast of Nemea indicates the cultivation of a few varieties of grain and legumes, along with the production of wine and perhaps olive oil. Additionally, there is evidence of meat consumption. Faunal remains, some exhibiting cutmarks, show that sheep and goats were the most common domesticated animals at the site, followed by pigs and cattle (Hjohlman 2002).

The results of the Nemea Valley Archaeological Project, which synthesize data from previous excavations, geological studies, and more recent archaeological surveys, suggest that the Nemea region was characterized by population growth and stability in Late Antiquity. As discussed in Chapter One, Wright et al. (1990) have demonstrated that draining the valley properly is crucial to the success of agriculture and probably also for habitation generally. Any project involving the clearing of natural channels and the creation of a suitable irrigation system would have required a substantial and sustainable workforce. While it is difficult to estimate the size of the Early Christian community with precision, the construction of substantial ecclesiastical structures and the scale of the agricultural activity at Nemea are consistent with a relatively large group of permanent residents. Given the modest size of Nemea and its location in an upland valley, it could be argued that the Early Christian community was marginal and isolated. On the other hand, Sanders and Whitbread (1990) demonstrate that Nemea was located along a network of reasonably well connected towns in antiquity.

The Abandonment of Early Christian Nemea

Bearing in mind the results of regional archaeological surface surveys and the evidence for agricultural and religious activity at Nemea, there is good reason to believe that the instability

which characterized much of the Balkans and the West during Late Antiquity was slow to reach rural communities in southern Greece. The evidence for the abandonment of Nemea during the 6th century AD adds to that assertion. According to the numismatic evidence, the Early Christian community was most prosperous during the second half of the 6th century (Landon 1990). In addition, construction projects at the site were ongoing and included the multi-roomed domestic structure located southeast of the Hellenistic Bath described above (Miller 1983).

Activity at Nemea ends abruptly, however. The life of the Early Christian housing complex seems to have been quite short. Miller (1983) dates the construction, use, and demise of the structure to within the second half of the 6th century, based on coins of Justin II. Its domestic contents along with the coins were left in place, suggesting that abandonment occurred rapidly. Archaeological evidence of additional activity in the Sanctuary of Zeus is lacking until around the 12th century AD. While there is ceramic evidence for continued activity in the valleys around Nemea in the early to mid-7th century (Christian Cloke, personal communication 2012), the surface surveys carried out by the Nemea Valley Archaeological Project generally produced little material that could be reliably dated to between the 7th and 9th centuries AD (Athanassopoulos 1993). These results are suggestive of a lengthy period of relative inactivity in the region.

The traditional explanation for the abandonment of Early Christian Nemea is the Slavic invasion of the Peloponnese in the 580s (Landon 1990; Miller 1983). Evidence of violent destruction at a small settlement south of the sanctuary at Nemea as well as at other sites in the region such as Corinth and Argos has been attributed to Slavic invaders (Landon 1990; Miller 1976). Furthermore, possible Slavic settlements have been identified in the region, for example

at Isthmia (Gregory 1993) and Olympia (Völling 2001). Additional evidence of a violent end to the Early Christian settlement at Nemea comes from the tunnel of the Hellenistic Stadium. The skeletal remains of a male individual discovered within the stadium tunnel exhibit a defect on the left parietal bone consistent with an injury caused by a sharp-edged weapon. The fact that this individual did not receive a proper Christian burial, in addition to the discovery nearby of animal bones, cooking vessels, and a coin hoard, suggested to the excavators that the tunnel may have served as a place of refuge during a period of crisis (Garvie-Lok 2010; Miller 1979, 1980).

Interestingly, it seems likely that there was no perceived threat of invasion among the Early Christian community at Nemea as there is no evidence of the fortification of the settlement. In addition, as discussed previously, linking evidence of destruction and abandonment to processes described in historical narratives is problematic. Especially in light of the debate over the Slavic presence in southern Greece, additional explanations should be sought for the rapid abandonment of Early Christian Nemea.

One such explanation is the so called “Justinianic Plague” that swept through much of the Byzantine world beginning in 541 AD. Outbreaks of plague were numerous and widespread in the Mediterranean and, according to the written sources, continued in waves probably into the mid-8th century (Stathakopoulos 2007b). Nearby Corinth was supposedly hard hit and, according to Procopius, lost around half of its population in the mid-6th century.⁹ The impact of plague was felt in the countryside as well as in more densely populated areas. Population losses were apparently great enough that it was necessary for the state to resettle groups of peasants in highly affected areas such as Thrace and Constantinople (Little 2007).

⁹ Procopius, *Secret History* 18.148-160.

The presence of plague at Nemea during the middle or latter half of the 6th century is difficult to prove, however. If the causative agent of the Justinianic Plague was *Yersinia pestis* as a number of recent scholars hypothesize, then no specific indicators would be present on the skeletal remains of those affected.¹⁰ Furthermore, the archaeological evidence at Nemea is inconsistent with the death of a large portion of the Early Christian community occurring around the same time. In that case, one would expect to find “plague pits,” containing groups of individuals buried together, perhaps haphazardly, in a short period of time (Antoine 2008; McCormick 2007). Instead, the Early Christian burials at Nemea are in large part single inhumations that display a high degree of consistency and organization. These burials are introduced in detail in Chapter Six.

Greece and Byzantium in the Middle to Late Byzantine Period

Prosperity under the Komnenoi

A period of revitalization in Byzantium following the so-called “Dark Ages” of the 7th-9th centuries resulted in a degree of growth and prosperity in the Greek countryside and the repopulation of the Nemea Valley after centuries of minimal activity (Bintliff 1996). The renewed strength of the Byzantine Empire in the late 11th and 12th centuries was due in large part to the policies of emperor Alexios Komnenos (AD 1081-1118) and his immediate successors, who were part of a new trend in which powerful administrative positions were held by aristocratic families (Cameron 2006). In addition to reviving a weakened military, Alexios successfully navigated increased interaction with the West and restructured the economic base of

¹⁰ See for example the molecular identification of *Y. pestis* in a 6th century double burial from southern Germany by Wiechmann and Grupe (2005) and the synthesis of the written, DNA, and epidemiological evidence by Sallares (2007).

the Empire (Gregory 2010). The occupation of Nemea again in the 12th century was almost certainly an effect of the population growth and reuse of previously abandoned land that characterized the Greek provinces during this period (Herrin 1985; Kazhdan and Epstein 1985). A more active countryside was accompanied by expansion in urban areas. Gregory (2010) points out that the sites of classical cities were frequently rebuilt or at least reconfigured to feature churches and relocated city centers. This can be seen at Corinth, where new construction in the area of the forum around the end of the 11th century coincides with increased local production and greater distribution of higher quality pottery (Sanders 2002, 2003).

Factors Precipitating Fragmentation

The 11th-12th centuries saw a growing interest in the east by western powers. On the one hand, this was a positive development, as increased trade with Italian merchants at urban centers such as Corinth was one outcome. The development of opportunities in adjacent rural areas like Nemea was probably an indirect result of this renewed economic activity (Athanassopoulos 1993, 2010). On the other hand, western ambitions in some cases extended beyond trade. Greece was periodically invaded by the Normans, who sacked Corinth and Thebes in 1147 AD and Thessalonica in 1185 (Herrin 1985). A weakening of the Byzantine Empire's defenses, precipitated by a gradual breakdown in the relationship between the central government and provincial officials near the end of the 12th century, was partly to blame (Herrin 1975, 1985).

As the provincial government became increasingly disconnected from Constantinople, various local officials competed with one another by collecting their own taxes from the peasantry (Herrin 1975). At the same time, the wealth of Constantinople grew at the expense of the provinces as the central administration was intent on maximizing the productivity of the

countryside and acquiring its products (Herrin 1985; Lock 1995). Also, as early as the 10th century, there was an increase in the number of powerful landowners who sought to obtain available smaller holdings, forcing the owners of those properties to become *paroikoi* or dependent peasants (Lefort 1993; Oikonomides 1996). Peasants were further exploited for their land, which could be taken as soon as farmers were sent away on forced military duty. Some local landowners, increasingly frustrated by the deteriorating conditions in provincial areas, led resistance movements and attempted to establish independent territories (Herrin 1975, 1985). Leon Sgouros, for example, infamously recruited his own army and conquered territory in central Greece and the Peloponnese in the early 13th century (Gregory 2010; Herrin 1975).

The invasions by western powers and the changes in patterns of land ownership described above seem to have been precursors to the profound alteration of Byzantine society that occurred at the beginning of the 13th century. By the time of the Crusades, the relationship between Constantinople and the West had already grown tenuous as a result of fundamental differences in outlook between eastern and western Christianities (Gregory 2010). Byzantine policy toward the Crusaders did little to diffuse those tensions. While Constantinople supported western troops on their journey to the Holy Land, it was sometimes suspicious of their intentions. Emperors also used crusading armies to achieve their own military goals (Herrin 1985). During the Fourth Crusade mutual mistrust, a weakened Byzantine state, and a desire for wealth by the West were ignited by broken promises and internal strife in Constantinople upon the arrival of the Crusaders (Cameron 2006; Gregory 2010).

The Fourth Crusade and the Conquest of the Peloponnese

In April of 1204 AD the Crusaders sacked Constantinople and instituted a period of Latin rule in the east. The territory of the Byzantine Empire was divided into Frankish states, minor lordships, and Italian colonies (Reinert 2002). Byzantine resistance to Latin occupation was confined to separate successor states such as Epirus in northwest Greece and Nicaea in Anatolia (Cameron 2006; Reinert 2002).

Conquest of the Peloponnese began a short time later as an army of Frankish knights passed through central Greece and laid siege to Corinth and Nauplion. Greek resistance, led by Leon Sgouros, held out at the fortress of Acrocorinth until 1210 AD and slightly longer at other strongholds in the northeastern Peloponnese such as Nauplion and Argos (Gregory 2010; Lock 1995).¹¹ From this position, the Franks proceeded gradually to control territory in southern Greece. While they encountered few additional episodes of significant local resistance, conquest of the entire Peloponnese was not complete until 1249 AD.

Lock (1995) points out that the Frankish holdings remained somewhat insecure and that the Frankish period in Greece was characterized by violence and instability. Conflicts with Byzantine successor states who aimed to re-conquer the Peloponnese continued into the later 13th century (Jacoby 2008; Lock 1995; Runciman 1980). The Byzantines under Michael VIII Palaiologos were finally successful in reestablishing themselves in southern Greece in 1262, after the Frankish knights ceded Monemvasia, Maina, and Mistra back to Byzantine rulers (Lock 1995). However, raids and sporadic fighting between the Franks and local Greeks intensified and became more widespread, resulting in what Lock (1995:84) describes as “daily hostilities, the destruction of towns, the depopulation of the countryside, the death of countless men cut down in

¹¹ Sgouros himself died in either 1208 or 1209 (Gregory 2010).

their prime and the compulsive search for plunder.” The inability of the Frankish rulers to maintain control over the Peloponnese necessitated an appeal for western aid and, by the 1270s, the Angevins under Charles of Anjou were in possession of the Frankish Morea (Lock 1995). Thus began a centuries-long period during which the French, Aragonese, and Italians competed for power and influence in southern and central Greece.

Frankish Greece

The establishment of Frankish Greece was part of the larger pattern of fragmentation of Byzantine territory that altered the political, economic, and demographic trends of the Aegean in the 13th century (Jacoby 2008). Under the Latin Empire, territory in Greece was divided into fiefdoms and bishoprics (Gregory 2010; Ilieva 1991; Williams 2003). The Peloponnese became the principality of Achaia and a western-style feudal system was established in the province by Frankish lords accustomed to a rigid social hierarchy (Jacoby 1973, 1986, 1989a, 2008). Powerful Greek landowners were gradually incorporated into the class of feudatories (Jacoby 1989a). Life for the average rural peasant is usually assumed not to have undergone substantial changes, aside from the destination of their taxes (Kardulias 1997).

However, there are reasons to believe that the western system imposed on Greek peasants did in fact have a negative impact on their well being. In contrast to Late Antiquity when peasants were largely independent, the stratified society of the Frankish lords made peasants’ position at the bottom of the social hierarchy both legal and hereditary (Jacoby 1973, 1989a, 2008; Lock 1995; Rautman 2006). In addition to losing their free status, the burden of taxes on peasants, which consisted of the products of their agricultural labor, was severe. Runciman (1980:26) suggests that peasants were required to give everything beyond what was necessary for “bare subsistence” to their lords. Peasants also lost their legal power and could no longer

direct a complaint against a lord. When abuses did take place, the courts apparently looked the other way. Jacoby (1989b) describes a case in which a landholder avoided any formal prosecution after he accidentally killed a *paroikos* for refusing to obey him. In a number of ways, then, the relationship between peasant and landlord deteriorated under Frankish rule when compared to the *pronoia* landholding system that developed during the Middle Byzantine period (Ilieva 1991; Jacoby 1989a).

Archaeological evidence from well-excavated urban centers like Corinth suggests that the long period of conflict and social transformation outlined above negatively affected living conditions in Frankish Greece. As previously discussed, Corinth appears to have enjoyed economic prosperity during the 12th century, perhaps even following the attack by the Normans in 1147 AD (Sanders 2002). However, Williams (2003) reports that the first half of the 13th century witnessed contraction, a decline in living standards, and a reduction in the size of the city's population. Examination of human skeletal material from Frankish Corinth reveals evidence of violence and poor health, indicating that urban life was precarious (Barnes 2003; Snyder and Williams 1997). It is only in the later 13th century, when the Franks had been long established in the northeastern Peloponnese, that conditions in the city appear to have improved (Williams 2003).

Less archaeological evidence is available that might add to the historical picture of conditions in the countryside of Frankish Greece. Evidence from archaeological field surveys in central Greece points to the proliferation of both nucleated communities and small rural sites (Bintliff 1996). However, the opposite pattern is apparent in the northeastern Peloponnese. Athanassopoulos (2010), for example, has recently demonstrated that the conditions around

Nemea deteriorated in the late 13th century to the extent that the inhabitants abandoned the valley in favor of the fortified hilltop of Polyphengi.

Social and Religious Change in the Middle to Late Byzantine Period

Religion

The events of the Fourth Crusade were, in part, the culmination of religious tension between the East and West that characterized the Middle Byzantine period. Disagreements between the Orthodox Byzantines and the Latin Catholics over a number of aspects of Christian doctrine had become vocal by the 9th century AD (Krueger 2006). In the East, religious practice took many forms including services that involved community participation and acts that could be more personal such as visiting healing shrines possessing saints' relics and the use of icons or pendants (Gerstel and Talbot 2006). Monasticism continued to be prominent and its influence on lay observance may have actually increased from Late Antiquity. Krueger (2006) points out that the distinction in the Early Byzantine period between monastic and parish liturgies broke down during the Middle Byzantine period. As a result, Christians were encouraged to participate in ascetic forms of religious behavior such as personal devotion and fasting.

The shift from public forms of worship to those that were more private was an important distinguishing feature of Byzantine Christianity in the later centuries of the Empire. In terms of the liturgy, large outdoor processions gave way to indoor services characterized by less participation by the laity (Krueger 2006). Greater emphasis was placed on the personal connection between an individual and religious imagery (Ousterhout 2008). This social transition is also reflected in the architecture of the period. Large basilicas were replaced by smaller

churches, many of which were used as private family chapels (Herrin 1985; Ousterhout 2008).¹² Additionally, internal design changes such as the development of the iconostasis created a greater physical separation between the clergy and the laity (Gerstel and Talbot 2006; Krueger 2006).

The establishment of the Latin Church in the lands conquered during the Fourth Crusade did not result in the disappearance of Byzantine Christianity. Rather the two traditions seem to have managed an uneasy coexistence. In the Morea, Greeks supposedly accepted Frankish rule on certain conditions, one of which was that they were able to keep their faith (Angold 1989). The presence of the Catholic Church there was established quickly as representatives were present in the armies of the Frankish knights that conquered the Peloponnese. Later, Catholic bishops were present in a number of towns including Patras, Corinth, and Argos. However, at least some Greek priests remained in the villages of the Morea, although they may have been treated poorly and, at least initially, subjected to high taxes (Ilieva 1991). Richard (1989) demonstrates that even the control of Greek monasteries by the Latin Church was not always based on the idea of the suppression of those institutions. Greek monks were not necessarily forced to leave and an Orthodox lifestyle might continue in those instances. In the less accessible mountainous or rural regions, Orthodox practices probably continued uninterrupted (Ilieva 1991). In her study of the interaction between the Franks and local Greeks in the Peloponnese, Ilieva (1991:246) is more comfortable characterizing the religious climate as one of “contact” and “opposition” rather than “symbiosis.”

¹² Small family chapels were also used for the burial of extended family during the Middle and Late Byzantine periods (Gerstel and Talbot 2006; Kazhdan and Epstein 1985).

Gender and the Family

The increasing popularity of private forms of religious devotion in the Middle Byzantine period had corresponding developments in the conception of the Byzantine family. By the 9th century AD, participation in social life had become narrower and greater emphasis was being placed on the nuclear family. Byzantine society had always been patriarchal, but the activity of women in public life that was characteristic of Late Antiquity declined sharply during this period and in its place were greater expectations within the family (Kazhdan and Epstein 1985). A high priority was placed on child-care and Talbot (1997) points out that bearing children was viewed as the most important role of women. The relative seclusion of women was suggested also to avoid attracting the attention of unrelated men (Kazhdan and Epstein 1985; Talbot 1985). Leaving the home even for the purpose of public religious worship may have been frowned upon by some (Talbot 2006).

Again, it should be noted that conformity to these ideas was probably greatest among the elite women of Byzantium. The extent to which they were observed by men and women of modest means in the countryside is unclear. It is unlikely, however, that women in rural areas and agricultural communities were confined to the household (Cameron 2006). Peasant women probably played significant roles in activities such as maintaining gardens and vineyards and feeding animals. They might also have assisted with grain harvests during periods of warfare or other calamities (Talbot 1997).

Jacoby (1989a:207) suggests that the stratified society established in the Frankish Morea, “ensured social segregation” between the Greeks and the Latin elite. While this might be overstating the case, mixed marriages were certainly discouraged and the illegitimate children of Latin fathers and Greek mothers could not become members of the feudal class. If western social

customs did influence gender relations in the Morea, the effect was not likely to have been positive for women given that traditional Frankish society was male-dominated. Laiou-Thomadakis' (1977) study of peasant society in the 14th-century Macedonian countryside shows that the social unit normally consisted of a patriarchal nuclear family. Men were generally regarded as the heads of households and were also typically the property owners and tax payers. Perhaps most telling, registers of households indicate that the sex ratio of males to females was high. While an overrepresentation of males in these data could be the result of bias in the registration process, it might also be attributed to greater female mortality resulting from the preferential treatment of males. Other researchers (e.g., Talbot 1997) have noted that childhood was more hazardous for Byzantine girls as a result of factors such as unequal attention and an earlier weaning age.

Medicine and Public Health

Byzantine medicine in general remained highly influenced by the work of Galen of Pergamon, but contemporary medical authors have been criticized for their emphasis on summarizing his work and for their lack of fresh ideas and original research (Nutton 1984). Galen's brand of preventative medicine is apparent in the large number of guidelines related to health and hygiene produced in both the East and West during the Middle Ages (Rosen 1958). While texts such as the *Regimina Sanitatis* contained a number of ideas that remain accepted (e.g., moderation in food and drink, regular exercise), they were aimed mostly at elites (Sotres 1998). For most people in the Byzantine Empire, the need for medical attention was probably met first at the household level. Simple remedies that involved the use of medicinal plants or amulets were widely known even in the countryside and did not require trained specialists (Rautman 2006).

The attitude of the public toward doctors during the Middle Byzantine period varies depending on the source and also changes through time. As in Late Antiquity, hagiographic texts are highly critical of doctors and often contrast their greed and lack of skill to the miraculous cures of saints. On the other hand, medical practice in the 12th century became the subject of satires, many of which describe doctors in a more positive light, remarking, for example, on their surgical abilities (Kazhdan and Epstein 1985).

Hospitals, which had their origins in monasteries and which opened their doors to the general public during Late Antiquity, as was discussed above, developed into prominent institutions during the Middle Byzantine period. As early as the 7th century AD, hospitals were no longer exclusively charitable establishments. Miller (1984) demonstrates that patients included wealthier members of society in addition to the poor and the homeless. The range of medical specialists employed in hospitals also increased during this period. The role of nursing was professionalized and portions of hospitals were dedicated to certain types of ailments and forms of treatment such as surgery. Hospitals were typically associated with cities, and large population centers such as Constantinople and Antioch had more than one. By the 12th century, Byzantine hospitals contained an experience-based hierarchy of physicians and an administrative staff that was chosen from those among that group (Miller 1984, 1997).

Despite these developments, the impact of hospitals on the health care of the average member of Middle to Late Byzantine society is not exactly clear. Some researchers (e.g., Horden 2008) have questioned whether the quality of hospital care was actually much different from what was available outside of hospitals. If hospitals did provide a superior level of medical treatment, one might still wonder about their accessibility. As an urban phenomenon, how often

were they visited by people living in the countryside? Furthermore, it seems likely that the events of the Fourth Crusade brought about a decline in the presence of hospitals. Comparable institutions did not exist in the West until the 13th century and it may be telling that it is difficult to find records of hospitals outside of Constantinople in the 14th century. Even Mistra, a major center of Byzantine culture in the post-Frankish Peloponnese, apparently did not have one (Miller 1984).

It is important to bear in mind that the health of any community is dependent first on a reliable subsistence base and second on institutions such as hospitals or doctors. A number of factors, both natural (e.g., climate shifts, insects and other pests) and anthropogenic (e.g., political instability, economic crises), affected the production and distribution of food in Byzantium (Rautman 2006). Stathakopoulos' (2004) extensive compilation of references to outbreaks of famine and plague in the Byzantine world demonstrates the consequences of such problems and attests to the importance of proper food storage during times of plenty. People living in the countryside might keep an entire year's harvest in large storage jars or *pithoi* as a buffer against misfortune (Grünbart 2007). Prolonged storage is also problematic, however, as it may deplete food of certain nutrients (Mays 2008). Food production and storage have important implications for the Middle to Late Byzantine community at Nemea. Like its Early Christian counterpart, it was a rural community whose livelihood was based on intensive agriculture.

The Middle to Late Byzantine Community at Nemea

Based on the evidence in and around the Sanctuary of Zeus at Nemea, there were few differences in the activities of the Early Christian and Middle to Late Byzantine communities.¹³ The remains of farming trenches and irrigation ditches dating to the 12th-13th centuries AD closely resemble those of the Early Christian community (Landon 1990; Miller 1975). The similarities in the impressions left on the landscape of Nemea by these two communities should be of no surprise as agricultural practices probably changed little during the course of the Byzantine Empire (Athanasopoulos 1993; Rautman 2006).

Once again, there is little data available in the excavation reports to provide a clear indication of the types of produce cultivated at Nemea during this period. However, Athanasopoulos (2010) suggests that gardens and probably vineyards were in use. Richard (1985) adds that wine grapes prospered in the Morea, and that wine and olives were commonly produced. Isotopic data from bone samples that may be used to reconstruct dietary composition is available for 25 Middle to Late Byzantine individuals from Nemea studied by Garvie-Lok (2001). Her data show that the diet of the later community at Nemea was nearly identical to that of the Early Christian community, which focused on grain along with some animal products.

In addition to the evidence of agriculture in the sanctuary, domestic activity is suggested by a two-room structure with associated cisterns dated to around the 13th century (Miller 1977). All other evidence of activity within the sanctuary during the Middle to Late Byzantine period is associated with the Early Christian basilica, the use of which differed markedly from Late Antiquity. At least portions of that structure had probably fallen out of use by this time, evidenced by a number of graves cut into its floor and walls (Frey 1998; Miller 1988). However,

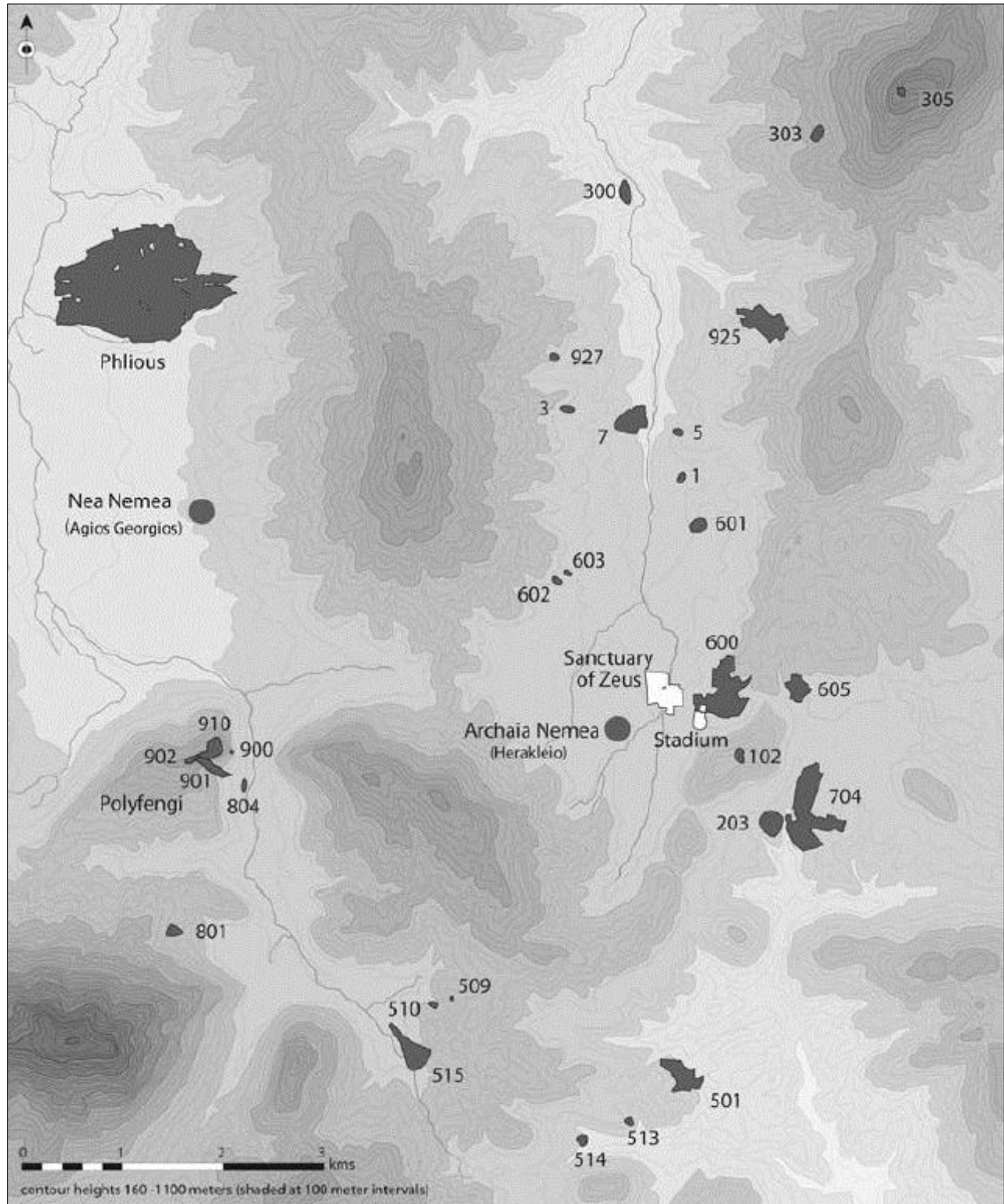
¹³ The distinct differences that exist are related to the patterns of burial during this later occupation. These will be treated separately in Chapters Five, Six, and Eight.

the presence of graves and the construction of a small chapel adjacent to or within one of the rooms of the basilica demonstrate that it retained some religious significance (Cousin and Dürrbach 1885; Landon 1990; Miller 1988). Burials continued to be placed within or adjacent to the remains of the basilica through the Late Byzantine period (Miller 1988).

Archaeological surveys in the Nemea Valley have recently produced a clearer picture of regional settlement patterns during the Middle to Late Byzantine periods. Based on concentrations of Byzantine pottery, Athanassopoulos (1997, 2010) has identified two relatively large settlements dating to the 12th-13th centuries AD in the area to the east of Nemea. Site 600, just to the east of the Sanctuary of Zeus, is the likely location of the hamlet whose inhabitants farmed the land and buried their dead at Nemea in this period (Figure 3.1).

The identification in the region of a number of smaller sites that probably represent farmsteads suggests that agricultural activity was expanding during the 12th-13th centuries. Athanassopoulos (2010) also points out that the presence of high-quality glazed pottery attests to a growth in the disposable income of peasants at this time. Once again, however, the settlement pattern in the Nemea Valley changes. By the late 13th century, almost certainly as a result of the need for greater security during a tumultuous period in the Peloponnese, dispersed activity in the valley ceased and the fortified village on the hilltop of Polyphengi became the center of habitation (Athanassopoulos 1997, 2010).

Figure 3.1: Map Showing Medieval Sites from the Nemea Valley Survey (Athanasopoulos [2010: Figure 1, Rosemary Robertson]). Reprinted with permission without modification or alteration (see Appendix C, p. 372).



Summary

This chapter outlines in detail the historical and archaeological contexts of the Early Christian and Middle to Late Byzantine settlements at Nemea. For each period, I have discussed developments in religious practice, conceptions of gender, and health care that may have shaped daily life in each community. I have also outlined some of the major sociopolitical transformations and events that may have had an impact on each community. Finally, I have provided in-depth discussions of the archaeology of each community at Nemea, with an emphasis on demonstrating what the observed patterns tell us about how those communities fit into the broader transformative processes of their respective time periods. I argue that the Early Christian settlement at Nemea may have enjoyed a greater degree of prosperity than is usually assumed based on a revised understanding of historical circumstances traditionally viewed as devastating, such as the Slavic “invasion” of the 6th century AD. The events associated with the Fourth Crusade and the Frankish conquest of southern Greece are more likely to have had negative consequences for the health of the Middle to Late Byzantine community.

CHAPTER 4: MORTUARY PRACTICE IN BYZANTIUM

As discussed in Chapter Two, the study of mortuary practice as reflected in the archaeological analysis of burials may be informative about aspects of sociocultural practice such as religious beliefs, status differentiation, family structure, and gender relationships. While the study of burial practices in the Roman Empire is well developed, comparatively little attention has been paid to burial in the Byzantine world. Furthermore, much of the scholarship on the subject of mortuary practice in Byzantium has focused on funerary rituals. Fewer studies have closely examined the context of burial and the organization of Byzantine cemeteries. Ignoring those components of mortuary practice limits our ability to answer a number of related questions about burial in Byzantium. For example, who decided where people were buried? Were family plots typical? How common were single inhumations and multiple burials, and what was the significance of each type? Did a systematic practice of exhumation and grave reuse exist in Byzantium? What determined whether or not someone received secondary burial treatment? What did the location of burials symbolize? Did there exist a “hierarchy of sacred space” as some have argued (e.g., Ivison 1993)? Did the rules governing cemetery organization change over time? Particularly after 1204 AD, can western influence be detected in burial practices? Acknowledging that Byzantine burial practices were likely to have been context specific, this study is uniquely positioned to shed light on those questions as they pertain to the Greek countryside.

In this chapter, I provide an overview of funerary ritual in Late Antiquity and the Byzantine period and discuss what is known about common aspects of burial practice in Byzantium. I then introduce the hypotheses about the association between burial location and

social status that are tested in this research using the archaeological evidence and skeletal samples from Nemea.

Early Christian and Byzantine Funerary Ritual

The evidence for Early Christian and Byzantine funerary ritual comes mainly from sources such as sermons and hagiographic texts. Rebillard (2009) has pointed out that it is difficult to construct a late antique Christian death ritual based the limitations of those sources, which offer only snapshots of practices that were locally variable. It is nevertheless useful to briefly examine the aspects of Christian funerals that appear in the written sources to better understand the outlook and worldview of early Christians and the ways in which those views changed during the Byzantine period. Furthermore, it is the archaeological evidence of funerary rituals in general that provides another avenue for the investigation of sociopolitical change in past societies (Morris 1992).

Certain aspects of Christian funerary rites in Late Antiquity were not dissimilar from those of Roman funerals. While Rebillard (2009) has shown that the Church was not as responsible for control over funerary rituals as previously assumed, it should probably be taken as significant that the early Church broke with tradition gradually. For example, when certain pagan practices were rejected, Christian substitutions for those practices were often made (Rush 1941). Additionally, Alexiou (2002) reports that aspects of ancient ritual that survived in Late Antiquity were sometimes simply adopted by the Church, even in the case of rites that had been previously denounced. Based on the tension apparent in Christian and pagan dialogue with regard to funerary practice, however, Rebillard (2009) notes that Christian funerals must have had a distinctive character. Rush (1941) provides an overview of common features of Early Christian funerary ritual and his work is the basis of the following discussion.

Among the first acts performed after death were closing of the eyes and mouth and stretching out of the hands and feet, which were intended to give the deceased the appearance of sleeping in addition to facilitating the soul's departure from the body (Kyriakakis 1974; Rautman 2006; Rush 1941). Throughout the Byzantine period, these initial rites were normally carried out by close family members (Kyriakakis 1974). A final kiss was given, although this served to demonstrate the connection between the living and the dead among Early Christians and was not necessarily connected to the catching of the soul with the last breath in the pagan tradition (Toynbee 1971). Interestingly, the "kiss of peace" demonstrates that Christians did not have the same anxiety about contact with the corpse that pagans did. Unlike Roman funerals, which required purification rites of those who came into close proximity to the body (Jones 1987; Lindsay 2000), Christian practices dissociated a ritual or legal state of death-pollution from contact with the dead (Samellas 2002).

Christianity retained a sense of the deceased person's need for protection on the journey to the next life but, as Rush (1941) demonstrated, this was an instance where a pagan tradition was modified or replaced with something new. The Christian version of the *viaticum*, in which the Eucharist was received at the time of death, was substituted for the act of placing of a coin in the mouth for Charon's fee. *Conclamatio*, the custom of calling out to and lamenting the deceased, was not formally adopted by Christianity. However, it is clear that some form of deliberate excess in the manifestation of grief similar to the pagan tradition continued to be practiced despite the vehement opposition of Church fathers such as John Chrysostom and Basil of Caesarea (Alexiou 2002; Rebillard 2009; Rush 1941).

The care of the body after death was the responsibility of relatives or, in some cases, the local Church community (Rush 1941). As in the Roman tradition, the body was washed and

anointed. However, it must have been common among Christians to restrict the use of perfumes to funerals as texts produced by non-Christians deride that practice (Rebillard 2009). The body was usually dressed in a white winding-sheet or sometimes in the finest clothes owned by the deceased (Alexiou 2002; Constan 2006; Rush 1941). The hands and feet were bound and the former were tied to either the stomach or chest (Kyriakakis 1974). The use of simple clothing or a shroud of white linen was promoted by Church Fathers, who spoke out against competitive display among wealthier Christians that developed from the practice of clothing the dead in special garments (Kyriakakis 1974; Rush 1941). The early Church also rejected the pagan practice of placing a crown upon the head of the deceased because this act likened the dead to the gods and was viewed as a form of idolatry (Rebillard 2009; Rush 1941). Despite the pagan association, it was popular in Byzantium to crown the dead with a wreath of flowers (Kyriakakis 1974).

Following the preparation of the body, Byzantine Christians held a wake or *prothesis* similar to that which was typical in Roman funerals (Alexiou 2002; Jones 1987; Kyriakakis 1974; Rush 1941; Toynbee 1971). While this might have involved the deceased lying-in-state at home, the wake could also be held at the grave in cases when burial happened quickly after death. Rush (1941) points out that it was not until the 4th century AD, when Christianity was more established, that church services began to be associated with the death of its members and that wakes were held at the church. In the Byzantine period, the body might be taken to the church and displayed in the narthex or nave following the *prothesis* at the house of the deceased (Constas 2006; Gerstel and Talbot 2006).

Christian funeral processions were ideally simpler and more subdued than those carried out in the Roman tradition. The singing of psalms was substituted for musicians and though

professional mourners and excessive displays of grief are attested, they were, in the preference of the Church, not part of this rite (Alexiou 2002; Constanas 2006). The protests by Church Fathers of extreme mourning practices were based on the idea that they were not useful to the dead and on the revised understanding of death in Christianity, which was supposed to elicit feelings of hope rather than sorrow (Rebillard 2009). The former notion was apparently also behind criticism of Early Christians who continued to offer items such as food, clothing, and candles at the grave (Alexiou 2002). In the Byzantine East, funerary services or prayers to commemorate the dead were held on the third, ninth, and fortieth days after death. Those dates were adopted and modified from the Greco-Roman tradition (the thirtieth day was replaced by the fortieth), with justification coming from Christian theology (Alexiou 2002; Gerstel and Talbot 2006; Paxton 2008; Rebillard 2009; Velkovska 2001).

Burial in Byzantium

The significance of a Byzantine cemetery to its community has been underscored by Rautman (2006:164), who states that “as a ceremonial focus and literal repository of its past, the cemetery was an enduring part of any village’s identity.” The Byzantine period was characterized by a closer physical association between the living and the dead, as cemeteries developed alongside churches that were increasingly located within towns and cities. Despite the strength of the relationship between cemetery and community, the creation and organization of cemeteries in Byzantium is not well understood. This section outlines general features of burial practice in the Byzantine world and explores how evidence from Byzantine cemeteries might be used to infer aspects of community social structure.

Grave Construction, Arrangement of the Body, and Grave Contents

Especially in the countryside, most Byzantine graves were simple pits that might be tile-lined or stone-lined and were often covered with tiles or stone slabs (Constas 2006; Rautman 2006). As in the later Roman period, inhumation rather than cremation was the norm for Byzantine burials. It was standard practice for Christian graves to be oriented east-west with the head to the west, so that the deceased would face east where Christ would appear at the resurrection. Bodies were usually arranged extended in a supine position, with the arms crossed over the chest or abdomen. Ivison (1993) has argued that coffins were probably used infrequently in Byzantine burials before Latin rule in 1204 AD, except perhaps among the wealthy. The practice of propping up or protecting the head using a stone pillow and placing tiles or fieldstones along the sides of the skull discussed by Gerstel and Talbot (2006) as well as Ivison (1992, 1993) may also be an indication of western influence. Ivison (1993) has demonstrated that this type of attention to the head of the deceased does not appear in Byzantium until the 13th century.

In contrast to Roman burials, which typically contained a variety of grave goods (Toynbee 1971; Jones 1987), Christian burials in Byzantium normally contain few mortuary artifacts. Constas (2006) and Rautman (2006) suggest that objects such as cross-inscribed ceramics, flasks, and occasionally coins might be placed with the deceased at burial. Standard articles of clothing such as belt buckles and items of personal adornment such as earrings and finger rings are also frequently recorded (Ivison 1993, 1996). It is possible that children and adolescents were buried with items of personal adornment more frequently than adults. The concern of Byzantine parents for the well-being of their children extended to the funerary context and it has been argued that jewelry and toys appearing in the graves of children indicate affection

and perhaps attempts to offer them an additional degree of protection in death (Iverson 1993; Pitarakis 2009; Talbot 2009; Tritsaroli and Valentin 2008).

Collective Burial and Secondary Burial

Gerstel and Talbot (2006) point out that it is not uncommon for Byzantine graves to contain multiple individuals. In most cases, such graves probably represent multiple primary interments (Iverson 1993). Large burial vaults specifically constructed to accommodate multiple extended burials have been described by Iverson (1993, 1996) at a number of Byzantine sites including Corinth. Smaller graves were used in a similar way, for example at Polystylon-Abdera (Agelarakis 1997) and Panakton (Gerstel et al. 2003), although earlier interments needed to be moved aside to make room for each subsequent burial.

While Constan (2006) notes that families were normally buried in the same cemetery, the extent to which multiple burials can be understood to contain family members is unclear. Talbot (2009:300) suggests that this was a common practice, stating that children might be buried in “family graves that held multiple burials.” The presence of children in graves containing multiple individuals may in fact be a good indication of family use as Gerstel and Talbot (2006) suggest that mothers and children were often buried together. In the case of multiple individuals included in a single grave or clusters of individuals buried near one another, one must also consider the possibility of a disruptive event such as an epidemic disease (Gerstel and Talbot 2006). For example, Barnes (1996, 2003) has related clusters of children’s burials at Frankish Corinth to a series of epidemics, possibly of malaria. A similar situation may have produced clusters of predominantly children’s burials at the site of Butrint, Albania (Beatrice et al. forthcoming).

Secondary burial in ossuaries was also carried out during the Byzantine period and may have been particularly common among monastic communities and saints (Abrahamse 1984;

Constas 2006). A number of researchers have suggested that this practice extended to laypeople as well (Constas 2006; Ivison 1993; Rautman 2006; Talbot 2009). Where this occurred, it involved exhuming the remains of the deceased after a few years and reburying the bones in community or family ossuaries or burial chapels (Constas 2006; Rautman 2006). Talbot (2009) points out that Byzantine children were included in secondary burial practices as their remains have also been found in ossuaries.

Ivison (1993) has argued that the popularity of secondary burial in Byzantium may be overestimated based on the tendency of archaeologists to misidentify sites of multiple primary burials as ossuaries. He demonstrates that true ossuaries can be identified based on their layout, which does not have to account for extended bodies, and on the pattern of disarticulation and sorting of the bones present. Empty or incomplete primary burials may also serve as indirect evidence of the practice of secondary burial.

The Spatial Organization of Byzantine Cemeteries

Burial Location and Religious Beliefs

The Roman practice of burying the dead outside the boundaries of towns began to break down in Late Antiquity, facilitated by the growth in popularity of martyr cults and the movement of relics from extramural to intramural churches (Harries 1992). By the end of the 4th century AD, graves were being placed within city walls (Davies 1999). Only a century later the public spaces of classical towns were being used for burial (Constas 2006; Ivison 1996). Early Christian burial sites also began to be closely associated with the basilicas and mortuary chapels that appeared in both East and West around this time (Davies 1999). By the Middle Byzantine period, burials were almost exclusively located either within or immediately outside of churches (Ivison 1996). The religious significance of basilicas was great enough that they retained their function

as places of burial in instances where they had been damaged or had otherwise fallen out of use (Caraher 2008, 2010).

The extent to which Christian burial locations were kept spatially distinct from those of pagans has been the subject of debate. It seems likely that practices varied from region to region and perhaps even between local communities. For example, Davies (1999) notes that a clear separation between pagan and Christian burials was maintained at the 4th century AD cemetery at Poundbury. Other reviews of mortuary behavior in Late Antiquity suggest that, in general, little effort was expended to separate burial space based on religious belief (Harries 1992; Johnson 1997).

Rebillard (2003, 2009) has argued that a number of statements by early religious leaders that appear to confirm a Christian preference for spatial segregation have been misinterpreted. He suggests that the Church held no official position on the sharing of burial space and that decisions about this aspect of burial location were left largely to the families. This conclusion is supported by Johnson (1997), who adds that Christianization was a lengthy process. While it might have divided families along religious lines, it probably would not have broken the tradition of maintaining family tombs in those cases. From an archaeological perspective, classifying burials into categories of pagan or Christian is not always straightforward because religious identity is one of many identities that might be expressed through the act of burial (Jenny 2011). Furthermore, such a classification presupposes the existence of strict religious affiliations that in reality may have been much more flexible.

Burial Location and the Social Hierarchy

One of the most fascinating ideas about the organization of Byzantine burials is the suggestion that their arrangement reproduced or was at least related to the social hierarchy. At a

basic level, this goes to the question of who received burial within a church. Most of the historical and epigraphic evidence suggests that church burial was reserved for the clergy and perhaps wealthy donors, while the burials of most laypeople were located in cemeteries around the church (Davies 1999; Ivison 1993; Samellas 2002; Yasin 2005). Individuals given church burial might be provided with tombs sunk into the floor, most often in the narthex or in an associated burial chapel (Constas 2006; Gerstel and Talbot 2006; Teteriatnikov 1984). In other cases, individuals were placed in burial chambers or *arcosolia*, which were arched niches carved into the walls of the church or chapel (Constas 2006; Teteriatnikov 1984).

A driving force behind the burial of privileged Christians within churches was the desire to receive burial in close proximity to the bodies or relics of saints (Harries 1992; Paxton 2005). It was believed that, through *ad sanctos* burial, the saint would intercede for the deceased and thus provide them with divine protection. Samellas (2002) has demonstrated that it was in fact beneficial to the Church to maintain control over relics because it allowed religious leaders to determine who had access to more sacred burial locations. Effros (1997) adds that the Church actively promoted the idea that *ad sanctos* burial offered not only protection for the soul, but also social prestige. Although the degree of control exerted by the Church over the placement of burials, especially those of the laity in Late Antiquity, has been questioned by Rebillard (2009), it seems likely that competition for burial space developed over time and that social distinctions were reflected in the spatial organization of Christian tombs and cemeteries. Paxton (2008:394) captures this argument in the following remarks:

In both East and West, burials were placed according to a moral scale, with the holiest of the dead at the center and others around them in proportion to their own claims to holiness: saints, bishops, abbots, monks, and pious (and wealthy) lay men and women.... For the most part, the medieval economy of death reproduced the social hierarchies of the living.

Iverson (1993) has expanded upon and refined the idea that burial space within Byzantine churches was organized in a hierarchical fashion. Using archaeological evidence along with written sources, he showed that tendencies in the location of elite burials at both Constantinople and Mistra were also visible in the churches of a number of provincial cities. In the pattern he identified, burials of important individuals were located in the *naos* or nave. Those closer to the east end of the church carried greater distinction because of their proximity to the altar and holy relics. Priests, for example, might be buried in the *bema*, a space they typically occupied during church services. The place of greatest honor was on the south side of the *naos*, toward the east end. This designation drew upon a symbolic association between the right side of the basilica and the idea of the right side as “that of The Saved” (Iverson 1993:74). It is important to emphasize here that access to sacred burial space, which was highly limited, was not just important to the deceased. The prestige associated with a prominent burial location probably extended to the deceased’s living relatives and may have been a factor in the legitimization of power relationships in Byzantine communities (Iverson 1993).

Although Iverson (1993) demonstrated that his model has wide applicability in Byzantium, the church burials he examined are from relatively large cities and towns. One of the goals of the present research is to test whether or not the associations between burial location and social status proposed by Iverson and others can be detected in the context of the Byzantine Greek countryside. Gerstel and Talbot’s (2006:97) assertion that “burial patterns in villages mirror those from urban contexts, though on a more modest scale” supports the application of Iverson’s model to places like Nemea. Furthermore, while Iverson (1993) focused on evidence from the Middle to Late Byzantine period, it is probable that social hierarchies were reflected in the spatial organization of Early Christian cemeteries as well. For example, Al-Shorman (2004) has

shown that three distinct cemeteries surrounding a 6th-century AD church at Yasideh in Jordan separated the congregation based on social rank. In this way, entire funerary landscapes created during the Byzantine period might be imbued with information about social distinctions.

Summary

This chapter has examined fundamental aspects of mortuary practice during Late Antiquity and the Byzantine period. I have shown that Early Christian and Byzantine funerary rituals borrowed elements from Roman practice, but often modified them to maintain consistency with Christian tradition. Despite the disapproval of religious leaders, funerals may have contained a mix of Christian and pagan themes and this has implications for what might be observable archaeologically in burials, especially from the Early Christian period. I have also reinforced the idea that Byzantine communities had powerful physical and symbolic connections with their cemeteries. This was expressed in the close association between cemeteries and community churches as well as through the organization of burial space both within and outside of churches. Archaeological and historical evidence suggests that status distinctions which existed during life were often maintained and delineated spatially in death. In Chapter Five, I outline the research questions and hypotheses used to test that assertion, as well as those used to investigate the impact of sociopolitical change on health in the Byzantine Greek countryside.

CHAPTER 5: RESEARCH QUESTIONS, HYPOTHESES, AND EXPECTATIONS

In chapters three and four I examined the sociopolitical context of Early Christian and Byzantine Nemea, as well as more detailed aspects of cultural practices associated with those periods. I highlighted instances where our understanding of the impact of certain events and cultural transformations is incomplete and also posed a number of questions that might be explored using an approach that augments the available historical and archaeological evidence with data from human skeletal analysis. In this chapter, I lay out the primary research questions that are addressed in this dissertation.

Investigating the Biological Impact of Sociopolitical Change

As discussed in Chapter Two, anthropological models of stress (e.g., Goodman et al. 1984, 1988) demonstrate that changing cultural and environmental circumstances can exceed the limits of an individual's biological resistance and result in physiological disruption. Especially in the case of chronic, unmitigated stress, physiological disruption is often reflected in the human skeleton as inhibited growth, pathological lesions, and elevated mortality. The need to adapt to changing conditions was common to all past populations. However, groups such as Greek peasants living in the Byzantine Peloponnese during 12th-13th centuries AD experienced changes in their physical and social environments that were particularly direct and dramatic. While the archaeological evidence discussed in Chapter Three indicates that the Early Christian community at Nemea was relatively prosperous just before the abandonment of the site in the late 6th century, the Middle to Late Byzantine community existed during a period characterized by increasing central and local administrative instability, a violent invasion, and the imposition of a feudal system. The effects of those processes on aspects of living conditions such as workload

and access to dietary resources may be assessed through the paleopathological analysis of the extant human skeletal remains. This study is also concerned with the statuses and roles of men and women in the Byzantine Greek countryside and their implications for health. Finally, this study applies data on skeletal health to questions about Byzantine cemetery organization.

The research questions investigated in this dissertation are as follows:

1. Did the sociopolitical changes of the 12th-13th centuries AD diminish quality of life among the Middle to Late Byzantine farming community at Nemea?
2. Are differential treatment and/or different spheres of activity for men and women in Late Antiquity and the Byzantine period evidenced by disparities in the skeletal health of males and females at Nemea?
3. Was the burial space at Nemea organized according to the social hierarchy?

The following section provides testable hypotheses that are used to address each of these questions in turn.

Research Hypotheses and Expectations

Hypothesis 1: *The Middle to Late Byzantine skeletal sample from Nemea will exhibit greater prevalence rates of physiological stress indicators than the Early Christian skeletal sample.*

The Middle to Late Byzantine community at Nemea faced three major problems unknown to the late antique community: (1) administrative instability that strained the provinces in the later 12th century; (2) the Frankish conquest of the Peloponnese; and (3) a decline in the socio-legal status of the Greek peasantry following the introduction of a western feudal system by the Franks.

As Herrin (1975, 1985) has pointed out, the breakdown in the relationship between the central and provincial administration of the Byzantine Empire in the late 12th century led to impoverishment and a degree of social upheaval in the countryside. Peasants would have been pressured to increase production in order to meet the demands of provincial officials collecting taxes. It is anticipated that workload associated with agricultural activities increased for both men and women. Greater prevalence rates of osteoarthritis and occupational trauma among the Middle to Late Byzantine skeletal sample would be consistent with that expectation.

It is also anticipated that the quantity and quality of the Byzantine community's diet declined as a greater proportion of its agricultural products needed to be sold, given to a landlord, or handed over in the payment of taxes. If this was the case, I expect to find greater prevalence rates of linear enamel hypoplasias, porotic hyperostosis, and cribra orbitalia in both children and adults in the Middle to Late Byzantine sample. Furthermore, the deterioration of social conditions evidenced by separatist movements in the provinces is expected to have contributed to the appearance of those indicators by reducing individual community members' resistance to nutritional and disease-related stressors. Decreased resistance to infection as a result of living in an unstable social environment is also likely to have increased the prevalence of periosteal reactions among both adults and children at Middle to Late Byzantine Nemea.

It is hypothesized that living conditions for the peasantry at Nemea deteriorated further in the 13th century when Frankish conquerors installed a western-style feudal system along with a rigid social hierarchy onto a Byzantine provincial social structure that was already becoming more stratified. Feudalism in the Peloponnese preserved Byzantine taxes while legalizing peasants' unfree status (Ilieva 1991; Jacoby 1973, 1989a, 2008). It also reduced the proportion of peasants' agricultural products that were used to meet their own subsistence needs (Runciman

1980). Furthermore, the potential for violent conflict almost certainly increased during this period. The mistreatment of peasants by landholders and provincial officials even prior to Frankish conquest was common. For example, Kazhdan (1997) reports that an inability or refusal to pay one's taxes frequently resulted in physical abuse. Conquest, however, brought with it periodic warfare throughout southern Greece as well as the potential for peasants to become caught between feuding lords attacking one another's villages. It is expected, then, that trauma reflecting interpersonal violence will be more prevalent at Middle to Late Byzantine Nemea. Warfare also contributes to problems such as food crises resulting from the disruption of agricultural cycles, the destruction of crops, and the increased strain of providing soldiers with food (Stathakopoulos 2004).

***Hypothesis 2:** Prevalence rates of physiological stress indicators associated with nutritional stress and infection will be greater among females than males in both phases at Nemea. Prevalence rates of activity related stress indicators will be greater among males in both phases.*

As discussed in Chapter Three, historical sources indicate that women were a marginalized group in both Late Antiquity and the Byzantine period. While there is some debate as to the extent to which contemporary descriptions reflect the reality of women's experiences (Cameron 2006; Laiou 1981), their activities are usually suggested to have revolved around the household. Frequently cited examples include grinding grain, preparing meals, washing and making clothes, and gardening, in addition to child care (Talbot 1997). By most accounts, child bearing, which was considered to be the most important role of women, took a serious toll on women's health (Connor 2004; Hill 1997; Talbot 1997). The emphasis placed on child bearing in Byzantine society is perhaps understandable given certain demographic realities. For example,

based on average birth rates, life expectancy, and rates of infant mortality during the Late Byzantine period, Laiou-Thomadakis (1977) has estimated that women would have needed to have six female children before it was likely that any of them would survive well into adulthood. However, having children was a dangerous process and health problems or even death resulting from complications of pregnancy and childbirth were not uncommon (Clark 1993).

In Late Antiquity and the Byzantine period women were assumed to be inferior to men both physically and intellectually. Boys were given preferential treatment from an early age, which led to health disparities during development (Talbot 1997). For example, Talbot (1997) has suggested that weaning occurred earlier for girls and this may have contributed to decreased disease resistance and elevated mortality relative to male children. This discrepancy may have carried over into adult life and, along with the hazards of childbirth, may have been a factor in the average life span, which was greater for males than females (Connor 2004; Rautman 2006; Talbot 1997). Previous skeletal studies in Greece have reported lower life expectancies for women at Hellenistic and Roman Corinth (Fox-Leonard 1997; Fox 2005) as well as at 6th-7th century AD Crete and the southern Peloponnese (Bourbou 2003).

While Christianity did offer women the option of a life devoted to the Church rather than to marriage and child care, it also reinforced the idea that young women should stay at home in order to help preserve their virginity (Talbot 1997). The Early Christian emphasis on maintaining one's virginity also affected dietary recommendations. Girls and young women were encouraged to have meager diets consisting of vegetables, bread, water, and occasionally fish. Never satisfying their hunger was thought to play a critical part in controlling the body and reducing sexual desire (Alberici and Harlow 2007; Grimm 1995). As Bonvillain (2001) points out, chronic

malnutrition resulting from such practices may lead to women's comparatively poor health status and, in turn, perpetuate ideas about their weakness and inferior social status.

If dietary restrictions and differential treatment of men and women were a reality at Nemea, then females in the Early Christian and Middle to Late Byzantine skeletal samples will exhibit greater prevalence rates of linear enamel hypoplasias, periosteal reactions, porotic hyperostosis, and cribra orbitalia when compared to males.

While women's activities in the countryside likely extended beyond the household (Cameron 2006; Laiou 1981), it is expected that the most physically demanding tasks such as plowing and harvesting were more often carried out by men. Thus, it is anticipated that males will exhibit greater prevalence rates of osteoarthritis and occupational trauma than females in both phases. It should be noted, however, that women probably assisted in harvesting and other intensive activities more regularly during stressful times such as military conflicts (Talbot 1997). If this occurred at Nemea, then the prevalence of degenerative joint disease and occupational trauma will be greater among Middle to Late Byzantine females than among Early Christian females.

Hypothesis 3: *There will be significant differences in the prevalence rates of physiological stress indicators between groups of individuals based on grave location.*

As outlined in Chapter Two, the spatial analysis of mortuary sites, in conjunction with evidence from historical sources and skeletal paleopathology, has great potential to contribute to our understanding of changes in social structure and their impact on the daily lives of past societies (Ashmore and Geller 2005; Buikstra and Charles 1999; Goldstein 1981; Silverman

2002; Tzortzopoulou-Gregory 2008). An interdisciplinary bioarchaeological approach to the burials at Nemea is thus a crucial component of this research.

The Early Christian and Byzantine cemeteries at Nemea will be examined in detail in Chapters Six and Eight. However, it is useful here to briefly describe the patterns of burial at the site, as it is otherwise difficult to discuss the expectations associated with Hypothesis Three. Frey (1998) has demonstrated that the burial practices of the Early Christian and Middle to Late Byzantine communities at Nemea were alike in that the dead were generally buried in simple graves with very few mortuary artifacts. However, marked differences between the two communities existed with respect to the choice of grave location and the number of individuals per grave. With few exceptions, graves in the Early Christian period consisted of single inhumations dispersed throughout the former sanctuary. Middle and Late Byzantine graves, by contrast, were concentrated in and around the remains of the Early Christian basilica and the associated chapel which was in use at that time.

It is anticipated that those patterns are tied to the social and religious changes that occurred in Byzantium from Late Antiquity to the Middle to Late Byzantine period. The first is the fundamental shift in Christian practice from public worship in the Early Christian period to individual devotion during the Middle Byzantine period (Kazhdan and Epstein 1985; Krueger 2006). The second is the heightened emphasis on the nuclear family and concern for one's lineage that developed in the Middle Byzantine period. Private dynastic chapels became popular as burial places among the elite, a process Kazhdan and Epstein (1985:104) referred to as the "architectural expression of the importance of self and family." Because burial patterns in rural settings emulated those of urban contexts (Gerstel and Talbot 2006), it is anticipated that this aspect of burial practice was not confined to urban elites and that burials containing multiple

individuals located around the remains of the basilica and the small Byzantine chapel at Nemea represent family tombs.¹⁴

In the near absence of mortuary artifacts, it is expected that any status distinctions at Nemea will be indicated by variability in other aspects of the burial program such as the spatial organization of the graves. As discussed in the previous chapter, Ivison (1993) has argued that there was a strong association between burial location and status in the Middle and Late Byzantine periods. While tombs could be located in different areas within and around churches, a spatial hierarchy existed that was meant to reflect the social hierarchy. Exclusive rights to the most sacred tomb locations were granted to prominent individuals such as church founders and high-ranking clergy. In the case of burials that took place within churches, the location of graves was associated with the positions that people occupied during the church service. Priests were buried in or close to the *bema*, while laypeople, if allowed church burial at all, were to be buried in the narthex or *naos* (Constas 2006; Ivison 1993). The place of greatest honor was “an eastern position on the south side of the *naos*” (Ivison 1993:70).

With Ivison’s (1993) model in mind, Frey’s (1998) observation that Middle to Late Byzantine burials at Nemea were concentrated near the southeast corner of the basilica is particularly noteworthy. Especially given the concern over lineage that arose during this period, it is possible that this pattern resulted from competition or at least effort among Byzantine family groups at Nemea to be buried in privileged space. Consistent with Ivison’s (1993:74) assertion that the location of Byzantine tombs could be used by living relatives to affirm their own status,

¹⁴ Because this study is primarily concerned with the assessment of skeletal health, metric and non-metric data useful in investigating the possibility of genetic relationships among the individuals in those graves were not collected. Such data constitute an important area of future research at Nemea. For the purposes of this dissertation, the possibility of family tombs is explored using the demographic profiles established for each multiple burial.

the concentration of multiple burials near the place of honor at the Nemea basilica could be interpreted within the framework of Goldstein's (1976, 1981) argument that corporate groups might legitimize their rights to resources by emphasizing descent through specialized disposal areas.

Based on the historical developments and archaeological evidence discussed above, status differences are expected to have been more strongly expressed in the Middle to Late Byzantine community at Nemea. However, spatially distinct cemeteries representing differences in social rank have also been reported in Early Byzantine mortuary landscapes (e.g., Al-Shorman 2004). Thus, the correlation between grave location and social status can be tested for both periods at Nemea. If status distinctions provided certain individuals with privileged burial locations in addition to advantages such as improved access to adequate nutrition, decreased risk of infections, and lower levels of psychosocial stress, then it is possible that skeletal health disparities will exhibit spatial patterns. It is anticipated that individuals buried closer to the basilica during the Early Christian period will exhibit lower prevalence rates of physiological stress indicators than those buried farther away. During the Middle to Late Byzantine period, when graves are mostly concentrated near or inside of the basilica, lower prevalence rates of physiological stress indicators are expected to be associated with greater proximity to the place of honor in the southeast end.

Summary

One of the goals of this research is to elucidate the effects of sociopolitical change on health in the Early Christian and Byzantine Greek countryside. It is hypothesized that more immediate and intense changes occurred during the Middle to Late Byzantine period, when the relationship between the central and provincial administrations became strained and the

Byzantine Empire was divided up during the violent transition to Latin rule. If the countryside was impoverished and subjugated as the historical record suggests, then living conditions for Greek peasants should have deteriorated and this should be reflected in poor skeletal health at Middle to Late Byzantine Nemea relative to Early Christian Nemea. It is also hypothesized that females will show greater prevalence rates of stress indicators associated with nutritional problems and infections than males during each period. However, greater prevalence rates of activity related stress indicators such as osteoarthritis are expected to be found among males.

Another goal of this research is to test archaeological models that link burial location with social status in the Byzantine world. If the mortuary space at Nemea was organized in a hierarchical fashion, then it is possible that prevalence rates of physiological stress indicators will decrease with greater proximity to the basilica. The lowest prevalence rates of physiological stress indicators should be found among those individuals buried within the basilica, especially toward the east end. The cemeteries and samples of human skeletons that are used to test these hypotheses are the subject of the next chapter.

CHAPTER 6: MATERIALS AND METHODS

This chapter introduces the burials and the samples of human skeletons recovered from Nemea. Here I also provide an overview of the methods used to collect and analyze demographic, paleopathological, and archaeological data in this research. The primary scoring criteria and recording system for demographic and paleopathological variables followed the protocols suggested by Buikstra and Ubelaker (1994). However, in some instances, modifications were made in order to facilitate comparison of the collected data with those from other studies of human skeletal remains from Byzantine Greece. Specific alterations are outlined below and also appear in Appendix A, which presents the data recording scheme utilized in this research. In most cases, significant deviations from the criteria suggested by Buikstra and Ubelaker (1994) were made for the recording of certain paleopathological variables. The alternative recording schemes for those variables followed the methods of the Global History of Health Project (Steckel et al. 2002a, 2006).

Research Materials

History of the Excavation of Burials at Nemea

Human burials have been excavated from within the Sanctuary of Zeus at Nemea since at least the 1920s, when excavation rights passed to the American School of Classical Studies at Athens (Frey 1998; Miller 1990). Earlier investigations carried out by French archaeologists in the late 19th century focused, among other areas, on the remains of a small chapel that was constructed on top of the Early Christian Basilica (Cousin and Dürrbach 1885). It is possible that graves were discovered by the French team given their great concentration in the area of the basilica. However, none were recorded.

Since American excavations began in 1924 under the direction of Bert Hodge Hill and Carl Blegen, nearly 300 burials from the Sanctuary of Zeus at Nemea have been recorded. However, Frey (1998) points out that a precise figure for the total number of graves is difficult to calculate. This problem is due mainly to inconsistencies in the recording of burials during nearly a century of excavations carried out by researchers from various institutions. References to burials in the Nemea excavation notebooks suggest that over the years graves were partially excavated and later re-recorded. In other instances skeletal remains were reburied in locations other than those from which they were excavated. Coupled with the fact that a number of graves were empty upon excavation, the total number of human skeletons is smaller than the number of graves which have been systematically excavated and recorded.

The division of the graves at Nemea into two broad chronological periods (Early Christian and Middle to Late Byzantine) follows the burial typology developed by Frey (1998) and also the dates provided by Steven Miller and Stella Miller in the published excavation reports.

The Early Christian Burials

During the Early Christian period, the Sanctuary of Zeus had an important function as a disposal area for the community's dead. The large number of graves placed within the sanctuary is overshadowed only by the ecclesiastical buildings and farming trenches when examining the most conspicuous pieces of evidence for activity at the site during the 5th-6th century.

In general, the chronology of the burials at Nemea is difficult to establish because the graves are remarkably uniform in certain respects. With only a single exception, all burials are oriented east-west. Furthermore, they contain very few mortuary artifacts such as grave goods or items of personal adornment. The construction of the graves is also somewhat repetitive across

the site. With some overlap, the burials fall into a small number of basic types: simple pits, graves lined and covered with roof tiles, graves lined and covered with field stones, and tombs constructed of large blocks previously used in earlier monumental architecture.

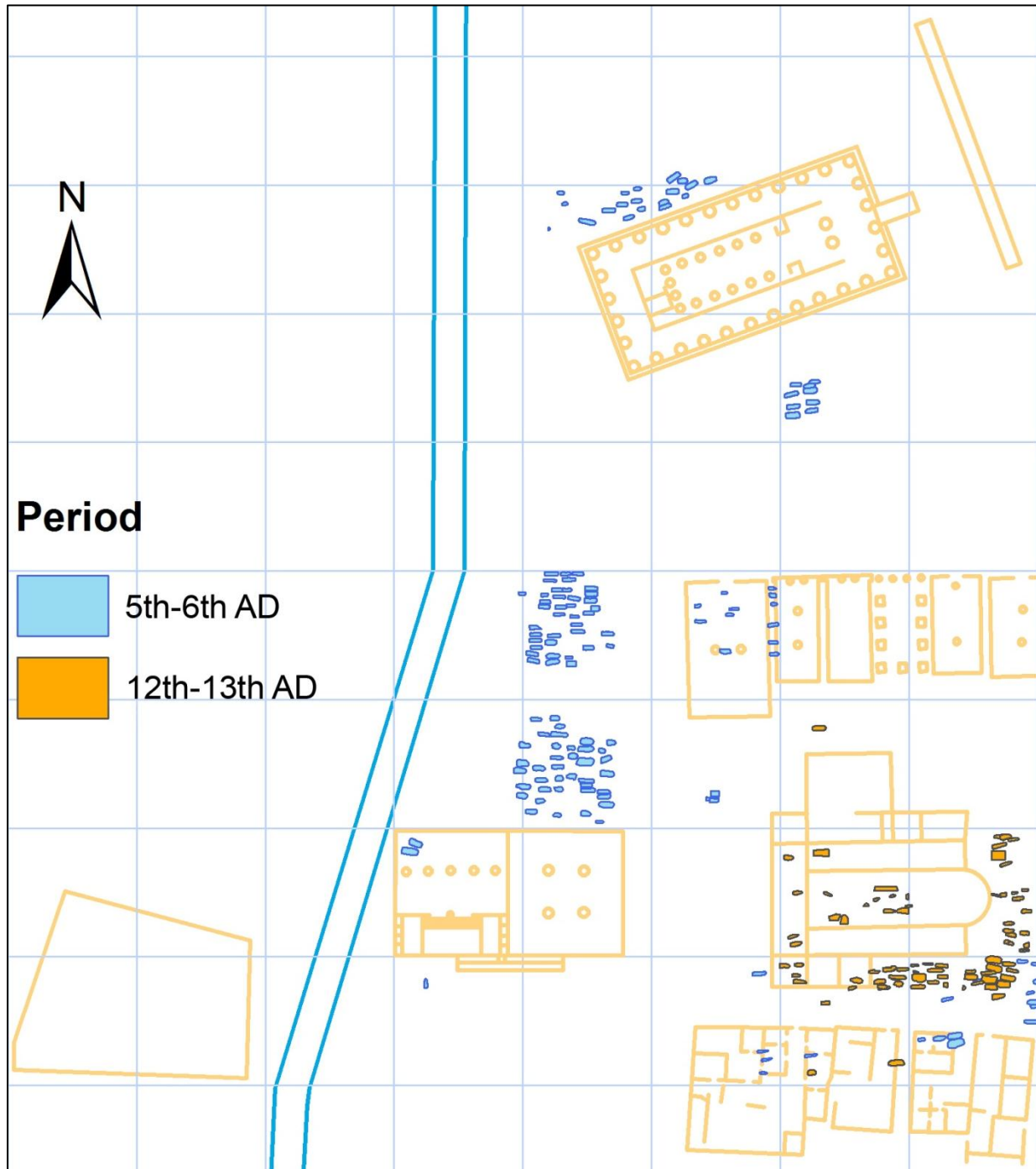
In some cases, graves could be dated confidently based on their association with architectural features. For example, some graves were cut into the floor and walls of the basilica and thus likely date later than its use as a place of worship during the Early Christian period. Others are located in the immediate vicinity of Byzantine farming trenches, which strongly suggests an earlier date. Aspects of the location, construction, and contents of the datable graves have been used to sort the less clear examples into either the Early Christian or Middle to Late Byzantine period (Frey 1998).

Early Christian burials at Nemea are located in three distinct areas of the sanctuary (Figure 6.1):

- 1) Northwest and south of the Temple of Zeus
- 2) Northeast of the Hellenistic Bath
- 3) Within the Early Christian basilica and outside of its east, west, and south walls

Frey (1998) suggests that within the Early Christian period, the twenty-eight graves associated with the temple are the earliest, followed by the ninety-six graves associated with the bath. The precise position of the twenty-one Early Christian graves associated with the basilica in the chronology is less clear.

Figure 6.1: Spatial Distribution of the Nemea Burials by Period.
For interpretation of the references to color in this and all other figures, the reader is referred to the electronic version of this dissertation.



One of the sharpest distinctions between the Early Christian burials at Nemea and their Middle to Late Byzantine counterparts is a clear emphasis on single inhumations. This subject

will be treated more extensively in Chapter Eight. However, it is important at this point to note that there are very few examples of multiple and commingled burials dating to this period. As discussed briefly above, a second interesting feature of the Early Christian burials is the frequency with which graves were completely empty upon excavation. While the degree of preservation of human skeletal remains does vary across the site, the fact that many empty graves were found adjacent to and at the same elevation as graves containing relatively complete skeletons begs a different explanation. It is possible that these graves represent cenotaphs or that it was common practice among the Early Christian community to exhume bodies, perhaps to reuse graves.

The treatment of the body is very consistent among Early Christian graves that contained preserved skeletons. Individuals were placed extended in a supine position and were oriented east-west with their heads to the west.

The Middle to Late Byzantine Burials

The Middle to Late Byzantine community at Nemea also utilized the Sanctuary of Zeus for the burial of the dead. However, instead of being widely dispersed throughout the sanctuary, burials dating to this period were concentrated in and around the collapsed ruins of the Early Christian basilica and the chapel constructed within or adjacent to it (see Figure 6.1). These burials were more frequently stone lined, although some were constructed using roof tiles or field stones. The well-built tombs that made use of portions of classical buildings date exclusively to this period.

In addition to an emphasis on proximity to the basilica, Middle to Late Byzantine burials are often distinguished by the presence of multiple individuals. Out of a total of 83 graves, only 21 graves having bones available for analysis contained single inhumations. Also unlike the Early Christian burials, graves dating to this period always contained skeletal remains.

Middle to Late Byzantine burials show the same consistency in the arrangement and orientation of the body as Early Christian burials. Among those for which body position was recorded, individuals lay extended and supine with their arms crossed either over the chest or abdomen (Frey 1998). Frey (1998) points out that one of the only unique features of some of the burials associated with the basilica is greater attention paid to the head of the deceased. In such cases, the head rested upon a stone pillow or was enclosed and supported by stones or tiles. As discussed in Chapter Four, Ivison (1992, 1993:86) has argued that these “cephalic burials” indicate western influence based on their presence in the Latin West and on their distribution in areas of the Byzantine Empire that were under Frankish control following 1204 AD.

As discussed in Chapter Three, the Middle to Late Byzantine graves at Nemea are believed to be those of the community that occupied the settlement just east of the sanctuary during the 12th-13th centuries AD. It should be noted that a subset of graves located outside of the Early Christian basilica near its southeast corner may in fact date to the 14th or 15th century (Miller 1988).¹⁵ For the purposes of this research, those graves and the skeletal remains recovered from them have been grouped together with the rest of the archaeological and skeletal material dating to the Middle to Late Byzantine period.

The Human Skeletal Samples from Nemea

As outlined above, the graves at Nemea can be categorized generally into either the Early Christian (5th-6th century AD) or Middle to Late Byzantine (12th-13th century AD) periods using the typology developed by Frey (1998). Thus, the collection of human skeletons recovered from Nemea represents two communities that occupied the site during distinct periods of time.

¹⁵ The numbers for these graves assigned by Miller (1988) are 1-16 and 18-26 from grid square M-19.

As a result of factors such as poor preservation, multiple interments, and extensive commingling in certain graves, the figures for the number of individuals in each period are minimum counts. The minimum number of individuals (MNI) for each commingled burial was determined after sorting skeletal elements by age and anatomical side. The most frequently duplicated element provided the basis for the MNI estimate.

Table 6.1 shows the MNI recovered and analyzed from each period of occupation. One hundred thirteen individuals date to the Early Christian period. The MNI for the Middle to Late Byzantine period (146) is greater even though the contents of fewer graves containing human remains were available for analysis. This is due, again, to the marked tendency of graves from that period to contain multiple individuals.

Table 6.1: Minimum Number of Individuals in Each Period.

Period	Total
Early Christian	113
Middle to Late Byzantine	146
Total Sample	259

All individuals available for analysis were examined in this dissertation research. The number of adults and subadults in each period are shown in Table 6.2 below. In the Early Christian sample, adults make up 69.9% (79/113) of the total sample and subadults make up 30.1% (34/113) of the total sample. Similarly, adults in the Middle to Late Byzantine sample make up 72.6% (106/146) of the total, while subadults form 27.4% (40/146) of the total. The number of subadults is distributed relatively evenly between phases at Nemea, while more adults are represented in the Middle to Late Byzantine period than in the Early Christian period.¹⁶

¹⁶ Many of the adult individuals in the Middle to Late Byzantine phase are from commingled burials and their presence is based on minimum counts. The number of discrete human skeletons in this phase is actually smaller than that in the Early Christian phase.

Table 6.2: Number of Adults and Subadults in Each Period.

Period	Subadult	Adult	Total
Early Christian	34	79	113
Middle to Late Byzantine	40	106	146
Total Sample	74	185	259

As discussed above, the individuals dating to the Early Christian period come from graves distributed across different areas of the site, and it is worth briefly examining the age demographics of each burial area to determine in a preliminary manner whether or not they represent specialized disposal areas. Table 6.3 shows the number of adults and subadults in each of the major Early Christian burial areas in the Sanctuary of Zeus. While no burial area was exclusive to adults or subadults, differences in their proportions in each area are apparent. Those differences will be explored in detail in Chapter Eight. All 146 individuals dated to the Middle to Late Byzantine period were recovered from burials located either within or adjacent to the basilica.

Table 6.3: Number of Early Christian Individuals by Burial Location.

Area	Subadult	Adult	Total
Temple	3	19	22
North of Bath	24	44	68
Basilica	7	16	23
Total	34	79	113

Research Methods

Skeletal Analysis

The osteological analysis of the human skeletal material recovered from Nemea was carried out using criteria suggested by Buikstra and Ubelaker (1994) and (Steckel et al. 2002a, 2006). Skeletal inventories that included notations on the presence and completeness of each bone and tooth were completed for each individual (or grave in the case of multiple, commingled burials). Additional osteological data collected in this research included morphological

observations appropriate for the estimation of age and sex in adults, and developmental indicators used to estimate age in subadults. Osteometric measurements of the postcranial skeleton were taken whenever possible. The bulk of the data recorded and analyzed in this research pertains to skeletal and dental paleopathologies. Indicators of physiological stress were recorded by presence and expression, while descriptive observations were made for specific pathological conditions and extensive trauma.

As discussed in Chapter Three and in the sections above, the graves from the Sanctuary of Zeus often contained multiple, commingled individuals. The frequent practice of including more than one individual in a grave resulted in a challenging osteological analysis that complicated efforts to determine basic demographic parameters such as the MNI for individual graves and age and sex estimates for their occupants. The MNI determined for graves containing multiple individuals at Nemea ranged from as few as two to as many as sixteen. Because individuals from a particular grave could not always be separated out, observations on paleopathological conditions were recorded by skeletal element. This approach, as opposed to recording the presence of such conditions by individual, enables data comparison between subgroups within the total skeletal sample (e.g., males and females, age categories, temporal phases) at Nemea.

Demographic Data Collection

Estimation of Age

The methods used in the estimation of age were dependent upon the specific skeletal elements available for each burial. In both subadults and adults, age ranges generated by multiple techniques were considered when possible. In most cases, at least one of the aging techniques outlined in Buikstra and Ubelaker (1994) was able to be applied. Age estimation from well-

preserved pelvic bones utilized the pubic symphysis (Brooks and Suchey 1990; Suchey and Katz 1986, 1998). In many cases, however, only the auricular surface (Lovejoy et al. 1985; Meindl and Lovejoy 1989) was available for use. Cranial suture closure (Buikstra and Ubelaker 1994) was used less frequently, but especially in cases of unassociated crania from commingled burials. In some instances, preservation of sternal rib ends permitted the application of the aging technique developed by İşcan et al. (1984, 1985). Whenever possible, individuals were placed into one of the following adult age categories recommended by Buikstra and Ubelaker (1994): young adult (20-35 years); middle adult (35-50 years); and old adult (50+).

Subadult ages were estimated using dental formation and eruption (Ubelaker 1989), diaphyseal length measurements, and degree of epiphyseal union (Schaefer et al. 2009; Scheuer and Black 2000). Hillson (1996) has pointed out that aging techniques based on dental development provide the most accurate estimates of age at death in subadults. This is because the development of the dentition—especially its formation—is under stronger genetic control than skeletal development (Saunders 2008). Thus, when teeth were available, estimates derived from their development were preferred. Each subadult was placed into one of the following age categories recommended by Buikstra and Ubelaker (1994): fetal (<birth); infant (birth-3 years); child (3-12 years); and adolescent (12-20 years).

Special considerations were necessary for the analysis of poorly preserved and/or commingled burials from which individuals could not be separated. Isolated skeletal elements that were developmentally complete (e.g., long bones) were placed into a general “adult” age category added to those suggested by Buikstra and Ubelaker (1994). Isolated subadult bones were classified into one of the above age categories based on diaphyseal length measurements or,

in the case of incomplete diaphyses, comparison with complete elements for which age could be estimated.

Determination of Sex

Sex was estimated for each adult individual from Nemea, as well as for isolated bones demonstrating sexual dimorphism in the case of commingled burials. The estimation of sex was not attempted for subadults as current anthroposcopic techniques fail to demonstrate a high degree of reliability (Roberts and Manchester 2005; Saunders 2008). The most accurate methods of sex determination utilize morphological traits observable in the pelvis and skull. While every effort was made to rely on the features of those bones, the specific criteria used in this analysis depended on the skeletal elements available for each individual.

When preservation allowed, the assessment of sex followed the criteria for the os pubis, as outlined by Buikstra and Ubelaker (1994). Their scoring criteria are based on the method developed by Phenice (1969), which considers the presence or absence of a ventral arc and subpubic concavity, as well as the morphology of the medial aspect of the ischiopubic ramus. When used together, those three traits may be used to accurately determine sex in at least 95% of cases. For many individuals at Nemea, however, the estimation of sex relied upon morphological traits that appear in more frequently preserved areas of the innominate. The sciatic notch, for example, is considered a less reliable indicator of sex but was often present in this skeletal sample (Walker 2005). When observable, this trait was scored according to the scale suggested by Buikstra and Ubelaker (1994). Finally, the presence and morphology of the preauricular sulcus was also evaluated according to the scale suggested by Steckel et al. (2006).

Morphological features of the skull are also useful in sex determination and were relied upon when pelvic remains were either poorly preserved or absent. The cranial traits scored

according to Buikstra and Ubelaker (1994) included the nuchal crest, mastoid process, supraorbital margin, supraorbital ridges, and the mental eminence.

Special considerations were necessary when graves contained extensively commingled remains. In those instances it was often impossible to associate isolated skeletal elements from which sex could be estimated with any particular individual. However, the determination of the sex of isolated and fragmentary long bones is important because it increases the sizes of subsamples when making comparisons using paleopathological data. For this reason, osteometric assessments of skeletal robusticity were used frequently in the estimation of sex. Metric measurements recommended by Buikstra and Ubelaker (1994) and Bass (2005) were taken on all long bones when preservation allowed. It was usually possible to measure anterior-posterior, medial-lateral, and circumferential dimensions even in cases where the proximal and distal ends were missing. Demarking points for those measurements were developed independently for the Early Christian and Middle to Late Byzantine samples using individuals for which sex was estimated based on pelvic and/or cranial features.¹⁷ When both right and left bones were available, measurements were taken on the element from the left side. In many cases, however, the right bone was substituted. Demarking points were established by calculating the average of the means for each sex following Šlaus and Tomičić (2005). When comparing the measurements of an unknown bone to the demarking point, higher values were classified as male and lower values were classified as female.

In the final determination of sex, each individual was classified into the one of the categories suggested by Buikstra and Ubelaker (1994): undetermined, probable female, female, ambiguous, probable male, and male. All subadults were placed into the “undetermined”

¹⁷ Appendix B contains the demarking points used in the sex estimation of unassociated skeletal elements.

category. Individuals were categorized into either “probable female” or “probable male” when missing or poorly preserved elements did not allow for a more confident assessment. Isolated skeletal elements for which sex was estimated based on metric assessments were also placed into those categories. The “ambiguous” category was used only once for an isolated pubic bone exhibiting both male and female features.

Measuring Physiological Stress at Nemea

Each individual from Nemea was examined macroscopically for the presence of the following paleopathological conditions (also outlined in Chapter Two): linear enamel hypoplasias, porotic hyperostosis, cribra orbitalia, periosteal reactions, osteoarthritis, and antemortem trauma. The following sections outline the data collection strategy employed in each case.

Linear Enamel Hypoplasias

In this research, data on enamel hypoplasias was collected in order to evaluate and compare the levels of physiological stress experienced during the early childhood years at Early Christian and Middle to Late Byzantine Nemea. Only linear enamel hypoplasias were recorded as they are the most common form appearing in the dentition (Hillson and Bond 1997). The presence of linear enamel hypoplasias was recorded on all available permanent incisors and canines. Decisions about which teeth to select for this analysis were based on demonstrated differences in the susceptibility of tooth types to hypoplasia formation. Goodman and Rose (1990) point out that the anterior teeth are affected more frequently than the posterior teeth and, furthermore, that the permanent maxillary central incisors and the mandibular canines are most susceptible.

Criteria for scoring the presence of a linear enamel hypoplasia followed the protocol of Steckel et al. (2002, 2006). Only defects that were clearly visible with the naked eye and able to be felt with a fingernail were recorded. These criteria are important because of the need to distinguish between the normal, subtle expression of perikyma grooves and the abnormal spacing of them which constitutes a linear enamel hypoplasia. The position and number of linear defects were also recorded for each tooth following the recommendations of Buikstra and Ubelaker (1994). The location of each linear hypoplastic defect was determined by measuring the distance from the cemento-enamel-junction to the most occlusal portion of the defect.

Prevalence rates of linear enamel hypoplasias were determined by tooth rather than by individual. This approach is more appropriate than the individual method for the skeletal samples from Nemea because of the frequency of commingled burials and poorly preserved remains. Recording and analyzing enamel defects by tooth provides a reasonable measure of prevalence while controlling for issues such as unassociated teeth and individuals missing the tooth types and classes in which those defects are mostly likely to be expressed.

Porotic Hyperostosis

Porotic hyperostosis was assessed in this research as an indication of stress likely resulting from dietary deficiencies, malabsorption related to parasitic infection, nutritional losses associated with diarrheal disease, or the synergistic effects of all three. It is usually assumed that the condition is associated primarily with stress experienced during childhood, as lesions characterized as active at the time of death are found more frequently in children than in adults (Larsen 1997; Stuart-Macadam 1985; Walker et al. 2009). The importance of noting the activity of lesions is actually two-fold, however. In addition to distinguishing between adult and subadult stress, a healing trend in adults can be used to help rule out the presence of a congenital

hemolytic anemia such as thalassemia or sickle cell anemia. When evaluating porotic hyperostosis at Nemea, consideration was given to the distribution of porous hypertrophic lesions in order to identify patterns of expression that may indicate the presence of genetic anemia. In addition to porotic hyperostosis produced by diploic expansion, individuals having a genetic anemia may also exhibit expansion of the facial bones, localized cranial ballooning, widening of the medullary canals of long bones, cortical thinning, enlarged nutrient foramina (especially in the hands), and fusion anomalies (Hershkovitz et al. 1991, 1997; Lagia et al. 2007; Ortner 2003; Tayles 1996).

The recording of porotic hyperostosis followed the protocol suggested by Buikstra and Ubelaker (1994). However, due to the additional complications of including occipital bones in the determination of prevalence rates in commingled burials, the decision was made to record the condition on the parietal bones only. The presence and expression of porotic hyperostosis was noted for all individuals having at least one observable parietal bone. Lesions were also recorded as active, healed, or exhibiting a mixed reaction at the time of death.

For commingled burials, prevalence rates of porotic hyperostosis were calculated based on the minimum number of parietal bones present and observable in the grave. This additional step was taken for two related reasons: (1) so that data on isolated bones is comparable to those collected from discrete individuals and (2) to prevent the overestimation of frequencies of porotic hyperostosis that may occur if all isolated parietal bones were included in the analysis. The minimum number of parietal bones for each burial was determined by sorting them by side and age. Only duplicated bones and those that could be demonstrated to belong to individuals of different ages (e.g., adult vs. non-adult) are included in the final count used in the calculation of prevalence rates for porotic hyperostosis.

Cribra Orbitalia

It may be not be possible to suggest a specific etiology for orbital lesions, although a pattern of porous lesions throughout the cranial and postcranial skeleton may be suggestive of a systemic disease such as scurvy. In the absence of a clear pattern of skeletal involvement, however, cribra orbitalia should be viewed more generally as an indicator of nutritional problems, infections, and their synergistic interaction.

Data on cribra orbitalia was collected using the criteria of Buikstra and Ubelaker (1994). All individuals having at least one preserved eye orbit were examined for the presence and expression of the condition. The activity of the lesion (active, healed, or mixed reaction) was also noted in each case. As with porotic hyperostosis, any isolated observable orbits from commingled burials were sorted by age and anatomical side. Prevalence rates were determined by noting the minimum number of affected orbits out of the minimum number of orbits present.

Periosteal Reactions

In this research, periosteal reactions were recorded on all available tibiae using the scoring system of Steckel et al. (2006). The presence, expression, and extent of the bone surface affected were noted in each case. Lesion activity (woven, sclerotic, or mixed reaction) was noted in order to distinguish between processes that were active, healed, or healing at the time of death. It is recognized that recording periosteal reactions by bone rather than by individual is a potential limitation of this research. Weston (2008) points out that this method is problematic because it precludes the observation of patterns of skeletal involvement and could result in the overestimation of disease prevalence. However, the nature of the skeletal sample from Nemea necessitates such an approach. Excluding unassociated tibiae in commingled burials, for example, would result in certain underestimation of physiological stress experienced at Nemea.

Therefore, isolated tibiae were included in the analysis of prevalence rates of periosteal reactions with the idea that the lesions should be interpreted more broadly as non-specific indicators of *stress* as opposed to infection.

Osteoarthritis

The possibility of changes in workload and patterns of activity over time at Nemea was investigated using patterns of osteoarthritis. Again, it should be noted that the severity and skeletal distribution of osteoarthritis should be understood as providing only general measures of levels and patterns of activity (Bridges 1994; Jurmain and Kilgore 1995; Steckel et al. 2002a, 2002b).

Observations on the presence and severity of osteoarthritis were recorded for both vertebral and non-vertebral joints in adults at Nemea. However, only non-vertebral joints are included in the analysis because they are currently understood as providing more sensitive data related to activity than changes in the vertebral column, which may be more closely associated with ageing, genetics, and normal biomechanical properties of the spine (Knüsel et al. 1997; Weiss and Jurmain 2007). Each major limb joint (shoulder, elbow, wrist/hand, hip, knee, ankle/foot) was scored as a unit following the protocol of Steckel et al. (2006). Osteoarthritis was scored as present if any element forming the joint showed evidence of marginal lipping, surface porosity, or eburnation. For commingled burials, one bone was chosen to represent each joint in order to avoid the difficulty of matching corresponding skeletal elements or determining the number of observable and affected joints out of groups of unassociated elements (Table 6.4). Following Andrushko (2007), decisions about the elements used to represent the major limb joints were based on the likelihood that their articular surfaces would be preserved. Andrushko (2007) points out that this approach to the assessment of osteoarthritis in commingled samples

provides a balance between incorporating as much data as possible and maintaining comparability with skeletal samples from both discrete and commingled burials.

Table 6.4: Skeletal Elements Chosen to Represent Each Joint Examined for Osteoarthritis in Commingled Burials.

Joint	Representative Element
Shoulder	Proximal Humerus
Elbow	Distal Humerus
Wrist/Hand	Distal Radius
Hip	Proximal Femur
Knee	Distal Femur
Ankle/Foot	Distal Tibia

Antemortem Trauma

The assessment of antemortem trauma in this dissertation focused on fractures. The presence of fractures was recorded using the bone count method recommended by Judd (2002) for samples characterized by poorly preserved long bones. This method relies on assessments of the degree of completeness of bone segments (proximal epiphysis, proximal diaphysis, middle diaphysis, distal diaphysis, and distal epiphysis) following Buikstra and Ubelaker (1994). Long bones were included in the total count for each bone if at least three out of five segments were 75% or more complete. Bones represented by fewer than three complete segments that exhibited clear evidence of trauma were also included in the analysis. All major cranial bones that were at least 75% complete were included in the total count for each bone.

Observations of bones affected by fractures included the bone type, side, and position of the fracture. Fractures were categorized according to the types presented by Lovell (1997). The extent of healing of each fracture was assessed using the criteria suggested by Steckel et al. (2006). Finally, complications associated with fractures such as problems with alignment were assessed using the criteria from Steckel et al. (2006). The prevalence of fractures was analyzed

both by individual (calculating the minimum number of individuals affected in commingled burials) and by bone using the bone count method.

Statistical Analysis: Indicators of Physiological Stress

The indicators of physiological stress outlined above are compared between subsamples (males and females, age categories, spatially distinct clusters of graves) at Nemea and between the samples from Nemea and those from other regional sites using prevalence rates. The prevalence of a particular condition refers to the number of individuals affected by that condition divided by the total number of individuals in the sample (Waldron 2007). As discussed in the sections above, the frequency of commingled burials meant that special considerations were necessary in order to represent the prevalence rates of stress indicators among subgroups at Nemea as accurately as possible. In most cases, calculating prevalence rates by individual was inappropriate due to the number of unassociated skeletal elements on which paleopathological conditions were observable. In order to include isolated elements in the analyses, prevalence rates are expressed as the number of affected bones or teeth out of the total number of that bone or tooth type in the sample.

Nonparametric statistics are used to assess the data collected on indicators of physiological stress. Prevalence rates are compared between subsamples using Pearson's chi-square test or two-tailed Fisher's exact probability tests. Decisions as to which test to use were based on cell sizes and employed the rule of five (VanPool and Leonard 2011). For 2 x 2 contingency tables, Fisher's exact test was used when any expected frequency was less than 5 and/or when the total number of observations is less than 20. For larger tables, categories were combined if more than 20 percent of the cells had expected frequencies of less than 5 and any cell had an expected frequency of less than 1 (Siegel 1956:110). The significance level was set at

$p < 0.05$. A lower value indicates that the null hypothesis (that the variables being tested are unrelated) should be rejected. All statistical comparisons were made using the Statistical Package for the Social Sciences (SPSS) 19.0.

Mortuary Analysis

Assessing Spatial and Temporal Variation in Burial Patterns at Nemea

One of the goals of this study is the identification and interpretation of variability in mortuary behavior through space and time at Nemea. This involves a systematic analysis of the relationships between aspects of the burial program that include the biological attributes of the deceased, the location of graves, the contents of graves and the arrangement of the body, and the characteristics of the graves themselves. In order to approach the burials at Nemea in this way, the results of the skeletal analysis of demography were first overlaid on a site plan created using ArcGIS 10.0. This was accomplished by linking a spreadsheet containing data on the age, sex, and minimum number of individuals within each grave to an attribute table for the graves in the GIS. Each grave was plotted accurately in space using the grid square locations of the burials recorded in the original Nemea excavations notebooks, along with digitized plans and scanned scale drawings imported into ArcGIS.

In addition to osteological data, the GIS was linked to data on the characteristics of each burial gleaned from the excavation notebooks. The following variables related to the archaeological context of each grave were examined in this research:

- 1) Grave type – graves were placed into one of the following categories of grave construction: plain pit, roof tile, field stone covered, field stone with lining, combination of field stones and roof tiles, and osteotheke.

- 2) Bodies present – burials were categorized according to the number of individuals present and whether or not the remains were commingled. These categories included single inhumation, double burial, commingled burial, truly empty grave, and no remains present because the bones were not kept.
- 3) Minimum number of individuals (MNI) in the grave.
- 4) Orientation of the body – either east-west or north-south orientation was noted.
- 5) Head treatment – any additional attention paid to the head of the deceased was recorded using the following categories: no treatment, stone pillow, enclosed with stone, tile pillow, enclosed with tile, and mixed stone and tile enclosure.
- 6) Grave goods – grave goods were recorded both by presence and by type. The categories of grave goods included items of personal adornment, mortuary artifacts, and both items of personal adornment and mortuary artifacts.

The spatial patterns of these variables were examined first through simple visual inspection using ArcGIS (Goldstein 1981). However, a visual inspection should only be used as a first step in the analytical process and patterns observable at this resolution were also tested statistically using SPSS 19.0. Associations between the above variables, the demographic profiles of the skeletal remains, and spatial location were tested for significance using Pearson's chi-square test or Fisher's exact test employing the rule of five as discussed above.

Examining Differences in Physiological Stress across Space

In order to test the hypothesis that burial location was associated with social status, it was necessary to test associations between prevalence rates of physiological stress indicators and the location of graves within the mortuary space at Nemea. If access to more privileged burial space was granted to individuals of higher social rank, then it is possible that prevalence rates will

decrease with greater proximity to the basilica and, specifically, to the southeast end. Once again, such patterns can be assessed initially through visual inspection.

Due to the complex archaeology of the burials at Nemea, a separate protocol was developed for the visual representation of the distribution of physiological stress indicators across the site using ArcGIS. Rather than displaying the presence or absence of pathological conditions at the level of the grave itself, each grave containing human remains was marked with a particular shape representing the individual or individuals interred. Discrete burials were marked with circles, while commingled burials were marked with a number of squares corresponding to the MNI for the grave. For commingled burials, the appropriate number of theoretical individuals was created in an SPSS spreadsheet and assigned to each of the square markers. The theoretical individuals created for each commingled burial represent the minimum number of individuals affected by each pathological condition under study. The spreadsheet containing those data was joined with an attribute table in the GIS so that the presence or absence of individual variables (paleopathologies) could be queried and displayed.

Statistical Analysis: Spatial Analysis

For Early Christian burials, which could be grouped into three distinct areas of the site, associations between the prevalence rates of physiological stress indicators and spatial location were examined using Pearson's chi-square test or Fisher's exact test as stated above. A different approach was necessary for Middle to Late Byzantine burials, which were concentrated in only one area of the site. Among those burials, high/low clustering (Getis-Ord General G) statistics were used to identify spatial concentrations of high or low values for the paleopathological conditions under study. This component of the spatial analysis was carried out using ArcGIS 10.0. Statistically significant *p*-values indicate that there is spatial clustering in excess of what

would be expected if the spatial distribution of the data was produced by random circumstances. ArcGIS also provides a z-score used to interpret the directionality of the clustering. Positive z-scores indicate that the distribution of high values is more spatially clustered than would be expected by chance, while negative z-scores indicate the same for the distribution of low values (ArcGIS 10.0 Resource Center).

Comparative Skeletal Samples

In order to place the results from Nemea into a broader regional context, the paleopathological data collected in this research were compared with data previously collected by Tritsaroli (2006) at contemporaneous sites in central Greece. This approach allows for a better understanding of the ways in which physiological stress levels varied in Byzantine Greece based on geography (central Greece versus the Peloponnese), type of site (rural versus urban), lifestyle, and local sociopolitical circumstances. The comparative samples used in this assessment were recovered from the sites of Akraiphnio and Thebes in Boeotia, and from Spata in Attica (Figure 6.2). The demographic profiles of each sample were established by Tritsaroli (2006) and are reproduced in Table 6.5.

Figure 6.2: Map Showing the Location of Comparative Sites
(Adapted from Tritsaroli [2006: Appendix 1, Figure 1]).

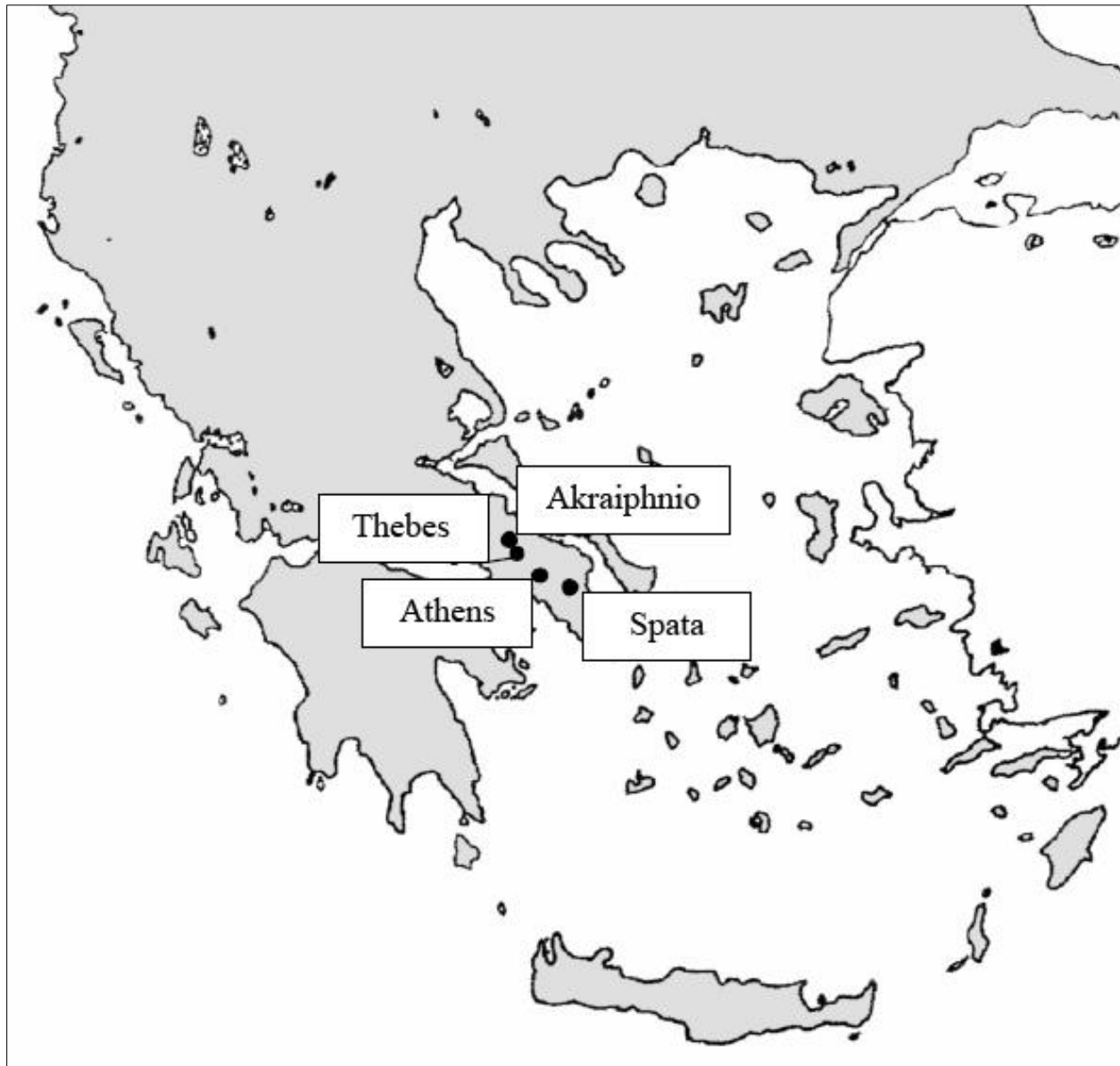


Table 6.5: Demographic Profiles of Comparative Skeletal Samples
(Adapted from Tritsaroli [2006: Table 1]).

Site	Date	Adults	Males	Females	Subadults	# of Individuals
Akraiphnio	6 th c. AD	27	4	1	18	45
Thebes	12 th -13 th c. AD	128	23	16	23	151
Spata	11 th -14 th c. AD	138	11	8	61	199
Total		293	38	25	102	395

Akraiphnio

The skeletal sample from Akraiphnio consists of 45 individuals. The skeletal material analyzed by Tritsaroli (2006) was excavated from graves that form part of a large cemetery complex with considerable time depth (8th century BC to 13th century AD). The graves have been dated to the 6th century AD based on associated mortuary artifacts. The human remains from Akraiphnio serve as an appropriate comparison with the skeletal sample from Early Christian Nemea because of their contemporaneity and also because the cemetery of Akraiphnio is associated with a site that is considered rural.

Thebes

The skeletal sample from Thebes is significantly larger, with a total of 151 individuals. The human remains were excavated from a cemetery associated with a church and are dated to the 12th-13th centuries AD. Like the Middle to Late Byzantine graves from Nemea, the graves dating to this period at Thebes were located in and around the narthex and nave of the church, which itself dates to an earlier period (10th-11th centuries AD). It is interesting to note, however, that the graves concentrate in areas north of the structure rather than to the south as is the case at Nemea. The graves consist of both simple and more elaborate tombs and contained multiple burials with at least some associated mortuary artifacts such as coins and items of personal adornment. It has been suggested that some of the tombs are those of aristocratic families (Tritsaroli 2006, 2008). In contrast to Akraiphnio and Spata, the human skeletal remains from Thebes represent members of an urban community.

Spata

The archaeological context of the skeletal sample from Byzantine Spata is perhaps most similar to that of the Middle to Late Byzantine sample from Nemea. The 199 individuals represented in this sample were recovered from a cemetery associated with a church, the graves of which have been dated to between the 11th and 14th centuries AD. Most of the graves are of modest construction and contain few noteworthy mortuary artifacts (Tritsaroli 2006). The site itself exhibits abundant evidence of agricultural activity to the west of the church in the form of storage vessels and farming implements (Tritsaroli 2006, 2008). Very much like the 12th-13th century AD skeletal sample from Nemea, the human remains from Spata represent a modest farming community that existed during the transition from the Middle to the Late Byzantine period.

Summary

Collectively the human skeletal samples from Nemea represent a minimum of 259 individuals that are analyzed in this research. A minimum of 113 individuals from 145 graves date to the Early Christian period (5th-6th centuries AD) and a minimum of 146 individuals from 83 graves date to the Middle to Late Byzantine period (12th-13th centuries AD). Data on age and sex was collected using standard anthropological criteria recommended by Buikstra and Ubelaker (1994) and, in cases of unassociated or fragmentary long bones, metric assessments of robusticity. The collection of data on indicators of physiological stress and activity followed the protocols of Buikstra and Ubelaker (1994) as well as those of Steckel et al. (2006). Skeletal paleopathologies were analyzed using prevalence rates, which were compared between age and sex classes and burial clusters using chi-square tests or Fisher's exact tests. The analysis of

archaeological data pertaining to burial attributes was carried out both in association with the skeletal data using SPSS 19.0 and using spatial statistics in ArcGIS 10.0. Comparative data on physiological stress in Byzantine Greece come from Tritsaroli's (2006) analysis of skeletal samples from the central Greek sites of Akraiphnio, Thebes, and Spata. In the next chapter, I present the results of the osteological analysis of the human skeletal samples from Nemea and compare the prevalence rates of paleopathological conditions at Nemea with those at the selected sites in central Greece.

CHAPTER 7: RESULTS OF THE SKELETAL ANALYSIS

In this chapter I present the results of the demographic and paleopathological analyses of the human skeletal samples from Nemea. The chapter is divided into four sections. The first two sections outline the results of estimations of sex and age and determinations of the prevalence rates of physiological stress indicators for the Early Christian and Middle to Late Byzantine skeletal samples independently. The indicators of stress and activity examined in this research include linear enamel hypoplasias, porotic hyperostosis, cribra orbitalia, periosteal reactions, osteoarthritis, and trauma. Prevalence rates were compared between subgroups of skeletons (males and females, age classes, adults and subadults) within each phase whenever sample sizes permitted. In most cases, it was necessary to collapse age categories in order to increase cell sizes for the purposes of statistical comparison. The third section presents the results of the skeletal analysis at Nemea in a comparative fashion. The distributions of sex, age at death profiles, and prevalence rates of physiological stress indicators established in the first two sections are compared between subgroups of skeletons from each phase. Finally, the paleopathological data collected in this research is compared against data from selected sites in central Greece in order to gain a broader perspective on health and living conditions at Nemea.

The data presented in this chapter is used to address the following research questions and associated hypotheses introduced in Chapter Five:

Research Question 1: Did the sociopolitical changes of the 12th-13th centuries AD diminish quality of life among the Middle to Late Byzantine farming community at Nemea?

Hypothesis 1: The Middle to Late Byzantine skeletal sample from Nemea will exhibit greater prevalence rates of physiological stress indicators than the Early Christian skeletal sample.

Research Question 2: Are differential treatment and/or different spheres of activity for men and women in Late Antiquity and the Byzantine period evidenced by disparities in the skeletal health of males and females at Nemea?

Hypothesis 2: Prevalence rates of physiological stress indicators associated with nutritional stress and infection will be greater among females than males in both phases at Nemea. Prevalence rates of activity related stress indicators will be greater among males in both phases.

The Early Christian Skeletal Sample

As presented in Chapter Six, the skeletal sample from Early Christian Nemea includes a minimum of 113 individuals. All of those individuals were analyzed in this research. The Early Christian skeletons were recovered from 101 graves containing human remains, most of which were single inhumations. Eleven graves dating to this period that contained skeletal remains available for analysis included multiple individuals.¹⁸ In general, the preservation of the Early Christian skeletons is not as good as that of the Middle to Late Byzantine skeletons. Skeletal elements are more frequently broken or missing portions and, in some cases, the bones present exhibit moderate to severe erosion of the cortical surfaces. In such cases, observations on physiological stress indicators such as porotic hyperostosis, cribra orbitalia, and periosteal

¹⁸ Additional graves at Nemea have been dated to the Early Christian period, but are not included in this count either because they were empty or because the human remains were not kept. Their attributes are included in the mortuary analysis presented in Chapter Eight.

reactions were scored as unobservable. The Early Christian sample includes 79 adults (69.9% of the total) and 34 subadults (30.1% of the total). The data on age and sex among the adults are discussed first.

Demographic Patterns: Adults

Age at Death

As discussed in Chapter Six, the methods used to estimate age at death were dependent upon the completeness and preservation of the skeletal material available for each individual. The morphological changes of the pubic symphysis (Brooks and Suchey 1990; Suchey and Katz 1986, 1998) and the sternal end of the fourth rib (İşcan et al. 1984, 1985) were relied upon when possible. However, the auricular surface of the ilium was more frequently preserved and estimates of age often utilized the technique of Lovejoy et al. (1985) and Meindl and Lovejoy (1989). The method for age estimation using cranial suture closure outlined by Buikstra and Ubelaker (1994) was used occasionally in cases where postcranial remains were either absent or poorly preserved.

Each adult individual was placed into one of the following age categories suggested by Buikstra and Ubelaker (1994): young adult (20-35 years); middle adult (35-50 years); and old adult (50+). In some cases, missing elements and/or poor preservation precluded the assignment of an age range narrower than “adult.” This occurred much more frequently in the Middle to Late Byzantine sample because of the greater number of commingled graves and, consequently, of isolated skeletal elements. An additional “adult” age category was created for both periods at Nemea.

Table 7.1: Number and Proportion of Early Christian Individuals in Each Adult Age Category.

Age Category	Number (<i>n</i>)	% Early Christian Adults
Young Adult (20-35)	28	35.4
Middle Adult (35-50)	36	45.6
Old Adult (50+)	10	12.7
Adult (20+)	5	6.3
Total	79	100.0

Sex

As was the case for the estimation of age at death, the methods used to determine sex depended upon the availability of skeletal elements as well as their degree of preservation. Whenever possible, sex was estimated using the technique developed by Phenice (1969) for the os pubis. More frequently, sex estimation relied on morphological features of the innominate including the greater sciatic notch (Buikstra and Ubelaker 1994) and the preauricular sulcus (Steckel et al. 2006), as well as on the cranial traits outlined by Buikstra and Ubelaker (1994). In one case, sex was assigned by comparing a femoral midshaft circumference measurement to a demarking point, which was calculated using the measurements of left femora from Early Christian adults for which sex was determined from pelvic or cranial morphology. The demarking point is the average of the means of femur midshaft circumference for each sex (Table 7.2).

Table 7.2: Number of Early Christian Femora and Demarking Point for Midshaft Circumference.

Sex	Number (<i>n</i>)	Mean Femur Midshaft Circumference (mm)	Demarking Point (mm)
Male	45	90.113	Males > 83.842 > Females
Female	28	77.571	
Total	73		

During the data collection process, each individual was placed into one of the following categories suggested by Buikstra and Ubelaker (1994): undetermined, probable female, female, ambiguous, probable male, and male. However, in order to increase cell sizes, individuals

originally placed into the “probable male” and “probable female” categories were reclassified into the categories of “male” and “female.” Table 7.3 shows the number of individuals in each category of sex. Sex was unable to be assigned in two cases due to the absence or poor preservation of bones from the pelvis, cranium, and limbs.

Table 7.3: Distribution of Sex among Adults in the Early Christian Sample.

Sex Category	Number (n)	% Early Christian Adults
Male	41	51.9
Female	36	45.6
Ambiguous	0	0
Undetermined	2	2.5
Total	79	100.0

Demographic Patterns: Subadults

The estimation of age at death among subadults from the Early Christian period relied primarily on the degree of formation and eruption of the dentition. This is because dental development is less influenced by extrinsic factors than skeletal development (Saunders 2008). In the absence of the dentition, subadult ages were based on degree of epiphyseal union and diaphyseal length measurements (Schaefer et al. 2009; Scheuer and Black 2000). Each subadult individual was placed into one of the following categories recommended by Buikstra and Ubelaker (1994): fetal (<birth); infant (birth-3 years); child (3-12 years); and adolescent (12-20 years). Perhaps the most interesting pattern apparent in Table 7.4 is that children make up more than half of all subadults buried at Nemea during this period.

Table 7.4: Number and Proportion of Early Christian Individuals in Each Subadult Age Category.

Age Category	Number (n)	% Early Christian Subadults
Fetal (<birth)	1	2.9
Infant (birth-3 years)	2	5.9
Child (3-12 years)	19	55.9
Adolescent (12-20 years)	12	35.3
Total	34	100.0

As discussed in Chapter Six, no systematic attempt was made to estimate the sex of subadults at Nemea because existing methods do not demonstrate a high degree of reliability (Roberts and Manchester 2005; Saunders 2008). However, three older adolescents (all with age estimates between 16 and 20 years) in the Early Christian sample were assigned a sex based on either pelvic or cranial morphology. Those individuals appear in Table 7.5 below.

Summary of Early Christian Demography

Table 7.5 provides an overview of the demographic structure of the Early Christian skeletal sample as a whole. Very few individuals from the fetal and infant categories are present. Individuals who died during the childhood years are much better represented. As stated previously, 69.9% of the individuals in this sample died as adults. Out of the adult age groups, the greatest number of individuals appears in the “middle adult” category. Young and middle adults make up more than half of the individuals in the sample and there is a clear decrease in the number of individuals who died later than the age of 50.

The sex distribution of the Early Christian sample is not particularly remarkable when considered by itself. There are more males than females, although the latter group is not significantly underrepresented. When broken down by age category, however, one interesting pattern is apparent: females outnumber males almost two to one among young adults while males are better represented in the middle and old adult age categories.

Table 7.5: Age and Sex Demographics of the Early Christian Skeletal Sample.

Age Category	Male	Female	Ambiguous	Undetermined	Total
Fetal (<birth)	-	-	-	1	1
Infant (birth-3 years)	-	-	-	2	2
Child (3-12 years)	-	-	-	19	19
Adolescent (12-20 years)	2	1	0	9	12
Young Adult (20-35)	10	18	0	0	28
Middle Adult (35-50)	20	15	0	1	36
Old Adult (50+)	7	3	0	0	10
Adult (20+)	4	0	0	1	5
Total	43	37	0	33	113

Physiological Stress Indicators: Intrapphase Results

In this section, I present the results of the analysis of each of the physiological stress indicators assessed in this research. The prevalence rates of each variable are discussed in turn and are compared between subgroups within the Early Christian sample. Together with the intraphase results from the Middle to Late Byzantine period, these data are used to test Hypothesis Two, which anticipates greater prevalence rates of physiological stress indicators among females in each period. The data on linear enamel hypoplasias are presented first.

Linear Enamel Hypoplasias

As discussed in Chapter Six, the data on linear enamel hypoplasias (LEH) are analyzed and reported by tooth rather than by individual. All available adult anterior teeth (maxillary and mandibular incisors and canines) that did not exhibit excessive wear were evaluated for LEHs. Table 7.6 shows the prevalence of LEHs for each anterior tooth in the Early Christian sample. Hypoplastic lesions were most frequent on the maxillary and mandibular canines, followed by the maxillary central incisors, the right mandibular lateral incisor, and the right maxillary lateral incisor. The mandibular central incisors were the least affected by LEHs.

Table 7.6: LEH Prevalence by Tooth in the Early Christian Period.

Tooth	Present	Absent	Total	% Affected
(#6) R. Maxillary Canine	25	14	39	64.1
(#7) R. Maxillary Lateral Incisor	15	23	38	39.5
(#8) R. Maxillary Central Incisor	16	24	40	40.0
(#9) L. Maxillary Central Incisor	20	18	38	52.6
(#10) L. Maxillary Lateral Incisor	10	24	34	29.4
(#11) L. Maxillary Canine	26	9	35	74.3
(#22) L. Mandibular Canine	37	18	55	67.3
(#23) L. Mandibular Lateral Incisor	13	41	54	24.1
(#24) L. Mandibular Central Incisor	6	37	43	14.0
(#25) R. Mandibular Central Incisor	9	31	40	22.5
(#26) R. Mandibular Lateral Incisor	17	25	42	40.5
(#27) R. Mandibular Canine	41	14	55	74.5

Statistical comparisons of LEH prevalence rates between age at death categories were problematic among both subadults and adults due to the small numbers of individuals with observable teeth in each category. In order to increase cell sizes, age categories were collapsed and prevalence rates were compared only between adults and subadults. Few clear patterns appear in Table 7.7. The maxillary canines of subadults are affected more frequently than those of adults. However, the mandibular canines do not show a consistent pattern. Other apparent differences are also inconsistent between corresponding right and left teeth. Statistical comparisons were carried out using Pearson's chi-square test or Fisher's exact test in the case of teeth for which any expected cell frequency was less than 5. The results show that none of the differences between adults and subadults in the prevalence of LEHs are significant at the $p < 0.05$ level.

Table 7.7: LEH Prevalence by Tooth in Early Christian Adults and Subadults.

Tooth	Adults			Subadults			χ^2	df	Two-tail <i>p</i> -value	<i>p</i> < 0.05 Yes/ No
	Pr (<i>n</i>)	Ab (<i>n</i>)	% Affected	Pr (<i>n</i>)	Ab (<i>n</i>)	% Affected				
#6	18	11	62.1	7	3	70.0		1	0.721	No
#7	12	13	48.0	3	10	23.1	2.224	1	0.136	No
#8	10	16	38.5	6	8	42.9	0.073	1	0.787	No
#9	13	12	52.0	7	6	53.8	0.012	1	0.914	No
#10	4	16	20.0	6	8	42.9		1	0.252	No
#11	17	8	68.0	9	1	90.0		1	0.235	No
#22	26	14	65.0	11	4	73.3		1	0.749	No
#23	8	28	22.2	5	13	27.8		1	0.740	No
#24	4	23	14.8	2	14	12.5		1	1.000	No
#25	4	21	16.0	5	10	33.3		1	0.255	No
#26	10	17	37.0	7	8	46.7	0.371	1	0.542	No
#27	29	9	76.3	12	5	70.6		1	0.742	No

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Prevalence rates of LEHs were also compared between males and females in the Early Christian sample (Table 7.8). The maxillary canines of females were affected more frequently than those of males, although prevalence rates are more similar for the mandibular canines. There are no clear patterns for the maxillary and mandibular central incisors. The mandibular lateral incisors are more frequently affected among females. Pearson's chi-square tests and Fisher's exact tests indicate that none of the differences between males and females in the prevalence rates of LEHs are significant at the $p < 0.05$ level.

Table 7.8: LEH Prevalence by Tooth in Early Christian Males and Females.

Tooth	Males			Females			χ^2	df	Two-tail <i>p</i> -value	<i>p</i> < 0.05 Yes/ No
	Pr (<i>n</i>)	Ab (<i>n</i>)	% Affected	Pr (<i>n</i>)	Ab (<i>n</i>)	% Affected				
#6	8	8	50.0	11	4	73.3	1.777	1	0.183	No
#7	6	8	42.9	6	8	42.9	0.000	1	1.000	No
#8	4	6	40.0	6	10	37.5		1	1.000	No
#9	9	5	64.3	4	9	30.8	3.033	1	0.082	No
#10	2	6	25.0	2	12	14.3		1	0.602	No
#11	7	4	63.6	10	3	76.9		1	0.659	No
#22	16	7	69.6	13	8	61.9	0.287	1	0.592	No
#23	2	16	11.1	6	15	28.6		1	0.247	No
#24	3	11	21.4	1	15	6.25		1	0.315	No
#25	2	11	15.4	3	12	20.0		1	1.000	No
#26	4	8	33.3	7	10	41.2		1	0.717	No
#27	17	6	73.9	13	4	76.5		1	1.000	No

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Porotic Hyperostosis

The presence or absence of porotic hyperostosis was recorded for all individuals in the Early Christian sample with at least one observable parietal bone. Some individuals having parietal bones were scored as unobservable due to significant erosion of the external surface of the cranial vault. In general, porotic hyperostosis was infrequent in this sample. Nine individuals (11%) exhibited porotic hyperostosis out of 82 individuals with at least one observable parietal bone.

As with the data on linear enamel hypoplasias, age categories were collapsed in the comparison of porotic hyperostosis prevalence rates between subgroups of Early Christian skeletons. The prevalence of porotic hyperostosis was slightly greater in subadults (Table 7.9), but Fisher's exact test shows that the difference is not statistically significant ($p = 0.717$). Among subadults, one individual exhibited barely discernible porosity and two exhibited lesions scored as "porosity only." Among adults, lesions observable in four individuals were scored as "barely

discernible” and those observable in two individuals were scored as “porosity only.” Active lesions were exhibited by 66.7% (2/3) of affected subadults and 33.3% (2/6) of affected adults.

Table 7.9: Prevalence Rates of Porotic Hyperostosis in Early Christian Adults and Subadults.

	Present	Absent	Total	% Affected
Adults	6	52	58	10.3
Subadults	3	21	24	12.5

Similarly, the prevalence of porotic hyperostosis is greater among females than males (Table 7.10), but the difference is not significant ($p = 0.409$). Both affected male individuals exhibited barely discernible lesions. Among females, two individuals exhibited barely discernible lesions and two exhibited lesions scored as “porosity only.” Active lesions were observed in 50% (2/4) of females. The lesions of both affected males were healed at the time of death.

Table 7.10: Prevalence Rates of Porotic Hyperostosis in Early Christian Males and Females.

	Present	Absent	Total	% Affected
Males	2	29	31	6.5
Females	4	24	28	14.3

Cribra Orbitalia

The presence or absence of cribra orbitalia was recorded for each individual exhibiting at least one observable eye orbit in the Early Christian sample. In the sample as a whole, cribra orbitalia was observed more frequently than porotic hyperostosis. Eighteen individuals (29.5%) were affected out of a total of 61 with an observable orbit. Age categories were collapsed and prevalence rates were compared between adults and subadults as well as between males and females.

In contrast to porotic hyperostosis, the prevalence of cribra orbitalia in adults and subadults is substantially different (Table 7.11). Subadults are affected much more frequently in this sample and Fisher’s exact test indicates that the difference is statistically significant ($p =$

0.001). Subadults also show greater severity of expression of cribra orbitalia. Among affected subadults, 33.3% (3/9) of lesions were scored as “barely discernible, 44.4% (4/9) were scored as “porosity only” and 22.2% (2/9) showed coalescence of foramina. Among affected adults, lesions were either barely discernible (55.6%; 5/9) or showed porosity only (44.4%; 4/9). Finally, active lesions are observed more frequently in subadults (77.8%; 7/9) than in adults (22.2%; 2/9).

Table 7.11: Prevalence Rates of Cribra Orbitalia in Early Christian Adults and Subadults.

	Present	Absent	Total	% Affected
Adults	9	39	48	18.8
Subadults	9	4	13	69.2

Meaningful differences are also found when prevalence rates of cribra orbitalia are compared between males and females (Table 7.12). Females exhibited cribra orbitalia more frequently than males and Pearson’s chi-square test shows that the difference is significant ($\chi^2 = 4.157$, $df = 1$, $p = 0.041$). Among affected females, 75% (6/8) of orbital lesions were barely discernible and 25% (2/8) of lesions were scored as “porosity only.” One affected male showed barely discernible cribra orbitalia and the expression in the other two males was scored as “porosity only.” Cribra orbitalia that was active at the time of death was observed in 25% (2/8) of affected females and 33.3% (1/3) of affected males.

Table 7.12: Prevalence Rates of Cribra Orbitalia in Early Christian Males and Females.

	Present	Absent	Total	% Affected
Males	3	23	26	11.5
Females	8	14	22	36.4

Periosteal Reactions

The presence or absence of periosteal reactions was recorded on all available tibiae with observable cortical surfaces. Prevalence rates for the left and right tibiae are analyzed and reported separately here so that the data may be compared with the results from the Middle to

Late Byzantine sample, which contained a large number of unassociated tibiae. Periosteal reactions were very common in the Early Christian sample. Among all individuals, the prevalence rate for the left tibia is 78.4% (40/51) and the prevalence rate for the right tibia is 83.3% (40/48). While those figures are quite high, it should be noted that, in the majority of cases (80.0% for the left tibia and 77.5% for the right tibia), reactions were scored as “markedly accentuated longitudinal striations,” the most minimal expression on the scale suggested by Steckel et al. (2006:30).

Comparison of prevalence rates between age and sex categories is once again hampered by small sample sizes, primarily among subadults and females. When subadults are taken together, they show consistently lower prevalence rates of periosteal reactions than adults (Table 7.13). However, the prevalence among subadults differs greatly between the right and left sides, probably as an artifact of the small subsamples. While the difference between adults and subadults is statistically significant for the left tibia ($p = 0.008$), it only approaches the level of significance for the right tibia ($p = 0.080$).

Table 7.13: Prevalence Rates of Periosteal Reactions in Early Christian Adults and Subadults.

Tibia	Present		Absent		Total		% Affected	
	L	R	L	R	L	R	L	R
Adults	37	36	6	5	43	41	86.0	87.8
Subadults	3	4	5	3	8	7	37.5	57.1

Adults also show a greater range of expression of periosteal reactions than subadults (Table 7.14). Extensive reactions that were also characterized by some degree of cortical expansion and/or deformation were only observed in adults.

Table 7.14: Expression of Periosteal Reactions in Early Christian Adults and Subadults.

Tibia	Accentuated Striations		Slight Discrete Patches (<1/4 Surface)		Moderate Involvement (<1/2 Surface)		Extensive Reaction (>1/2 Diaphysis)	
	L	R	L	R	L	R	L	R
Adults	31	30	1	1	1	2	4	3
Subadults	1	1	1	2	1	1	0	0

Most periosteal reactions in this sample were scored as “sclerotic,” which means that they were healed at the time of death (Table 7.15). Active lesions appearing as woven bone were observed in one adult and one subadult.

Table 7.15: Activity of Periosteal Reactions in Early Christian Adults and Subadults.

Tibia	Woven		Sclerotic		Mixed Reaction	
	L	R	L	R	L	R
Adults	1	0	32	30	3	6
Subadults	1	0	1	1	1	3

High prevalence rates of periosteal reactions are exhibited by both males and females in this phase. Again, more consistent figures would likely be generated with larger subsample sizes. The prevalence rate for the left tibia is greater among females, while that for the right tibia is greater in males. The difference between males and females for neither the right ($p = .307$) nor the left tibia ($p = .153$) is significant.

Table 7.16: Prevalence Rates of Periosteal Reactions in Early Christian Males and Females.

Tibia	Present		Absent		Total		% Affected	
	L	R	L	R	L	R	L	R
Males	22	22	6	2	28	24	78.6	91.7
Females	12	9	0	3	12	12	100.0	75.0

Males and females in this sample show no clear differences in the expression of periosteal reactions (Table 7.17). Extensive reactions are more common in males, but the differences in subsample sizes make this pattern difficult to evaluate.

Table 7.17: Expression of Periosteal Reactions in Early Christian Males and Females.

Tibia	Accentuated Striations		Slight Discrete Patches (<1/4 Surface)		Moderate Involvement (<1/2 Surface)		Extensive Reaction (>1/2 Diaphysis)	
	L	R	L	R	L	R	L	R
Males	18	18	0	1	1	0	3	3
Females	10	7	1	0	0	2	1	0

For both males and females, most periosteal reactions were scored as “sclerotic” (Table 7.18). The only woven (active) lesion observed among sexed adults was present on the left tibia of a male.

Table 7.18: Activity of Periosteal Reactions in Early Christian Males and Females.

Tibia	Woven		Sclerotic		Mixed Reaction	
	L	R	L	R	L	R
Males	1	0	18	18	2	4
Females	0	0	11	7	1	2

Osteoarthritis

The prevalence of osteoarthritis in all Early Christian adults is reported for each major appendicular joint in Table 7.19 below. All joint categories examined in the Early Christian sample showed some evidence of osteoarthritis with the exception of the right ankle. The most frequently affected joints were the shoulder and hip, with the right shoulder exhibiting the highest prevalence rate at 36%. In general the elbow, wrist/hand, knee, and ankle/foot joints show much lower prevalence rates. The ankle/foot joint was the least affected by osteoarthritis. None of the differences between right and left sides are statistically significant.

Table 7.19: Osteoarthritis Prevalence by Joint in the Early Christian Period.

Joint	Present	Absent	Total Joints	% Affected
L. Shoulder	6	15	21	28.6
R. Shoulder	9	16	25	36.0
L. Elbow	2	23	25	8.0
R. Elbow	3	22	25	12.0
L. Wrist/Hand	2	18	20	10.0
R. Wrist/Hand	4	30	34	11.8
L. Hip	13	27	40	32.5
R. Hip	11	32	43	25.6
L. Knee	4	20	24	16.7
R. Knee	3	24	27	11.1
L. Ankle/Foot	1	19	20	5.0
R. Ankle/Foot	0	15	15	0.0

When the available joints in the Early Christian sample are compared by sex, greater prevalence rates are seen in males for most joint categories (Table 7.20). The exceptions are the left knee and the right ankle/foot, which have problematic subsample sizes. While sample sizes are small for all joints, especially among females, the difference between males and females for the left hip was found to be statistically significant. A similar pattern is apparent for the right hip, although the difference only approaches the level of significance using Fisher's exact test.

Table 7.20: Osteoarthritis Prevalence by Joint in Early Christian Males and Females.

Joint	Males			Females			χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
	Pr (n)	Ab (n)	% Affected	Pr (n)	Ab (n)	% Affected				
L. Shoulder	6	10	37.5	0	5	0.0		1	0.262	No
R. Shoulder	7	10	41.2	2	4	33.3		1	1.000	No
L. Elbow	1	12	7.7	0	5	0.0		1	1.000	No
R. Elbow	2	14	12.5	0	5	0.0		1	1.000	No
L. Wrist/Hand	1	11	8.3	0	3	0.0		1	1.000	No
R. Wrist/Hand	2	19	9.5	0	4	0.0		1	1.000	No
L. Hip	11	11	50.0	2	13	13.3	5.261	1	0.022	YES
R. Hip	10	17	37.0	1	12	7.7		1	0.068	No
L. Knee	3	14	17.6	1	3	25.0		1	1.000	No
R. Knee	3	15	16.7	0	6	0.0		1	0.546	No
L. Ankle/Foot	1	11	8.3	0	5	0.0		1	1.000	No
R. Ankle/Foot	0	9	0.0	0	1	0.0	-	-	-	-

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Antemortem Trauma

The analysis of antemortem trauma focused on fractures. The presence or absence of fractures in the Early Christian period was recorded by bone so that the data are comparable to the figures for the Middle to Late Byzantine period and to other regional studies. As discussed in Chapter Six, cranial bones were included in the bone count if they were at least 75% complete, and long bones were included if at least three out of five segments (proximal epiphysis, proximal diaphysis, middle diaphysis, distal diaphysis, and distal epiphysis) were 75% or more complete. Because no examples of antemortem trauma were observed in Early Christian subadults, the following discussion includes adults only.

The prevalence rates of fractures in the major cranial bones are reported for the Early Christian period in Table 7.21. Fractures were observed only on bones of the cranial vault, including the left frontal and the left and right parietals. The left parietal was the most frequently affected element, with three bones out of 40 (7.5%) exhibiting fractures. One left frontal bone and one left parietal bone were also affected. Four of the cranial fractures observed in this period were classified as depression fractures and were well healed at the time of death. A defect on the left parietal of a young adult male was classified as a penetrating fracture and was also well healed at the time of death (Table 7.22).

Table 7.21: Fracture Prevalence by Cranial Bone in the Early Christian Period (Adults Only).

Bone	Present	Absent	Total Bones	% Affected
L. Frontal*	1	25	26	3.8
R. Frontal*	0	24	24	0.0
L. Parietal	3	37	40	7.5
R. Parietal	1	36	37	2.7
Occipital	0	34	34	0.0
L. Temporal	0	19	19	0.0
R. Temporal	0	15	15	0.0
L. Zygomatic	0	28	28	0.0
R. Zygomatic	0	23	23	0.0
L. Maxilla	0	15	15	0.0
R. Maxilla	0	12	12	0.0
L. Mandible*	0	35	35	0.0
R. Mandible*	0	27	27	0.0

*Observations were made separately on the left and right portions of the frontal bone and the mandible following the inventory form in Buikstra and Ubelaker (1994).

Table 7.22: Type and Healing Status of Early Christian Cranial Fractures.

Skeleton	Bone	Fracture Type	Healing	Sex	Age
SK 066	L. Frontal	Depression	Well Healed	Male	40-55
SK 076	L. Parietal	Depression	Well Healed	Male	35-50
SK 155	L. Parietal	Depression	Well Healed	Male	35-50
SK 160	L. Parietal	Penetrating	Well Healed	Male	24-34
SK 009	R. Parietal	Depression	Well Healed	Female	20-29

Among postcranial bones, the right clavicle was the most frequently fractured element. The prevalence rate for the right clavicle (10.0%) was also the highest of any bone in the Early Christian sample. Fractures were also observed on a right ulna and a right femur (Table 7.23). All postcranial fractures were classified as oblique fractures and were well healed with the exception of one midshaft clavicle fracture that was partially healed (Table 7.24).

Table 7.23: Fracture Prevalence by Postcranial Bone in the Early Christian Period (Adults Only).

Bone	Present	Absent	Total Bones	% Affected
L. Clavicle	0	25	25	0.0
R. Clavicle	3	27	30	10.0
L. Humerus	0	26	26	0.0
R. Humerus	0	31	31	0.0
L. Radius	0	20	20	0.0
R. Radius	0	30	30	0.0
L. Ulna	0	17	17	0.0
R. Ulna	1	27	28	3.6
L. Femur	0	30	30	0.0
R. Femur	1	32	33	3.0
L. Tibia	0	16	16	0.0
R. Tibia	0	14	14	0.0
L. Fibula	0	8	8	0.0
R. Fibula	0	5	5	0.0

Table 7.24: Type, Location, and Healing Status of Early Christian Postcranial Fractures.

Skeleton	Bone	Fracture Type	Location	Healing	Sex	Age
SK 012	R. Clavicle	Oblique	Lateral	Well Healed	Male	30-40
SK 116	R. Clavicle	Oblique	Lateral	Well Healed	Indeterminate	Adult
SK 023	R. Clavicle	Oblique	Middle	Partially Healed	Male	35-50
SK 116	R. Ulna	Oblique	Middle	Well Healed	Indeterminate	Adult
SK 014	R. Femur	Oblique	Proximal	Well Healed	Male	40-50

For bones exhibiting fractures, prevalence rates are compared between Early Christian males and females in Table 7.25. While none of the differences between males and females for individual bones are statistically significant, there is a clear tendency for males to be affected by fractures more frequently than females. When all ten fractures in the Early Christian sample are considered, seven occurred in males, one female was affected, and the remaining two are exhibited on unassociated elements of indeterminate sex. The only fracture exhibited by a female was observed on a right parietal. The fractured right ulna and a third fractured right clavicle, which were not assigned a sex and do not appear in Table 7.25, are unassociated elements from the same commingled burial.

Table 7.25: Fracture Prevalence by Bone in Early Christian Males and Females.

Bone	Males			Females			χ^2	df	Two-tail <i>p</i> -value	<i>p</i> < 0.05 Yes/ No
	Pr (<i>n</i>)	Ab (<i>n</i>)	% Affected	Pr (<i>n</i>)	Ab (<i>n</i>)	% Affected				
L. Frontal	1	15	6.7	0	10	0.0		1	1.000	No
L. Parietal	3	20	13.0	0	17	0.0		1	0.248	No
R. Parietal	0	20	0.0	1	16	5.9		1	0.459	No
R. Clavicle	2	18	10.0	0	8	0.0		1	1.000	No
R. Ulna	0	15	0.0	0	6	0.0	-	-	-	-
R. Femur	1	22	4.3	0	9	0.0		1	1.000	No

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

The Middle to Late Byzantine Skeletal Sample

The minimum number of individuals represented in the Middle to Late Byzantine skeletal sample from Nemea is 146. As was the case for the Early Christian sample, all of those individuals were analyzed in this research. While the preservation of the Middle to Late Byzantine sample is much better, with very few examples of erosion of the cortical surfaces, it presents its own unique limitations. The skeletal material in this sample was recovered from 61 graves containing human remains. The marked disparity between the number of graves and the minimum number of individuals is due to the fact that Middle to Late Byzantine burials often contained multiple individuals that were extensively commingled. This situation complicates the analysis of both demographic and paleopathological data. The latter is frequently reported here by bone or tooth rather than by individual in order to include isolated elements while controlling for the possibility of over-reporting prevalence rates. As the presence and preservation of bones is not uniform across graves, the number of individuals in a given set of results may vary greatly depending on the variable being analyzed.

The Middle to Late Byzantine sample includes 106 adults (72.6% of the total) and 40 subadults (27.4% of the total). The data on age and sex among the adults is reported first.

Demographic Patterns: Adults

Age at Death

The number of individuals placed into each adult age category recommended by Buikstra and Ubelaker (1994) appear in Table 7.26 below. Individuals in the generic “adult” category were missing the skeletal elements (innominates, crania, ribs) used to estimate age at death for adults in this research. Individuals placed into that category were usually those represented by duplicated elements such as long bones that were developmentally complete.

Table 7.26: Number and Proportion of Middle to Late Byzantine Individuals in Each Adult Age Category.

Age Category	Number (n)	% Middle to Late Byzantine Adults
Young Adult (20-35)	29	27.4
Middle Adult (35-50)	36	34.0
Old Adult (50+)	12	11.3
Adult (20+)	29	27.4
Total	106	100.0

Sex

In a sample composed of a large number of multiple and commingled burials, the approach to the determination of sex was somewhat different. Assessments of sex were carried out on a grave by grave basis. This first involved identifying and analyzing the reliable indicators of sex that were duplicated in each grave. Other skeletal elements that might indicate sex through metric measurements (e.g., femur) were relied upon secondarily. However, due to the number of incomplete skeletons and isolated skeletal elements, sex determinations relied to a greater degree on metric assessments of robusticity. Demarking points were developed for a number of bones for the Middle to Late Byzantine sample and are presented in Appendix B. Each was derived from measurements of adult individuals for which sex was established using pelvic or cranial

remains. In the analysis of paleopathologies, sex was assigned to isolated skeletal elements using those points.

The number of adult individuals in each category of sex appears in Table 7.27. There is a marked difference between the number of males and females in this phase. The larger number of individuals of undetermined sex in this sample is due to the greater frequency with which individuals were represented by partial skeletons or isolated skeletal elements not useful in sex determination.

Table 7.27: Distribution of Sex among Adults in the Middle to Late Byzantine Sample.

Sex Category	Number (n)	% Middle to Late Byzantine Adults
Male	67	63.2
Female	24	22.6
Ambiguous	0	0
Undetermined	15	14.2
Total	106	100.0

Demographic Patterns: Subadults

As was the case for the Early Christian sample, the analysis of subadult demography focused on the estimation of age. Sex was assigned only to two older adolescents, one male and one female. Table 7.28 shows the number of individuals placed into each subadult age category recommended by Buikstra and Ubelaker (1994). Again, children are the best represented category, making up more than half of the subadults buried at Nemea during the Middle to Late Byzantine period.

Table 7.28: Number and Proportion of Middle to Late Byzantine Individuals in Each Subadult Age Category.

Age Category	Number (n)	% Middle to Late Byzantine Subadults
Fetal (<birth)	5	12.5
Infant (birth-3 years)	2	5.0
Child (3-12 years)	21	52.5
Adolescent (12-20 years)	12	30.0
Total	40	100.0

Summary of Middle to Late Byzantine Demography

The overall demographic structure of the Middle to Late Byzantine skeletal sample is presented in Table 7.29. While a more detailed comparison with the Early Christian sample will be presented later, it is worth mentioning at this point that the age at death structures of the two samples show a very similar pattern. Very few individuals in the Middle to Late Byzantine period died as infants or during the prenatal period. There is a noticeable increase in the number of individuals who died during the childhood years. Young and middle adults make up almost half (44.5%; 65/146) of the total sample and fewer individuals died as old adults.

Table 7.29: Age and Sex Demographics of the Middle to Late Byzantine Skeletal Sample.

Age Category	Male	Female	Ambiguous	Undetermined	Total
Fetal (<birth)	-	-	-	5	5
Infant (birth-3 years)	-	-	-	2	2
Child (3-12 years)	-	-	-	21	21
Adolescent (12-20 years)	1	1	0	10	12
Young Adult (20-35)	15	11	0	3	29
Middle Adult (35-50)	22	10	0	4	36
Old Adult (50+)	11	0	0	1	12
Adult (20+)	19	3	0	7	29
Total	68	25	0	53	146

The most obvious and interesting demographic pattern in this sample is the marked overrepresentation of males. The distribution of sex is relatively even among young adults, but becomes skewed dramatically in middle and older adults. This pattern does not seem to be the result of a bias toward the identification of males in a challenging sample characterized by

missing skeletal elements and frequent commingling. Males would be substantially overrepresented even if every adult individual placed in the “undetermined” category was in reality female. Furthermore, males are overrepresented among less complicated burials—those that contained either one individual or two individuals who were not commingled (Table 7.30).

Table 7.30: Sex Distribution among Non-commingled Middle to Late Byzantine Burials.

Sex Category	Number (n)	% Non-commingled Burials
Male	23	53.5
Female	11	25.6
Ambiguous	0	0
Undetermined	9	20.9
Total	43	100.0

Physiological Stress Indicators: Intraphase Results

This section outlines the results of the analysis of physiological stress indicators in the Middle to Late Byzantine sample. Prevalence rates for each paleopathological condition are compared between subgroups of skeletons, beginning with linear enamel hypoplasias (LEH).

Linear Enamel Hypoplasias

The prevalence rates of LEHs for the Middle to Late Byzantine sample are reported by tooth in Table 7.31 below. The canine teeth were most affected by hypoplasias. The maxillary incisors exhibit moderate prevalence rates and the mandibular incisors are the least affected. Due to the small number of left maxillary central incisors available in this sample, that tooth is not included in subsequent statistical analyses.

Table 7.31: LEH Prevalence by Tooth in the Middle to Late Byzantine Period.

Tooth	Present	Absent	Total	% Affected
(#6) R. Maxillary Canine	22	8	30	73.3
(#7) R. Maxillary Lateral Incisor	8	10	18	44.4
(#8) R. Maxillary Central Incisor	10	14	24	41.7
(#9) L. Maxillary Central Incisor	5	5	10	50.0
(#10) L. Maxillary Lateral Incisor	10	10	20	50.0
(#11) L. Maxillary Canine	25	8	33	75.8
(#22) L. Mandibular Canine	22	8	30	73.3
(#23) L. Mandibular Lateral Incisor	6	19	25	24.0
(#24) L. Mandibular Central Incisor	4	16	20	20.0
(#25) R. Mandibular Central Incisor	4	14	18	22.2
(#26) R. Mandibular Lateral Incisor	6	17	23	26.1
(#27) R. Mandibular Canine	28	7	35	80.0

As was the case for the Early Christian sample, age categories were collapsed in order to compensate as much as possible for small sample sizes for each tooth. Thus, age-based differences in prevalence rates were investigated only between adults and subadults. The prevalence rates for each tooth are compared in Table 7.32. Especially among subadults, the numbers of each tooth available are small and do not allow for definitive statements to be made regarding the association between age and LEH prevalence. Fisher's exact tests indicate that none of the differences between adults and subadults in the prevalence rates of LEHs are significant at the $p < 0.05$ level.

Table 7.32: LEH Prevalence by Tooth in Middle to Late Byzantine Adults and Subadults.

Tooth	Adults			Subadults			χ^2	df	Two-tail <i>p</i> -value	<i>p</i> < 0.05 Yes/ No
	Pr (<i>n</i>)	Ab (<i>n</i>)	% Affected	Pr (<i>n</i>)	Ab (<i>n</i>)	% Affected				
#6	17	8	68.0	5	0	100.0		1	0.287	No
#7	7	9	43.8	1	1	50.0		1	1.000	No
#8	8	10	44.4	2	4	33.3		1	1.000	No
#9	3	3	50.0	2	2	50.0		1	1.000	No
#10	8	8	50.0	2	2	50.0		1	1.000	No
#11	22	8	73.3	3	0	100.0		1	0.560	No
#22	19	8	70.4	3	0	100.0		1	0.545	No
#23	4	17	19.0	2	2	50.0		1	0.234	No
#24	2	13	13.3	2	3	40.0		1	0.249	No
#25	2	11	15.4	2	3	40.0		1	0.533	No
#26	5	13	27.8	1	4	20.0		1	1.000	No
#27	24	7	77.4	4	0	100.0		1	0.562	No

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Comparison of LEH prevalence rates between males and females in this sample also proved to be problematic due to small sample sizes for each tooth, particularly among females. Fisher's exact tests carried out on teeth for which observations on the presence and absence of LEHs were made indicate that the differences in prevalence rates between males and females were significant only for the left mandibular canine ($p = 0.045$). In this case, males were affected much more frequently than females.

Table 7.33: LEH Prevalence by Tooth in Middle to Late Byzantine Males and Females.

Tooth	Males			Females						
	Pr (n)	Ab (n)	% Affected	Pr (n)	Ab (n)	% Affected	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
#6	10	5	66.7	2	2	50.0		1	0.603	No
#7	5	5	50.0	2	3	40.0		1	1.000	No
#8	4	5	44.0	2	4	33.3		1	1.000	No
#9	3	3	50.0	0	0	0.0	-	-	-	-
#10	6	6	50.0	0	1	0.0		1	1.000	No
#11	13	5	72.2	2	1	66.7		1	1.000	No
#22	14	3	82.4	2	4	33.3		1	0.045	YES
#23	3	9	25.0	1	4	20.0		1	1.000	No
#24	2	7	22.2	0	3	0.0		1	1.000	No
#25	2	8	20.0	0	2	0.0		1	1.000	No
#26	5	9	35.7	0	2	0.0		1	1.000	No
#27	14	4	77.8	5	2	71.4		1	1.000	No

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Porotic Hyperostosis

The presence or absence of porotic hyperostosis was recorded on all observable parietal bones in the Middle to Late Byzantine sample. Prevalence rates were based on the number of duplicated parietal bones after sorting by age and anatomical side, as well as on the minimum number of individuals in each grave. Fifteen individuals (16.5%) exhibited porotic hyperostosis out of 91 individuals with at least one observable parietal bone.

The prevalence of porotic hyperostosis in Middle to Late Byzantine adults and subadults is nearly identical (Table 7.34). The proportions of cases observed in categories of lesion severity are also equal. Barely discernible lesions were present in 66.7% of affected adults (8/12) and subadults (2/3), while 33.3% of affected adults (4/12) and subadults (1/3) exhibited lesions scored as "porosity only." Lesions that were active at the time of death were observed only in one subadult in this sample.

Table 7.34: Prevalence Rates of Porotic Hyperostosis in Middle to Late Byzantine Adults and Subadults.

	Present	Absent	Total	% Affected
Adults	12	61	73	16.4
Subadults	3	15	18	16.7

When males and females are compared a greater prevalence rate is seen in the former, although Fisher's exact test indicates that the difference is not significant ($p = 1.000$). The single affected female exhibited barely discernible porotic hyperostosis. Among affected males, 50% (3/6) exhibited barely discernible lesions and 50% (3/6) exhibited lesions scored as "porosity only."

Table 7.35: Prevalence Rates of Porotic Hyperostosis in Middle to Late Byzantine Males and Females.

	Present	Absent	Total	% Affected
Males	6	39	45	13.3
Females	1	13	14	7.1

Cribra Orbitalia

As was the case for porotic hyperostosis, the presence or absence of cribra orbitalia was recorded on all observable eye orbits in the Middle to Late Byzantine sample. Prevalence rates were based on the number of duplicated orbits after sorting by age and anatomical side, as well as on the minimum number of individuals in each grave. Seventeen individuals (30.4%) exhibited cribra orbitalia out of 56 individuals with at least one observable orbit.

Subadults in this sample show a greater prevalence rate of cribra orbitalia than adults (Table 7.36). However, Fisher's exact test shows that the difference is not significant ($p = 0.152$). Among subadults, 40% (2/5) exhibited barely discernible lesions, while 60% (3/5) exhibited lesions scored as "porosity only." Interestingly, adults in this admittedly small subsample showed a greater range of cribra orbitalia expression. Among adults, 41.7% (5/12) exhibited barely discernible lesions, 50% (6/12) exhibited lesions scored as "porosity only," and the

remaining individual showed cribra orbitalia characterized by coalescence of foramina. The proportions of active and healed lesions are nearly equal. Active lesions are exhibited by 40% (2/5) of subadults and 41.7% (5/12) of adults. One adult individual exhibited cribra orbitalia that was in the process of healing at the time of death.

Table 7.36: Prevalence Rates of Cribra Orbitalia in Middle to Late Byzantine Adults and Subadults.

	Present	Absent	Total	% Affected
Adults	12	34	46	26.1
Subadults	5	5	10	50.0

Similarly, the prevalence of cribra orbitalia is greater in males than in females (Table 7.37), but the difference is not significant ($p = 0.700$). Both affected females exhibited barely discernible cribra orbitalia that was healed at the time of death. Among males, 33.3% (3/9) exhibited barely discernible lesions and 55.6% (5/9) showed lesions scored as “porosity only.” The single individual that exhibited lesions with coalescing foramina was also male. Also of interest in this sample is the fact that most males (55.6%; 5/9) exhibited lesions that were active at the time of death. The lesions of three males were healed and one male exhibited cribra orbitalia that was healing at the time of death.

Table 7.37: Prevalence Rates of Cribra Orbitalia in Middle to Late Byzantine Males and Females.

	Present	Absent	Total	% Affected
Males	9	22	31	29.0
Females	2	8	10	20.0

Periosteal Reactions

The presence or absence of periosteal reactions was recorded on all available tibiae with observable cortical surfaces. For isolated tibiae, sex was estimated using the demarking point for circumference at the nutrient foramen determined for this sample, which is presented in Appendix B. When all Middle to Late Byzantine individuals are included in the analysis of

periosteal reactions, the prevalence rate for the left tibia is 61.9% (52/84) and the prevalence rate for the right tibia is 72.5% (58/80). As in the Early Christian sample, the overwhelming majority of reactions (96.2% on the left tibia and 93.1% on the right tibia) were minimally expressed and observable as “markedly accentuated longitudinal striations” (Steckel et al. 2006:30).

When adults and subadults are compared, the prevalence of periosteal reactions is consistently greater in the former (Table 7.38). The difference between adults and subadults is statistically significant for both the left ($\chi^2 = 3.883$, $df = 1$, $p = 0.049$) and right tibia ($p = 0.003$).

Table 7.38: Prevalence Rates of Periosteal Reactions in Middle to Late Byzantine Adults and Subadults.

Tibia	Present		Absent		Total		% Affected	
	L	R	L	R	L	R	L	R
Adults	45	54	22	14	67	68	67.2	79.4
Subadults	7	4	10	8	17	12	41.2	33.3

As was the case in the Early Christian sample, adults also show a greater range of expression of periosteal reactions than subadults (Table 7.39). All recorded lesions among subadults were scored as “accentuated striations,” while lesions appearing as discrete patches and moderate involvement of the diaphysis were observed among adults.

Table 7.39: Expression of Periosteal Reactions in Middle to Late Byzantine Adults and Subadults.

Tibia	Accentuated Striations		Slight Discrete Patches (<1/4 Surface)		Moderate Involvement (<1/2 Surface)		Extensive Reaction (>1/2 Diaphysis)	
	L	R	L	R	L	R	L	R
Adults	43	50	1	3	1	1	0	0
Subadults	7	4	0	0	0	0	0	0

Only one lesion, observed on the left tibia of a subadult, was scored as “woven” or active at the time of death. Adults exhibited almost exclusively “sclerotic” or healed periosteal reactions.

Table 7.40: Activity of Periosteal Reactions in Middle to Late Byzantine Adults and Subadults.

Tibia	Woven		Sclerotic		Mixed Reaction	
	L	R	L	R	L	R
Adults	0	0	45	53	0	1
Subadults	1	0	4	2	2	2

A comparison of prevalence rates by sex shows an inconsistent pattern, probably due to the smaller number of females than males (Table 7.41). The prevalence of periosteal reactions is greater in males for the left tibia, although the difference is not significant ($p = 0.730$). Females are more frequently affected when the right tibia is considered. In that case as well the difference does not reach the $p < 0.05$ level of significance ($p = 0.309$).

Table 7.41: Prevalence Rates of Periosteal Reactions in Middle to Late Byzantine Males and Females.

Tibia	Present		Absent		Total		% Affected	
	L	R	L	R	L	R	L	R
Males	27	29	11	10	38	39	71.1	74.4
Females	8	15	5	2	13	17	61.5	88.2

When the degree of expression is considered, females exhibited only reactions that were scored as “accentuated striations.” While the periosteal reactions observable in most males were also placed into that category, a small number of individuals exhibited more severely expressed lesions (Table 7.42). All periosteal reactions exhibited by males and females in this sample were healed at the time of death (Table 7.43).

Table 7.42: Expression of Periosteal Reactions in Middle to Late Byzantine Males and Females.

Tibia	Accentuated Striations		Slight Discrete Patches (<1/4 Surface)		Moderate Involvement (<1/2 Surface)		Extensive Reaction (>1/2 Diaphysis)	
	L	R	L	R	L	R	L	R
Males	25	27	1	2	1	0	0	0
Females	8	15	0	0	0	0	0	0

Table 7.43: Activity of Periosteal Reactions in Middle to Late Byzantine Males and Females.

Tibia	Woven		Sclerotic		Mixed Reaction	
	L	R	L	R	L	R
Males	0	0	27	29	0	0
Females	0	0	8	15	0	0

Osteoarthritis

The presence or absence of osteoarthritis was recorded on all major non-vertebral joints available in the Middle to Late Byzantine sample. Subsample sizes for each joint category in this phase are generally larger than those in the Early Christian sample due to better preservation and to the greater number of individuals represented. The prevalence of osteoarthritis in all Middle to Late Byzantine adults is reported by joint and anatomical side in Table 7.44 below. As discussed in Chapter Six, one bone was chosen to represent each joint in the case of commingled burials because of the problematic nature of re-associating their constituent skeletal elements.¹⁹

The most frequently affected joint in this sample was the knee, with 40% or more of the observable joints showing evidence of osteoarthritis. High prevalence rates of osteoarthritis are also found for the shoulder and hip joints. The elbow and wrist/hand show more moderate prevalence rates. The ankle/foot joint was least affected by osteoarthritis. None of the differences between the right and left sides are statistically significant.

¹⁹ See Table 6.4 for a list of the bones selected to represent each joint.

Table 7.44: Osteoarthritis Prevalence by Joint in the Middle to Late Byzantine Period.

Joint	Present	Absent	Total Joints	% Affected
L. Shoulder	9	29	38	23.7
R. Shoulder	17	25	42	40.5
L. Elbow	8	45	53	15.1
R. Elbow	14	45	59	23.7
L. Wrist/Hand	8	32	40	20.0
R. Wrist/Hand	8	32	40	20.0
L. Hip	16	35	51	31.4
R. Hip	13	32	45	28.9
L. Knee	21	30	51	41.2
R. Knee	20	30	50	40.0
L. Ankle/Foot	2	34	36	5.6
R. Ankle/Foot	3	36	39	7.7

Prevalence rates of osteoarthritis were compared between males and females, utilizing metric assessments of robusticity to estimate sex in cases of unassociated long bones.²⁰ Males show greater prevalence rates of osteoarthritis than females for most joints and the smaller number females in this sample makes the patterns that deviate from that trend difficult to interpret (Table 7.45). For example, males show a greater tendency toward arthritic changes in the shoulder, while for the elbow and hip the greater sex-based prevalence rate depends on the anatomical side considered. It is likely that the inconsistency in the data for the latter joints is an artifact of the relatively small number of female observations rather than a reflection of differences in patterns of behavior. Similarly, while females show no evidence of osteoarthritis in the wrist/hand joint, this is almost certainly due to the size of the subsamples. Fisher's exact tests indicate that none of the apparent differences between males and females in the prevalence of osteoarthritis are statistically significant.

²⁰ See Appendix B for a list of demarking points used in the estimation of sex from isolated long bones.

Table 7.45: Osteoarthritis Prevalence by Joint in Middle to Late Byzantine Males and Females.

Joint	Males			Females						
	Pr (n)	Ab (n)	% Affected	Pr (n)	Ab (n)	% Affected	χ^2 *	df	Two-tail p-value	p < 0.05 Yes/ No
L. Shoulder	8	20	28.6	0	9	0.0		1	0.159	No
R. Shoulder	14	17	45.2	3	8	27.3		1	0.477	No
L. Elbow	4	29	12.1	3	10	23.1		1	0.385	No
R. Elbow	9	27	25.0	3	16	15.8		1	0.511	No
L. Wrist/Hand	4	18	18.2	0	4	0.0		1	1.000	No
R. Wrist/Hand	6	20	23.1	0	3	0.0		1	1.000	No
L. Hip	14	26	35.0	2	8	20.0		1	0.468	No
R. Hip	8	25	24.2	5	6	45.5		1	0.256	No
L. Knee	18	22	45.0	2	5	28.6		1	0.682	No
R. Knee	17	20	45.9	3	7	30.0		1	0.481	No
L. Ankle/Foot	0	23	0.0	1	4	20.0		1	0.179	No
R. Ankle/Foot	1	22	4.3	0	6	0.0		1	1.000	No

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Antemortem Trauma

The presence or absence of fractures was recorded by bone in the Middle to Late Byzantine sample. As was the case for the Early Christian sample, cranial bones were included in the bone count if they were at least 75% complete, and long bones were included if at least three out of five segments (proximal epiphysis, proximal diaphysis, middle diaphysis, distal diaphysis, and distal epiphysis) were 75% or more complete. No examples of antemortem trauma were observed in Middle to Late Byzantine subadults and the results reported here include adults only.

Table 7.46 shows the distribution and prevalence of cranial fractures in the Middle to Late Byzantine sample. Only two bones, each a left parietal belonging to an adult male, were affected. Both defects were categorized as depression fractures and were well healed at the time of death.

Table 7.46: Fracture Prevalence by Cranial Bone in the Middle to Late Byzantine Period (Adults Only).

Bone	Present	Absent	Total Bones	% Affected
L. Frontal*	0	22	22	0.0
R. Frontal*	0	20	20	0.0
L. Parietal	2	25	27	7.4
R. Parietal	0	26	26	0.0
Occipital	0	30	30	0.0
L. Temporal	0	20	20	0.0
R. Temporal	0	17	17	0.0
L. Zygomatic	0	16	16	0.0
R. Zygomatic	0	21	21	0.0
L. Maxilla	0	14	14	0.0
R. Maxilla	0	19	19	0.0
L. Mandible*	0	35	35	0.0
R. Mandible*	0	29	29	0.0

*Observations were made separately on the left and right portions of the frontal bone and the mandible following the inventory form in Buikstra and Ubelaker (1994).

Table 7.47: Type and Healing Status of Middle to Late Byzantine Cranial Fractures.

Skeleton	Bone	Fracture Type	Healing	Sex	Age
SK 107a	L. Parietal	Depression	Well Healed	Male	21-34
SK 144b	L. Parietal	Depression	Well Healed	Male	40-50

Fractures were present on a number of postcranial bones, although prevalence rates for individual bone types are low. The most frequently fractured elements were the left clavicle and the left radius, with two bones out of 28 (7.1%) affected in each case. It should be noted that many of the fractures reported in Tables 7.48 and 7.49 below appear on skeletal elements belonging to the same adult male individual (SK 091). This individual exhibits bilateral impacted fractures of the distal humeri and proximal radii and ulnae. An additional transverse fracture is present on the distal third of the left ulna. It is also possible that the fractured left tibia and left fibula from the commingled burial designated “SK 117” belong to the same individual. All fractures recorded in this sample were well healed at the time of death.

Table 7.48: Fracture Prevalence by Postcranial Bone in the Middle to Late Byzantine Period (Adults Only).

Bone	Present	Absent	Total Bones	% Affected
L. Clavicle	2	26	28	7.1
R. Clavicle	0	20	20	0.0
L. Humerus	1	29	30	3.3
R. Humerus	1	38	39	2.6
L. Radius	2	26	28	7.1
R. Radius	1	21	22	4.5
L. Ulna	1	22	23	4.3
R. Ulna	1	25	26	3.8
L. Femur	0	39	39	0.0
R. Femur	0	38	38	0.0
L. Tibia	1	27	28	3.6
R. Tibia	0	28	28	0.0
L. Fibula	1	19	20	5.0
R. Fibula	1	16	17	5.9

Table 7.49: Type, Location, and Healing Status of Middle to Late Byzantine Postcranial Fractures.

Skeleton	Bone	Fracture Type	Location	Healing	Sex	Age
SK 127	L. Clavicle	Transverse	Middle	Well Healed	Male	34-44
SK 141b	L. Clavicle	Comminuted	Lateral	Well Healed	Female	35-60
SK 091	L. Humerus	Impacted	Distal	Well Healed	Male	34-44
SK 091	R. Humerus	Impacted	Distal	Well Healed	Male	34-44
SK 126	L. Radius	Oblique	Distal	Well Healed	Female	21-35
SK 091	L. Radius	Impacted	Proximal	Well Healed	Male	34-44
SK 091	R. Radius	Impacted	Proximal	Well Healed	Male	34-44
SK 091	L. Ulna*	Impacted	Proximal	Well Healed	Male	34-44
SK 091	L. Ulna*	Transverse	Distal	Well Healed	Male	34-44
SK 091	R. Ulna	Impacted	Proximal	Well Healed	Male	34-44
SK 117	L. Tibia	Oblique	Proximal	Well Healed	Indeterminate	Adult
SK 117	L. Fibula	Oblique	Middle	Well Healed	Indeterminate	Adult
SK 100a	R. Fibula	Compression	Proximal	Well Healed	Male	45-60

*Bone exhibits multiple fractures.

For bones exhibiting fractures, prevalence rates are compared between Middle to Late Byzantine males and females in Table 7.50. No significant differences are found between the sexes and small subsample sizes especially in females make definitive statements about the sex distribution of fractures difficult. At first glance, fractures are exhibited far more frequently in males. However, the distribution of fractures between the sexes is relatively even when the

multiple fractures exhibited by individual SK 091 are taken into consideration. As stated above, the fractured left tibia and left fibula, which were not assigned a sex and do not appear in Table 7.50, are unassociated elements from the same commingled burial.

Table 7.50: Fracture Prevalence by Bone in Middle to Late Byzantine Males and Females.

Bone	Males			Females						
	Pr (n)	Ab (n)	% Affected	Pr (n)	Ab (n)	% Affected	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
L. Parietal	2	16	11.1	0	8	0.0			1.000	No
L. Clavicle	1	15	6.3	1	5	16.7			0.481	No
L. Humerus	1**	23	4.2	0	6	0.0			1.000	No
R. Humerus	1**	26	3.7	0	12	0.0			1.000	No
L. Radius	1**	20	4.8	1	5	16.7			0.402	No
R. Radius	1**	19	5.0	0	2	0.0			1.000	No
L. Ulna	1**	15	6.3	0	4	0.0			1.000	No
R. Ulna	1**	15	6.3	0	4	0.0			1.000	No
L. Tibia	0	23	0.0	0	3	0.0	-	-	-	-
L. Fibula	0	15	0.0	0	2	0.0	-	-	-	-
R. Fibula	1	10	9.1	0	3	0.0			1.000	No

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

**Fractured bone from SK 091.

Summary of Significant Results Pertinent to Hypothesis Two

One of the goals of this research is the identification of sex-based differences in the prevalence of physiological stress indicators within each skeletal sample that potentially reflect health disparities between men and women in each community at Nemea. If women were a marginalized group in Byzantine society, then it is anticipated that the prevalence rates of most skeletal indicators of stress will be greater among females. The results from the first two sections of this chapter are used to test the second hypothesis of this dissertation.

Hypothesis 2: Prevalence rates of physiological stress indicators associated with nutritional stress and infection will be greater among females than males in both phases at Nemea. Prevalence rates of activity related stress indicators will be greater among males in both phases.

Intraphase comparisons of prevalence rates of physiological stress indicators between males and females that produced statistically significant results are presented in Table 7.51. While this analysis reveals very few significant differences between males and females, those that do exist are in accordance with Hypothesis Two. In the Early Christian sample, the prevalence rate of cribra orbitalia, a non-specific stress indicator usually linked with nutritional stress, is greater in females than in males. The prevalence rate of osteoarthritis affecting the left hip joint, an activity-related condition, is greater in males than in females. In the case of the latter, it is worth noting that although the $p < 0.05$ level of significance is reached only for the left side, the differences between males and females when the corresponding hip joint is considered does approach significance ($p = 0.068$). Although significant differences expressed bilaterally would make a stronger case for sex-based differences in activity patterns, these figures at least suggest that males experienced greater levels of activity-related stress that affected the hip joint.

The significant result for linear enamel hypoplasias in the Middle to Late Byzantine sample is more problematic. While the frequencies of the presence and absence of hypoplasias on the left mandibular canine differ from those expected by chance and the prevalence is greater in males, the subsample sizes especially in the case of females are quite small. Furthermore, the results for the corresponding right mandibular canine show no evidence of a similar trend. The absence of a systemic pattern and the small sample sizes together suggest that there is no broader significance to this particular result.

Table 7.51: Summary of Statistically Significant Results Pertinent to Hypothesis Two.

Period	Paleopathological Condition	Significant Result ($p < 0.05$) (frequencies differ from those expected by chance)
Early Christian	Cribra Orbitalia	Cribra orbitalia is present more frequently in females than in males.
Early Christian	Osteoarthritis	Osteoarthritis is present on the left hip joints of males more frequently than on those of females.
Middle to Late Byzantine	Linear Enamel Hypoplasias	Linear enamel hypoplasias are present on the left mandibular canines (tooth #22) of males more frequently than on those of females.

It should be noted that although no statistically significant differences between males and females were found when the frequencies of fractures were compared by bone, there is a tendency for fractures to appear in males. In fact, the inability to detect significant differences is probably due only to the fact that there are a relatively small number of fractures affecting many different bones on which prevalence rates were calculated independently. Among fractured skeletal elements that could be assigned a sex in the Early Christian sample, 80% (4/5) of cranial fractures occurred in males and all three postcranial fractures affected males. The pattern is less clear for the Middle to Late Byzantine sample because many of the observed fractures affected a single individual. While it is not verified statistically then, the pattern for antemortem trauma, at least for the Early Christian period, is consistent with Hypothesis Two.

Interphase Comparison

This section presents the results of the skeletal analysis of the Early Christian and Middle to Late Byzantine skeletal samples from Nemea using a comparative temporal approach. Comparisons of prevalence rates of linear enamel hypoplasias are limited to the maxillary and mandibular canines because those teeth were the most frequently affected in each sample. As in the previous sections, associations between demographic subgroups and the physiological stress indicators used in this research were tested using Pearson's chi-square test or Fisher's exact test

when any expected cell frequency was less than 5. The level of significance is set at $p < 0.05$. The demographic profiles of each sample are compared first.

Demography

The results of the demographic analysis reveal both similarities and distinct differences between the Early Christian and Middle to Late Byzantine skeletal samples. The age and sex distributions for each sample are reproduced in Table 7.52 below. Earlier it was mentioned that one of the points of similarity between the two samples was their age at death distributions. As can be seen in Table 7.52, the numbers of individuals are similar or even match in every age category except for the generic “adult” category. The differences apparent in that category can be explained by the difficulties of establishing narrower age ranges for adults represented by incomplete skeletons or isolated bones from commingled graves. Given the fact that the individuals represented by these samples lived roughly half a millennium apart, the degree of concordance in the number of individuals in each age at death category is extraordinary.

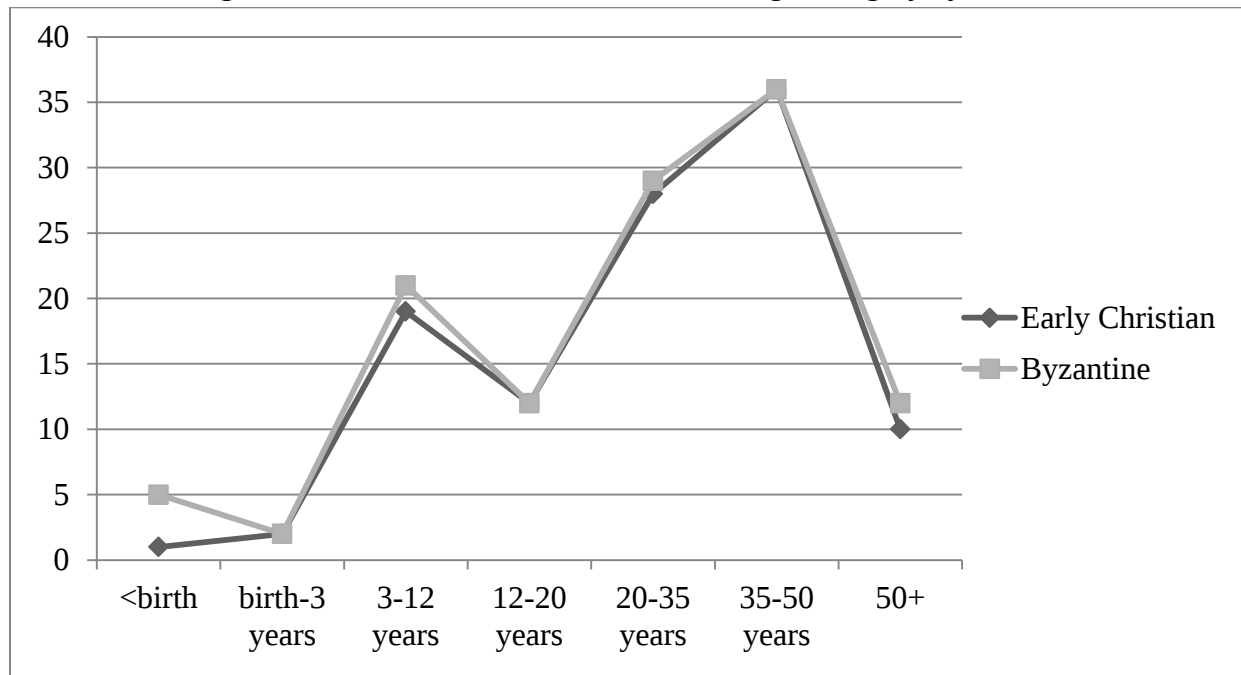
Table 7.52: Age and Sex Demographics of the Early Christian (EC) and Middle to Late Byzantine (B) Samples.

Age Category	Male		Female		Ambiguous		Undetermined		Total	
	EC	B	EC	B	EC	B	EC	B	EC	B
Fetal (<birth)	-	-	-	-	-	-	1	5	1	5
Infant (birth-3 years)	-	-	-	-	-	-	2	2	2	2
Child (3-12 years)	-	-	-	-	-	-	19	21	19	21
Adolescent (12-20 years)	2	1	1	1	0	0	9	10	12	12
Young Adult (20-35)	10	15	18	11	0	0	0	3	28	29
Middle Adult (35-50)	20	22	15	10	0	0	1	4	36	36
Old Adult (50+)	7	11	3	0	0	0	0	1	10	12
Adult (20+)	4	19	0	3	0	0	1	7	5	29
Total	43	68	37	25	0	0	33	53	113	146

When the number of individuals in each period able to be placed with confidence into an age at death category is plotted graphically the curves are nearly identical and, as mentioned above, actually do overlap in the infant, adolescent, and middle adult categories (Figure 7.1). If

commingling was less common among the Middle to Late Byzantine sample, it is likely that the number of adults placed into the generic “adult” category would be reduced and that the totals for the adult age categories in the Middle to Late Byzantine period would be greater. However, it is unlikely that the curve in Figure 7.1 would be significantly altered because of the probability of those adults falling into the early or middle adult categories.

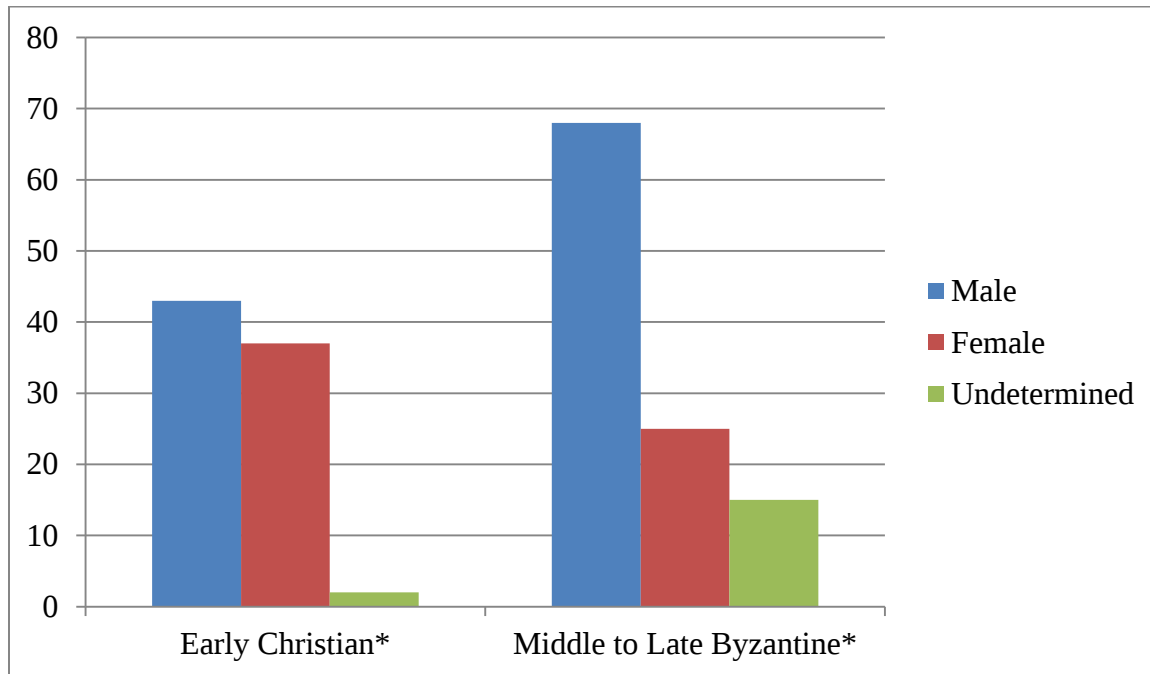
Figure 7.1: Number of Individuals in Each Age Category by Period.



Despite the remarkable similarity between the age-at-death profiles of the two samples, there are clear differences in the distributions of sex. Among Early Christian skeletons, 43 were determined to be male and 37 were determined to be female. The sex of two adults was undetermined. In contrast to that relatively even distribution, males in the Middle to Late Byzantine sample outnumber females nearly three to one. In that sample 68 individuals were determined to be male and 25 individuals were determined to be female. The sex of 15 adults was undetermined (Figure 7.2). The differences in the proportions of males and females between the two samples is statistically significant at the $p < 0.01$ level ($\chi^2 = 7.016$, $df = 1$, $p = 0.008$).

Possible explanations for the overrepresentation of males among Middle to Late Byzantine burials at Nemea will be discussed in Chapter Nine.

Figure 7.2: Number of Individuals in Each Sex Category by Period.



*Includes adolescents for which sex was determined.

While the differences in the distribution of sex between periods at Nemea might lend themselves to a social or behavioral explanation, the consistency in the distributions of age at death may be indicative of similar living conditions in each period. The next section compares the prevalence rates of physiological stress indicators in the Early Christian and Middle to Late Byzantine samples in order to test Hypothesis One, which anticipates poorer health and living conditions in the later period.

Indicators of Physiological Stress

Comparisons of prevalence rates of physiological stress indicators between samples from Nemea initially included all individuals. In most cases prevalence rates are greater in the Middle to Late Byzantine sample, although there are no substantial differences between the two periods (Table 7.53). Periosteal reactions are the exception, with greater prevalence rates in Early

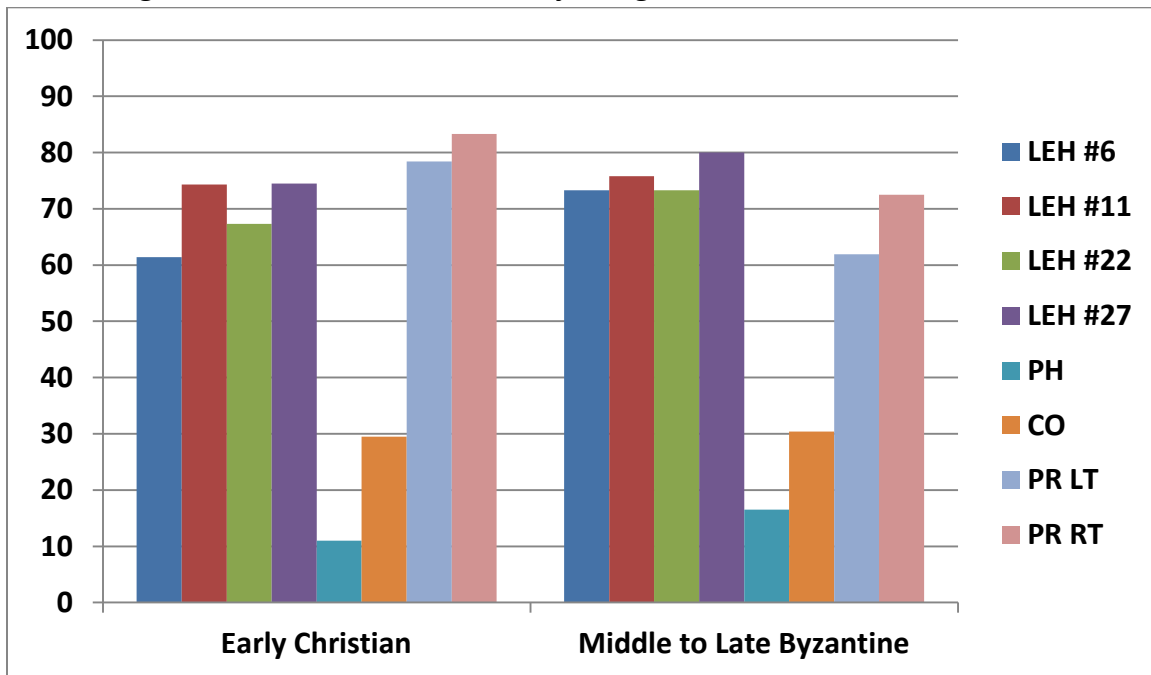
Christian individuals for both the left and right tibiae. For linear enamel hypoplasias, none of the differences between samples were statistically significant at the $p < 0.05$ level. Similarly, the differences for porotic hyperostosis and cribra orbitalia were not significant. The differences between the two samples in the prevalence of periosteal reactions is interesting in that they trend in the opposite direction as the other stress indicators and do show statistically significant results, albeit for the left tibia only.

Table 7.53: Frequency and Prevalence Rates of Physiological Stress Indicators at Nemea.

Condition	Early Christian			Middle to Late Byzantine						
	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
LEH #6	25	14	61.4	22	8	73.3	0.665	1	0.415	No
LEH #11	26	9	74.3	25	8	75.8	0.020	1	0.889	No
LEH #22	37	18	67.3	22	8	73.3	0.336	1	0.562	No
LEH #27	41	14	74.5	28	7	80.0	0.356	1	0.551	No
PH	9	73	11.0	15	76	16.5	1.095	1	0.295	No
CO	18	43	29.5	17	39	30.4	0.010	1	0.920	No
PR L. Tibia	40	11	78.4	52	32	61.9	3.993	1	0.046	YES
PR R. Tibia	40	8	83.3	58	22	72.5	1.962	1	0.199	No

LEH = linear enamel hypoplasia, PH = porotic hyperostosis, CO = cribra orbitalia, PR = periosteal reaction.

Figure 7.3: Prevalence Rates of Physiological Stress Indicators at Nemea.



LEH = linear enamel hypoplasia, PH = porotic hyperostosis, CO = cribra orbitalia, PR LT = periosteal reaction left tibia, PR RT = periosteal reaction right tibia.

Efforts were also made to compare prevalence rates between periods at Nemea within categories of age and sex. As was the case for the intraphase assessments, the categories considered in the temporal comparison include adults, subadults, males, and females.

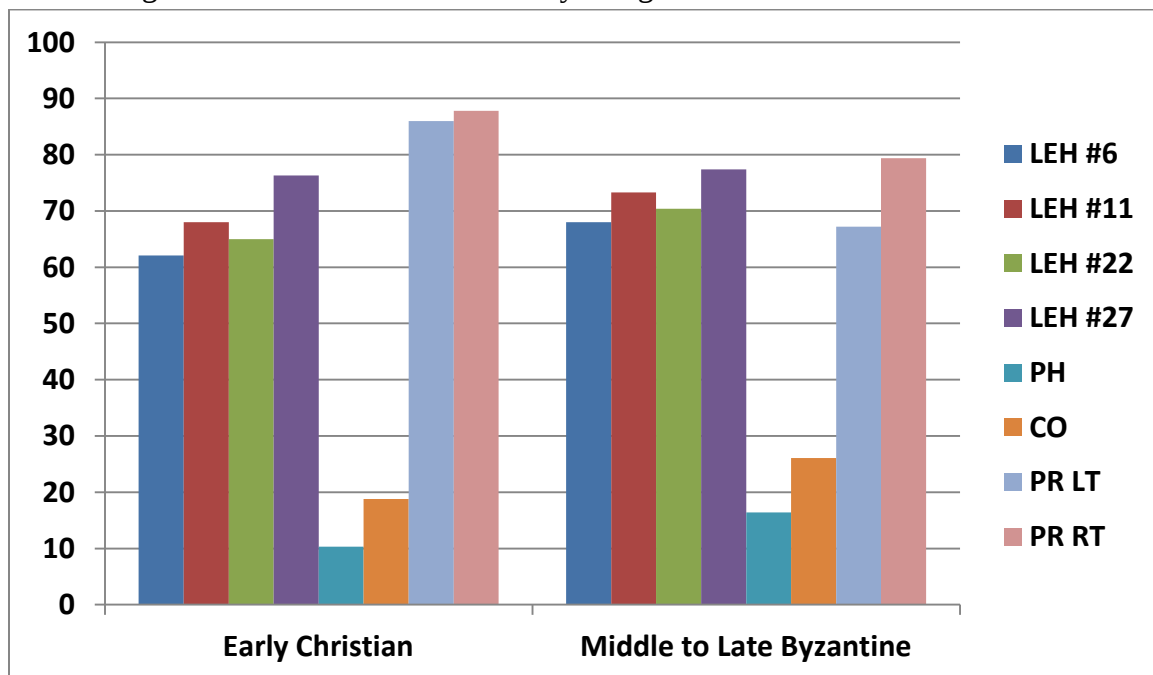
When only adults are considered, the general pattern apparent above for all individuals is unchanged. Prevalence rates for all physiological stress indicators except for periosteal reactions are greater, even if by a small margin, in the Middle to Late Byzantine sample (Table 7.54). Again, however, most of the differences are not significant at the $p < 0.05$ level. No significant differences in prevalence rates were found for linear enamel hypoplasias, porotic hyperostosis, or cribra orbitalia. The prevalence of periosteal reactions on both right and left tibiae is greater in the Early Christian sample. The difference between periods is significant for the left tibia, but not for the right tibia.

Table 7.54: Frequency and Prevalence Rates of Physiological Stress Indicators in Adults.

Condition	Early Christian			Middle to Late Byzantine						
	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
LEH #6	18	11	62.1	17	8	68.0	0.207	1	0.649	No
LEH #11	17	8	68.0	22	8	73.3	0.188	1	0.665	No
LEH #22	26	14	65.0	19	8	70.4	0.211	1	0.646	No
LEH #27	29	9	76.3	24	7	77.4	0.012	1	0.914	No
PH	6	52	10.3	12	61	16.4	1.013	1	0.314	No
CO	9	39	18.8	12	34	26.1	0.729	1	0.393	No
PR L. Tibia	37	6	86.0	45	22	67.2	4.921	1	0.027	YES
PR R. Tibia	36	5	87.8	54	14	79.4	1.252	1	0.263	No

LEH = linear enamel hypoplasia, PH = porotic hyperostosis, CO = cribra orbitalia, PR = periosteal reaction.

Figure 7.4: Prevalence Rates of Physiological Stress Indicators in Adults.



LEH = linear enamel hypoplasia, PH = porotic hyperostosis, CO = cribra orbitalia, PR LT = periosteal reaction left tibia, PR RT = periosteal reaction right tibia.

No statistically significant differences were found when prevalence rates were compared between Early Christian and Middle to Late Byzantine subadults (Table 7.55). In this case non-significant results could be attributed to the small size of the subsamples for each paleopathological condition. The relatively small number of subadults available for analysis also

means that the prevalence rates reported here, which are quite high for certain stress indicators, must be interpreted with caution. All canine teeth from individuals dating to the Middle to Late Byzantine period exhibit linear enamel hypoplasias. The prevalence rates of hypoplasias in observable teeth dating to the Early Christian period are lower, although Fisher's exact tests indicate that the differences are not significant. Middle to Late Byzantine subadults are affected by porotic hyperostosis more frequently than Early Christian subadults, but the difference is not significant. The opposite pattern is apparent for cribra orbitalia, which is more prevalent among Early Christian subadults. Middle to Late Byzantine subadults show a greater prevalence rate for the left tibia, while Early Christian subadults exhibit a greater prevalence rate for the right tibia. Fisher's exact test indicates that neither difference is statistically significant.

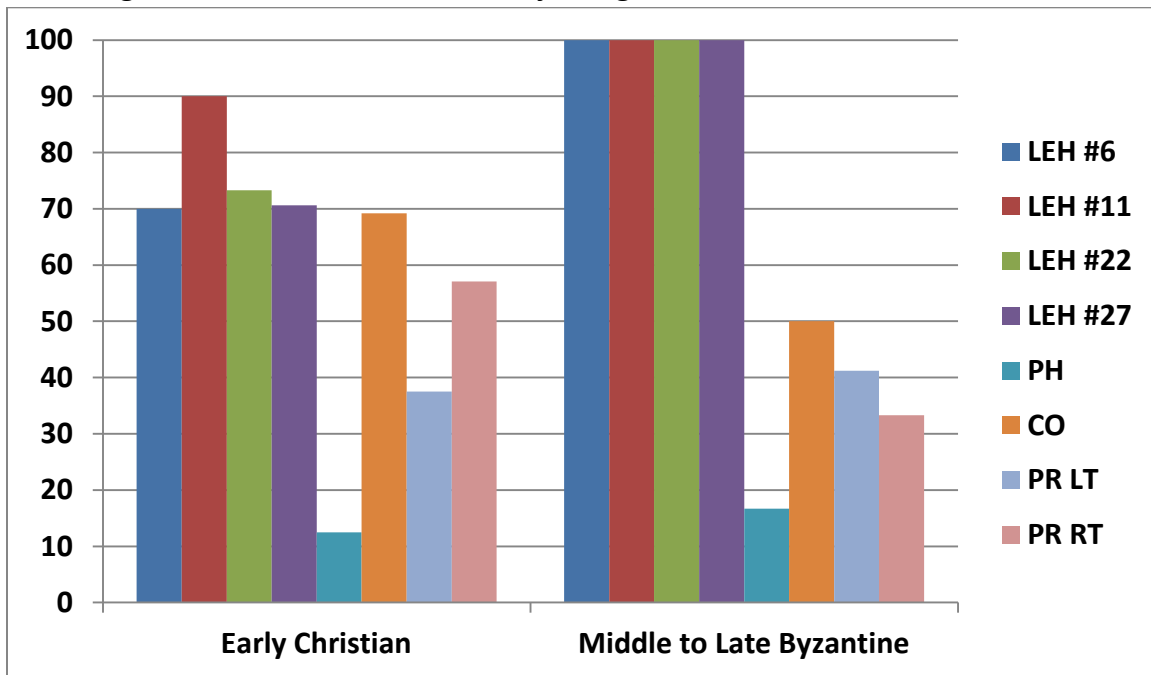
Table 7.55: Frequency and Prevalence Rates of Physiological Stress Indicators in Subadults.

Condition	Early Christian			Middle to Late Byzantine						
	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2 *	df	Two-tail p-value	p < 0.05 Yes/ No
LEH #6	7	3	70.0	5	0	100.0		1	0.505	No
LEH #11	9	1	90.0	3	0	100.0		1	1.000	No
LEH #22	11	4	73.3	3	0	100.0		1	1.000	No
LEH #27	12	5	70.6	4	0	100.0		1	0.532	No
PH	3	21	12.5	3	15	16.7		1	1.000	No
CO	9	4	69.2	5	5	50.0		1	0.417	No
PR L. Tibia	3	5	37.5	7	10	41.2		1	1.000	No
PR R. Tibia	4	3	57.1	4	8	33.3		1	0.377	No

LEH = linear enamel hypoplasia, PH = porotic hyperostosis, CO = cribra orbitalia, PR = periosteal reaction.

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Figure 7.5: Prevalence Rates of Physiological Stress Indicators in Subadults.



LEH = linear enamel hypoplasia, PH = porotic hyperostosis, CO = cribra orbitalia, PR LT = periosteal reaction left tibia, PR RT = periosteal reaction right tibia.

Next, prevalence rates were compared between phases among males only. Males show a similar pattern to that observed when periods are compared among adults more generally and when all individuals are included. Prevalence rates are greater in the Middle to Late Byzantine sample for all indicators except for periosteal reactions (Table 7.56). While the right and left tibiae of Early Christian males are affected by periosteal reactions more frequently than those of Middle to Late Byzantine males, the difference for neither bone is significant. In fact, the results of chi-square and Fisher's exact tests indicate that none of the differences between Early Christian males and Middle to Late Byzantine males are statistically significant.

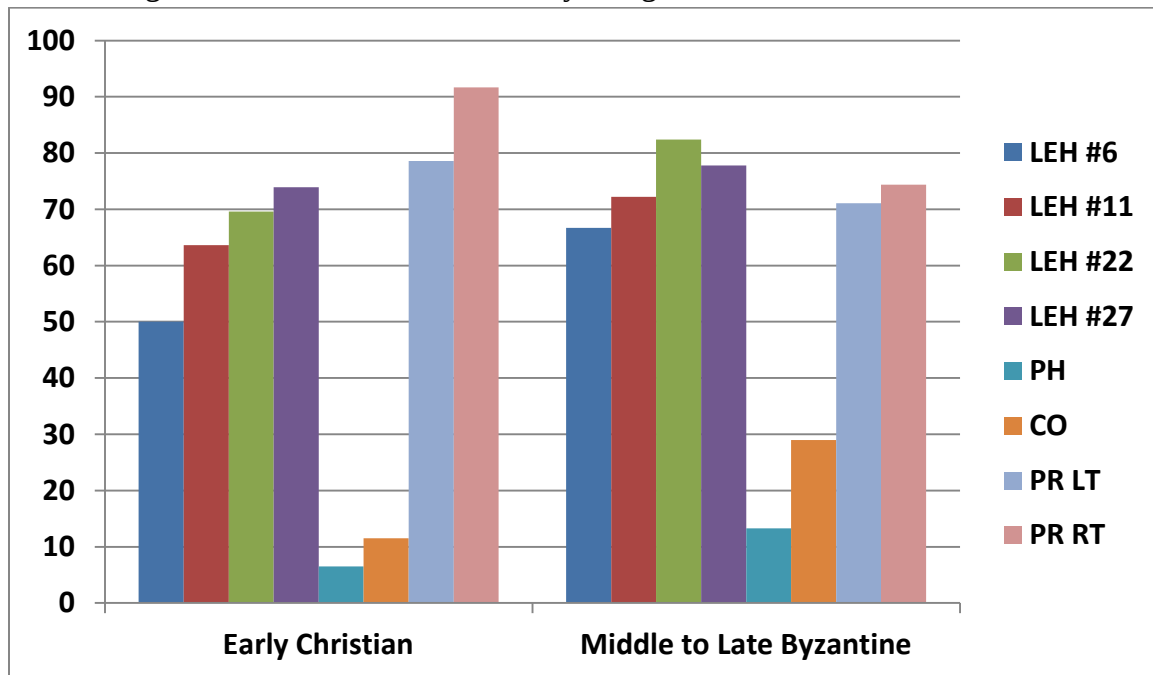
Table 7.56: Frequency and Prevalence Rates of Physiological Stress Indicators in Males.

Condition	Early Christian			Middle to Late Byzantine						
	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
LEH #6	8	8	50.0	10	5	66.7	0.883	1	0.347	No
LEH #11	7	4	63.6	13	5	72.2		1	0.694	No
LEH #22	16	7	69.6	14	3	82.4		1	0.471	No
LEH #27	17	6	73.9	14	4	77.8		1	1.000	No
PH	2	29	6.5	6	39	13.3		1	0.460	No
CO	3	23	11.5	9	22	29.0	2.604	1	0.107	No
PR L. Tibia	22	6	78.6	27	11	71.1	0.477	1	0.490	No
PR R. Tibia	22	2	91.7	29	10	74.4		1	0.110	No

LEH = linear enamel hypoplasia, PH = porotic hyperostosis, CO = cribra orbitalia, PR = periosteal reaction.

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Figure 7.6: Prevalence Rates of Physiological Stress Indicators in Males.



LEH = linear enamel hypoplasia, PH = porotic hyperostosis, CO = cribra orbitalia, PR LT = periosteal reaction left tibia, PR RT = periosteal reaction right tibia.

Finally, prevalence rates of physiological stress indicators were compared across periods among females (Table 7.57). The patterns for females differ in most cases from those apparent when all individuals, all adults, and males are compared. However, these results must be

interpreted with caution due to the small subsample sizes for each stress indicator, particularly among Middle to Late Byzantine females.

For each tooth considered, the prevalence of linear enamel hypoplasias is greater in Early Christian females. However, none of the differences between periods are statistically significant. Early Christian females also show greater prevalence rates of porotic hyperostosis and cribra orbitalia, though again neither difference is significant. When periosteal reactions in females are compared by period, the prevalence rate is significantly greater for the left tibia during the Early Christian period. The right tibia is affected more frequently in Middle to Late Byzantine females, but the difference is not significant.

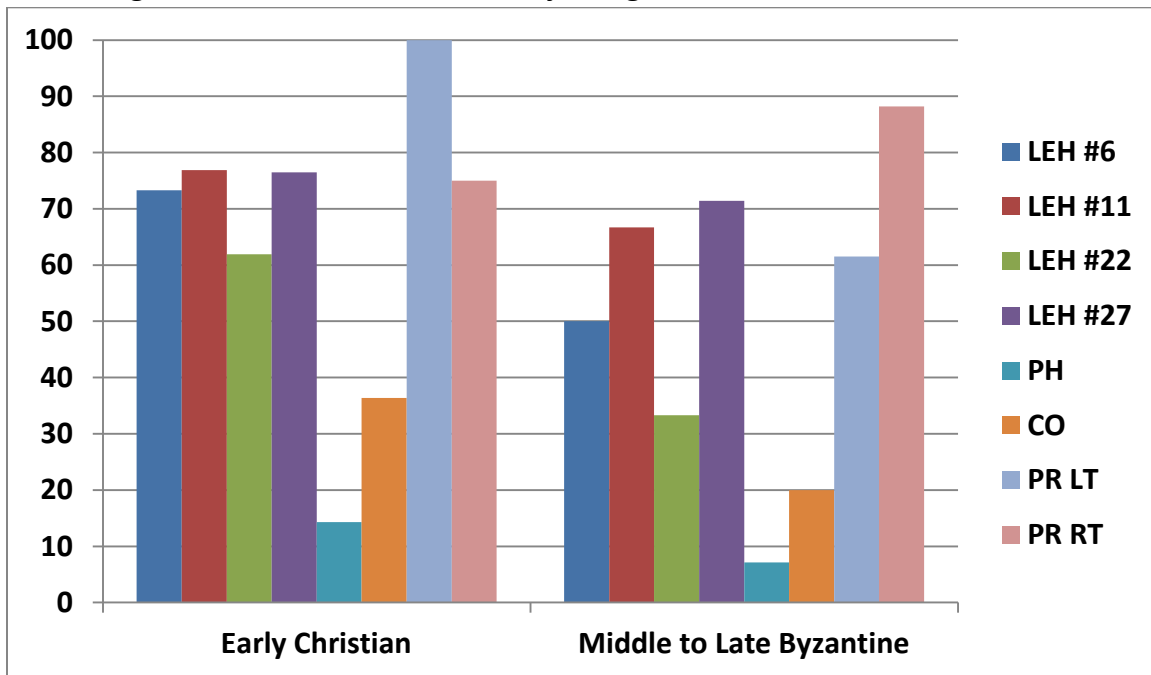
Table 7.57: Frequency and Prevalence Rates of Physiological Stress Indicators in Females.

Condition	Early Christian			Middle to Late Byzantine			χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%				
LEH #6	11	4	73.3	2	2	50.0		1	0.557	No
LEH #11	10	3	76.9	2	1	66.7		1	1.000	No
LEH #22	13	8	61.9	2	4	33.3		1	0.357	No
LEH #27	13	4	76.5	5	2	71.4		1	1.000	No
PH	4	24	14.3	1	13	7.1		1	0.650	No
CO	8	14	36.4	2	8	20.0		1	0.440	No
PR L. Tibia	12	0	100.0	8	5	61.5		1	0.039	YES
PR R. Tibia	9	3	75.0	15	2	88.2		1	0.622	No

LEH = linear enamel hypoplasia, PH = porotic hyperostosis, CO = cribra orbitalia, PR = periosteal reaction.

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Figure 7.7: Prevalence Rates of Physiological Stress Indicators in Females.



LEH = linear enamel hypoplasia, PH = porotic hyperostosis, CO = cribra orbitalia, PR LT = periosteal reaction left tibia, PR RT = periosteal reaction right tibia.

Activity-Related Conditions

Osteoarthritis

The prevalence rates of osteoarthritis were compared between phases at Nemea among all adults, males, and females. In order to maximize subsample sizes, the data were not further broken down by age category. The marked similarity in the age-at-death structures of the Early Christian and Middle to Late Byzantine samples functions as a built in control for age, which is a factor in the appearance of osteoarthritis.

When all adults in each period are compared, greater prevalence rates of osteoarthritis are apparent in the Middle to Late Byzantine sample for most joints (Table 7.58). The elbow and wrist/hand joints are affected around twice as frequently as they were in the Early Christian period, although Pearson's chi-square and Fisher's exact tests indicate that the differences between the two periods for those joints are not significant. The most obvious difference

between the two periods is apparent in the knee joint, which shows a substantial increase in osteoarthritis prevalence in the Middle to Late Byzantine period. The difference is statistically significant for both the left and right knee. The shoulder, hip, and ankle joints show much less variation through time. Osteoarthritis affecting the shoulder and elbow joints shows a predilection for the right side in both phases, a pattern that is more exaggerated in the Middle to Late Byzantine period.

Table 7.58: Frequency and Prevalence Rates of Osteoarthritis in Adults.

Joint	Early Christian			Middle to Late Byzantine						
	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
L. Shoulder	6	15	28.6	9	29	23.7	0.170	1	0.680	No
R. Shoulder	9	16	36.0	17	25	40.5	0.132	1	0.716	No
L. Elbow	2	23	8.0	8	45	15.1		1	0.487	No
R. Elbow	3	22	12.0	14	45	23.7	1.496	1	0.221	No
L. Wrist/Hand	2	18	10.0	8	32	20.0		1	0.471	No
R. Wrist/Hand	4	30	11.8	8	32	20.0	0.917	1	0.338	No
L. Hip	13	27	32.5	16	35	31.4	0.013	1	0.909	No
R. Hip	11	32	25.6	13	32	28.9	0.121	1	0.728	No
L. Knee	4	20	16.7	21	30	41.2	4.412	1	0.036	YES
R. Knee	3	24	11.1	20	30	40.0	6.985	1	0.008	YES
L. Ankle/Foot	1	19	5.0	2	34	5.6		1	1.000	No
R. Ankle/Foot	0	15	0.0	3	36	7.7		1	0.552	No

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Similar patterns are apparent when the prevalence of osteoarthritis is compared between males in each period (Table 7.59). Again, prevalence rates for most joints increase through time, with the clearest example being the knee. The difference between Early Christian and Middle to Late Byzantine males for that joint is statistically significant for the right side and approaches the level of significance for the left side. Prevalence rates for the elbow and wrist joints increase through time for both anatomical sides as well, although in those cases the differences are not significant. The pattern is less clear for the shoulder joint, which shows greater prevalence rates in Early Christian males for the left shoulder and in Middle to Late Byzantine males for the right

shoulder. The hip is the only joint for which prevalence rates are greater in Early Christian males for the right and left sides. As was the case among all adults, osteoarthritis was uncommon in the ankle/foot joint during both periods.

Table 7.59: Frequency and Prevalence Rates of Osteoarthritis in Males.

Joint	Early Christian			Middle to Late Byzantine						
	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2 *	df	Two-tail p-value	p < 0.05 Yes/ No
L. Shoulder	6	10	37.5	8	20	28.6	0.374	1	0.541	No
R. Shoulder	7	10	41.2	14	17	45.2	0.071	1	0.790	No
L. Elbow	1	12	7.7	4	29	12.1		1	1.000	No
R. Elbow	2	14	12.5	9	27	25.0		1	0.468	No
L. Wrist/Hand	1	11	8.3	4	18	18.2		1	0.635	No
R. Wrist/Hand	2	19	9.5	6	20	23.1		1	0.269	No
L. Hip	11	11	50.0	14	26	35.0	1.327	1	0.249	No
R. Hip	10	17	37.0	8	25	24.2	0.958	1	0.328	No
L. Knee	3	14	17.6	18	22	45.0	3.836	1	0.050	No
R. Knee	3	15	16.7	17	20	45.9	4.486	1	0.034	YES
L. Ankle/Foot	1	11	8.3	0	23	0.0		1	0.343	No
R. Ankle/Foot	0	9	0.0	1	22	4.3		1	1.000	No

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Comparing prevalence rates of osteoarthritis between females in each period is problematic for certain joint categories because of small subsample sizes. Among female joints that can be compared statistically, small samples mean that the results should be interpreted with extreme caution. When the available data are considered, prevalence rates are greater in Middle to Late Byzantine females for all joints except for the shoulder. This trend is most evident for the elbow, hip, and knee joints, although none of the differences between females from each period were found to be statistically significant (Table 7.60).

Table 7.60: Frequency and Prevalence Rates of Osteoarthritis in Females.

Joint	Early Christian			Middle to Late Byzantine						
	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
L. Shoulder	0	5	0.0	0	9	0.0	-	-	-	-
R. Shoulder	2	4	33.3	3	8	27.3		1	1.000	No
L. Elbow	0	5	0.0	3	10	23.1		1	0.522	No
R. Elbow	0	5	0.0	3	16	15.8		1	1.000	No
L. Wrist/Hand	0	3	0.0	0	4	0.0	-	-	-	-
R. Wrist/Hand	0	4	0.0	0	3	0.0	-	-	-	-
L. Hip	2	13	13.3	2	8	20.0		1	1.000	No
R. Hip	1	12	7.7	5	6	45.5		1	0.061	No
L. Knee	1	3	25.0	2	5	28.6		1	1.000	No
R. Knee	0	6	0.0	3	7	30.0		1	0.250	No
L. Ankle/Foot	0	5	0.0	1	4	20.0		1	1.000	No
R. Ankle/Foot	0	1	0.0	0	6	0.0	-	-	-	-

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Antemortem Trauma

Prevalence rates of antemortem trauma were compared by bone between periods for all adults, males, and females. The results for bones that exhibited fractures are reported in the tables below. To facilitate the comparison of the frequency and prevalence of fractures between subsamples at Nemea and between skeletal samples from other sites in Byzantine Greece, right and left bones were combined to produce one prevalence rate for each bone.

Table 7.61 shows the results when prevalence rates are compared by period among all adults. The prevalence of fractures ranges from 1.6% for Early Christian femora to 6% for Middle to Late Byzantine radii. Fractures of cranial bones are more common in the Early Christian sample, although the differences in prevalence rates between the two periods are not significant whether the frontal and parietal bones are considered separately, or whether those bones are combined for a crude prevalence of cranial fractures (3.9% or 5/127 in the Early Christian period and 2.1% or 2/95 in the Middle to Late Byzantine period). Similarly, more postcranial bones exhibit fractures in the Middle to Late Byzantine sample, but there are no

statistically significant differences between prevalence rates by bone or between the crude prevalence of postcranial fractures in the Early Christian (2.3%; 10/440) and Middle to Late Byzantine (2.9% or 14/481) periods.

Table 7.61: Frequency and Prevalence Rates of Fractures by Bone in Adults.

Bone	Early Christian			Middle to Late Byzantine						
	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2 *	df	Two-tail p-value	p < 0.05 Yes/ No
Frontal	1	49	2.0	0	42	0.0		1	1.000	No
Parietal	4	73	5.2	2	51	3.8		1	1.000	No
Clavicle	3	52	5.5	2	46	4.2		1	1.000	No
Humerus	0	57	0.0	2	67	2.9		1	0.501	No
Radius	0	50	0.0	3	47	6.0		1	0.242	No
Ulna	1	44	2.2	2	47	4.1		1	1.000	No
Femur	1	62	1.6	0	77	0.0		1	0.450	No
Tibia	0	30	0.0	1	55	1.8		1	1.000	No
Fibula	0	13	0.0	2	35	5.4		1	1.000	No

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Prevalence rates were also compared by period among males only. As was the case for all adults, no significant differences were found between males in each period when skeletal elements are considered individually (Table 7.62). In terms of general patterns, fractures were observed more frequently on the cranial bones of Early Christian males than on those of Middle to Late Byzantine males. If the frontal and parietal bones are combined, the prevalence rate of cranial fractures is 5.4% (4/74) for the Early Christian period and 3.1% (2/65) for the Middle to Late Byzantine period. The difference is not significant. The opposite pattern is apparent for postcranial fractures, which were more common in Middle to Late Byzantine males. If postcranial bones exhibiting fractures are combined, the prevalence rate is 2.7% (7/257) for the Early Christian sample and 3.3% (10/303) for the Middle to Late Byzantine sample.

Table 7.62: Frequency and Prevalence Rates of Fractures by Bone in Males.

Bone	Early Christian			Middle to Late Byzantine						
	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
Frontal	1	30	3.2	0	30	0.0		1	1.000	No
Parietal	3	40	7.0	2	33	5.7		1	1.000	No
Clavicle	2	34	5.6	1	27	3.6		1	1.000	No
Humerus	0	35	0.0	2	49	3.9		1	0.512	No
Radius	0	34	0.0	2	39	4.9		1	0.498	No
Ulna	0	30	0.0	2	30	6.3		1	0.492	No
Femur	1	40	2.4	0	60	0.0		1	0.406	No
Fibula	0	7	0.0	1	25	3.8		1	1.000	No

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Finally, prevalence rates of fractures were compared by period in females (Table 7.63). Only four fractured bones belong to individuals determined to be female. Once again subsample sizes are small enough that statistically significant differences are unlikely to be found and any observable patterns cannot be given much weight in interpretation. Among females, the only cranial fracture appears on the right parietal of an individual from the Early Christian sample. One fractured clavicle is present among females in each period. The only additional postcranial fracture appears on a left radius belonging to a Middle to Late Byzantine female.

Table 7.63: Frequency and Prevalence Rates of Fractures by Bone in Females.

Bone	Early Christian			Middle to Late Byzantine						
	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
Parietal	1	33	2.9	0	17	0.0		1	1.000	No
Clavicle	1	16	5.9	1	8	11.1		1	1.000	No
Radius	0	9	0.0	1	7	12.5		1	0.471	No

Summary of Significant Results Pertinent to Hypothesis One

Another one of the principal goals of this research is to determine whether or not the sociopolitical transformations of the 12th-13th centuries resulted in comparatively poorer living conditions for the Middle to Late Byzantine community at Nemea. If living conditions

deteriorated during this period, then skeletal stress indicators should be more prevalent in the Middle to Late Byzantine sample than in the Early Christian sample. The results of the interphase comparison are used to test the first hypothesis set forth in this dissertation.

Hypothesis 1: The Middle to Late Byzantine skeletal sample from Nemea will exhibit greater prevalence rates of physiological stress indicators than the Early Christian skeletal sample.

As was the case when males and females within each sample were compared, very few statistically significant differences were identified when demographic subgroups were compared between samples (Table 7.64). The results for periosteal reactions, which are more prevalent in certain Early Christian subgroups, argue for the rejection of Hypothesis One. However, those results are difficult to interpret. Among both adults and females, the significant differences between the samples are for the left tibia only. Neither group shows a similar pattern when the right tibia is considered and, in fact, prevalence rates of periosteal reactions on that bone among females are greater in the Middle to Late Byzantine sample. The inconsistent results for females are probably due to relatively small subsample sizes.

The results for osteoarthritis are more straightforward and support Hypothesis One. Among all adults, the prevalence rate of osteoarthritis of the knee joint increased significantly from the Early Christian period to the Middle to Late Byzantine period. A significant increase in the frequency of osteoarthritis over time is also confirmed in males for the right knee joint. While the differences between Early Christian and Middle to Late Byzantine males only approach the level of significance for the corresponding knee, they are at least consistent with this trend.

Table 7.64: Summary of Statistically Significant Results Pertinent to Hypothesis One.

Paleopathological Condition	Demographic Subgroup	Significant Result ($p < 0.05$) (frequencies differ from those expected by chance)
Periosteal Reactions	Adults	Periosteal reactions were present on the left tibiae of Early Christian adults more frequently than on those of Middle to Late Byzantine adults.
Periosteal Reactions	Females	Periosteal reactions were present on the left tibiae of Early Christian females more frequently than on those of Middle to Late Byzantine females.
Osteoarthritis	Adults	Osteoarthritis was present on the left and right knee joints of Middle to Late Byzantine adults more frequently than on those of Early Christian adults.
Osteoarthritis	Males	Osteoarthritis was present on the right knee joint of Middle to Late Byzantine males more frequently than on that of Early Christian males.

A Regional Perspective on Health in Byzantine Greece: Nemea, Akraiphnio, Thebes, and Spata

In the final section of this chapter, data on skeletal health from Nemea are compared with the results from selected sites in central Greece. This approach helps to place the health patterns at Nemea within a broader, regional context. It also sheds additional light on the comparative sites themselves and, in doing so, provides a better understanding of regional patterns of health and living conditions in Byzantine Greece. The comparative data used in this research come from the sites of Akraiphnio and Thebes in Boeotia, and Spata in Attica. They were collected, analyzed, and reported by Tritsaroli (2006). The human skeletal remains from Akraiphnio, which date to the 6th century AD, are compared with the skeletal sample from Early Christian Nemea. The skeletal samples from Thebes and Spata, which respectively date to the 12th-13th and 11th and 14th centuries AD, are compared with the Middle to Late Byzantine skeletal material from Nemea. Each comparative site is described in greater detail in Chapter Six.

Tritsaroli (2006) includes data on all of the health indicators analyzed in the present research with the exception of osteoarthritis. However, certain modifications to the way in which the data from Nemea have been reported thus far are necessary in order to compare them directly to her results. First, the prevalence rates of linear enamel hypoplasias are analyzed by tooth type, grouping together the available permanent maxillary incisors, maxillary canines, mandibular incisors, and mandibular canines. For periosteal reactions, Tritsaroli (2006) reports the prevalence rates by individual for each bone examined. For comparative purposes, her result for the tibia at each site is compared separately to the figures for the right and left tibiae from Nemea, which reflect individual counts. Comparisons of the prevalence rates of fractures were carried out using the same approach. No changes were necessary for porotic hyperostosis and cribra orbitalia as those conditions were recorded on the parietal bones and eye orbits, respectively. Because the material from Akraiphnio, Thebes, and Spata provide limited data on sex, intersite comparisons are made only between adults and subadults.

The data reported in the tables below include the number of individuals or bones/teeth for which a given condition is present (Pr/n), the total number of observable individuals or bones/teeth (T/N), and the prevalence (%) of the condition. The data from Early Christian Nemea and Akraiphnio are examined first.

Akraiphnio

When adults are considered, the prevalence rates of physiological stress indicators are more frequently greater at Nemea (Table 7.65). An overall pattern for enamel hypoplasias is difficult to discern, as prevalence rates are greater for the incisors at Akraiphnio and greater for the canines at Nemea. The differences between adults at the two sites are significant for both mandibular tooth types. The prevalence of porotic hyperostosis is greater at Akraiphnio, while

cribra orbitalia is present only at Nemea. Neither difference is statistically significant. A clear pattern is apparent for periosteal reactions, which are much more prevalent at Nemea. The differences for the right and left sides are statistically significant.

Table 7.65: Comparison of Prevalence Rates of Physiological Stress Indicators in Adults at Early Christian Nemea and Akraiphnio.

Condition	Nemea			Akraiphnio						
	Pr (n)	T (N)	%	Pr (n)	T (N)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
LEH Max. Incisors**	61	150	40.7	13	24	54.2	1.54	1	0.215	No
LEH Max. Canines**	51	74	68.9	8	17	47.1	2.90	1	0.089	No
LEH Mand. Incisors**	45	179	25.1	19	21	90.5	36.87	1	<0.0001	YES
LEH Mand. Canines**	78	110	70.9	9	19	47.4	4.09	1	0.043	YES
PH	6	58	10.3	3	16	18.8		1	0.396	No
CO	9	48	18.8	0	13	0.0		1	0.184	No
PR L. Tibia	37	43	86.0	6	25	24.0	26.18	1	<0.0001	YES
PR R. Tibia	36	41	87.8				27.32	1	<0.0001	YES

LEH = linear enamel hypoplasias, PH = porotic hyperostosis, CO = cribra orbitalia, PR = periosteal reaction.

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

**Includes adults and subadults with observable permanent teeth.

Among subadults, subsample sizes at both Early Christian Nemea and Akraiphnio are small. As was the case for adults, the prevalence of porotic hyperostosis is greater in the sample from Akraiphnio, while the prevalence of cribra orbitalia is greater at Nemea. Small sample sizes produce an inconsistent pattern for periosteal reactions, which are more prevalent at Nemea if the right side is considered, but less prevalent at Nemea if the left side is examined. None of the differences in prevalence rates between subadults at Nemea and Akraiphnio are statistically significant (7.66).

Table 7.66: Comparison of Prevalence Rates of Physiological Stress Indicators in Subadults at Early Christian Nemea and Akraiphnio.

Condition	Nemea			Akraiphnio			χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
	Pr (n)	T (N)	%	Pr (n)	T (N)	%				
PH	3	24	12.5	3	10	30.0		1	0.328	No
CO	9	13	69.2	2	9	22.2		1	0.080	No
PR L. Tibia	3	8	37.5	8	17	47.1		1	0.695	No
PR R. Tibia	4	7	57.1					1	1.000	No

LEH = linear enamel hypoplasias, PH = porotic hyperostosis, CO = cribra orbitalia, PR = periosteal reaction.

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Both adults and subadults with observable long bones are included in the comparative assessment of fractures. Fractures are infrequent among the bones for which comparative data was available (Table 7.67). Neither skeletal sample contained examples of fractures of the humerus, tibia, and fibula. Fractured elements of the upper limb include a right radius from Akraiphnio and a right ulna from Nemea. The only lower limb fracture was noted on a right femur from Nemea. There are no significant differences in the prevalence rates of fractures between the Nemea and Akraiphnio samples.

Table 7.67: Prevalence Rates of Fractures at Early Christian Nemea and Akraiphnio.

Bone	Nemea			Akraiphnio			χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
	Pr (n)	T (N)	%	Pr (n)	T (N)	%				
L. Humerus	0	30	0.0	0	23	0.0	-	-	-	-
R. Humerus	0	35	0.0				-	-	-	-
L. Radius	0	22	0.0	1	21	4.8		1	0.488	No
R. Radius	0	34	0.0					1	0.382	No
L. Ulna	0	19	0.0	0	21	0.0	-	-	-	-
R. Ulna	1	31	3.2					1	1.000	No
L. Femur	0	32	0.0	0	24	0.0	-	-	-	-
R. Femur	1	34	2.9					1	1.000	No
L. Tibia	0	17	0.0	0	25	0.0	-	-	-	-
R. Tibia	0	15	0.0				-	-	-	-
L. Fibula	0	10	0.0	0	23	0.0	-	-	-	-
R. Fibula	0	6	0.0				-	-	-	-

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Thebes

The prevalence rates of physiological stress indicators in adults are compared between the skeletal samples from Middle to Late Byzantine Nemea and Thebes (12th-13th centuries AD) in Table 7.68. Most indicators show statistically significant differences between the two samples. Furthermore, the prevalence rate of each of those indicators is greater in the Nemea sample with the exception of porotic hyperostosis. In contrast to the comparison between Early Christian Nemea and Akraiphnio, a clear pattern is observable for enamel hypoplasias. The Nemea sample is characterized by significantly greater prevalence rates of enamel hypoplasias on the maxillary and mandibular canines. The presence of hypoplasias on the maxillary incisors is also greater at Nemea and, while the mandibular incisors were affected more frequently at Thebes, the difference is small and is not statistically significant. The prevalence rates of cribra orbitalia and periosteal reactions are significantly greater at Middle to Late Byzantine Nemea. The elevated presence of porotic hyperostosis at Thebes is interesting because all other significant differences trend in the opposite direction and because a similar pattern is observable in the comparison between Early Christian Nemea and Akraiphnio, although the difference was not significant in that case.

Table 7.68: Comparison of Prevalence Rates of Physiological Stress Indicators in Adults at Middle to Late Byzantine Nemea and Thebes.

Condition	Nemea			Thebes						
	Pr (n)	T (N)	%	Pr (n)	T (N)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
LEH Max. Incisors*	33	72	45.8	10	29	34.5	1.09	1	0.296	No
LEH Max. Canines*	47	63	74.6	9	22	40.9	8.24	1	0.004	YES
LEH Mand. Incisors*	20	86	23.3	21	75	28.0	0.48	1	0.488	No
LEH Mand. Canines*	50	65	76.9	17	42	40.5	14.48	1	0.0001	YES
PH	12	73	16.4	25	66	37.9	8.16	1	0.004	YES
CO	12	46	26.1	4	47	8.5	5.04	1	0.025	YES
PR L. Tibia	45	67	67.2	52	104	50.0	4.89	1	0.027	YES
PR R. Tibia	54	68	79.4				15.04	1	<0.0001	YES

LEH = linear enamel hypoplasias, PH = porotic hyperostosis, CO = cribra orbitalia, PR = periosteal reaction.

*Includes adults and subadults with observable permanent teeth.

Comparisons of prevalence rates of physiological stress indicators between subadults at Middle to Late Byzantine Nemea and Thebes reveal no statistically significant differences (Table 7.69). The prevalence rates of porotic hyperostosis, cribra orbitalia and, to a lesser degree, periosteal reactions are similar in the two skeletal samples. However, these results must be interpreted with caution because of small subsample sizes, especially in the case of the subadult sample from Thebes.

Table 7.69: Comparison of Prevalence Rates of Physiological Stress Indicators in Subadults at Middle to Late Byzantine Nemea and Thebes.

Condition	Nemea			Thebes						
	Pr (n)	T (N)	%	Pr (n)	T (N)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
PH	3	18	16.7	1	5	20.0		1	1.000	No
CO	5	10	50.0	3	5	60.0		1	1.000	No
PR L. Tibia	7	17	41.2	5	9	55.5		1	0.683	No
PR R. Tibia	4	12	33.3					1	0.396	No

LEH = linear enamel hypoplasias, PH = porotic hyperostosis, CO = cribra orbitalia, PR = periosteal reaction.

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

When the presence of fractures is compared between the two samples, greater prevalence rates are found in the sample from Middle to Late Byzantine Nemea for all bones that exhibit

fractures (Table 7.70). However, none of the differences in prevalence rates reached a level of statistical significance. The radius was the most frequently fractured bone in both samples.

Table 7.70: Prevalence Rates of Fractures at Middle to Late Byzantine Nemea and Thebes.

Bone	Nemea			Thebes						
	Pr (n)	T (N)	%	Pr (n)	T (N)	%	χ^2 *	df	Two-tail p-value	p < 0.05 Yes/ No
L. Humerus	1	37	2.7	0	84	0.0		1	0.306	No
R. Humerus	1	45	2.2					1	0.349	No
L. Radius	2	33	6.1	2	65	3.1		1	0.601	No
R. Radius	1	27	3.7					1	1.000	No
L. Ulna	1	26	3.8	1	74	1.4		1	1.000	No
R. Ulna	1	29	3.4					1	1.000	No
L. Femur	0	51	0.0	0	116	0.0	-	-	-	-
R. Femur	0	47	0.0				-	-	-	-
L. Tibia	1	33	3.0	0	104	0.0		1	0.241	No
R. Tibia	0	31	0.0				-	-	-	-
L. Fibula	1	23	4.3	1	73	1.3		1	0.424	No
R. Fibula	1	20	5.0					1	0.386	No

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Spata

Fewer statistically significant differences are found when the data on physiological stress at Middle to Late Byzantine Nemea is compared with the results from Spata (11th-14th centuries AD). A general trend observable in the previous two comparative assessments is apparent again: prevalence rates for enamel hypoplasias on the canine teeth, cribra orbitalia, and periosteal reactions are greater at Nemea, while prevalence rates for porotic hyperostosis and enamel hypoplasias on the incisors are greater at Spata (Table 7.71). However, statistically significant differences are observed only for the mandibular incisors and for periosteal reactions affecting the right tibiae at Nemea.

Table 7.71: Comparison of Prevalence Rates of Physiological Stress Indicators in Adults at Middle to Late Byzantine Nemea and Spata.

Condition	Nemea			Spata						
	Pr (n)	T (N)	%	Pr (n)	T (N)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
LEH Max. Incisors*	33	72	45.8	36	59	61.0	3.00	1	0.083	No
LEH Max. Canines*	47	63	74.6	27	45	60.0	2.60	1	0.107	No
LEH Mand. Incisors*	20	86	23.3	45	84	53.6	16.54	1	<0.0001	YES
LEH Mand. Canines*	50	65	76.9	38	59	64.4	2.35	1	0.125	No
PH	12	73	16.4	19	70	27.1	2.41	1	0.121	No
CO	12	46	26.1	7	59	11.9	3.53	1	0.060	No
PR L. Tibia	45	67	67.2	50	90	55.6	2.17	1	0.141	No
PR R. Tibia	54	68	79.4				9.80	1	0.002	YES

LEH = linear enamel hypoplasias, PH = porotic hyperostosis, CO = cribra orbitalia, PR = periosteal reaction.

*Includes adults and subadults with observable permanent teeth.

Subsample sizes are somewhat larger when indicators of stress are compared between subadults in the Nemea and Spata samples. The prevalence of cribra orbitalia is greater at Nemea and the difference between the two samples is statistically significant. The differences in the prevalence rates of porotic hyperostosis and periosteal reactions do not reach the level of statistical significance.

Table 7.72: Comparison of Prevalence Rates of Physiological Stress Indicators in Subadults at Middle to Late Byzantine Nemea and Spata.

Condition	Nemea			Spata						
	Pr (n)	T (N)	%	Pr (n)	T (N)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
PH	3	18	16.7	4	31	12.9		1	1.000	No
CO	5	10	50.0	2	20	10.0		1	0.026	YES
PR L. Tibia	7	17	41.2	23	36	63.9	2.42	1	0.120	No
PR R. Tibia	4	12	33.3				3.41	1	0.065	No

LEH = linear enamel hypoplasias, PH = porotic hyperostosis, CO = cribra orbitalia, PR = periosteal reaction.

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Finally, fractures were uncommon at Spata, affecting just two long bones among all individuals observed. As was the case in the comparison with Thebes, the prevalence rate of

fractures is greater at Middle to Late Byzantine Nemea for each bone on which fractures were observed. However, none of the differences between the two samples are statistically significant.

Table 7.73: Prevalence Rates of Fractures at Middle to Late Byzantine Nemea and Spata.

Bone	Nemea			Spata						
	Pr (n)	T (N)	%	Pr (n)	T (N)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
L. Humerus	1	37	2.7	0	75	0.0		1	0.330	No
R. Humerus	1	45	2.2					1	0.375	No
L. Radius	2	33	6.1	0	75	0.0		1	0.091	No
R. Radius	1	27	3.7					1	0.265	No
L. Ulna	1	26	3.8	1	75	1.3		1	1.000	No
R. Ulna	1	29	3.4					1	1.000	No
L. Femur	0	51	0.0	0	111	0.0	-	-	-	-
R. Femur	0	47	0.0				-	-	-	-
L. Tibia	1	33	3.0	0	90	0.0		1	0.268	No
R. Tibia	0	31	0.0				-	-	-	-
L. Fibula	1	23	4.3	1	89	1.1		1	0.370	No
R. Fibula	1	20	5.0					1	0.335	No

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Summary

In this chapter, I have presented the results of the analysis of physiological indicators of stress and activity for the Early Christian and Middle to Late Byzantine skeletal samples from Nemea. The comparative approach employed in this research allows for the examination of differences in levels of stress between demographic subgroups both within and between periods. I have also utilized data on non-specific stress indicators from Tritsaroli (2006) in a comparative fashion in order to provide a regional perspective on skeletal health at Nemea.

Two specific hypotheses were tested in this chapter. Hypothesis One, which anticipated that the prevalence rates of physiological stress indicators would be greater in the Middle to Late Byzantine sample from Nemea, is neither fully supported nor completely rejected. The prevalence of osteoarthritis of the knee joint increased significantly through time among all adults and among males. However, significantly greater prevalence rates of periosteal reactions

on the left tibia were found in the Early Christian sample among adults in general and among females. Osteoarthritis and periosteal reactions provide insight into different types of life stresses and the implications for health and living conditions of the patterns identified here will be discussed in Chapter Nine. Perhaps even more important than the significant differences in the prevalence of those two conditions, however, is the remarkable number of comparisons that revealed no significant differences between periods at Nemea for most stress indicators. This strongly suggests that each community experienced very similar levels and patterns of physiological stress.

Hypothesis Two, which anticipated that stress indicators associated with nutritional stress and infection would be more prevalent among females while those more closely associated with activity would be more common among males, is partially confirmed for the Early Christian period. Statistically significant differences were found between males and females for the presence of cribra orbitalia (greater in females) and osteoarthritis of the hip joint (greater in males). Furthermore, although the small number of fractures precluded the identification of significant differences when analyzed by bone, there is a clear tendency for males to be affected more frequently than females. There is some evidence, then, that males and females had different life experiences during the Early Christian period.

Hypothesis Two can be rejected for the Middle to Late Byzantine period. The differences in the presence of linear enamel hypoplasias on the left mandibular canine, which is the only statistically significant difference between males and females in this period, is problematic because it is not expressed bilaterally and because it is characterized by very small subsample sizes.

In general, more statistically significant differences in the prevalence rates of physiological stress indicators are found when the samples from Nemea are compared with those from Akraiphnio, Thebes, and Spata. In each case, a greater number of those differences suggest that the communities at Nemea experienced elevated levels of stress. The results from Nemea, however, are more consistent with those from the rural sites of Akraiphnio and Spata than with the figures from Thebes, which are derived from individuals that represent members of an urban community. The sharp contrasts in skeletal health between the samples from Thebes and Middle to Late Byzantine Nemea may be due to differences in the type of site (rural versus urban) and/or factors such as differences in socioeconomic status and resource availability. These possibilities are explored further in Chapter Nine.

CHAPTER 8: RESULTS OF THE MORTUARY ANALYSIS

This chapter presents the results of the mortuary analysis of the Early Christian and Middle to Late Byzantine burials at Nemea. In the first section of the chapter, I outline the spatial, temporal, and age and sex-based patterning of the mortuary variables used in this research. The second section of the chapter focuses on spatial patterns of demography as well as on the spatial distribution of indicators of physiological stress. Variability in the mortuary space at Nemea is identified through visual inspection and is examined in greater detail through the use of statistical comparisons using SPSS 19.0 and spatial statistics using ArgGIS 10.0. The data presented in this chapter is used to address the third research question and associated hypothesis introduced in Chapter Five.

Research Question 3: Was the burial space at Nemea organized according to the social hierarchy?

Hypothesis 3: There will be significant differences in the prevalence rates of physiological stress indicators between groups of individuals based on grave location.

Variability in Mortuary Treatment at Nemea: Graves and Their Contents

Sources of Data

One of the challenging aspects of carrying out a mortuary analysis at Nemea concerns the broad period of time over which burials were recorded and excavated. The recording of burials began in the 1920s and continued under the direction of researchers from different institutions through excavation seasons into the late 1990s. As a result, descriptions of graves in the original excavation notebooks vary in their degree of detail, completeness, and attention to certain features of the burials and human remains. Despite these limitations, the notebooks are altogether

the best available source of archaeological data related to the Nemea burials. The mortuary variables used in this research were chosen and coded for each grave relying on the excavation notebooks as well as on the analysis and compilation of notebook references to burials contained within the M.A. thesis by Frey (1998). The variables examined in this research include the type of grave, the absence or presence of a skeleton and the type of burial (e.g., empty grave, single inhumation, double inhumation), the minimum number of individuals present, the orientation of the grave, the absence or presence and type of head treatment, and the absence or presence and type of grave goods. In cases where original descriptions were incomplete or unclear with regard to certain variables, observations were coded as “unknown.”

Location of the Graves

As discussed in Chapter Six, burials at Nemea are located in three distinct areas within the Sanctuary of Zeus (Figure 8.1):

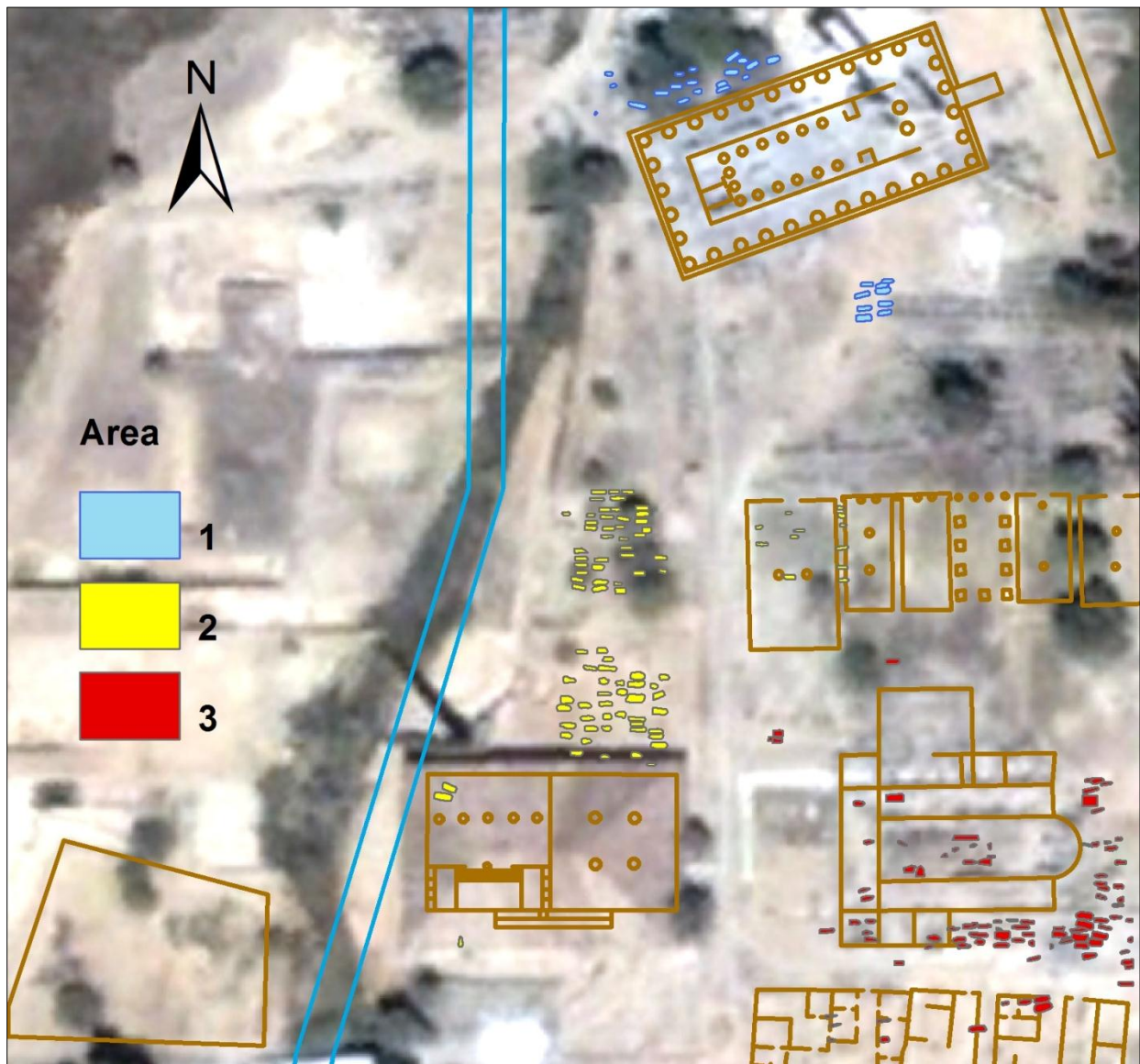
- 1) Northwest and south of the Temple of Zeus
- 2) Northeast of the Hellenistic Bath
- 3) Within the Early Christian basilica and outside of its east, west, and south walls

Early Christian burials are distributed among all three of those areas. Twenty-eight are associated with the temple, ninety-six are associated with the bath, and twenty-one are associated with the basilica. None of the Early Christian graves were located within the basilica. The 83 Middle to Late Byzantine graves were placed only within and around the basilica (Figure 8.2).

It is possible that some of the Early Christian burial space was more continuous than has been revealed through excavation. For example, the two large clusters of burials to the north of the bath (highlighted in yellow in Figure 8.1 below) correspond to the 20 m grid squares J-16 (north cluster) and J-17 (south cluster) in the overall excavation plan of the site. The apparent

space between the clusters is likely due to the area left unexcavated between grid squares and, as those burials probably represent one cemetery area, they are treated together in this research. Based on the available data, the site-level grouping of the Early Christian burials around the temple, the bath, and the basilica reflects real spatial distinctions and also perhaps the development of the mortuary space within that time period (Frey 1998).

Figure 8.1: Spatial Distribution of the Nemea Burials.¹



¹Background aerial image from Google Earth.

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Mortuary Variables

Grave Type

The graves at Nemea show a limited amount of variation in their construction. At a basic level, the graves are either simple pits without elaboration or pits that were lined and covered with terra-cotta roof tiles, limestone slabs, or stones used previously in monuments from earlier periods. In some cases, graves were only covered with stones instead of being lined by them. Graves that were constructed with a mix of stones and tiles are another variation on the basic themes. Finally, in a few cases, well-built tombs constructed using spolia contained the remains of multiple individuals (Frey 1998). Each grave was placed into one of the following grave type categories: plain pit, roof tile, field stone covered, field stone with lining, combination of field stones and roof tiles, and osteotheke.

The frequencies of each type of grave in the Early Christian and Middle to Late Byzantine periods are compared in Table 8.1. In the Early Christian period, most of the graves were either roof tile graves or graves that were covered but not lined with field stones. The only other grave type category that is relatively well represented in the Early Christian period is construction characterized by a combination of field stones and roof tiles. An interesting feature associated with the Early Christian burials is a stone structure located in the grave cluster immediately north of the bath. It consists of three chambers that together contained the fragmentary and commingled remains of at least three individuals, along with deposits of lime. Based on excavation notebook descriptions and the skeletal analysis, this structure was designated as an ossuary.

In the Middle to Late Byzantine period, graves at Nemea much more often exhibited a stone lining in addition to a stone covering. Graves that were only covered with fieldstones and

those constructed of roof tiles are considerably less common when compared to the Early Christian period. Graves constructed using a combination of field stones and roof tiles are also less common in the Middle to Late Byzantine period. Three burials containing large numbers of commingled individuals were placed into the “osteotheke” category.²¹ Simple pit graves with no elaboration are uncommon and occur at around the same frequency in both periods.

Table 8.1: Frequency of Grave Types in Each Period.

Grave Type	Early Christian		Middle to Late Byzantine		Total	
	(n)	%	(n)	%	(n)	%
Unknown	6	4.1	13	15.7	19	8.3
Plain Pit	7	4.8	5	6.0	12	5.3
Roof Tile	48	33.1	7	8.4	55	24.1
Field Stone Covered	57	39.3	7	8.4	64	28.1
Field Stone Lined	9	6.2	45	54.2	54	23.7
Field Stone and Roof Tile	17	11.7	3	3.6	20	8.8
Osteotheke	1	0.7	3	3.6	4	1.8
TOTAL	145	100.0	83	100.0	228	100.0

The spatial distribution of grave types in the Early Christian period is outlined by general burial area in Table 8.2 and illustrated in Figure 8.3. Using visual inspection to identify more detailed patterns, it is clear that most clusters of graves exhibit multiple types of grave construction. However, grave clusters are also characterized by internal patterns that give each one distinguishing features. For example, nearly all of the graves located northwest of the Temple of Zeus are constructed of roof tiles. The three exceptions are all plain pits. Roof tile graves also form the majority of burials located south of the temple. In this case, the exceptions include a field stone covered grave, a field stone lined grave, and a grave constructed with a combination of field stones and roof tiles.

²¹ These ossuaries were excavated in the 1920s and not all of the human skeletal remains were available for study.

The graves located to the northeast of the bath exhibit a different pattern. In the large cluster immediately north of the bath, most of the graves were constructed using only field stone covers. Tile graves are also common and four graves are characterized by a mix of field stone and tiles. The only Early Christian grave placed into the “osteotheke” category appears in this cluster.

Field stone covered graves are also the most common form in the large cluster located north of the aforementioned group adjacent to the bath. This cluster also contains an equal number of roof tile graves and stone-lined graves, the latter of which are absent in the cluster immediately north of the bath. Only one example of a plain pit grave is found in this cluster.

The group of graves that lies to the immediate east of the northernmost cluster associated with the bath is composed almost entirely of either field stone covered graves or graves exhibiting both field stones and roof tiles. The single exception is a roof tile grave.

Also apparent upon visual inspection is a strong tendency for graves of similar construction to cluster together. This seems to be true not only within the large groups of graves, but also for many of the small, more isolated grave clusters. For example, the clusters of two, three, and four graves that appear respectively within the bath, between the bath and the basilica, and within the houses to the southeast of the basilica are all composed of roof tile graves.

Table 8.2: Spatial Distribution of Early Christian Grave Types.

Grave Type	Temple		Bath		Basilica	
	(n)	%	(n)	%	(n)	%
Unknown	1	3.6	4	4.2	1	4.8
Plain Pit	3	10.7	1	1.0	3	14.3
Roof Tile	21	75.0	17	17.7	10	47.6
Field Stone Covered	1	3.6	54	56.3	2	9.5
Field Stone Lined	1	3.6	6	6.3	2	9.5
Field Stone and Roof Tile	1	3.6	13	13.5	3	14.3
Osteotheke	0	0.0	1	1.0	0	0.0
TOTAL	28	100.0	96	100.0	21	100.0

Figure 8.3: Spatial Distribution of Grave Types in the Early Christian Period.



The spatial distribution of grave types in the Middle to Late Byzantine period is illustrated in Figure 8.4. As mentioned above, graves that were lined with stones are the most common during this period. Stone-lined graves appear both inside and outside of the basilica. They are highly clustered along its outside margins near the southeast and northeast corners, as well as inside within the narthex. Stone-lined graves also form the majority of the graves located outside of the basilica in a position south of the nave. However, other types of graves appear there as well, including graves that have field stone covers only and graves constructed of both field stones and roof tiles. The greatest range of grave types exists in the area outside of the basilica to the immediate east of the apse. All grave types can be found there with the exception of ossuaries, which appear only within the basilica. The other graves within the nave of the basilica are either stone-lined graves, roof tile graves, or simple pits.

Figure 8.4: Spatial Distribution of Grave Types in the Middle to Late Byzantine Period.



The possibility of associations between the type of grave used and age at death was also investigated. Among Early Christian graves, one apparent pattern is that adults were more

frequently buried in roof tile graves, while subadults were more frequently buried in field stone covered graves (Table 8.3). However, a chi-square test shows that there is not a statistically significant association between adults and subadults and those grave types ($\chi^2 = 2.925$, $df = 1$, $p = 0.087$). If the categories of field stone covered graves and field stone lined graves are collapsed into a general “field stone grave” category, then the differences between adults and subadults still only approaches the $p < 0.05$ level of significance ($\chi^2 = 3.471$, $df = 1$, $p = 0.062$). However, the possibility that adolescents (individuals 12-20 years of age) were treated in a manner more consistent with adults must be considered, as adulthood probably began in many cases during the teenage years in Byzantine society (Rautman 2006; Tritsaroli and Valentin 2008). When adolescents are included with adults for the purposes of this analysis, then the association between adults and subadults and roof tile and field stone covered graves is significant (Table 8.4).

The only grave type that is exclusive to either adults or subadults during the Early Christian period is the osteotheke. As described above, only one such structure can be dated to this period. It was found to contain a minimum of three individuals, all of which were adults.

Table 8.3: Frequency of Early Christian Adults and Subadults in Each Grave Type.

Grave Type	Adults		Subadults	
	(n)	%	(n)	%
Unknown	3	3.8	0	0.0
Plain Pit	2	2.5	1	2.9
Roof Tile	34	43.0	10	29.4
Field Stone Covered	24	30.4	16	47.1
Field Stone Lined	5	6.3	4	11.8
Field Stone and Roof Tile	8	10.1	3	8.8
Osteotheke	3	3.8	0	0.0
TOTAL	79	100.0	34	100.0

Table 8.4: Early Christian Adults and Subadults in Roof Tile and Field Stone Covered Graves.

Grave Type	Adults*		Subadults		χ^2	df	Two-tail <i>p</i> -value	<i>p</i> < 0.05 Yes/ No
	(<i>n</i>)	%	(<i>n</i>)	%				
Roof Tile	37	60.7	7	30.4	6.116	1	0.013	YES
Field Stone Covered	24	39.3	16	69.6				
TOTAL	61	100.0	23	100.0				

*Includes adolescents

Among Middle to Late Byzantine burials the proportion of adults and subadults in each grave type is quite consistent (Table 8.5). This is probably due to the greater tendency to include multiple individuals in graves during this period.

Table 8.5: Frequency of Middle to Late Byzantine Adults and Subadults in Each Grave Type.

Grave Type	Adults		Subadults	
	(<i>n</i>)	%	(<i>n</i>)	%
Unknown	12	11.3	6	15.0
Plain Pit	10	9.4	2	5.0
Roof Tile	7	6.6	3	7.5
Field Stone Covered	6	5.7	1	2.5
Field Stone Lined	65	61.3	22	55.0
Field Stone and Roof Tile	2	1.9	2	5.0
Osteotheke	4	3.8	4	10.0
TOTAL	106	100.0	40	100.0

The frequencies of adults and subadults in each grave type are compared by period in Table 8.6 below. While the popularity of certain grave types changed over time, there were no significant differences between periods in the frequency with which adults and subadults were associated with any particular grave type.

Table 8.6: Frequency of Adults and Subadults in Each Grave Type by Period.

Grave Type	Early Christian		Middle to Late Byzantine					
	A (n)	S (n)	A (n)	S (n)	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
Unknown	3	0	12	6	-	-	-	-
Plain Pit	2	1	10	2		1	0.516	No
Roof Tile	34	10	7	3		1	0.689	No
Field Stone Covered	24	16	6	1		1	0.396	No
Field Stone Lined	5	4	65	22		1	0.247	No
Field Stone and Roof Tile	8	3	2	2		1	0.560	No
Osteotheke	3	0	4	4		1	0.236	No
TOTAL	79	34	106	40				

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Finally, the distribution of males and females among the grave types was examined (Tables 8.7 and 8.8). Although the sample sizes are smaller in this case, some interesting patterns are apparent. Among Early Christian individuals for which sex could be determined, only males were found in plain pit graves and the osteotheke. Males were absent, however, in graves that were both covered and lined with fieldstones, while nearly 11% of females were found in those graves. When roof tile graves and field stone covered graves are compared, there is a greater proportion of males buried in the former and a greater proportion of females in the latter. The differences between males and females in this case is not statistically significant ($\chi^2 = 1.451$, $df = 1$, $p = 0.228$). The differences remain non-significant if males and females are compared after collapsing the categories of field stone covered graves and field stone lined graves into a general "field stone grave" category ($\chi^2 = 3.023$, $df = 1$, $p = 0.082$).

Table 8.7: Frequency of Early Christian Males and Females in Each Grave Type.

Grave Type	Males		Females	
	(n)	%	(n)	%
Unknown	1	2.3	2	5.4
Plain Pit	2	4.7	0	0.0
Roof Tile	21	48.8	13	35.1
Field Stone Covered	12	27.9	14	37.8
Field Stone Lined	0	0.0	4	10.8
Field Stone and Roof Tile	4	9.3	4	10.8
Osteotheke	3	7.0	0	0.0
TOTAL	43	100.0	37	100.0

Among Middle to Late Byzantine burials, small subsample sizes particularly among females limit the degree to which definitive statements can be made about any associations between grave type and sex. The absence of females in field stone covered graves is potentially noteworthy, although females are well represented in graves that are also characterized by a stone lining. The differences between males and females in those two grave type categories are not statistically significant ($p = 0.326$).

Table 8.8: Frequency of Middle to Late Byzantine Males and Females in Each Grave Type.

Grave Type	Males		Females	
	(n)	%	(n)	%
Unknown	8	11.8	5	20.0
Plain Pit	7	10.3	2	8.0
Roof Tile	3	4.4	1	4.0
Field Stone Covered	6	8.8	0	0.0
Field Stone Lined	42	61.8	13	52.0
Field Stone and Roof Tile	0	0.0	2	8.0
Osteotheke	2	2.9	2	8.0
TOTAL	68	100.0	25	100.0

Significant differences were found when the frequencies of males and females in each grave type were compared by period (Table 8.9). For field stone covered graves, the number of males and females is nearly equal in the Early Christian period, while only males are represented in the Middle to Late Byzantine period. Similarly, only females are present in Early Christian

field stone lined graves, while males are more frequent in graves of that type dating to the Middle to Late Byzantine period.

Table 8.9: Frequency of Males and Females in Each Grave Type by Period.

Grave Type	Early Christian		Middle to Late Byzantine					
	M (n)	F (n)	M (n)	F (n)	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
Unknown	1	2	8	5	-	-	-	-
Plain Pit	2	0	7	2		1	1.000	No
Roof Tile	21	13	3	1		1	1.000	No
Field Stone Covered	12	14	6	0		1	0.024	YES
Field Stone Lined	0	4	42	13		1	0.005	YES
Field Stone and Roof Tile	4	4	0	2		1	0.467	No
Osteotheke	3	0	2	2		1	0.429	No
TOTAL	43	37	68	25				

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Bodies Present/Burial Type

Another distinguishing feature of burials at Nemea is the type of each burial with respect to the number of individuals interred and whether or not those individuals were commingled. There are generally five such categories of burials in addition to those graves for which this information is unknown: single inhumation, double burial, commingled, truly empty, and bones not kept. The latter two categories help to address the significance of the relatively large number of empty graves at Nemea.

As previously discussed, the publications by Miller and Frey as well as the analysis of the human skeletal material suggest that this categorization of burials shows clear differences by period. This is confirmed when the information on burial type contained in the excavation notebooks is systematically examined in conjunction with the skeletal evidence (Table 8.10). In the Early Christian period, single inhumations were the norm. Double burials and commingled burials were considerably less common. Graves that were empty upon excavation are also surprisingly common, making up 21.4% of the total number dated to the Early Christian period.

Whether empty graves at Nemea represent cenotaphs, the practice of exhumation and the reuse of graves, or some other process is as yet unclear. However, it is interesting to note that isolated skeletal elements, such as teeth, from additional individuals were found within both multiple primary interments and burials recorded as single inhumations. Because of the likelihood that small, unassociated bones and teeth would be missed during the process of exhumation, their appearance in these burials lends support to the possibility that grave reuse was a common practice in the Early Christian community at Nemea.

While burials that took place during the Middle to Late Byzantine period also include single inhumations, the numbers of double burials and especially commingled burials increase dramatically. Commingled burials make up the largest percentage (33.7%) of burials in this period. Another interesting contrast that is apparent when the frequencies of burial types are compared between the periods is the fact that no graves dating to the Middle to Late Byzantine period were found to be completely empty upon excavation.

Table 8.10: Frequency of Burial Types in Each Period.

Burial Type	Early Christian		Middle to Late Byzantine		Total	
	(n)	%	(n)	%	(n)	%
Unknown	5	3.4	0	0.0	5	2.2
Single Inhumation	89	61.4	21	25.3	107	46.9
Double Burial	7	4.8	12	14.5	19	8.3
Commingled	4	2.8	28	33.7	32	14.0
Truly Empty	31	21.4	0	0.0	31	13.6
Bones Not Kept	9	6.2	22	26.5	34	14.9
TOTAL	145	100.0	83	100.0	228	100.0

The spatial distribution of burial types with regard to the number of individuals in the grave and whether or not they were commingled is illustrated for the Early Christian period in Figure 8.5 and outlined by general burial area in Table 8.11. Upon visual inspection, the predominance of single inhumations is apparent in all areas of the site. As stated above, double burials are much less common, but appear in all three areas. Commingled burials, which are even

less common, were found in the grave clusters associated with the bath and the basilica, but not in those associated with the temple.

Perhaps the most interesting spatial pattern that is observable when burial types are considered is the tendency for empty graves to appear in the area northeast of the bath. While empty graves can be found associated with the temple and basilica as well, the vast majority of them (87.1%; 27/31) are associated with the bath. It is possible that this pattern is the reason for which the burials around the bath show a lower proportion of single inhumations when compared with those associated with the temple and the basilica, which are quite consistent in the proportions of single inhumations and empty graves. The differences between burial areas when those two categories of burial type are compared are statistically significant (Table 8.12).

The spatial relationships between empty graves and graves containing human remains are also noteworthy. Empty graves are distributed throughout the grave clusters and are often located immediately adjacent to and at the same level as burials containing relatively well-preserved skeletons. These patterns suggest that complete decomposition as a result of poor soil conditions can be ruled out as an explanation for the absence of human remains in Early Christian graves.

Figure 8.5: Spatial Distribution of Burial Types in the Early Christian Period.

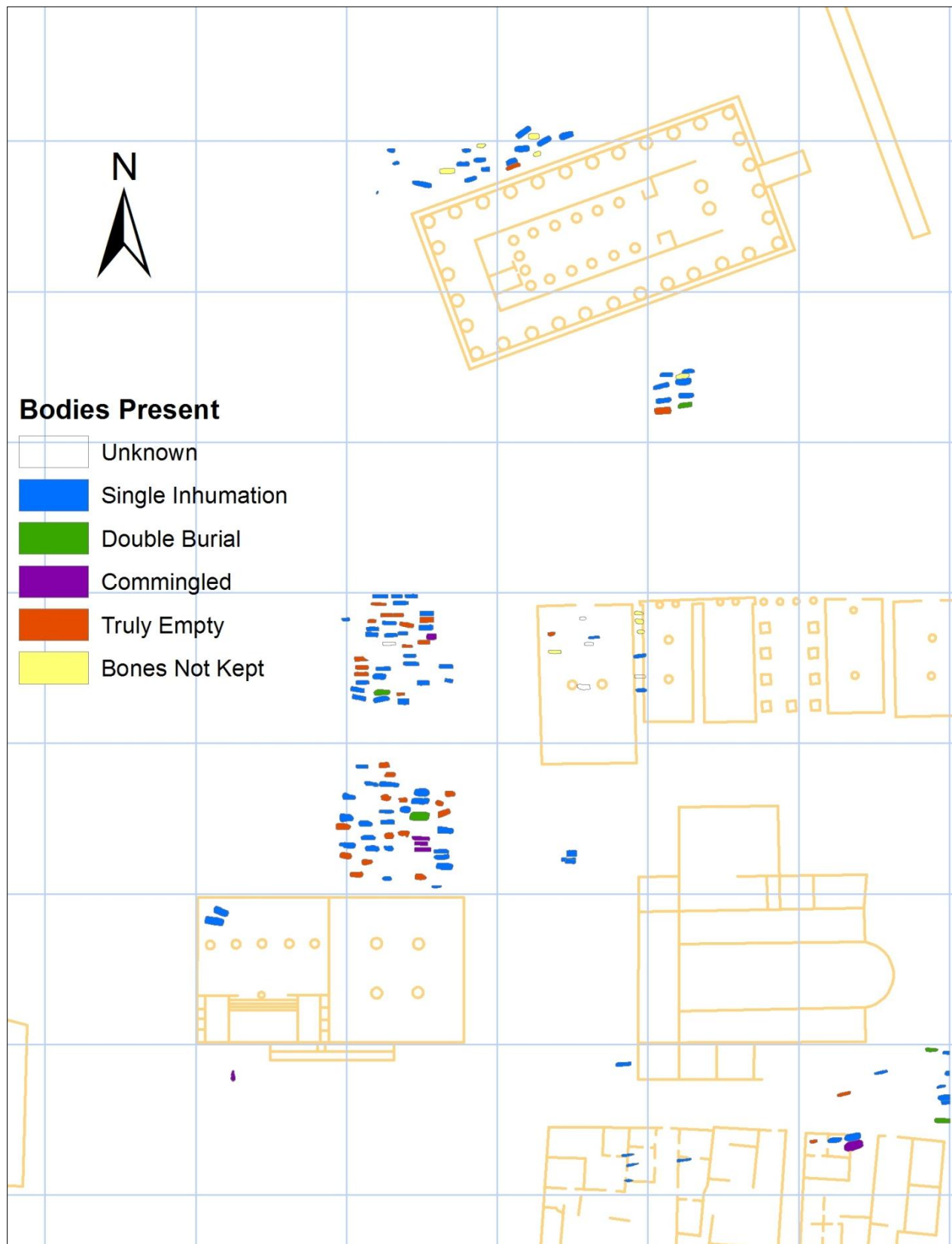


Table 8.11: Spatial Distribution of Early Christian Burial Types.

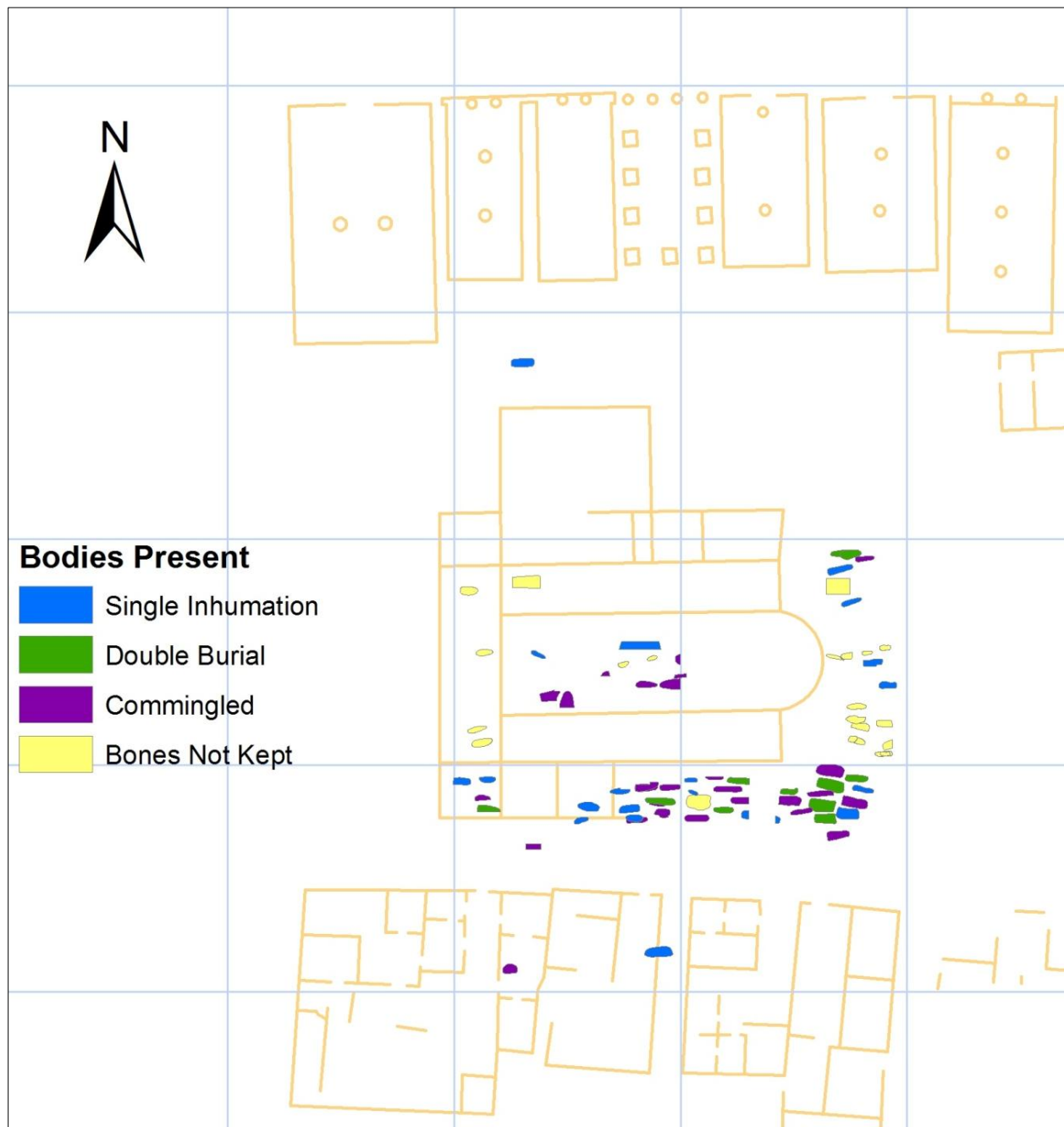
Burial Type	Temple		Bath		Basilica	
	(n)	%	(n)	%	(n)	%
Unknown	0	0.0	5	5.2	0	0.0
Single Inhumation	20	71.4	53	55.2	16	76.2
Double Burial	1	3.6	4	4.2	2	9.5
Commingled	0	0.0	3	3.1	1	4.8
Truly Empty	2	7.1	27	28.1	2	9.5
Bones Not Kept	5	17.9	4	4.2	0	0.0
TOTAL	28	100.0	96	100.0	21	100.0

Table 8.12: Spatial Distribution of Single Inhumations and Empty Graves in the Early Christian Period.

Burial Type	Temple		Bath		Basilica					
	(n)	%	(n)	%	(n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
Single Inhumation	20	90.9	53	66.2	16	88.9	7.872	2	0.020	YES
Truly Empty	2	9.1	27	33.8	2	11.1				
TOTAL	22	100.0	77	100.0	18	100.0				

The spatial distribution of burial types in the Middle to Late Byzantine period is illustrated in Figure 8.6. Single inhumations appear both inside and outside of the basilica, although they are concentrated primarily around its exterior walls. Most double burials are located outside of the basilica along the southern wall and southeast corner. Only one double burial appears within the basilica, specifically in the southern room of the narthex. Commingled burials are the most frequent type appearing within the basilica. Inside that structure, commingled graves are found primarily within the nave, but an example also appears in the southern room of the narthex adjacent to the double burial. Like double burials, commingled burials appear frequently outside of the basilica along the southeast wall and adjacent to the southeast corner.

Figure 8.6: Spatial Distribution of Burial Types in the Middle to Late Byzantine Period.



As was the case for grave construction, the possibility of associations between the type of burial and age at death was investigated. Among Early Christian graves, the proportions of adults and subadults in each burial type are very similar (Table 8.13). These figures strongly suggest

that adult or subadult status was not a significant factor influencing whether an individual was buried individually, in a double burial, or in a commingled burial.

Table 8.13: Frequency of Early Christian Adults and Subadults in Each Burial Type.

Burial Type	Adults		Subadults	
	(n)	%	(n)	%
Unknown	0	0.0	0	0.0
Single Inhumation	61	77.2	28	82.4
Double Burial	9	11.4	3	8.8
Commingled	9	11.4	3	8.8
Truly Empty	0	0.0	0	0.0
Bones Not Kept	0	0.0	0	0.0
TOTAL	79	100.0	34	100.0

A similar pattern is observable among Middle to Late Byzantine graves, although the greatest proportion of both adults and subadults is found in commingled graves rather than single inhumations (Table 8.14). While relatively small differences are apparent in the frequency with which adults and subadults were buried in double and commingled burials, those differences are not statistically significant ($\chi^2 = 1.097$, $df = 1$, $p = 0.295$).

Table 8.14: Frequency of Middle to Late Byzantine Adults and Subadults in Each Burial Type.

Burial Type	Adults		Subadults	
	(n)	%	(n)	%
Unknown	0	0.0	0	0.0
Single Inhumation	15	14.2	6	15.0
Double Burial	18	17.0	4	10.0
Commingled	73	68.9	30	75.0
Truly Empty	0	0.0	0	0.0
Bones Not Kept	0	0.0	0	0.0
TOTAL	106	100.0	40	100.0

The frequencies of adults and subadults in each grave type are compared by period in Table 8.15. While the aforementioned differences in the preference of burial type in each period are once again made clear, there are no statistically significant differences between periods in the frequency with which adults and subadults were associated with specific burial types.

Table 8.15: Frequency of Adults and Subadults in Each Burial Type by Period.

Burial Type	Early Christian		Middle to Late Byzantine					
	A (n)	S (n)	A (n)	S (n)	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
Unknown	0	0	0	0	-	-	-	-
Single Inhumation	61	28	15	6	0.066	1	0.797	No
Double Burial	9	3	18	4		1	0.677	No
Commingled	9	3	73	30		1	1.000	No
Truly Empty	0	0	0	0	-	-	-	-
Bones Not Kept	0	0	0	0	-	-	-	-
TOTAL	79	34	106	40				

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

The possibility of associations between burial type and sex in each period was also considered. Early Christian burials show relatively consistent proportions of males and females in each burial type, which suggests that an individual's sex did not play a role in whether he or she was buried by themselves, with another individual, or with additional individuals whose remains were mixed together in the grave (Table 8.16).

Table 8.16: Frequency of Early Christian Males and Females in Each Grave Type.

Burial Type	Males		Females	
	(n)	%	(n)	%
Unknown	0	0.0	0	0.0
Single Inhumation	34	79.1	29	78.4
Double Burial	5	11.6	3	8.1
Commingled	4	9.3	5	13.5
Truly Empty	0	0.0	0	0.0
Bones Not Kept	0	0.0	0	0.0
TOTAL	43	100.0	37	100.0

Among Middle to Late Byzantine graves, the proportion of males and females in single inhumations is nearly identical. Small differences are apparent between the sexes when commingled burials are considered and females seem to have been buried in double burials more often than males (Table 8.17). When the data on single inhumations is temporarily removed and only double burials and commingled burials are considered, however, the differences in the

proportion of males and females in those burial types are not statistically significant ($\chi^2 = 1.256$, $df = 1$, $p = 0.262$).

Table 8.17: Frequency of Middle to Late Byzantine Males and Females in Each Grave Type.

Burial Type	Males		Females	
	(n)	%	(n)	%
Unknown	0	0.0	0	0.0
Single Inhumation	11	16.2	4	16.0
Double Burial	12	17.6	7	28.0
Commingled	45	66.2	14	56.0
Truly Empty	0	0.0	0	0.0
Bones Not Kept	0	0.0	0	0.0
TOTAL	68	100.0	25	100.0

Finally, the frequencies of males and females in each burial type were compared by period. No statistically significant differences were found between periods in the frequencies of males and females occupying particular burial types (Table 8.18).

Table 8.18: Frequency of Males and Females in Each Burial Type by Period.

Burial Type	Early Christian		Middle to Late Byzantine					
	M (n)	F (n)	M (n)	F (n)	χ^2 *	df	Two-tail p-value	p < 0.05 Yes/ No
Unknown	0	0	0	0	-	-	-	-
Single Inhumation	34	29	11	4	1.861	1	0.172	No
Double Burial	5	3	12	7		1	1.000	No
Commingled	4	5	45	14		1	0.103	No
Truly Empty	0	0	0	0	-	-	-	-
Bones Not Kept	0	0	0	0	-	-	-	-
TOTAL	43	37	68	25				

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Minimum Number of Individuals (MNI)

The mortuary space at Nemea was examined more generally for spatial and temporal patterns in the MNI for each grave. This variable was determined during the osteological analysis of the human remains. The MNI is expressed simply as a number and was entered into a grave attribute table in ArcGIS 10.0.

Some of the patterns apparent in the results of the analysis of grave MNIs have already been revealed in the analysis of the burial type or “bodies present” variable presented above. For example, most of the burials dating to the Early Christian period contained one individual. The large number of graves containing no evidence of skeletal remains has also been discussed. The pattern in the Middle to Late Byzantine period is quite different, with many more graves dating to that period containing two or more individuals. Among Early Christian burials, MNIs range from zero to three. Only four graves contained three individuals. Middle to Late Byzantine burials show a much greater range of MNIs. All burials contained at least one individual and the largest grave in terms of the number interred contained a minimum of sixteen individuals, based on duplicated portions of the distal right humerus.

Interestingly, the numbers of empty graves, single inhumations, and double and commingled burials in the Early Christian period correspond precisely with the number of graves having MNIs of zero, one, two, and three. This is a noteworthy pattern for burials containing multiple individuals because graves containing two individuals, for example, can be either double burials or commingled burials. That each grave with an MNI of two was a double burial and each grave with an MNI of three was a commingled burial suggests that less care was taken to maintain the integrity and/or spatial distinction of each body once the number of individuals in a grave exceeded two. In the Middle to Late Byzantine period, by contrast, a number of commingled burials contained two individuals.

Table 8.19: Frequency of MNI for Early Christian and Middle to Late Byzantine Burials.

MNI	Early Christian		Middle to Late Byzantine		Total	
	(n)	%	(n)	%	(n)	%
Unknown	14	9.7	23	27.7	37	16.2
0	31	21.4	0	0.0	31	13.6
1	89	61.4	21	25.3	110	48.2
2	7	4.8	23	27.7	30	13.2
3	4	2.8	6	7.2	10	4.4
4	0	0.0	3	3.6	3	1.3
5	0	0.0	4	4.8	4	1.8
6	0	0.0	1	1.2	1	0.4
8	0	0.0	1	1.2	1	0.4
16	0	0.0	1	1.2	1	0.4
TOTAL	145	100.0	83	100.0	228	100.0

Figure 8.7 shows the spatial distribution of the MNI for each grave during the Early Christian period. The results are also outlined in Table 8.20 below. As demonstrated previously in the analysis of burial type (see Table 8.12), the differences between burial areas in the frequencies of empty graves versus single inhumations are significant and this is reflected in the comparison of MNIs by burial area. Burials associated with the bath much more frequently exhibited no evidence of human remains when compared with those associated with the temple and the basilica. Additionally, fewer burials associated with the bath contained a single individual—probably a related phenomenon.

Removing from consideration the graves for which the MNI was unknown, the proportion of graves containing a single individual is greatest among burials associated with the temple (87%). The temple burials also exhibit the fewest examples of graves containing two or three individuals. Small numbers of burials containing two individuals are found in all areas, while burials containing three individuals are only found in association with the bath and the basilica. The predominance of single individuals buried in the graves associated with the temple is most apparent upon visual inspection (see Figure 8.7).

Table 8.20: Spatial Distribution of MNI by Burial Area in the Early Christian Period.

MNI	Temple		Bath		Basilica	
	(<i>n</i>)	%	(<i>n</i>)	%	(<i>n</i>)	%
Unknown	5	17.9	9	9.4	0	0.0
0	2	7.1	27	28.1	2	9.5
1	20	71.4	53	55.2	16	76.2
2	1	3.6	4	4.2	2	9.5
3	0	0.0	3	3.1	1	4.8
TOTAL	28	100.0	96	100.0	21	100.0

Figure 8.7: Spatial Distribution of MNI among Early Christian Burials.

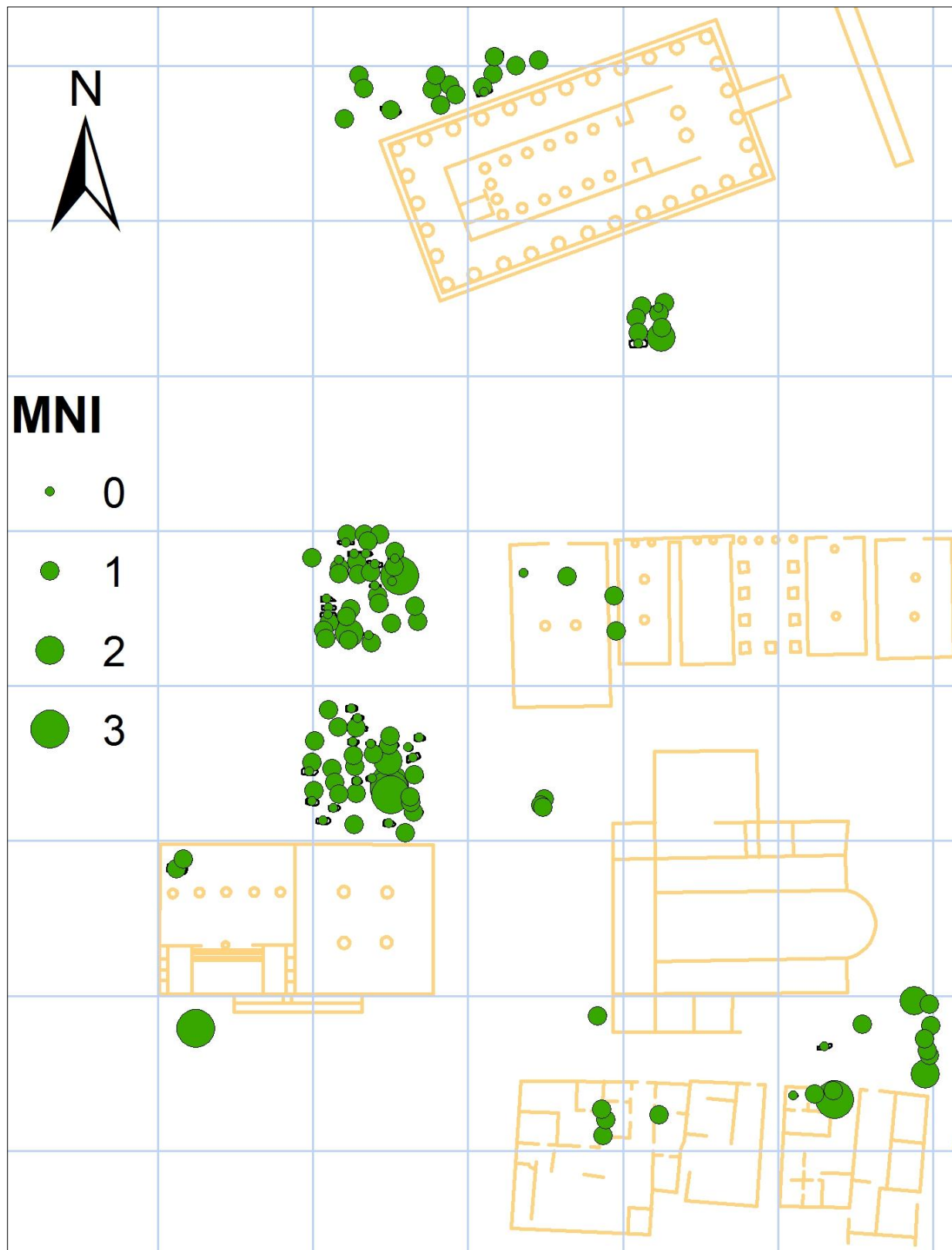
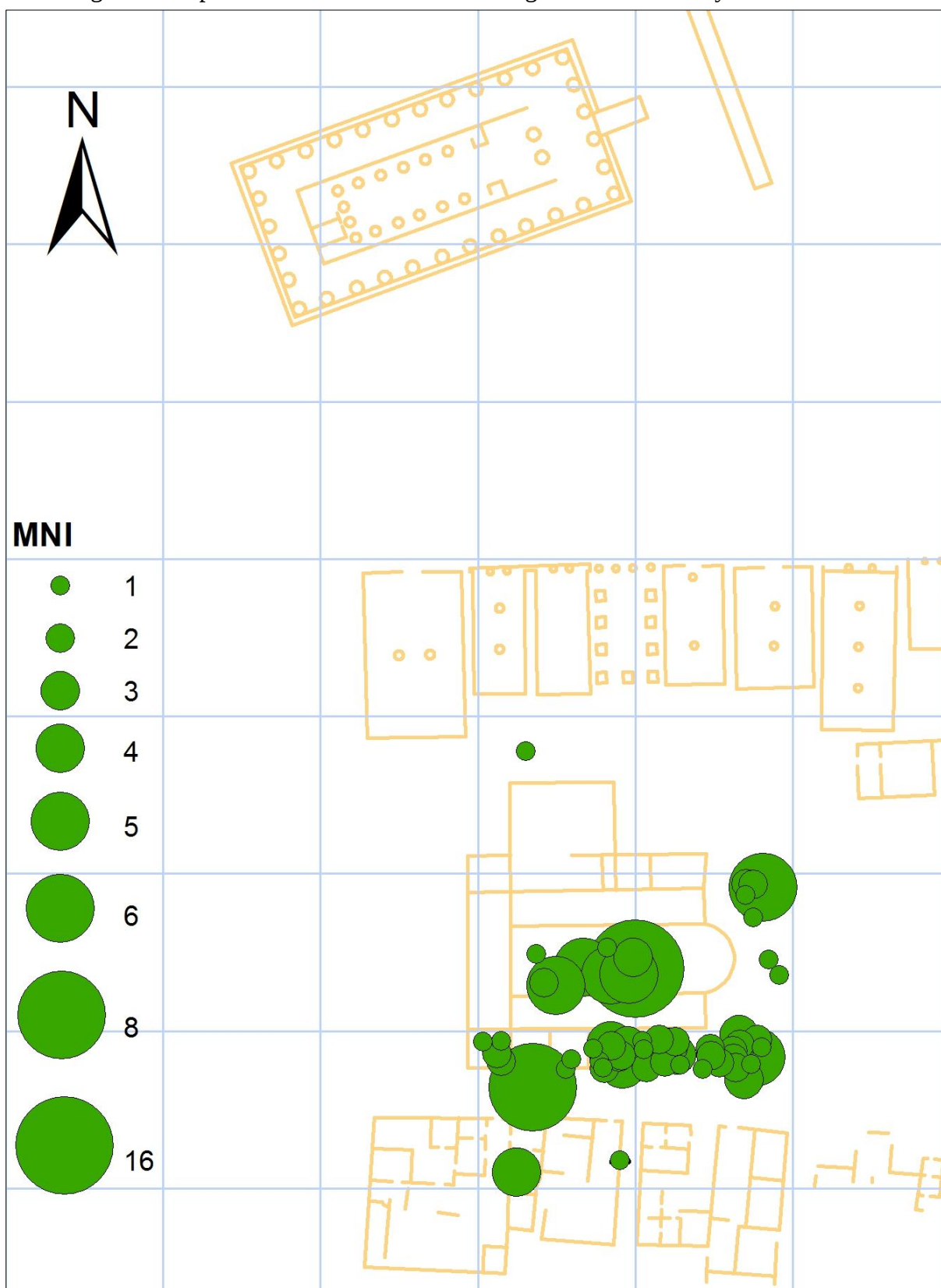


Figure 8.8 shows the spatial distribution of the MNI for each grave during the Middle to Late Byzantine period. In general, there is a tendency for burials containing large numbers of individuals to appear within the nave of the basilica, although such burials can also be found to the south and east of that structure.

Burials containing only one individual were found both inside and outside of the basilica, although most of them are located along its outside margins. The vast majority of burials containing two individuals were concentrated outside of the basilica, primarily along the south walls and especially in the southeast corner. Only one burial with an MNI of two was located in the nave of the basilica. A similar statement can be made about the smaller number of burials containing the remains of at least three individuals: all but one of those burials are located to the south or southeast of the basilica. The exception appears near the center of the nave. Two burials containing a minimum of four individuals were located along the southern walls of the basilica, while one such burial is relatively isolated within the second of the Early Christian houses to the southwest of the basilica. Similarly, only one of the four graves containing five individuals was located outside of the basilica, near its southeast corner. The rest were located within the nave. Graves containing a minimum of six and eight individuals were located to the northeast and southwest of the basilica, respectively. Finally, the grave containing a minimum of sixteen individuals was located in a central position in the nave.

Figure 8.8: Spatial Distribution of MNI among Middle to Late Byzantine Burials.



When age at death is compared across categories of MNI, the proportions of adults and subadults in each category are quite similar for Early Christian burials (Table 8.21). Most adults and subadults were buried in graves by themselves and neither age group shows a particular association with burials containing two or three individuals. No grave MNI was exclusive to adults or subadults.

Table 8.21: Frequency of Early Christian Adults and Subadults by Grave MNI.

MNI	Adults		Subadults	
	(n)	%	(n)	%
1	61	77.2	28	82.4
2	9	11.4	3	8.8
3	9	11.4	3	8.8
TOTAL	79	100.0	34	100.0

Among Middle to Late Byzantine burials, the proportions of adults and subadults are quite similar in graves containing a single individual and show small differences in graves containing MNIs of two, four, eight, and sixteen. Larger differences in the proportions of adults and subadults are apparent in graves containing three, five, and six individuals.

Table 8.22: Frequency of Middle to Late Byzantine Adults and Subadults by Grave MNI.

MNI	Adults		Subadults	
	(n)	%	(n)	%
1	15	14.2	6	15.4
2	33	31.1	11	28.2
3	16	15.1	2	5.1
4	10	9.4	2	5.1
5	11	10.4	9	23.1
6	1	0.9	5	12.8
8	7	6.6	1	2.6
16	13	12.3	3	7.7
TOTAL	106	100.0	39	100.0

A chi-square test was performed in order to test for an association between age at death and graves containing multiple individuals. The differences in the proportion of adults and subadults in single versus multiple burials are not significant (Table 8.23). Nevertheless, the

apparent differences in certain MNI categories highlight the uniqueness of some of the graves containing multiple individuals. For example, the only grave containing a minimum of six individuals contained five subadults and one adult male with an estimated age at death between 20 and 30 years. As was the case for Early Christian burials, no grave MNI was specific to either adults or subadults.

Table 8.23: Adults and Subadults in Single versus Multiple Burials in the Middle to Late Byzantine Period.

MNI	Adults		Subadults		χ^2	df	Two-tail <i>p</i> -value	<i>p</i> < 0.05 Yes/ No
	(<i>n</i>)	%	(<i>n</i>)	%				
1	15	14.2	6	15.4	0.035	1	0.852	No
>1	91	85.8	33	84.6				
TOTAL	106	100.0	39	100.0				

A comparison of MNI categories by sex shows that the proportions of Early Christian males and females in each category are quite similar (Table 8.24). Regardless of sex, most individuals were buried in single graves. Comparable proportions of males and females were buried in multiple burials.

Table 8.24: Frequency of Early Christian Males and Females by Grave MNI.

MNI	Males		Females	
	(<i>n</i>)	%	(<i>n</i>)	%
1	34	79.1	29	78.4
2	5	11.6	3	8.1
3	4	9.3	5	13.5
TOTAL	43	100.0	37	100.0

In general, males and females buried during the Middle to Late Byzantine period exhibit the same pattern with regard to grave MNI. Especially in the case of burials containing one and two individuals, the proportions of males and females in categories of MNI do not show large differences (Table 8.25).

Table 8.25: Frequency of Middle to Late Byzantine Males and Females by Grave MNI.

MNI	Males		Females	
	(n)	%	(n)	%
1	11	16.2	4	16.0
2	22	32.4	9	36.0
3	12	17.6	2	8.0
4	4	5.9	2	8.0
5	9	13.2	2	8.0
6	1	1.5	0	0.0
8	5	7.4	2	8.0
16	4	5.9	4	16.0
TOTAL	68	100.0	25	100.0

When the categories of grave MNI are collapsed into single and multiple burials, the proportions of males and females are very nearly identical (Table 8.26). This clearly demonstrates that there is no association between sex and grave MNI in the Middle to Late Byzantine period.

Table 8.26: Males and Females in Single versus Multiple Burials in the Middle to Late Byzantine Period.

MNI	Males		Females					
	(n)	%	(n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
1	11	16.2	4	16.0	0.000	1	0.984	No
>1	57	83.8	21	84.0				
TOTAL	68	100.0	25	100.0				

Grave Orientation

The analyses of spatial orientation in this dissertation focus on the graves themselves rather than on the bodies within them. This is because information on the orientation of the bodies was often either unavailable or problematic, such as in the case of commingled burials. As discussed in Chapter Six, there is almost no variation whatsoever in the orientation of the graves at Nemea. Aside from a single clear example of a burial aligned north-south, all graves were oriented east-west.

Figure 8.9 shows the orientation of the Early Christian graves. The single exception to the pattern of east-west oriented graves is dated to this period and is located southwest of the Hellenistic bath. Interestingly, this is one of the few commingled graves dating to the Early Christian period. It was found to contain a minimum of three individuals: two young adult females and one adolescent of indeterminate sex.

Among all other graves, which are oriented east-west, the only observable variation is that graves associated with the temple and the basilica show a tendency toward less precision in their orientation. For example, some of the graves northwest of the temple follow the orientation of that structure, which is not precisely east-west. By contrast, the graves associated with the bath are generally much more regular and accurate in their east-west orientation.

There is one Early Christian grave for which the orientation is unknown. It is, in fact, not truly a grave but another example of a unique occurrence in the mortuary space at Nemea. An isolated, fragmentary cranium was discovered northwest of the temple and is represented in Figure 8.9 by the small hollow shape near the temple's northwest corner. In the excavation notebook, the cranium is described as wedged between fallen temple blocks.

The orientation of the graves dated to the Middle to Late Byzantine period is illustrated in Figure 8.10. Once again, all graves dated to this period were oriented east-west. Some variation in the precision of that orientation is apparent, most notably in the graves within the nave of the basilica.

Figure 8.9: Grave Orientation of Early Christian Burials.

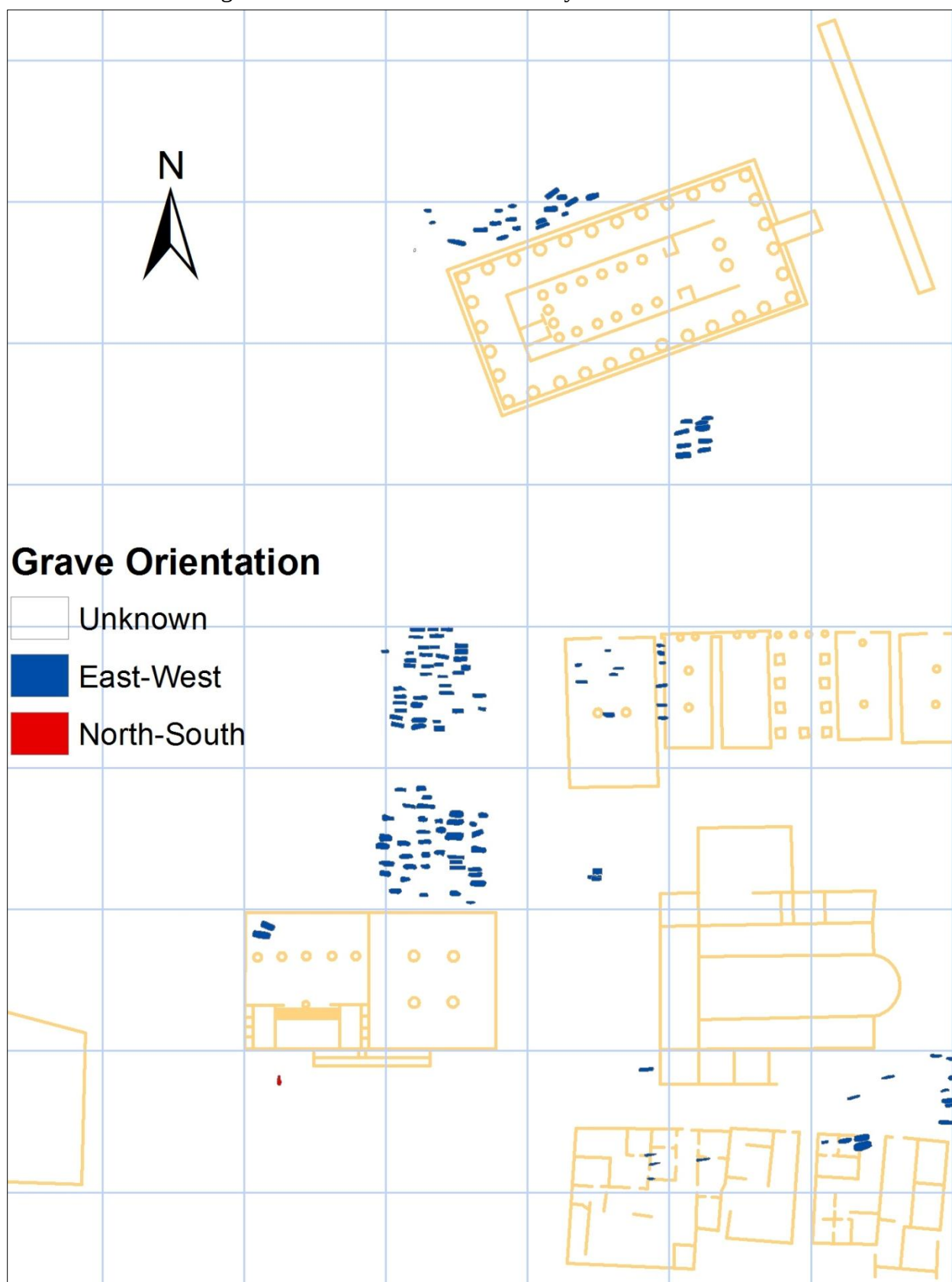
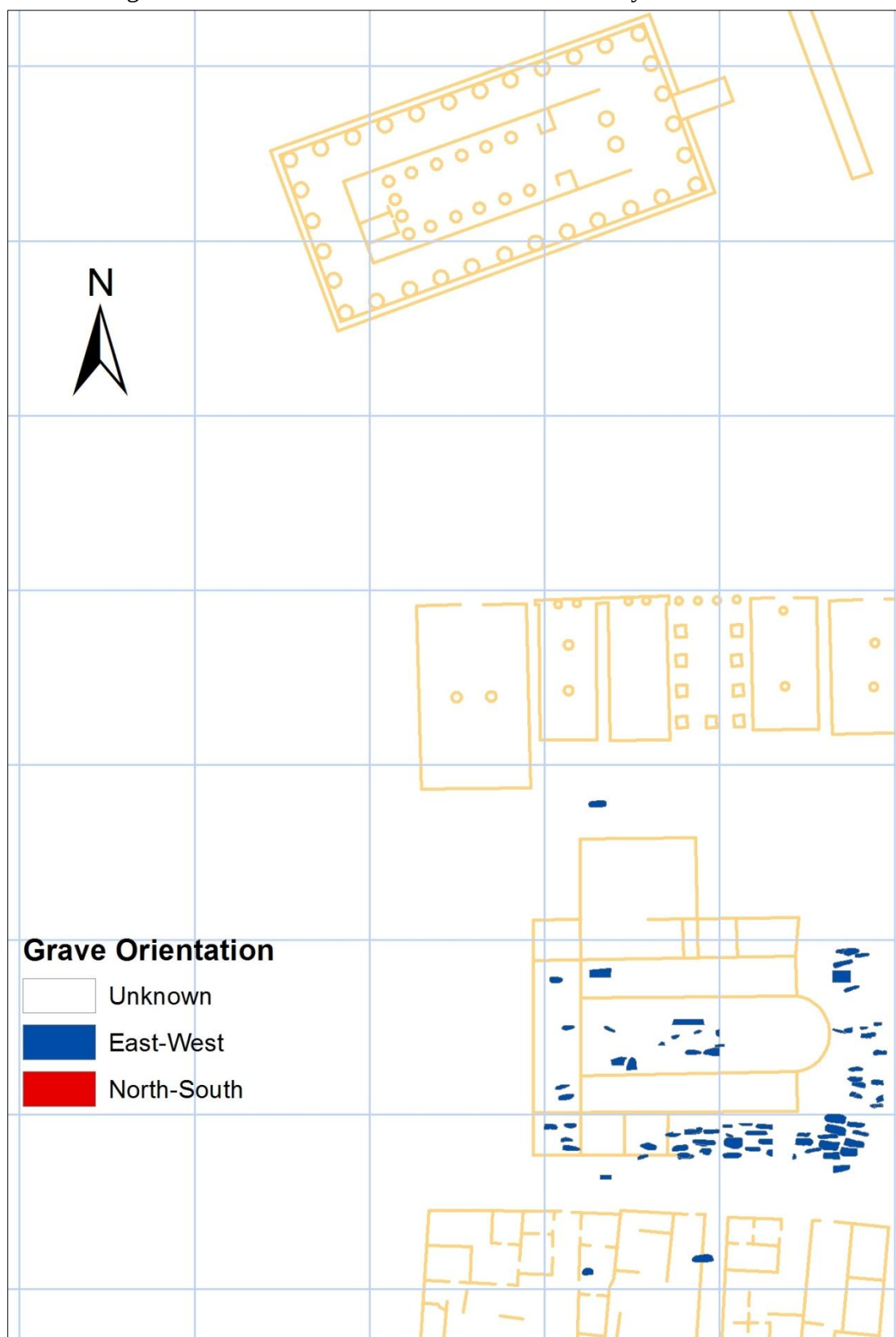


Figure 8.10: Grave Orientation of Middle to Late Byzantine Burials.



Head Treatment

Some burials at Nemea showed evidence of additional attention given to the head of the deceased. In some cases, a stone or tile “pillow” was placed underneath the head. Other variations on this practice included enclosing the head with stones or tiles. Each grave containing an individual with head treatment was placed into one of the following categories, which are based on variation in the manner and type of material used in this practice: stone pillow, enclosed with stone, tile pillow, enclosed with tile, and mixed stone and tile enclosure. Graves were also categorized more generally based on the presence or absence of head treatment, although this was somewhat problematic because observations on head treatment were typically recorded in the excavation notebooks only when it was present—the absence of head treatment was not necessarily recorded. If no statement was made about the presence or absence of head treatment, then the grave was placed into the category “unknown.” The spatial patterns in the maps below were evaluated bearing in mind that, while it is possible that some of the “unknown” burials did contain examples of head treatment, it is likely that most of them did not. The presence of head treatment seems to have been an unusual finding and it is probably the case that the graves for which there is no description of elaboration associated with the head truly lacked evidence of that practice.

Clear spatial patterns in the presence of graves in which increased attention was given to the head have been demonstrated by Frey (1998) and are reconfirmed in this analysis. Based on the available data, the emphasis on propping up or protecting the head of the deceased was apparent only among burials associated with the basilica. A small number of burials dated to the Early Christian period by Miller (1988) contained individuals exhibiting some form of head treatment. Those four burials are illustrated in Figure 8.11 below. Each of the four graves is

located within the boundaries of the Early Christian houses immediately south of the basilica. From west to east, two of the graves are located in house one, one of them is in house two, and the remaining grave is in house four. A high/low cluster analysis carried out using ArcGIS 10.0 confirms that Early Christian burials exhibiting head treatment are more highly clustered than would be expected by chance ($p = 0.027$; $z\text{-score} = 2.22$).

Figure 8.11: Presence or Absence of Head Treatment in Early Christian Burials.

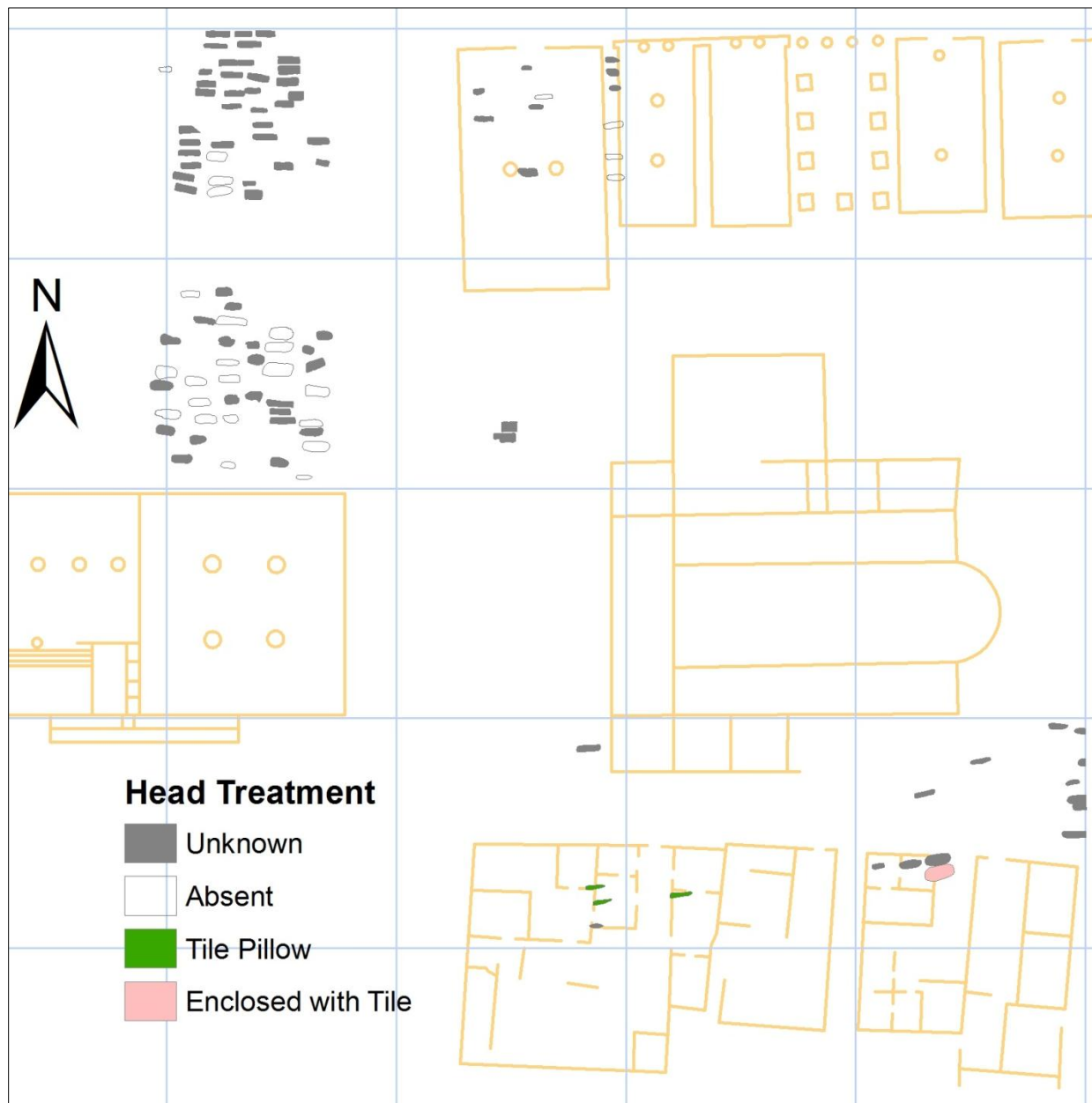


The type of head treatment used in these four burials is illustrated in Figure 8.12. It is interesting to note that, although two different styles of head treatment were employed, tiles were the only material used in the Early Christian burials. Three graves in which the occupant's head rested on a tile pillow are located close to one another in houses one and two. The grave in which the occupant's head was enclosed with tiles is located in another small cluster of graves in house four.

Using the available data, it can be determined that at least three of the four Early Christian individuals exhibiting head treatment were adults. Among the three tile pillow graves, all of which contained a single individual, the two individuals buried closest together in house one were middle adult males and the individual buried to the east in house two was an older adult female. The picture for the larger grave located in house four is more complicated. It was found to contain the remains of three individuals: a child around nine years of age, a middle adult male, and a middle adult female. While it is clear from the notebook description that the head of one of those individuals was enclosed by tiles, there is not enough information to determine exactly which individual is being referred to.

Based on the small number of Early Christian graves exhibiting head treatment then, it is apparent only that this practice was not exclusive to either males or females. It is possible that only adults received such treatment or at least that it was more common in the burials of adults.

Figure 8.12: Spatial Distribution of Head Treatment Types in Early Christian Burials.



Increased attention given to the head of the deceased seems to have been more common during the Middle to Late Byzantine period, as eleven graves dating to that period were recorded as exhibiting some form of head treatment. The spatial distribution of head treatment presence also demonstrates that individuals with head treatment were concentrated in a different area during the Middle to Late Byzantine period (Figure 8.13). Nearly all of the Middle to Late

Byzantine graves containing individuals with head treatment are found outside of the basilica near its east end. The single exception is located centrally in the nave. A high/low cluster analysis indicates an absence of significant clustering of Middle to Late Byzantine graves exhibiting head treatment ($p = 0.149$; $z\text{-score} = -1.44$).

Figure 8.13: Presence or Absence of Head Treatment in Middle to Late Byzantine Burials.



The results of recorded examples of head treatment are organized by type in Table 8.27 and illustrated spatially in Figure 8.14. In contrast to the Early Christian burials, which utilized only tiles, stone pillows or enclosures were used frequently during the Middle to Late Byzantine period. Enclosing the head with stone was the most frequent type of elaboration, followed by tile and stone pillows. In one case an individual's head was protected using a combination of tiles and stones.

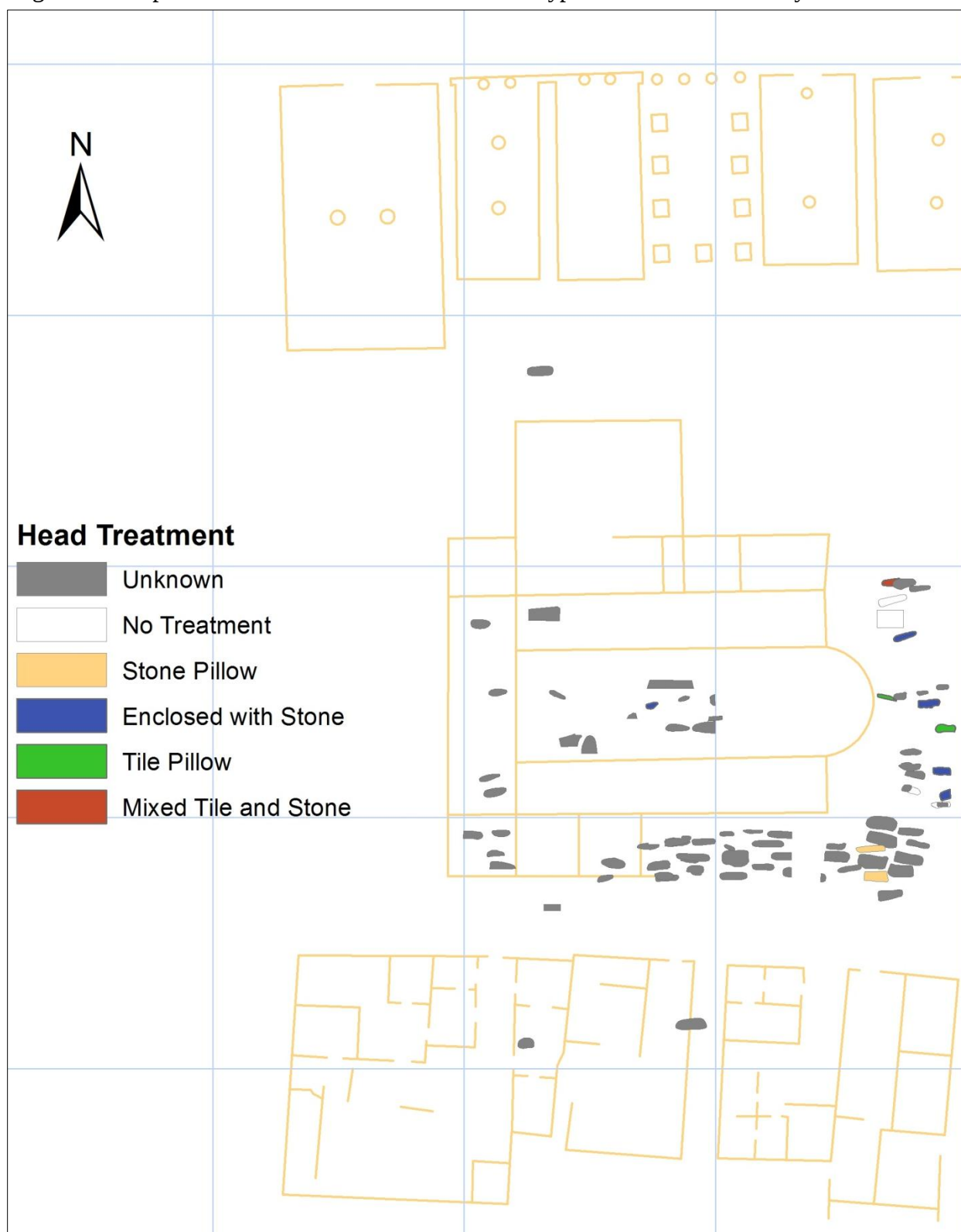
Table 8.27: Frequency of Head Treatment Types in Middle to Late Byzantine Burials.

Type of Head Treatment	Middle to Late Byzantine	
	(n)	%
Stone Pillow	2	18.2
Enclosed with Stone	5	45.5
Tile Pillow	3	27.3
Mixed Tile and Stone	1	9.1
TOTAL	11	100.0

While again the small number of burials for which a type of head treatment could be identified precludes any broad statements about spatial patterning, it can be said that graves containing individuals with similar types of head treatment do appear in close proximity to one another.

As may have been the case for the Early Christian burials, all Middle to Late Byzantine individuals exhibiting head treatment were adults. Assessing a relationship between sex and head treatment is again problematic. Two of the burials in this period contained multiple individuals and the excavation notebooks refer to only one of the skeletons as having some form of elaboration focused on the head. As the analysis of sex is only now completed, it is unclear which individual received that treatment. Among graves containing a single individual whose remains were available for analysis, two males and three females were given head treatment.

Figure 8.14: Spatial Distribution of Head Treatment Types in Middle to Late Byzantine Burials.



Grave Goods

Grave goods were uncommon among the burials at Nemea. However, some graves did contain items, such as coins and ceramic vessels, which fall under the category of grave goods or mortuary artifacts. Graves at Nemea also occasionally contained objects more appropriately classified as items of personal adornment, such as finger rings, earrings, crosses, and belt buckles. In this analysis, each grave was assessed for the presence of grave goods—in this case a general category that included either mortuary artifacts or items of personal adornment. Graves were also classified more specifically into one of the following categories, based on the type of object or objects they contained: items of personal adornment, mortuary artifacts, and both items of personal adornment and mortuary artifacts.

As was the case for the analysis of head treatment and grave orientation, the reasons for which the analysis of grave goods was carried out primarily by grave rather than by individual should be made clear. First, some of the data on grave goods was gleaned from burials containing human remains that were not saved. Thus, estimates of age and sex are not available in all cases. Second, the phenomenon of large and in some cases extensively commingled burials makes it very difficult, especially decades after excavation, to determine whether or not a particular item in a grave was associated with a particular individual. As a result of these issues, it is practical to use the data on grave goods in conjunction with data on age and sex only in the case of single inhumations. While this approach provides results that are more limited in scope, it is nevertheless useful as an avenue of exploration.

When compared by period, the proportions of graves containing grave goods are very similar (Table 8.28). Around 20% of graves in each period contained either mortuary artifacts or

items of personal adornment. The presence of grave goods in Middle to Late Byzantine graves (23.7%; 18/76) is slightly greater than that in Early Christian graves (20.1%; 28/139).

Table 8.28: Presence or Absence of Graves Goods in Each Period.

Grave Goods	Early Christian		Middle to Late Byzantine		Total	
	(n)	%	(n)	%	(n)	%
Present	28	20.1	18	23.7	46	21.4
Absent	111	79.9	58	76.3	169	78.6
TOTAL	139*	100.0	76*	100.0	215	100.0

*The presence or absence of grave goods was unknown for six Early Christian and seven Middle to Late Byzantine graves.

The spatial distribution of grave goods among the Early Christian burials is outlined by burial area in Table 8.29 and illustrated in Figure 8.15. Among burials associated with the temple, grave goods are concentrated in graves closest to the northwest corner. The burials to the north of the temple but located near the middle of the structure contained no evidence of grave goods. Similarly, only one of the nine graves clustered to the south of the temple contained grave goods.

The burials associated with the bath show few clear patterns when the presence of grave goods is considered, although all clusters of graves in that area contain examples of burials with grave goods. One such burial that is of additional interest is the relatively isolated grave located southwest of the bath. It is a commingled burial containing a minimum of three individuals (two young adult females and one adolescent of indeterminate sex) and, as described previously, it is also the only grave at Nemea with a north-south orientation. The grave was covered with stones and a large pot was placed directly at its north end at the level of the covering. Fragments of the base of a second large pot were found within the grave, associated with the remains of one of the occupants. The characteristics of this grave—its location, orientation, and contents—are unique among the Early Christian graves at Nemea and perhaps suggest a different religious or ethnic group affiliation for the occupants.

Many examples of burials containing grave goods were found near the Early Christian basilica. All burials located to the west of the basilica and most of those located to the south within the Early Christian houses contained either mortuary artifacts or items of personal adornment. If the presence of grave goods is compared between the general burial areas (temple, bath, basilica), the largest proportion of graves containing those items is found among the burials associated with the basilica (Table 8.29). A chi-square test shows that the differences between the areas are statistically significant ($\chi^2 = 12.665$, $df = 2$, $p = 0.002$), although one cell has an expected count of less than five. As a result, Fisher's exact test was used when necessary to compare the differences between two areas at a time. The differences between the graves associated with the temple and the bath ($p = 0.359$) and between those associated with the temple and the basilica ($\chi^2 = 3.429$, $df = 1$, $p = 0.064$) are not significant. However, a significant association was found when the presence or absence of grave goods was compared between the graves associated with the bath and those associated with the basilica ($p = 0.001$).

Table 8.29: Frequency and Distribution of Grave Goods in Early Christian Burials.

Grave Goods	Temple		Bath		Basilica	
	(n)	%	(n)	%	(n)	%
Present	6	22.2	12	13.2	10	47.6
Absent	21	77.8	79	86.8	11	52.4
TOTAL	27*	100.0	91*	100.0	21	100.0

*The presence or absence of grave goods was unknown for six Early Christian burials.

Figure 8.15: Spatial Distribution of the Presence of Grave Goods in Early Christian Burials.



The spatial distribution of Middle to Late Byzantine burials containing grave goods is not dissimilar to that of burials exhibiting some form of head treatment (Figure 8.16). Grave goods were frequently found among the burials outside of the basilica that lie immediately to the east of that structure. A few burials within the nave of the basilica as well as some that lie either along or within its southern walls also contained grave goods. A high/low cluster analysis indicates that Middle to Late Byzantine burials with grave goods are not clustered in space to a greater degree than would be expected by chance ($p = 0.939$; $z\text{-score} = -0.077$).

Figure 8.16: Spatial Distribution of the Presence of Grave Goods in Middle to Late Byzantine Burials.



The spatial distribution of graves containing grave goods was also examined with regard to the type of items found within the graves. Although the number of Early Christian burials

containing grave goods is small, certain patterns are apparent in their distribution—especially if burial areas are compared against each other (Table 8.30). The area around the temple exhibits the lowest proportion of graves containing items of personal adornment and the greatest proportion of graves containing mortuary artifacts. Moving to the graves associated with the bath, there is an increase in the proportion of items of personal adornment, while the proportion of graves containing mortuary artifacts decreases. Finally, grave goods among the burials associated with the basilica are exclusively items of personal adornment. Fisher’s exact test demonstrates that the differences between temple and basilica burials in the proportions of graves with items of personal adornment and those containing mortuary artifacts are statistically significant ($p = 0.022$).

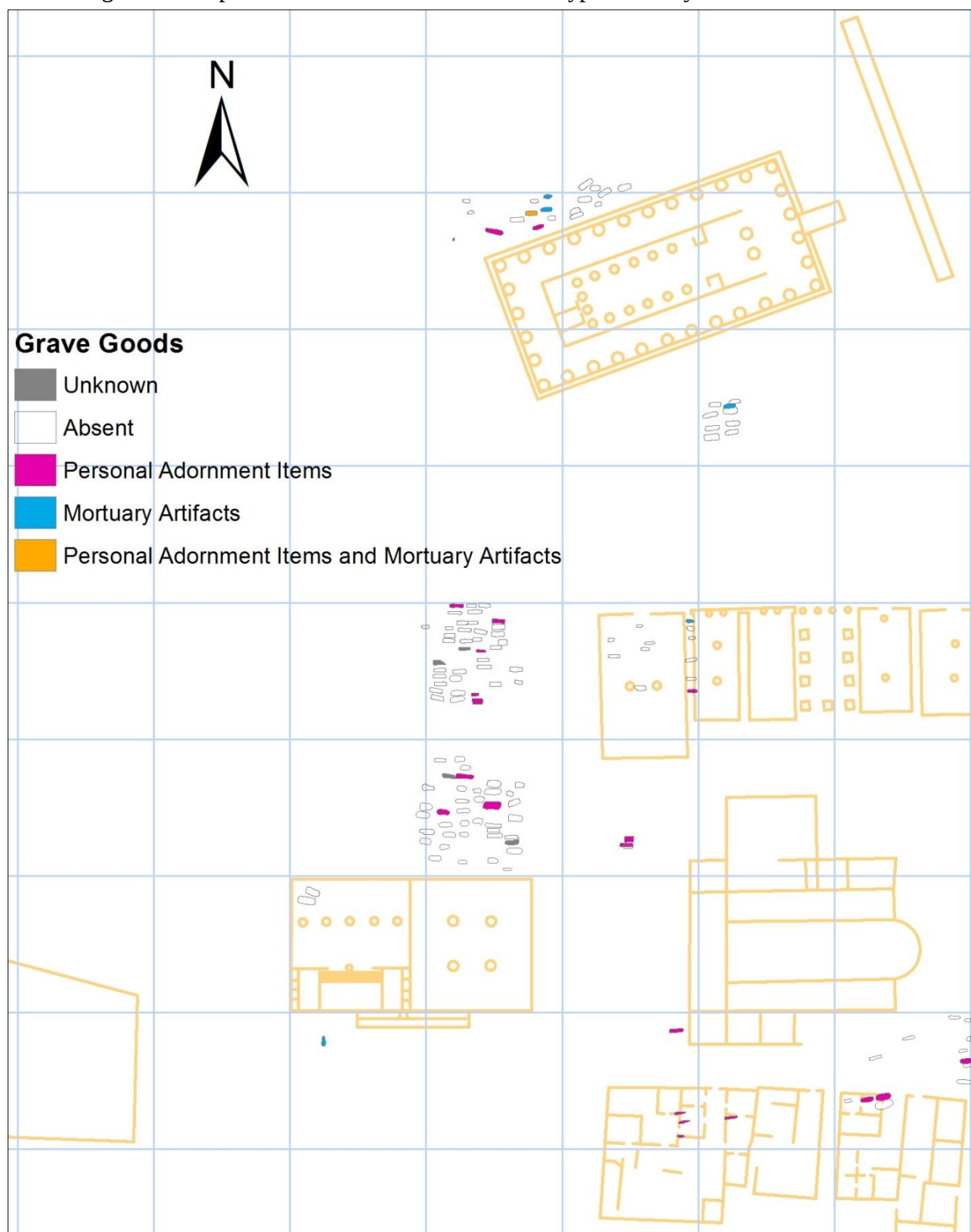
Table 8.30: Frequency and Distribution of Grave Good Types in Early Christian Burials.

Grave Good Type	Temple		Bath		Basilica	
	(n)	%	(n)	%	(n)	%
Items of Personal Adornment	2	33.3	9	75.0	10	100.0
Mortuary Artifacts	3	50.0	3	25.0	0	0.0
Items of Personal Adornment and Mortuary Artifacts	1	16.7	0	0.0	0	0.0
TOTAL	6	100.0	12	100.0	10	100.0

It is possible that the differences in the types of grave goods between burial areas are a reflection of the development of the mortuary space of Nemea through time. Based on criteria such as datable finds, relationships to datable architecture, and variation in grave construction, Frey (1998) has suggested a progression through time for the burials in these three main areas. In this model, the burials associated with the temple are the earliest, those concentrated around the bath occupy a transitional position, and those associated with the basilica are the latest in time. The objects discovered within the graves also offer potential clues in support of this chronology. For example, one of the burials located near the northwest corner of the temple (colored orange in Figure 8.17) is particularly unique because of its apparent wealth. In stark contrast to the rest

of the burials at Nemea, the young adult female occupying this grave was buried with a number of mortuary artifacts including bronze items, an incised stone plaque, and a coin, in addition to many pieces of jewelry (Frey 1998; Miller 1981). Frey (1998) has posited that this grave could be an example of a burial carried out with Christian and pagan syncretism. The presence of mortuary artifacts such as pots and fragments of bronze in two adjacent graves perhaps lends support to that argument. In terms of broader patterns, the suggestion that the graves associated with the temple are the earliest at Nemea seems even more likely when viewed in the context of the distribution of grave good types across the site.

Figure 8.17: Spatial Distribution of Grave Good Types in Early Christian Burials.



Among Middle to Late Byzantine burials, items included within the graves were most often items of personal adornment (Table 8.31). Four graves contained mortuary artifacts that included coins, a cooking pot, and a sgraffito bowl. As in the case of the Early Christian burials, one grave contained both items of personal adornment and mortuary artifacts, although the contents of this grave, a bronze finger ring and a bronze needle, were nowhere near as copious as those of the Early Christian grave described above. Coincidentally, this Middle to Late Byzantine grave also contained the skeletal remains of a young adult female.

The spatial distribution of grave good types during this period is illustrated in Figure 8.18. No obvious clustering of any particular type is apparent upon visual inspection. Graves containing items of personal adornment as well as those containing mortuary artifacts were located both inside and outside of the basilica. The greatest concentrations of the former appear in the southwest portion of the nave and along the exterior walls of the southeast corner. The latter are dispersed widely in the area of the basilica. The only grave containing both classes of grave goods is located outside of the apse at the basilica's east end.

Table 8.31: Frequency of Grave Good Types in Middle to Late Byzantine Burials.

Grave Good Type	Middle to Late Byzantine	
	(n)	%
Items of Personal Adornment	13	72.2
Mortuary Artifacts	4	22.2
Items of Personal Adornment and Mortuary Artifacts	1	5.6
TOTAL	18	100.0

Figure 8.18: Spatial Distribution of Grave Good Types in Middle to Late Byzantine Burials.



As discussed at the beginning of this section, the possibility of an association between the presence of grave goods and age at death was investigated only for those burials with a MNI of one. While this conservative approach excludes a number of graves, mostly dating to the Middle to Late Byzantine period, it ensures the ability to discern a relationship between the individual and the items contained within each grave considered.

Among Early Christian single burials, the proportions of adults and subadults buried with either items of personal adornment or mortuary artifacts are almost identical (Table 8.32). There is no association between age at death and the presence or absence of grave goods in this period.

Table 8.32: Presence of Grave Goods in Early Christian Adult and Subadult Burials.

Grave Goods	Adults		Subadults		χ^2	df	Two-tail <i>p</i> -value	<i>p</i> < 0.05 Yes/ No
	(<i>n</i>)	%	(<i>n</i>)	%				
Present	14	24.6	7	25.0	0.002	1	0.965	No
Absent	43	75.4	21	75.0				
TOTAL	57	100.0	28	100.0				

The proportion of subadults buried with grave goods is greater than that of adults among single inhumations dated to the Middle to Late Byzantine period, although the subsample sizes are quite small (Table 8.33).

Table 8.33: Presence of Grave Goods in Middle to Late Byzantine Adult and Subadult Burials.

Grave Goods	Adults		Subadults		χ^2	df	Two-tail <i>p</i> -value	<i>p</i> < 0.05 Yes/ No
	(<i>n</i>)	%	(<i>n</i>)	%				
Present	2	14.3	2	33.3		1	0.549	No
Absent	12	85.7	4	66.7				
TOTAL	14	100.0	6	100.0				

*Empty cell indicates that Fisher's exact test was used instead of Pearson's chi-square test.

If all burials from the Middle to Late Byzantine period are considered regardless of the number of individuals they contained, then the elevated proportion of subadults buried with grave goods is still apparent (Table 8.34). However, the differences between those age categories remain non-significant.

Table 8.34: Presence of Grave Goods in All Middle to Late Byzantine Burials by Age.

Grave Goods	Adults		Subadults		χ^2	df	Two-tail <i>p</i> -value	<i>p</i> < 0.05 Yes/ No
	(<i>n</i>)	%	(<i>n</i>)	%				
Present	16	15.7	10	25.6	1.859	1	0.173	No
Absent	86	84.3	29	74.4				
TOTAL	102	100.0	39	100.0				

Age based patterns in the types of grave goods recovered from the Nemea burials were also investigated. In the Early Christian period, adults were buried with all categories of grave goods, while objects included in subadult graves were exclusively items of personal adornment such as earrings (Table 8.35). It is possible that this pattern is suggestive of a preference for subadults to be buried with such items, but more examples of graves containing grave goods would be necessary to confirm that interpretation. Using the available figures, the differences between adults and subadults are not significant even when the adult buried with both categories of grave goods is collapsed into the category of mortuary artifacts ($p = 0.521$).

Table 8.35: Frequency of Early Christian Adults and Subadults by Grave Good Type.

Grave Good Type	Adults		Subadults	
	(n)	%	(n)	%
Items of Personal Adornment	11	78.6	7	100.0
Mortuary Artifacts	2	14.3	0	0.0
Items of Personal Adornment and Mortuary Artifacts	1	7.1	0	0.0
TOTAL	14	100.0	7	100.0

The problem of small subsample sizes is even more serious for Middle to Late Byzantine burials. Among single inhumations with grave goods, one adult was buried with an item of personal adornment and another was buried with an item of personal adornment as well as a mortuary artifact. Each of the Middle to Late Byzantine subadults with grave goods was buried with items of personal adornment. Together with the data from the Early Christian graves, these results may at least hint at an association between subadult status and the inclusion of items of personal adornment in burials throughout the Byzantine period at Nemea.

The distribution of grave goods among males and females was also investigated, again with a focus on single inhumations. In the Early Christian period, the proportions of males and females buried with grave goods are very similar (Table 8.36). There is no association between sex and the presence or absence of grave goods.

Table 8.36: Presence of Grave Goods in Early Christian Male and Female Burials.

Grave Goods	Males		Females					
	(n)	%	(n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
Present	8	24.2	6	23.1	0.011	1	0.917	No
Absent	25	75.8	20	76.9				
TOTAL	33	100.0	26	100.0				

The pattern is quite different among single inhumations dated to the Middle to Late Byzantine period. In this case, only females were associated with the presence of either mortuary artifacts or items of personal adornment (Table 8.37). Fisher's exact test demonstrates that the difference between males and females in the presence or absence of grave goods is statistically significant.

Table 8.37: Presence of Grave Goods in Middle to Late Byzantine Male and Female Burials.

Grave Goods	Males		Females					
	(n)	%	(n)	%	χ^2 *	df	Two-tail p-value	p < 0.05 Yes/ No
Present	0	0.0	2	66.7		1	0.033	YES
Absent	11	100.0	1	33.3				
TOTAL	11	100.0	3	100.0				

*Empty cell indicates that Fisher's exact test was used instead of Pearson's chi-square test.

The broader significance of this finding is difficult to evaluate because of the small sizes of the subsamples involved. If all Middle to Late Byzantine burials are considered, then the proportions of males and females associated with grave goods are similar. However, this approach introduces a different type of bias—the greater number of males in the sample together with many multiple burials means that the proportion of males associated with grave goods is exaggerated. For that reason, it is perhaps best to tentatively suggest that an association existed between females and the presence of grave goods, based on the figures for single inhumations.

Finally, single burials containing grave goods were examined for associations between grave good type and the sex of the occupants. In the Early Christian period, items of personal

adornment were the only grave good type found in male burials. In contrast, females were associated with all categories of grave goods (Table 8.38). The differences between males and females, however, are not statistically significant even if the female buried with both grave good types is placed into either individual category.

Table 8.38: Frequency of Early Christian Males and Females by Grave Good Type.

Grave Good Type	Males		Females	
	(n)	%	(n)	%
Items of Personal Adornment	8	100.0	3	50.0
Mortuary Artifacts	0	0.0	2	33.3
Items of Personal Adornment and Mortuary Artifacts	0	0.0	1	16.7
TOTAL	8	100.0	6	100.0

Among Middle to Late Byzantine single inhumations containing grave goods, one female was associated with items of personal adornment and the other was associated with both items of personal adornment and mortuary artifacts.

Spatial Analysis of Demography and Physiological Stress Indicators

In this section, the analysis of spatial and temporal patterns in the mortuary space of Nemea sharpens its focus on the occupants of the graves. Here I incorporate the results of the skeletal analysis in order to examine the spatial distribution of age classes and sex categories, as well as spatial patterns in the presence and absence of variables associated with health status. This portion of the mortuary analysis is concerned with identifying spatial variability in patterns of health that may provide insight into the organization of the mortuary space. Based on the possibility that individuals of higher status experienced lower levels of physiological stress and were granted access to privileged burial locations, the results presented in this section will test the hypothesis that the burial space at Nemea was organized according to the social hierarchy.

Demography and Burial Location

Age

A visual inspection of the spatial distribution of age at death among the Early Christian burials across the site as a whole reveals no obvious clustering of adults or subadults. Adults and subadults were found in graves in all areas of the site, which strongly suggests that no particular burial area was reserved for children or adults. An absence of significant spatial clustering of adults or subadults is confirmed using a high/low cluster analysis ($p = 0.390$; $z\text{-score} = -0.859$).

When burial areas are compared against each other, the burials associated with the temple were found to contain an elevated proportion of adults and a lower proportion of subadults (Table 8.39). However, a chi-square test demonstrates that there are no statistically significant differences in the frequencies of adults and subadults between burial areas ($\chi^2 = 3.708$, $df = 2$, $p = 0.157$). This holds true when temple burials are compared with bath and basilica burials independently (Tables 8.40 and 8.41).

Table 8.39: Frequency and Distribution of Adults and Subadults in Early Christian Burials.

Age Category	Temple		Bath		Basilica	
	(n)	%	(n)	%	(n)	%
Adult	19	86.4	44	64.7	16	69.6
Subadult	3	13.6	24	35.3	7	30.4
TOTAL	22	100.0	68	100.0	23	100.0

Table 8.40: Frequency of Adults and Subadults in Temple versus Bath Burials.

Age Category	Temple		Bath		χ^2	df	Two-tail $p\text{-value}$	$p < 0.05$ Yes/ No
	(n)	%	(n)	%				
Adult	19	86.4	44	64.7	3.713	1	0.054	No
Subadult	3	13.6	24	35.3				
TOTAL	22	100.0	68	100.0				

Table 8.41: Frequency of Adults and Subadults in Temple versus Basilica Burials.

Age Category	Temple		Basilica		χ^2 *	df	Two-tail <i>p</i> -value	<i>p</i> < 0.05 Yes/ No
	(<i>n</i>)	%	(<i>n</i>)	%				
Adult	19	86.4	16	69.6		1	0.284	No
Subadult	3	13.6	7	30.4				
TOTAL	22	100.0	23	100.0				

*Empty cell indicates that Fisher's exact test was used instead of Pearson's chi-square test.

When particular burial areas are viewed at a micro level, a small number of clusters of adult burials are apparent. For example, based on the skeletal remains available for analysis, the cluster of burials located immediately south of temple contained only adults (Figure 8.19).

Figure 8.19: Spatial Distribution of Age at Death among Temple Burials.



Similarly, certain rows of graves within the burial clusters located to the northeast of the bath included only adults (Figure 8.20).

Figure 8.20: Spatial Distribution of Age at Death among Bath Burials.



A general absence of clustering is also observed upon visual inspection when Middle to Late Byzantine burials are examined (Figure 8.21). This is confirmed by a high/low cluster analysis, which demonstrates that neither adults nor subadults are clustered in space to a greater degree than would be expected by chance ($p = 0.448$; $z\text{-score} = 0.759$). Adults and subadults

were found both within and outside of the basilica and neither age group shows an overwhelming concentration in those areas. A chi-square test confirms that there is no association between adult and subadult status and burial location within or outside of the basilica (Table 8.42).

Figure 8.21: Spatial Distribution of Age at Death among Middle to Late Byzantine Burials.

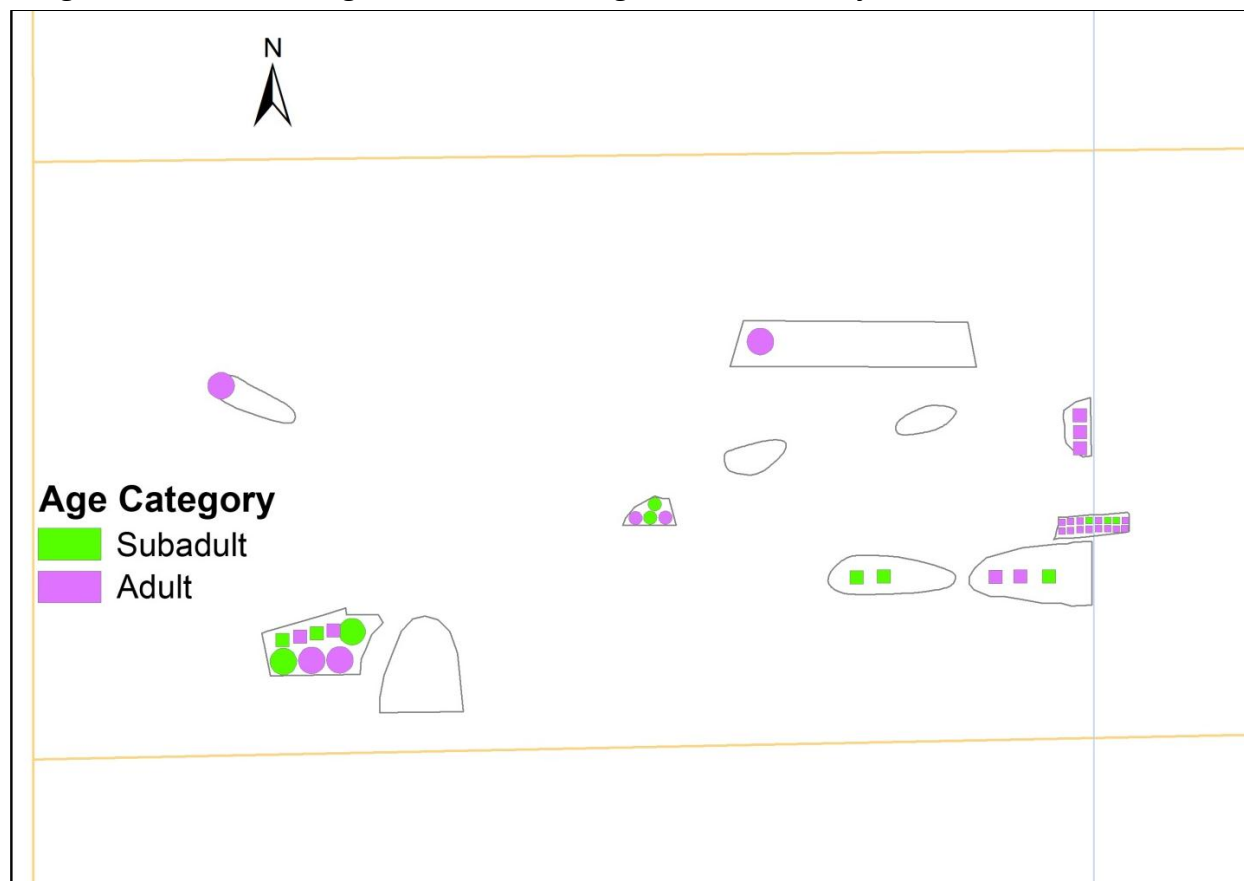


Table 8.42: Frequency of Adults and Subadults Inside versus Outside of the Basilica.

Age Category	Inside		Outside		χ^2	df	Two-tail <i>p</i> -value	<i>p</i> < 0.05 Yes/ No
	(<i>n</i>)	%	(<i>n</i>)	%				
Adult	31	67.4	75	75.0	0.917	1	0.425	No
Subadult	15	32.6	25	25.0				
TOTAL	46	100.0	100	100.0				

As was demonstrated previously but is apparent again in Figures 8.21 and 8.22, burials containing multiple individuals frequently included both adults and subadults. This pattern may suggest that graves were used as family tombs during this period.

Figure 8.22: Detail of Age Distribution among Middle to Late Byzantine Burials in the Nave.



Sex

The spatial distribution of sex was also compared across burial areas using both visual inspection and statistical analysis. Among Early Christian graves containing human remains for

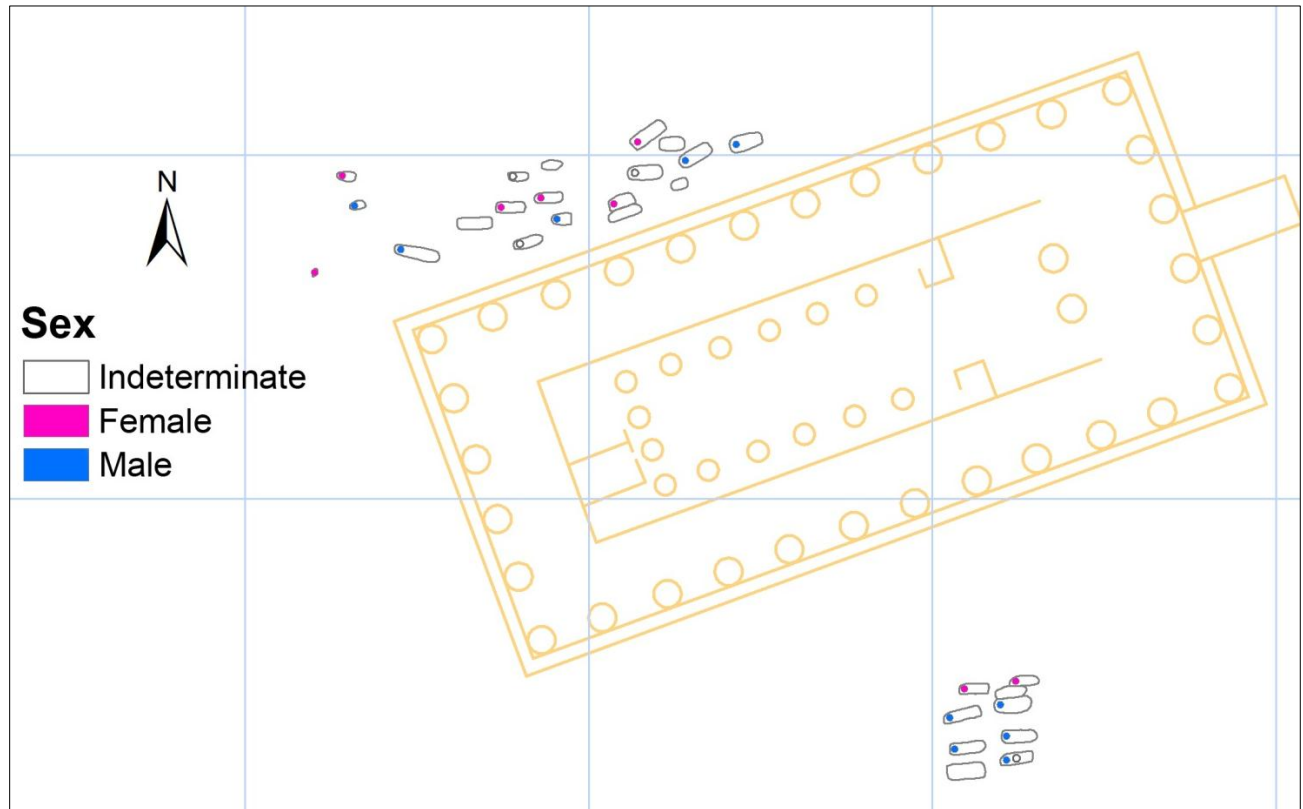
which sex could be estimated, the distribution of males and females appears unremarkable (Figures 8.23 and 8.24). As was the case for adults and subadults, males and females do not show a tendency to concentrate in any particular area of the site. A high/low cluster analysis indicates that neither sex is more spatially clustered than would be expected by chance ($p = 0.916$; $z\text{-score} = 0.359$). Furthermore, the proportions of males and females in each burial area are remarkably consistent (Table 8.43). A chi-square test demonstrates that there are no significant differences in the frequencies of males and females between those areas ($\chi^2 = 0.110$, $df = 2$, $p = 0.947$).

Table 8.43: Spatial Distribution of Sex in Early Christian Burials.

Age Category	Temple		Bath		Basilica	
	(n)	%	(n)	%	(n)	%
Male	10	55.6	24	52.2	9	56.2
Female	8	44.4	22	47.8	7	43.8
TOTAL	18	100.0	46	100.0	16	100.0

A few examples of potentially interesting patterns are visible *within* burial clusters. One of those concerns the two neat rows of burials immediately south of the temple, discussed above because the skeletons from those graves are all adults (Figure 8.23). This somewhat isolated group of graves contains the remains of five males, two females, and one individual of indeterminate sex represented only by an additional set of permanent dentition. The northernmost grave of each row is occupied by a female and it is tempting to hypothesize that each row or perhaps the entire group of graves is representative of a family burial plot.

Figure 8.23: Spatial Distribution of Sex among Temple Burials.



The other interesting sex-based pattern in the spatial arrangement of the Early Christian graves appears in the cluster of graves immediately north of the bath (Figure 8.24). Within this group, all individuals available for analysis from the easternmost row of graves were determined to be female. The osteotheke, which was discussed earlier, lies immediately to the west of this row of burials. That structure was found to contain the fragmentary remains of a minimum of three individuals—all consistent with males based on metric assessments of robusticity.

Figure 8.24: Spatial Distribution of Sex among Bath Burials.



Among Middle to Late Byzantine burials, there appears to be a relative scarcity of females to the immediate south and southwest of the basilica (Figure 8.25). However, a high/low cluster analysis indicates that there is an absence of significant spatial clustering of either males or females during this period ($p = 0.722$; $z\text{-score} = -0.355$). Males and females were found within

the basilica (Figure 8.26) as well as in all areas along its external walls, if in lower concentrations in the case of females to the south and southwest of that structure. A chi-square test demonstrates that there is no association between sex and burial location with respect to the basilica in this period (Table 8.44).

Figure 8.25: Spatial Distribution of Sex among Middle to Late Byzantine Burials.

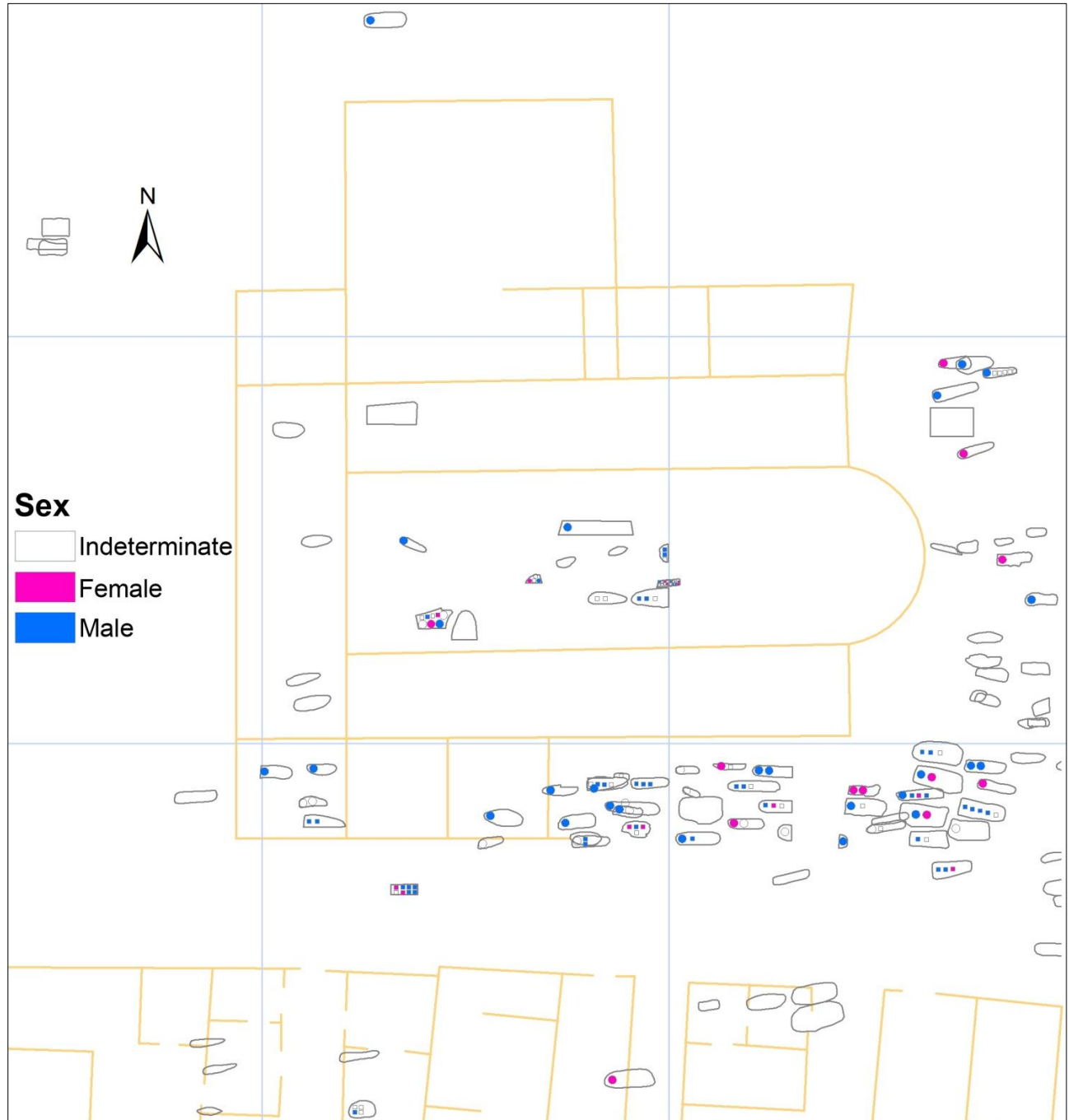


Figure 8.26: Detail of Sex Distribution among Middle to Late Byzantine Burials in the Nave.

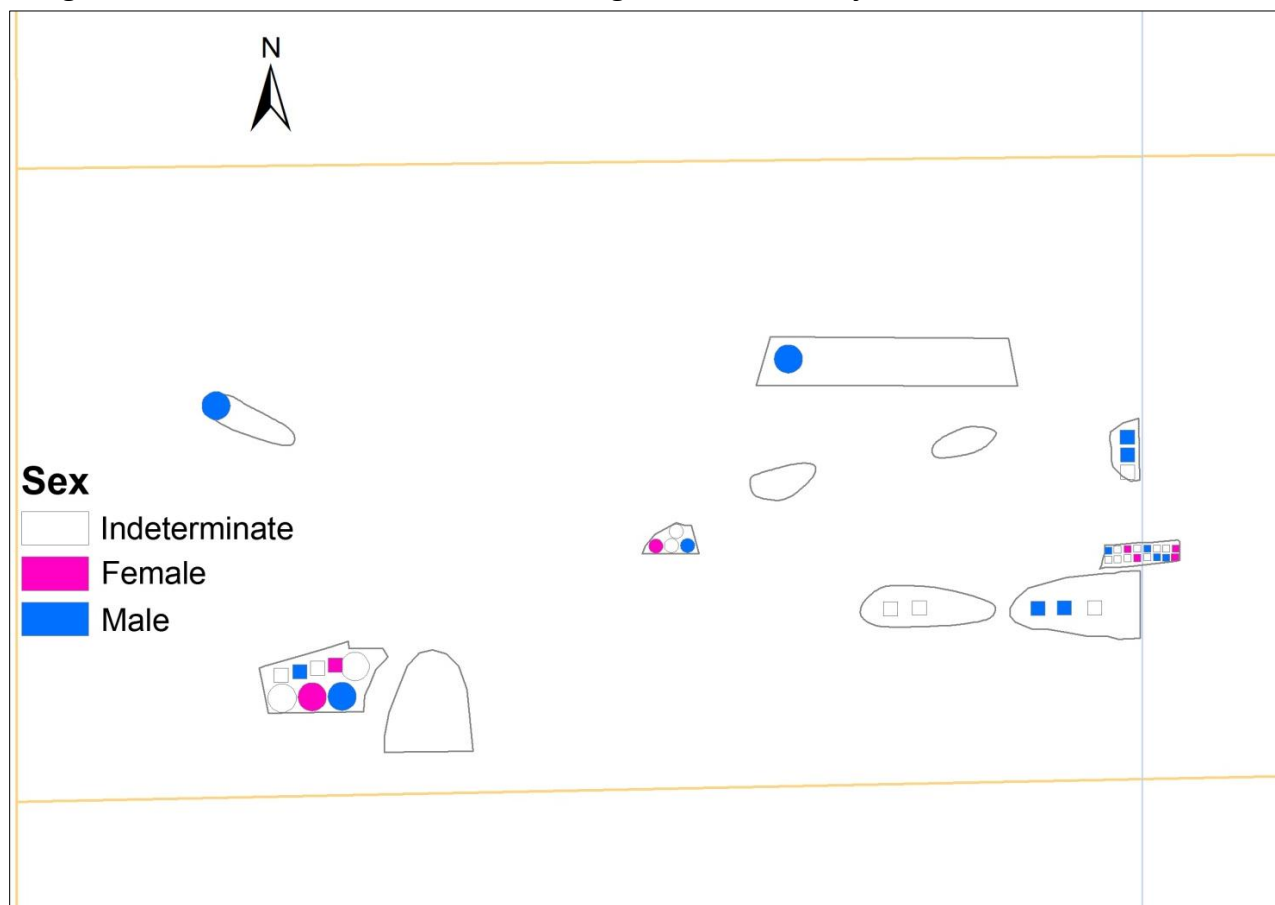


Table 8.44: Frequency of Males and Females Inside versus Outside of the Basilica.

Sex	Inside		Outside		χ^2	df	Two-tail p-value	$p < 0.05$ Yes/ No
	(n)	%	(n)	%				
Male	18	72.0	50	73.5	0.022	1	0.883	No
Female	7	28.0	18	26.5				
TOTAL	25	100.0	68	100.0				

Physiological Stress and Burial Location

Linear Enamel Hypoplasias

As discussed in Chapters Six and Seven, the prevalence rates of linear enamel hypoplasias were calculated and analyzed by tooth rather than by individual in this research. As the analysis of the spatial distribution of linear enamel hypoplasias for all anterior teeth independently would be cumbersome and unlikely to yield different results, the results for only

the mandibular canines are used. The mandibular canines were chosen because they have been demonstrated to be among the most susceptible to hypoplasia formation (Goodman and Rose 1990), a conclusion supported by the results from Nemea.

The spatial distribution of the presence of linear enamel hypoplasias affecting the left mandibular canines (tooth #22) among Early Christian burials is illustrated in Figures 8.27, 8.28, and 8.29. As is clear upon visual inspection as well as from the figures in Table 8.45 below, individuals from all three burial areas show moderate to high prevalence rates. The presence of linear enamel hypoplasias does not appear to be concentrated in any one of those areas. An absence of significant spatial clustering of either the presence or the absence of the condition is confirmed through a high/low cluster analysis ($p = 0.413$; $z\text{-score} = 0.819$).

Figure 8.27: Spatial Distribution of Linear Enamel Hypoplasias on Left Mandibular Canines among Temple Burials.

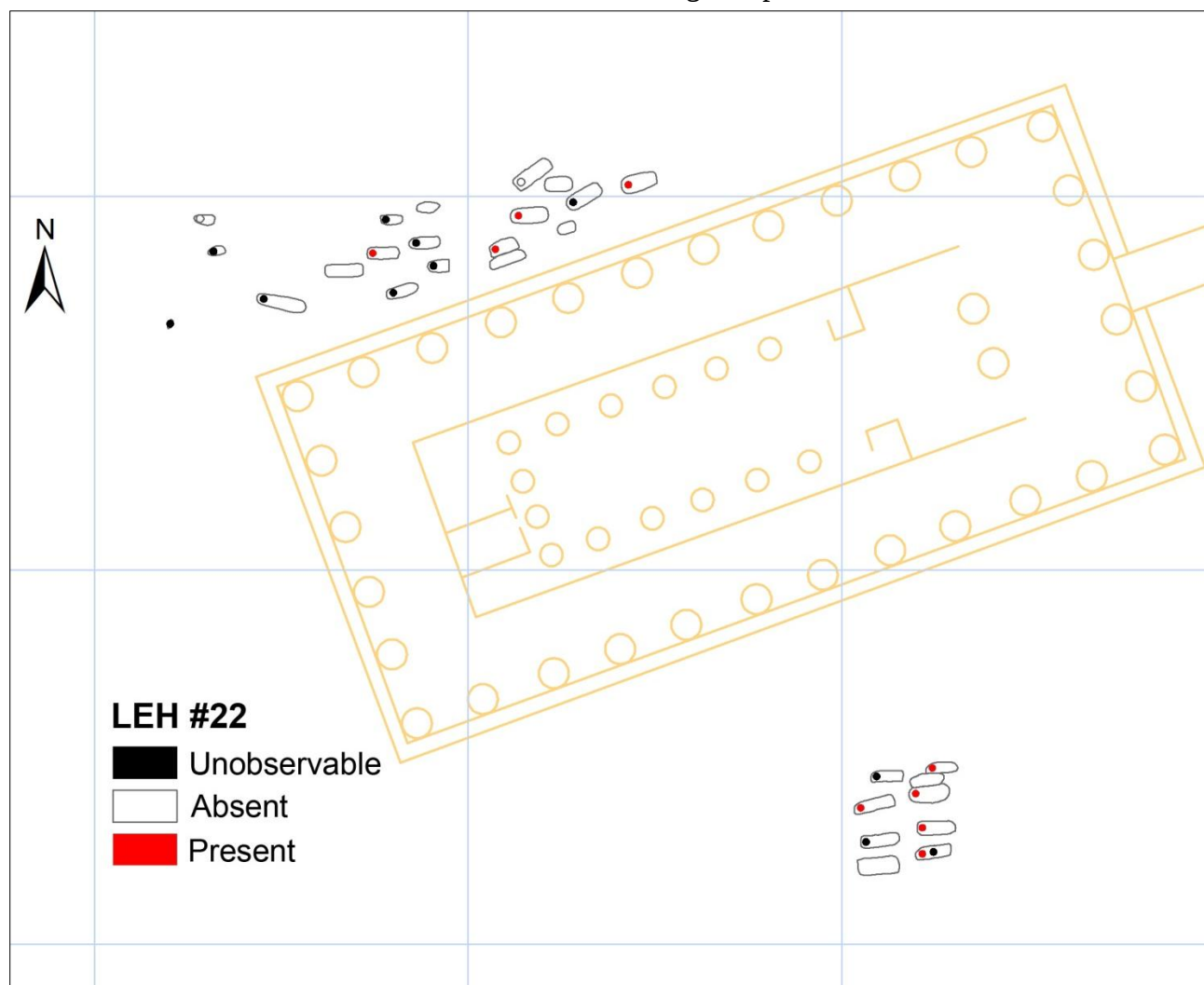


Figure 8.28: Spatial Distribution of Linear Enamel Hypoplasias on Left Mandibular Canines among Bath Burials.

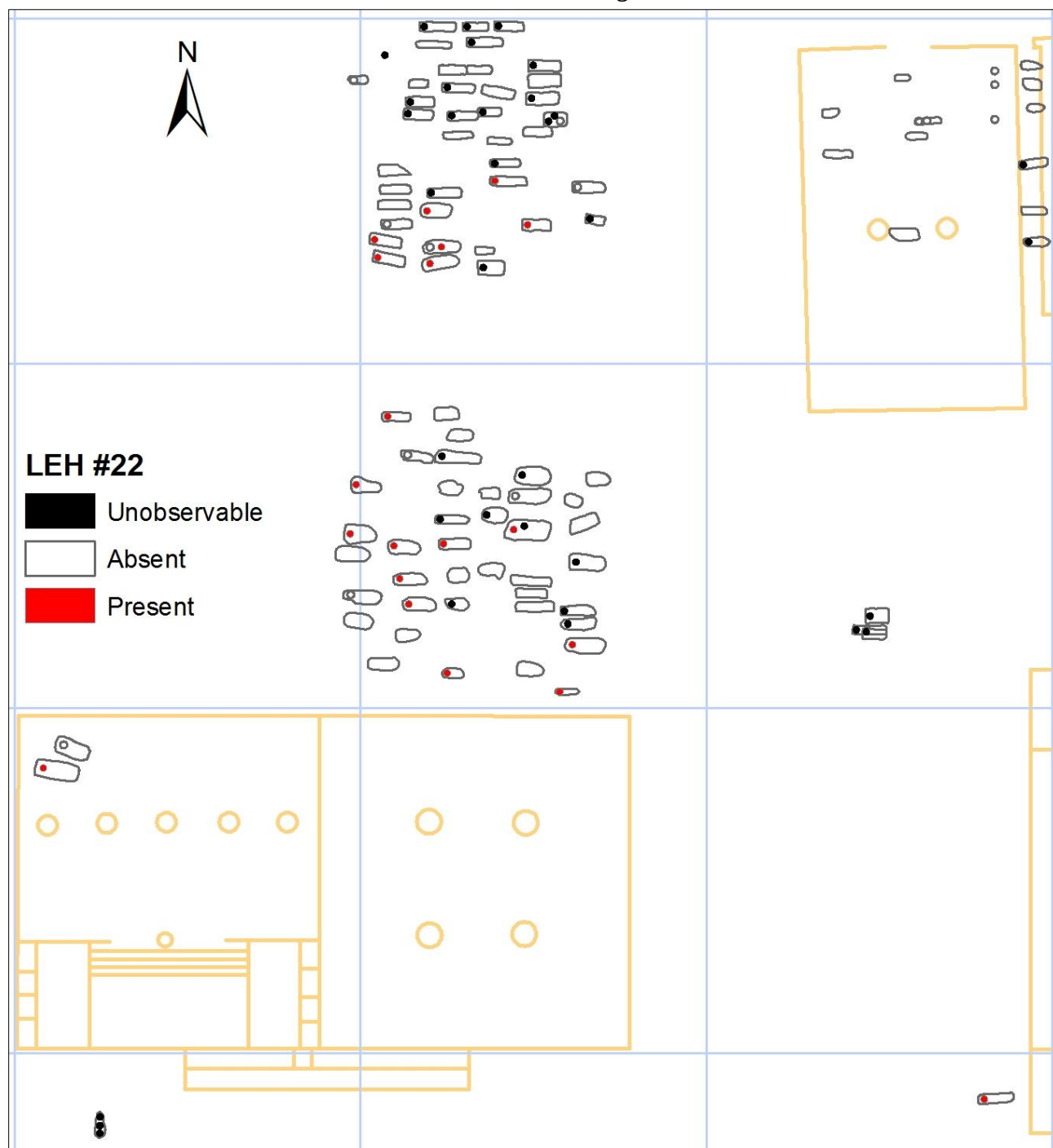


Figure 8.29: Spatial Distribution of Linear Enamel Hypoplasias on Left Mandibular Canines among Early Christian Basilica Burials.

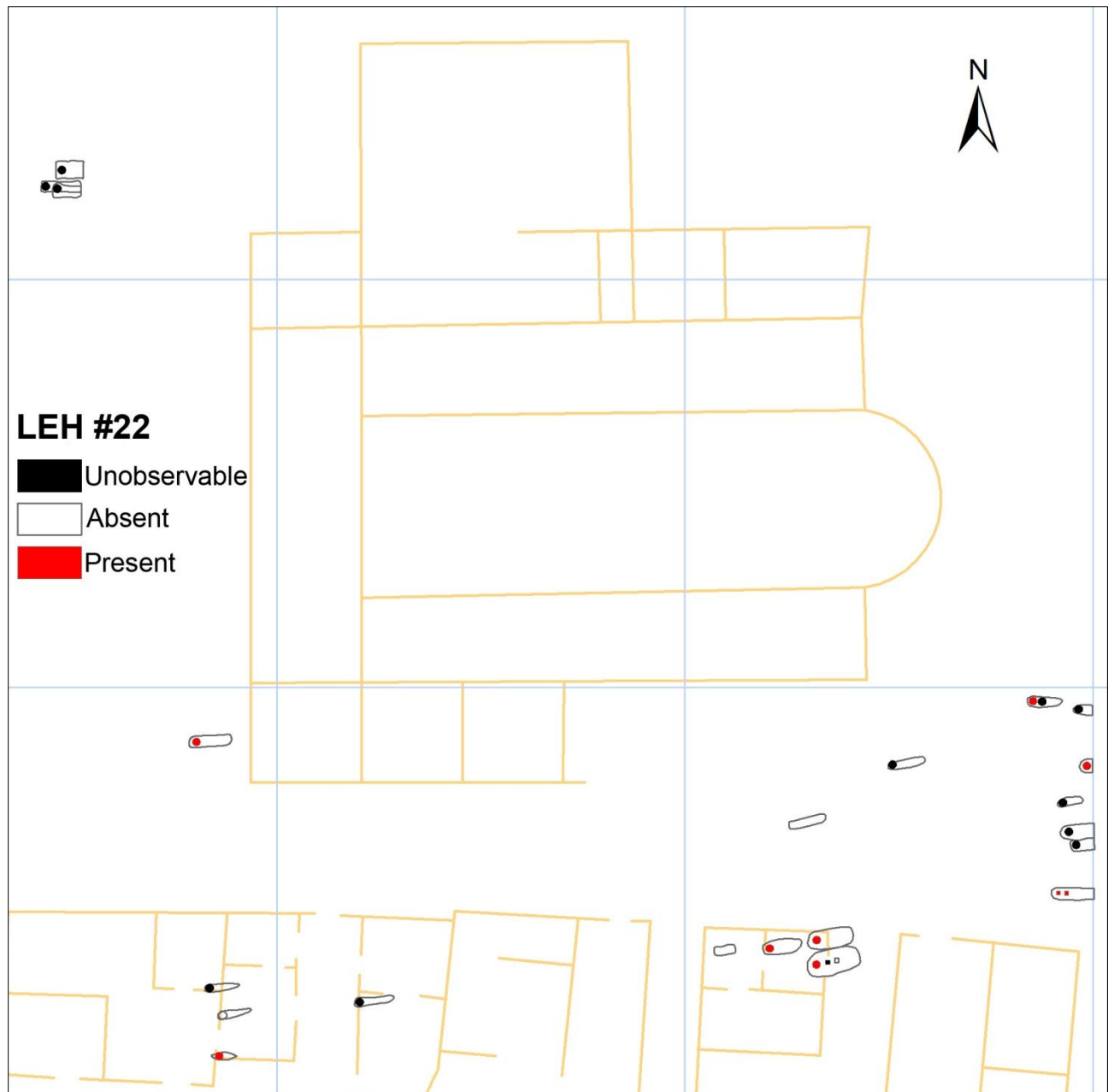


Table 8.45 presents the frequency data related to the spatial distribution of the presence of linear enamel hypoplasias on observable left mandibular canines. While small subsample sizes make the evaluation of spatial patterns difficult, individuals buried in association with the bath appear to exhibit fewer hypoplastic left mandibular canines than those buried in association with

the temple or the basilica. However, Fisher's exact test demonstrates that the differences between those burial areas are not statistically significant (Table 8.46).

Table 8.45: Spatial Distribution of Linear Enamel Hypoplasias (LEH) on Left Mandibular Canines (#22) among Early Christian Burials.

LEH	Temple			Bath			Basilica						
#22	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
	9	2	81.8	19	14	57.6	9	2	81.8	3.524*	2	0.172	No

*At least one cell has an expected count less than five.

Table 8.46: Comparison of Linear Enamel Hypoplasias (LEH) on Left Mandibular Canines (#22) between Bath and Temple/Basilica Burials.

LEH	Bath			Temple/Basilica**								
#22	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No		
	19	14	57.6	9	2	81.8		1	0.278	No		

*Empty cell indicates that Fisher's exact test was used instead of Pearson's chi-square test.

**The figures for the temple and basilica burials are identical.

A similar pattern is apparent when the right mandibular canines (tooth #27) are considered (Table 8.47). High prevalence rates of linear hypoplasias are found in each burial area and a high/low cluster analysis confirms that neither the presence nor the absence of the condition is clustered in space to a greater degree than would be expected by chance ($p = 0.137$; z -score = 1.488). Again, individuals from burials located near the bath show a lower prevalence rate of linear enamel hypoplasias when compared with those from burials located near the temple and the basilica. However, Fisher's exact tests indicate that there is no statistically significant association between burial location and the presence or absence of enamel hypoplasias (Tables 8.48 and 8.49).

Table 8.47: Spatial Distribution of Linear Enamel Hypoplasias (LEH) on Right Mandibular Canines (#27) among Early Christian Burials.

LEH	Temple			Bath			Basilica						
#27	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
	5	1	83.3	24	11	68.6	12	2	85.7	1.823*	2	0.402	No

*At least one cell has an expected count less than five.

Table 8.48: Comparison of Linear Enamel Hypoplasias (LEH) on Right Mandibular Canines (#27) between Bath and Temple Burials.

LEH	Bath			Temple								
#27	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No		
	24	11	68.6	5	1	83.3		1	0.651	No		

*Empty cell indicates that Fisher's exact test was used instead of Pearson's chi-square test.

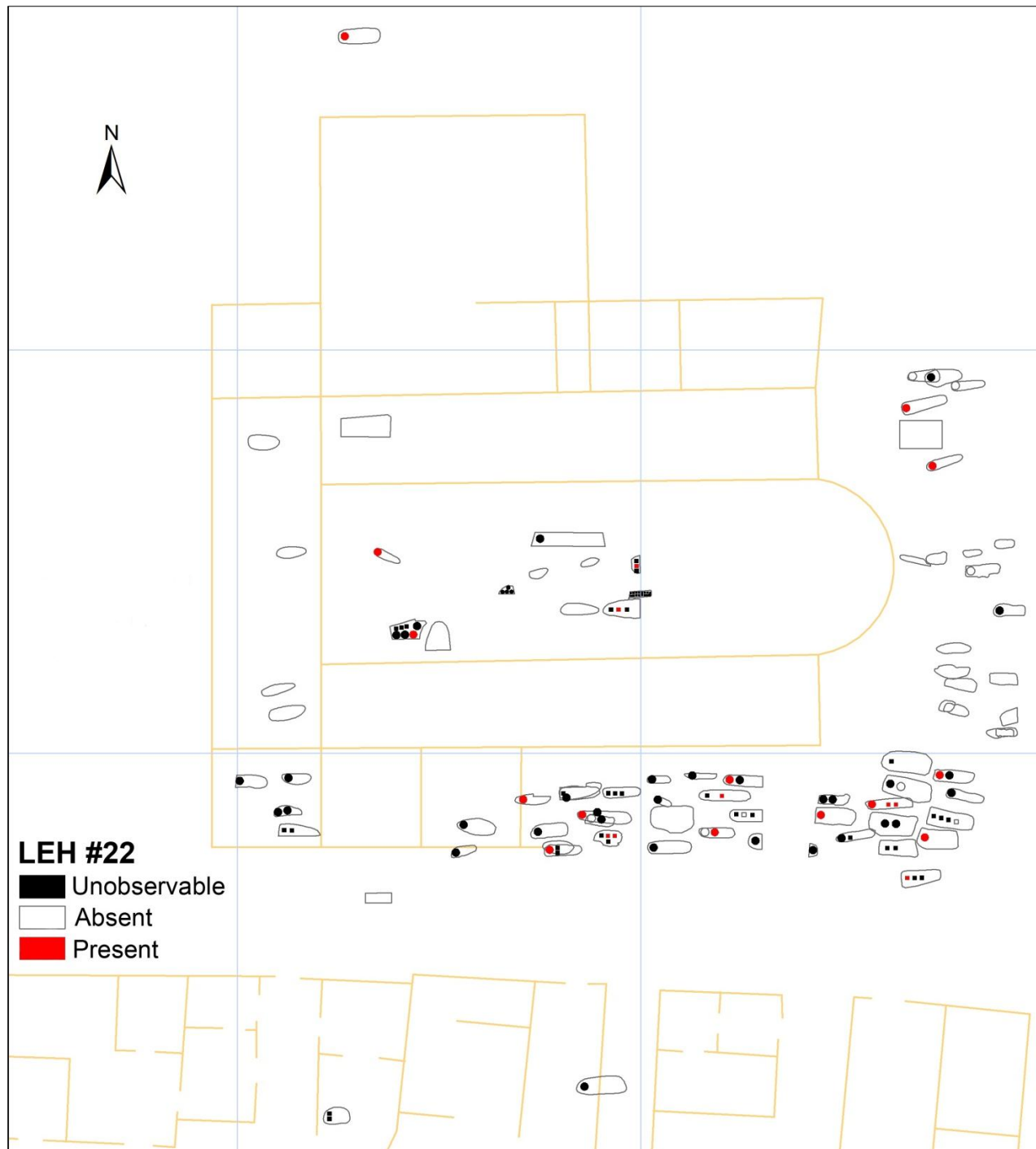
Table 8.49: Comparison of Linear Enamel Hypoplasias (LEH) on Right Mandibular Canines (#27) between Bath and Basilica Burials.

LEH	Bath			Basilica								
#27	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No		
	24	11	68.6	12	2	85.7		1	0.297	No		

*Empty cell indicates that Fisher's exact test was used instead of Pearson's chi-square test.

Among Middle to Late Byzantine burials containing individuals with observable left mandibular canines (tooth #22), the presence of linear enamel hypoplasias does not appear to cluster in any particular area inside or outside of the basilica (Figure 8.30). As was the case for the Early Christian burials, most left mandibular canines exhibited at least one hypoplasia. A high/low cluster analysis confirms that there is no statistically significant spatial clustering of the presence or absence of linear enamel hypoplasias on this tooth ($p = 0.671$; z-score = -0.425). The same pattern is observed when the corresponding right mandibular canine (tooth #27) is considered. The results for this tooth also indicate that neither the presence nor the absence of linear enamel hypoplasias is spatially clustered to a greater degree than would be expected by chance ($p = 0.387$; z-score = 0.865).

Figure 8.30: Spatial Distribution of Linear Enamel Hypoplasias on Left Mandibular Canines among Middle to Late Byzantine Burials.



A comparison of the prevalence of linear enamel hypoplasias on the left and right mandibular canines between Middle to Late Byzantine burials located inside and outside of the basilica reveals a potentially interesting pattern, although small subsample sizes once again

prove problematic. For each of those teeth, burials located within the basilica show greater prevalence rates than those located outside of the basilica. All left mandibular canines belonging to individuals buried inside the basilica were hypoplastic, while 92.9% (13/14) of right mandibular canines from such burials exhibited linear enamel hypoplasias (Tables 8.50 and 8.51). Figure 8.31 shows a detailed view of the distribution of the presence and absence of hypoplasias on the latter tooth among burials in the nave of the basilica. Despite this apparent pattern, Fisher's exact test demonstrates that there is no association between burial inside or outside of the basilica and the presence or absence of linear enamel hypoplasias for both the left and right mandibular canines (Tables 8.50 and 8.51).

Table 8.50: Comparison of Linear Enamel Hypoplasias (LEH) on Left Mandibular Canines (#22) Inside versus Outside of the Basilica.

LEH	Inside			Outside						
#22	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
	4	0	100.0	18	8	69.2		1	0.550	No

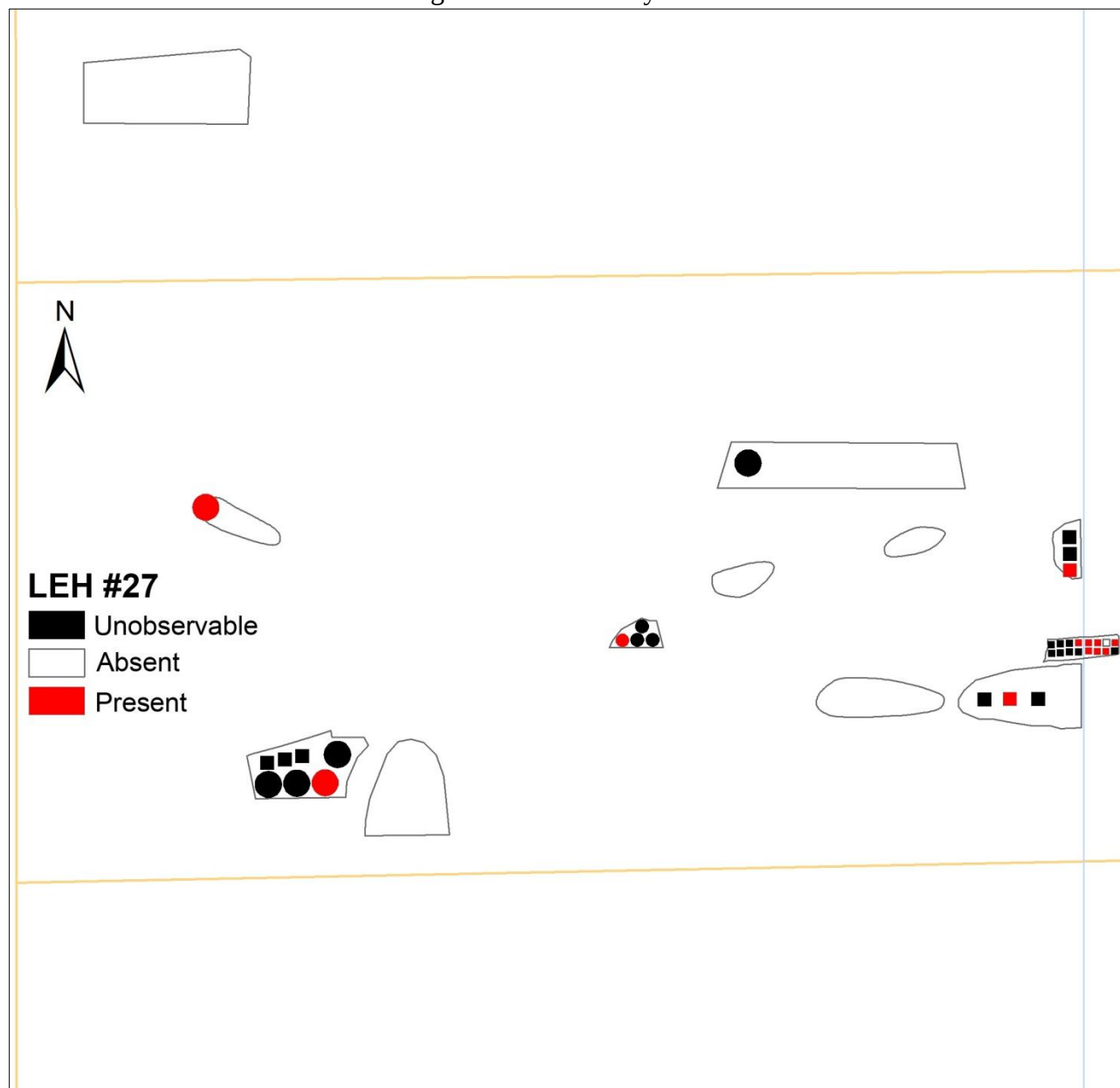
*Empty cell indicates that Fisher's exact test was used instead of Pearson's chi-square test.

Table 8.51: Comparison of Linear Enamel Hypoplasias (LEH) on Right Mandibular Canines (#27) Inside versus Outside of the Basilica.

LEH	Inside			Outside						
#27	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
	13	1	92.9	15	6	71.4		1	0.203	No

*Empty cell indicates that Fisher's exact test was used instead of Pearson's chi-square test.

Figure 8.31: Detail of the Spatial Distribution of Linear Enamel Hypoplasias on Right Mandibular Canines among Middle to Late Byzantine Burials in the Nave.



Porotic Hyperostosis

As demonstrated in Chapter Seven, porotic hyperostosis was not common in the Early Christian skeletal sample and this is represented visually in Figures 8.32, 8.33, and 8.34. Upon visual inspection, individuals exhibiting porotic hyperostosis appear to be concentrated around the temple. Only a few individuals associated with the bath exhibit porotic hyperostosis and among basilica burials only a single case was recorded. A high/low cluster analysis demonstrates that the spatial distribution of the presence and absence of porotic hyperostosis among Early Christian burials across the site does not differ significantly from what would be expected by chance ($p = 0.989$; $z\text{-score} = 0.014$).

Figure 8.32: Spatial Distribution of Porotic Hyperostosis among Temple Burials.

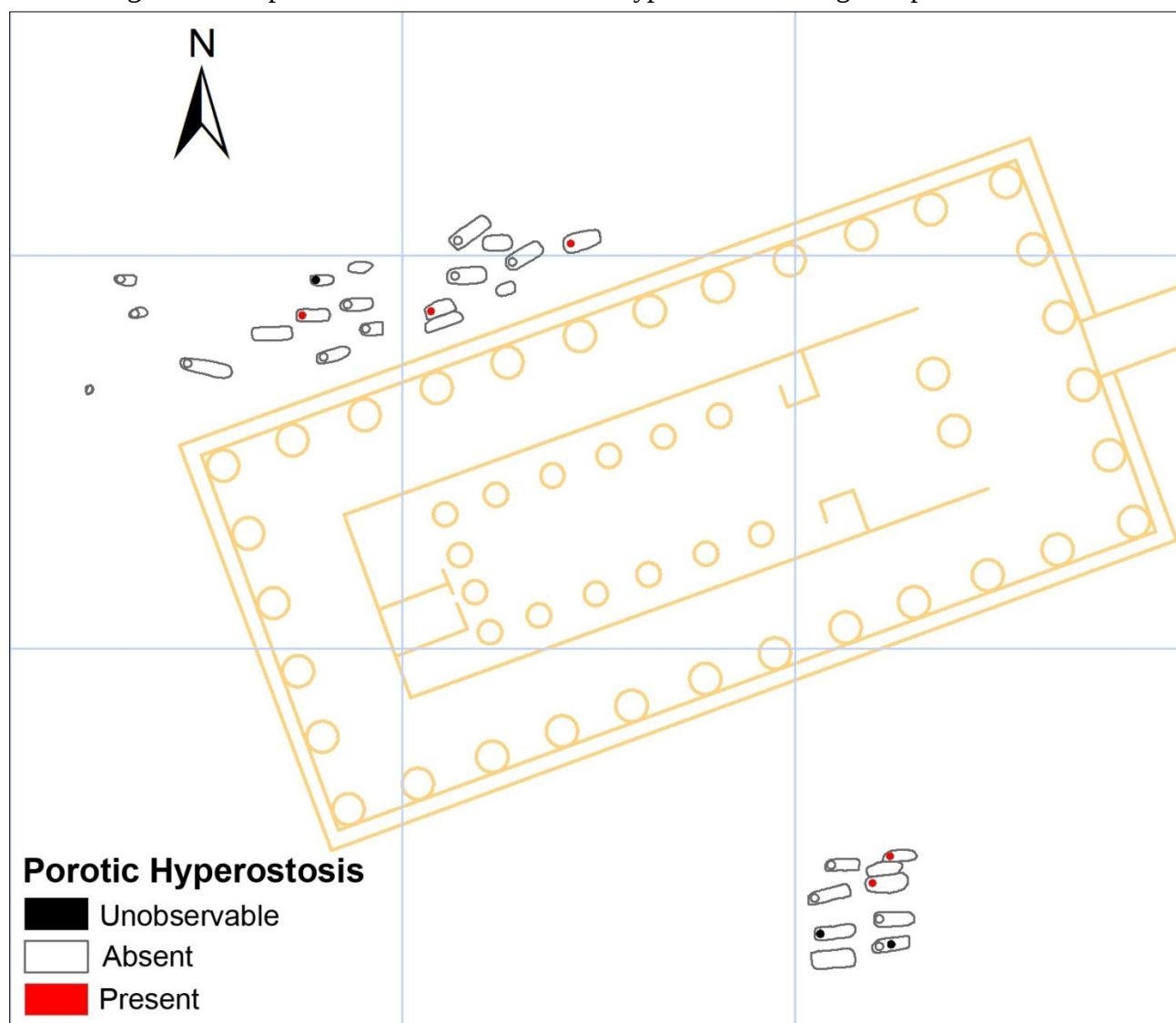


Figure 8.33: Spatial Distribution of Porotic Hyperostosis among Bath Burials.

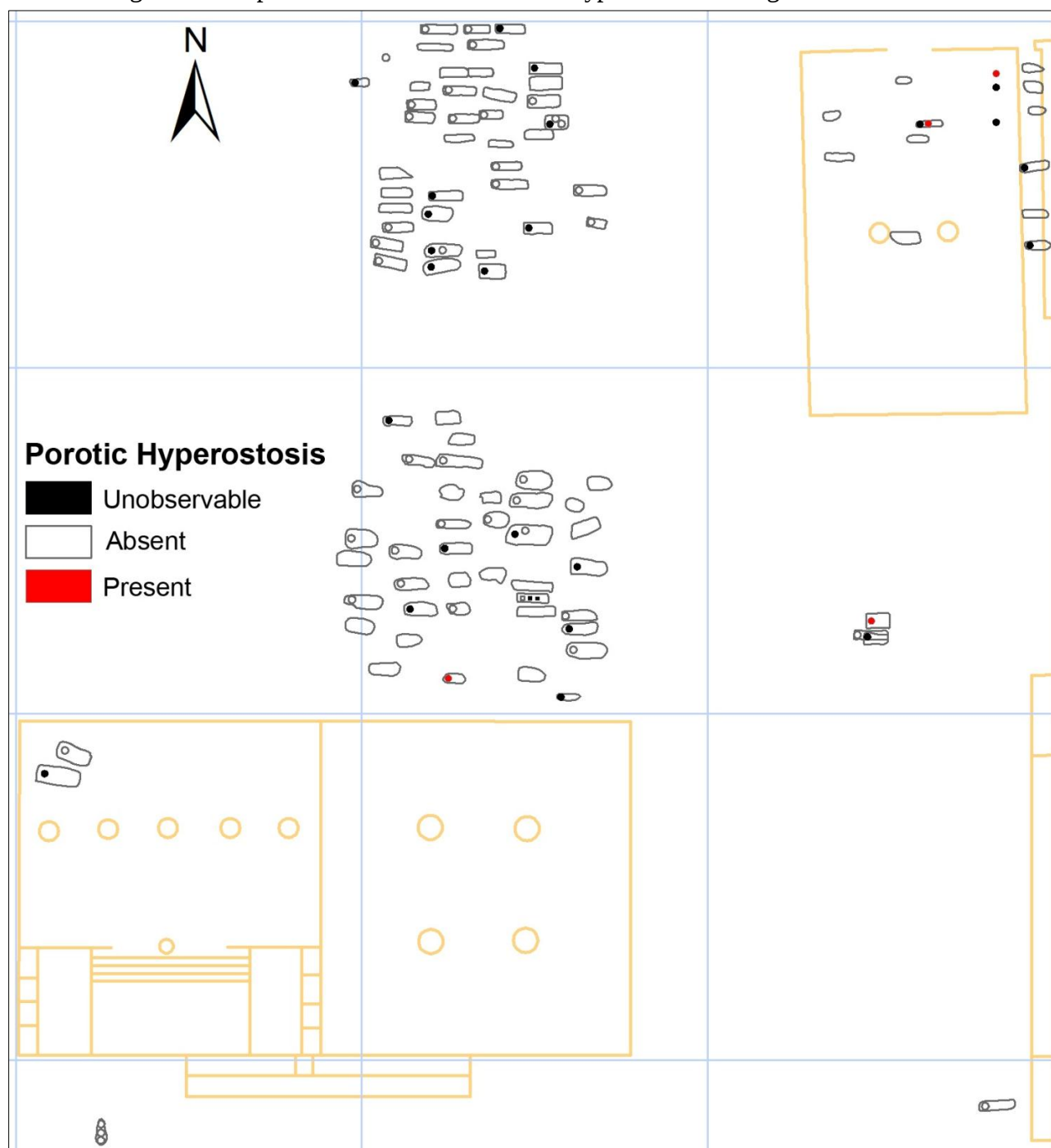
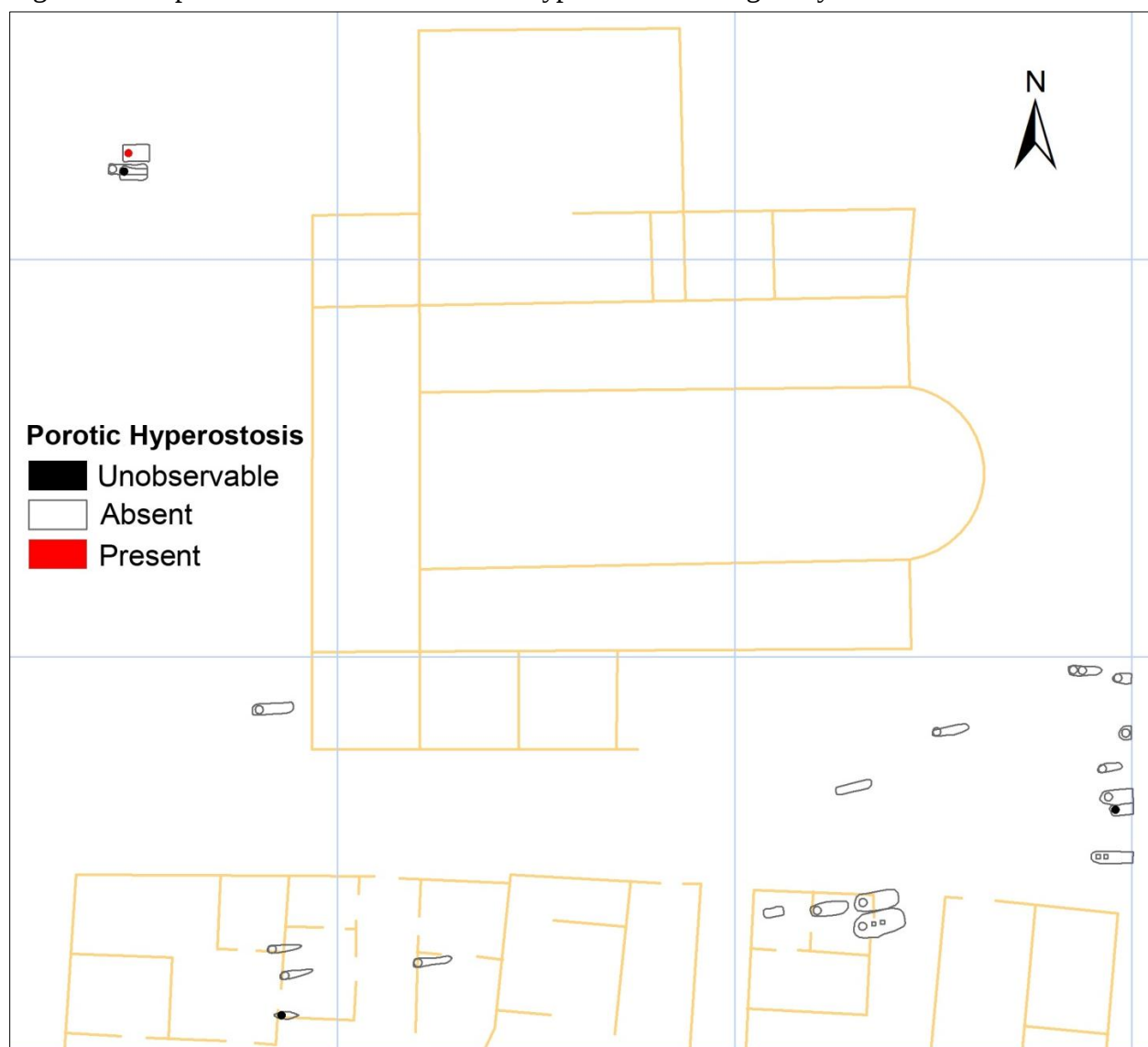


Figure 8.34: Spatial Distribution of Porotic Hyperostosis among Early Christian Basilica Burials.



The figures for the presence and absence of porotic hyperostosis in Early Christian burial areas are compared in Table 8.52. Again, the proportion of temple burials containing crania exhibiting porotic hyperostosis is elevated when viewed against the burials associated with the bath and the basilica. To avoid violating the assumptions of the chi-square test, those burial areas were compared against each other using Fisher's exact test. Despite the apparent pattern, the differences between the temple burials and those associated with the bath and the basilica only approach the $p < 0.05$ level (Tables 8.53 and 8.54).

Table 8.52: Spatial Distribution of Porotic Hyperostosis (PH) among Early Christian Burials.

PH	Temple			Bath			Basilica			χ^2	df	Two-tail <i>p</i> -value	<i>p</i> < 0.05 Yes/ No
	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%				
	5	14	26.3	3	40	7.0	1	19	5.0	6.011*	2	0.050	No

*At least one cell has an expected count less than five.

Table 8.53: Comparison of Porotic Hyperostosis (PH) between Temple and Bath Burials.

PH	Temple			Bath									
	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail <i>p</i> -value	<i>p</i> < 0.05 Yes/ No			
	5	14	26.3	3	40	7.0		1	0.050	No			

*Empty cell indicates that Fisher's exact test was used instead of Pearson's chi-square test.

Table 8.54: Comparison of Porotic Hyperostosis (PH) between Temple and Basilica Burials.

PH	Temple			Basilica									
	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail <i>p</i> -value	<i>p</i> < 0.05 Yes/ No			
	5	14	26.3	1	19	5.0		1	0.091	No			

*Empty cell indicates that Fisher's exact test was used instead of Pearson's chi-square test.

Among Middle to Late Byzantine burials, most individuals exhibiting porotic hyperostosis are located outside of the basilica along its south and southeast walls (Figure 8.35). Only three individuals with porotic hyperostosis were recovered from graves within the basilica. There were no examples of porotic hyperostosis in individuals with observable parietal bones from graves located at the east end of the basilica outside of the apse. Despite this apparent pattern in the distribution of the condition, a high/low cluster analysis shows that neither the presence nor the absence of porotic hyperostosis is clustered in space to a greater degree than would be expected by chance ($p = 0.274$; z -score = 1.093). Similarly, the differences in the presence of porotic hyperostosis between individuals whose graves were inside the basilica and those whose graves were outside of that structure are not statistically significant (Table 8.55).

Figure 8.35: Spatial Distribution of Porotic Hyperostosis among Middle to Late Byzantine Burials.



Table 8.55: Presence of Porotic Hyperostosis (PH) Inside versus Outside of the Basilica.

PH	Inside			Outside						
	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
	3	23	11.5	12	53	18.5		1	0.541	No

*Empty cell indicates that Fisher's exact test was used instead of Pearson's chi-square test.

Cribra Orbitalia

The spatial distribution of cribra orbitalia among Early Christian burials is illustrated in Figures 8.36, 8.37, and 8.38. The condition was a relatively common observation in skeletons recovered from graves associated with the temple and the bath. Fewer examples of cribra orbitalia were observed among the individuals buried closest to the basilica. No obvious clustering of cribra orbitalia in any particular burial area is apparent upon visual inspection and this is confirmed by a high/low cluster analysis, which indicates an absence of spatial clustering of the presence or absence of the condition ($p = 0.655$; $z\text{-score} = -0.447$).

Figure 8.36: Spatial Distribution of Cribra Orbitalia among Temple Burials.

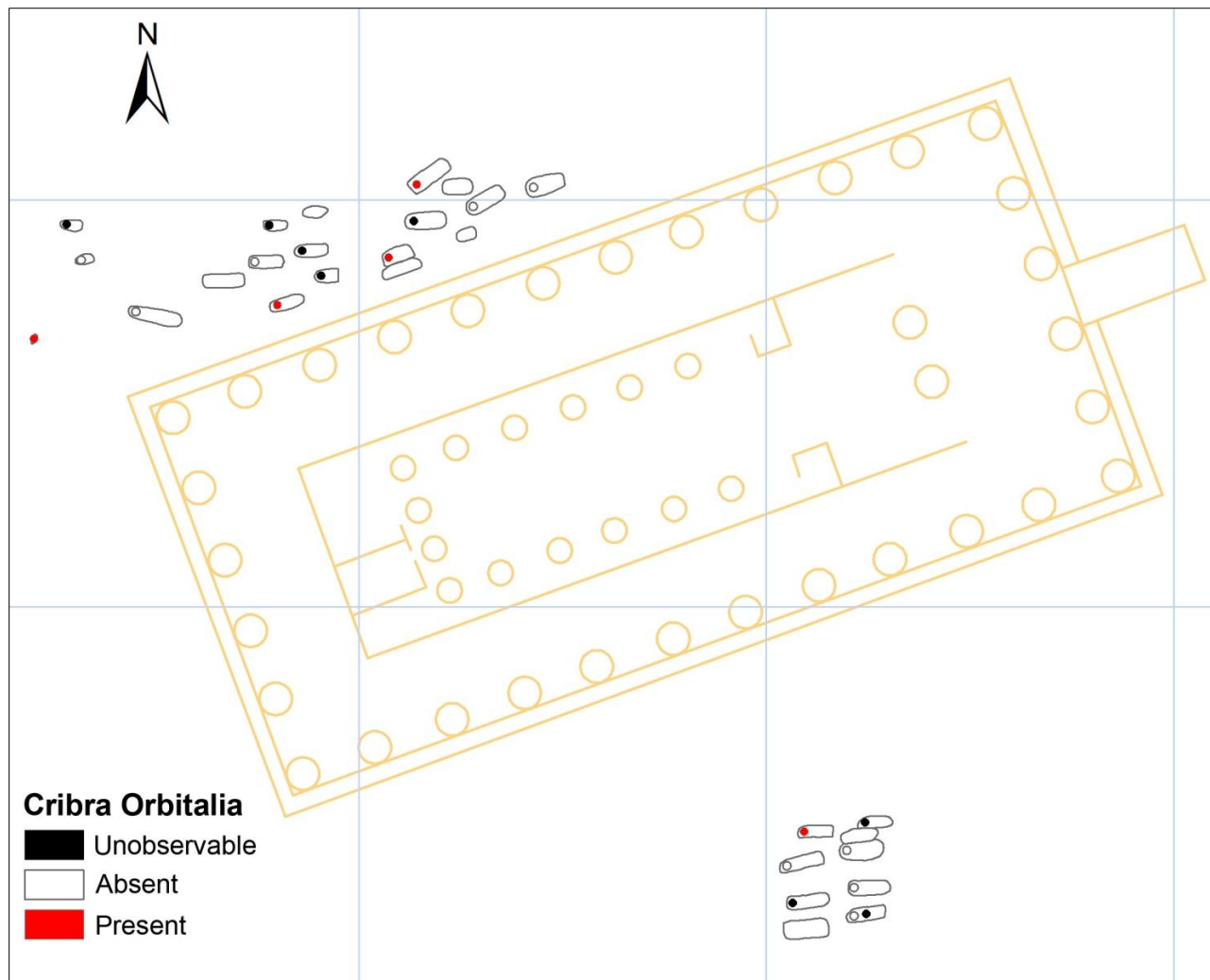
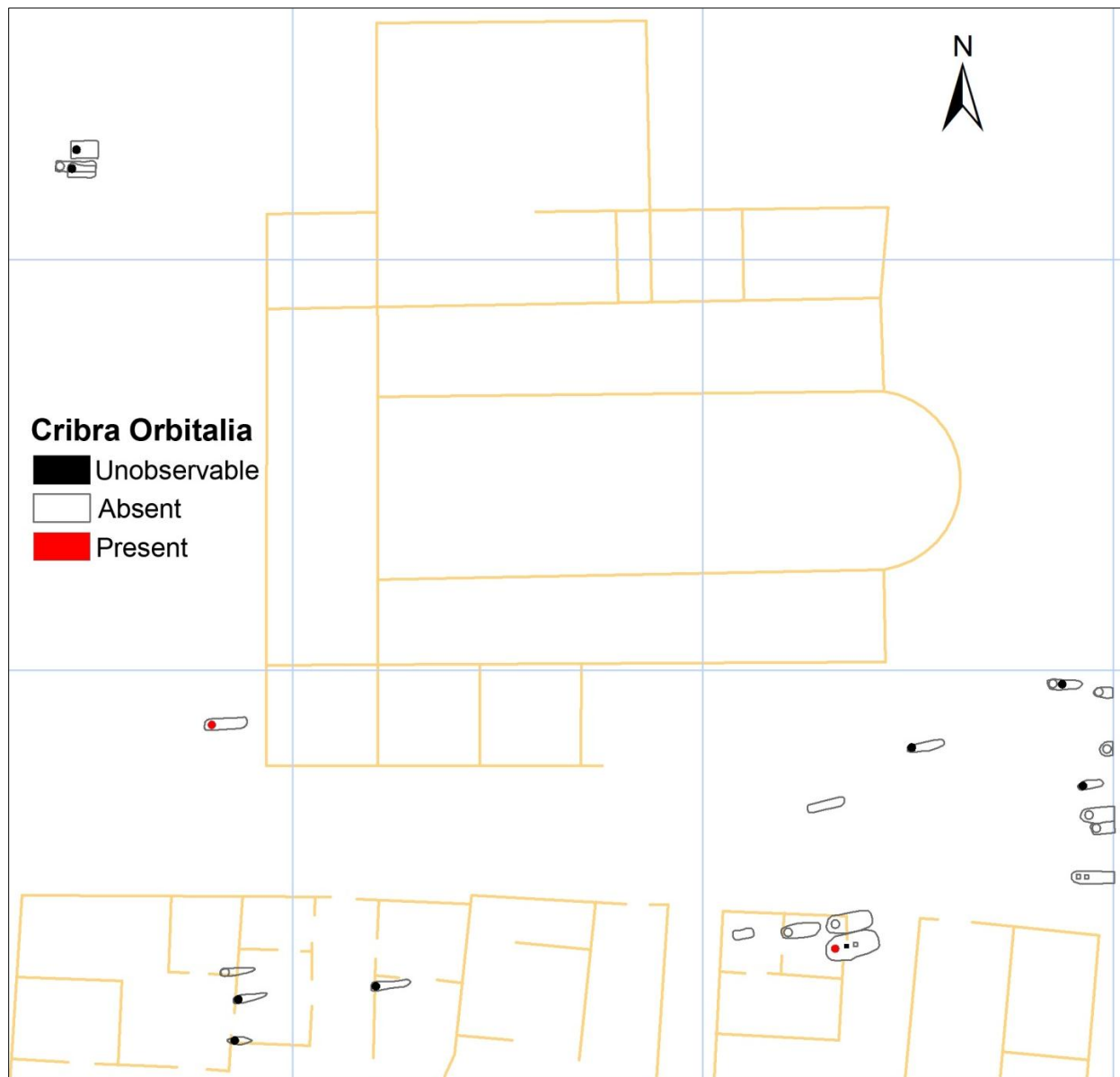


Figure 8.37: Spatial Distribution of Cribra Orbitalia among Bath Burials.



Figure 8.38: Spatial Distribution of Cribra Orbitalia among Early Christian Basilica Burials.



The figures detailing the presence and absence of cribra orbitalia among Early Christian burials are compared between burial areas in Table 8.56. While the prevalence of cribra orbitalia is lower among individuals recovered from graves associated with the basilica, the differences between those individuals and the subsamples from the temple and the bath are not statistically significant (Tables 8.57 and 8.58).

Table 8.56: Spatial Distribution of Cribra Orbitalia (CO) among Early Christian Burials.

CO	Temple			Bath			Basilica			χ^2	df	Two-tail <i>p</i> -value	<i>p</i> < 0.05 Yes/ No
	Pr (<i>n</i>)	Ab (<i>n</i>)	%	Pr (<i>n</i>)	Ab (<i>n</i>)	%	Pr (<i>n</i>)	Ab (<i>n</i>)	%				
	5	9	35.7	11	22	33.3	2	12	14.3	2.051*	2	0.359	No

*At least one cell has an expected count less than five.

Table 8.57: Comparison of Cribra Orbitalia (CO) between Basilica and Temple Burials.

CO	Basilica			Temple								
	Pr (<i>n</i>)	Ab (<i>n</i>)	%	Pr (<i>n</i>)	Ab (<i>n</i>)	%	χ^2	df	Two-tail <i>p</i> -value	<i>p</i> < 0.05 Yes/ No		
	2	12	14.3	5	9	35.7		1	0.385	No		

*Empty cell indicates that Fisher's exact test was used instead of Pearson's chi-square test.

Table 8.58: Comparison of Cribra Orbitalia (CO) between Basilica and Bath Burials.

CO	Basilica			Bath								
	Pr (<i>n</i>)	Ab (<i>n</i>)	%	Pr (<i>n</i>)	Ab (<i>n</i>)	%	χ^2	df	Two-tail <i>p</i> -value	<i>p</i> < 0.05 Yes/ No		
	2	12	14.3	11	22	33.3		1	0.288	No		

*Empty cell indicates that Fisher's exact test was used instead of Pearson's chi-square test.

The distribution of cribra orbitalia among individuals buried in Middle to Late Byzantine graves is similar to that of porotic hyperostosis (Figure 8.39). Cribra orbitalia was present in just three individuals from two graves within the basilica—one grave is located in the western portion of the nave and the other in the southern room of the narthex. No examples of cribra orbitalia were observed in individuals buried outside of the basilica adjacent to the apse at its east end. Most of the individuals exhibiting the condition were recovered from graves located outside of the basilica along its south wall and adjacent to the southeast corner. A high/low cluster analysis demonstrates that this pattern is statistically significant—the presence of cribra orbitalia is clustered in space to a greater degree than would be expected by chance ($p = 0.032$; z -score = 2.139). There is, however, one caveat. When compared to porotic hyperostosis, which showed a very similar but non-significant pattern, the results for cribra orbitalia include more individuals scored as “unobservable” because of missing or unobservable eye orbits. It must be considered

then, that the significant result for the spatial clustering of cribra orbitalia might be due to essentially removing some of the outliers in terms of distance from the primary concentration of burials from the analysis. Still, the results for both porotic hyperostosis and cribra orbitalia at least hint at the possibility that there is significant spatial patterning of the presence of those two conditions and it is noteworthy that they both appear most frequently in graves located immediately southeast of the basilica.

When the presence of cribra orbitalia is compared between individuals buried inside and outside of the basilica, those buried outside exhibit a slightly elevated prevalence rate. However, Fisher's exact test demonstrates that the differences between those two subgroups of burials are not statistically significant (Table 8.59).

Figure 8.39: Spatial Distribution of Cribra Orbitalia among Middle to Late Byzantine Burials.

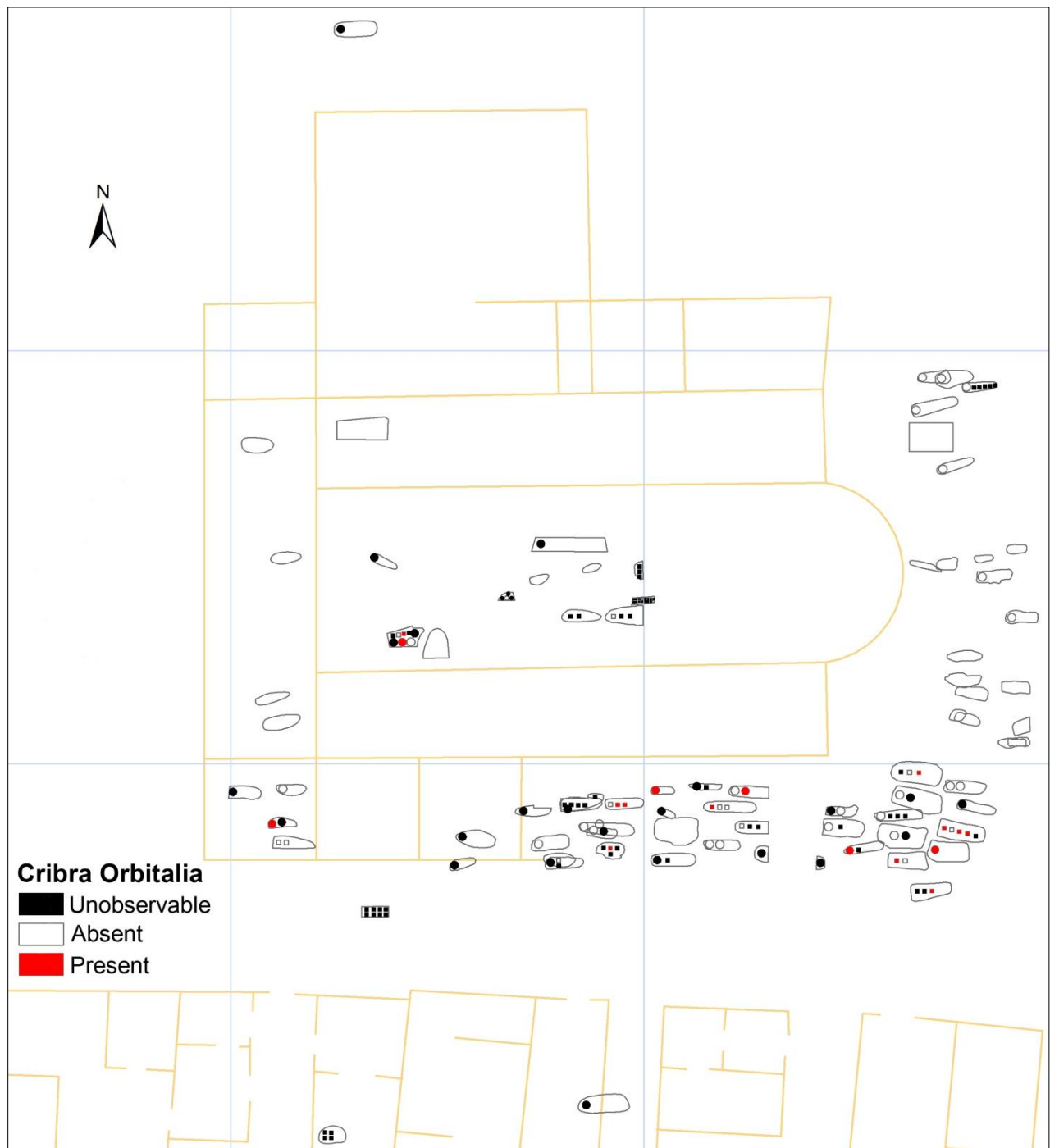


Table 8.59: Presence of Cribra Orbitalia (CO) Inside versus Outside of the Basilica.

CO	Inside			Outside						
	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
	3	9	25.0	14	30	31.8		1	0.738	No

*Empty cell indicates that Fisher's exact test was used instead of Pearson's chi-square test.

Periosteal Reactions

As discussed in Chapter Seven, periosteal reactions having a minimum degree of expression were extremely common in individuals from both periods at Nemea. Tables 8.60 and 8.61 present the figures for the spatial distribution of periosteal reactions on the left and right tibiae of individuals recovered from Early Christian burials. For both anatomical sides, the prevalence rates of periosteal reactions are quite consistent between each burial area. No statistically significant differences were found when burial areas were compared against each other two at a time using Fisher's exact test. The widespread distribution of periosteal reactions is confirmed with a high/low cluster analysis, which indicates that neither the presence nor the absence of periosteal reactions is clustered to a greater degree than would be expected by chance (left tibia: $p = 0.197$; z-score = 1.290; right tibia: $p = 0.100$; z-score = 1.642).

Table 8.60: Spatial Distribution of Periosteal Reactions (PR)
on Left Tibiae among Early Christian Burials.

PR	Temple			Bath			Basilica						
L. Tib	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	$p < 0.05$ Yes/ No
	10	3	76.9	13	4	76.5	17	4	81.0	0.135*	2	0.935	No

*At least one cell has an expected count less than five.

Table 8.61: Spatial Distribution of Periosteal Reactions (PR)
on Right Tibiae among Early Christian Burials.

PR	Temple			Bath			Basilica						
R. Tib	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	$p < 0.05$ Yes/ No
	11	2	84.6	13	3	81.2	16	3	84.2	0.076*	2	0.963	No

*At least one cell has an expected count less than five.

Similarly, the presence of periosteal reactions shows no tendency to cluster in any particular area among graves dating to the Middle to Late Byzantine period. For both anatomical sides, individuals exhibiting tibial periosteal reactions are found within the narthex and nave of the basilica, as well as outside of the basilica along the southeast wall and outside of the apse at

the east end. The absence of significant spatial clustering of periosteal reactions is confirmed using a high/low cluster analysis (left tibia: $p = 0.805$; z-score = -0.247; right tibia: ($p = 0.643$; z-score = -0.463).

When the presence of periosteal reactions on the tibiae is compared by burial location inside versus outside of the basilica, the right and left anatomical sides show opposite patterns. When the left tibia is considered, a greater prevalence rate is found among individuals buried outside of the basilica. For the right tibia, by contrast, periosteal reactions were observed more frequently among individuals buried within the basilica. Chi-square tests confirm that there is no statistically significant relationship between burial location with respect to the basilica and the presence or absence of tibial periostitis for either anatomical side (Tables 8.62 and 8.63).

Table 8.62: Presence of Periosteal Reactions (PR) on Left Tibiae
Inside versus Outside of the Basilica.

PR	Inside			Outside						
L. Tib	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
	12	11	52.2	40	21	65.6	1.272	1	0.259	No

Table 8.63: Presence of Periosteal Reactions (PR) on Right Tibiae
Inside versus Outside of the Basilica.

PR	Inside			Outside						
R. Tib	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
	18	5	78.3	40	17	70.2	0.537	1	0.464	No

Osteoarthritis

The spatial distribution of osteoarthritis among Early Christian burials is presented in Table 8.64 below. Statistical comparisons between burial areas are problematic due to the small sizes of the subsamples. The differences between burial areas in the presence and absence of osteoarthritis were found to be significant for the left knee joint. However, the differences for the right knee joint are non-significant and, furthermore, the cell sizes violate the assumptions of the

chi-square test. To produce statistically valid figures, comparisons were also made between two burial areas at a time using Fisher's exact test, for all combinations of burial areas and for every joint. None of those comparisons yielded statistically significant results, which demonstrates that there is no association between burial location and the presence or absence of osteoarthritis in the Early Christian period.

Table 8.64: Spatial Distribution of Osteoarthritis (OA) among Early Christian Burials.

OA	Temple			Bath			Basilica						
Joint	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
L. Shoulder	0	4	0.0	2	7	22.2	4	4	50.0	3.578*	2	0.167	No
R. Shoulder	1	6	14.3	5	5	50.0	3	5	37.5	2.291*	2	0.318	No
L. Elbow	0	2	0.0	0	8	0.0	2	13	13.3	1.449*	2	0.485	No
R. Elbow	0	7	0.0	1	6	14.3	2	9	18.2	1.387*	2	0.500	No
L. Wrist	1	4	20.0	0	6	0.0	1	8	11.1	1.235*	2	0.539	No
R. Wrist	0	8	0.0	1	11	8.3	3	11	21.4	2.462*	2	0.292	No
L. Hip	4	6	40.0	7	12	36.8	2	9	18.2	1.448*	2	0.485	No
R. Hip	3	8	27.3	5	11	31.2	3	13	18.8	0.679*	2	0.712	No
L. Knee	0	8	0.0	0	6	0.0	4	6	40.0	6.720*	2	0.035	YES
R. Knee	0	8	0.0	0	6	0.0	3	10	23.1	3.635*	2	0.162	No
L. Ankle	0	5	0.0	0	4	0.0	1	10	9.1	0.861*	2	0.650	No
R. Ankle	0	3	0.0	0	3	0.0	0	9	0.0	-	-	-	-

*At least one cell has an expected count less than five.

The presence or absence of osteoarthritis in individuals buried during the Middle to Late Byzantine period was also examined for evidence of spatial patterns. The results of high/low cluster analyses for each joint appear in Table 8.65 below. The only joint for which the presence of osteoarthritis was found to be spatially clustered at a level of statistical significance was the left ankle. However, the number of individuals with affected left ankle joints (2) is extremely small and this result is due to the fact that those individuals happen to come from burials relatively close together south of the basilica. Especially given that no other joint (including the corresponding ankle joint) shows significant results, there is no broader significance to this pattern.

Table 8.65: Results of High/low Cluster Analyses of Osteoarthritis (OA) Presence by Joint among Middle to Late Byzantine Burials.

Joint	Two-tail <i>p</i>-value	<i>p</i> <0.05 Yes/ No	z-score
L. Shoulder	0.115	No	1.575
R. Shoulder	0.670	No	-0.426
L. Elbow	0.803	No	-0.250
R. Elbow	0.972	No	0.035
L. Wrist/Hand	0.475	No	0.714
R. Wrist/Hand	0.939	No	0.076
L. Hip	0.958	No	-0.052
R. Hip	0.772	No	-0.290
L. Knee	0.082	No	1.738
R. Knee	0.477	No	-0.711
L. Ankle/Foot	0.038	YES	2.076
R. Ankle/Foot	0.771	No	0.291

The figures for osteoarthritis were also compared by joint between individuals buried inside and outside of the basilica (Table 8.66). The differences for the presence and absence of that condition approach the $p < 0.05$ level of significance only for the left knee, which is affected more frequently in individuals buried outside of the basilica. However, in addition to this result being non-significant, the figures trend in the opposite direction when the corresponding knee is considered. These results provide no evidence for a relationship between the presence or absence of osteoarthritis and burial either within or outside of the basilica.

Table 8.66: Presence of Osteoarthritis (OA) Inside versus Outside of the Basilica.

OA	Inside			Outside						
Joint	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
L. Shoulder	3	7	30.0	6	22	21.4		1	0.673	No
R. Shoulder	7	5	58.3	10	20	33.3		1	0.174	No
L. Elbow	1	13	7.1	7	32	17.9		1	0.665	No
R. Elbow	4	16	20.0	10	29	25.6		1	0.753	No
L. Wrist/Hand	3	8	27.3	5	24	17.2		1	0.660	No
R. Wrist/Hand	2	8	20.0	6	24	20.0		1	1.000	No
L. Hip	4	7	36.4	12	28	30.0		1	0.723	No
R. Hip	3	9	25.0	10	23	30.3		1	1.000	No
L. Knee	3	11	21.4	18	19	48.6	3.107	1	0.078	No
R. Knee	6	3	66.7	14	27	34.1		1	0.130	No
L. Ankle/Foot	0	9	0.0	2	25	7.4		1	1.000	No
R. Ankle/Foot	2	9	18.2	1	27	3.6		1	0.187	No

*Empty cells indicate that Fisher's exact test was used instead of Pearson's chi-square test.

Antemortem Trauma

Due to the relatively small number of fractures affecting any given bone type and anatomical side, this analysis focuses on the spatial location of graves containing individuals with fractures rather than on the distribution of fractures by bone. The figures in this section also include the presence of fractures on less substantial skeletal elements (e.g., vertebrae, metacarpals) that were not considered in the trauma analysis presented in the skeletal analysis results chapter.

The spatial distribution of fractures among Early Christian graves that contained human remains is illustrated in Figures 8.40, 8.41, and 8.42. Graves containing individuals with fractures are not clustered in any particular area upon visual inspection and an absence of statistically significant clustering is confirmed through a high/low cluster analysis ($p = 0.411$, z-score = -0.822).

Figure 8.40: Spatial Distribution of Early Christian Temple Graves
Containing Individuals with Fractures.

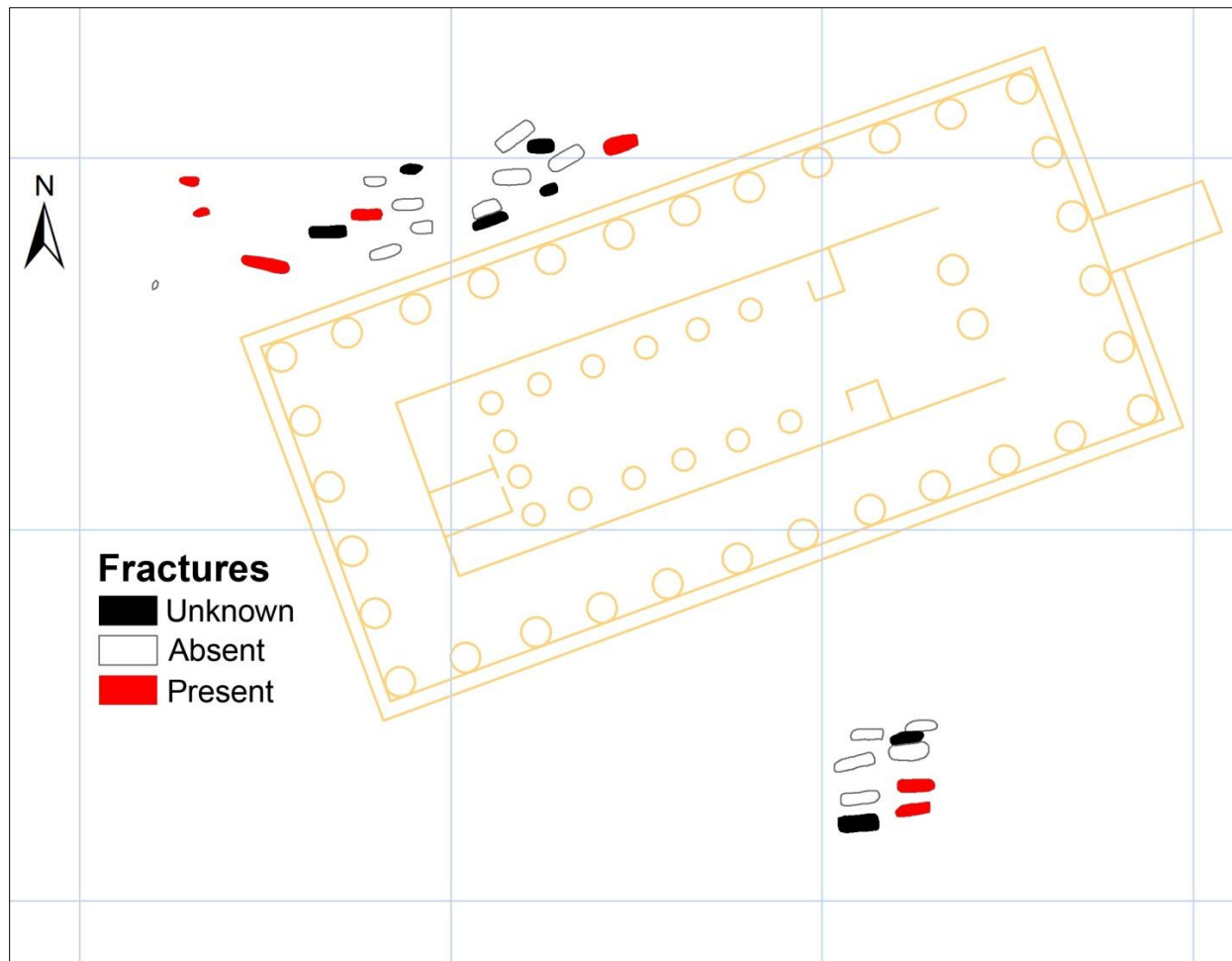
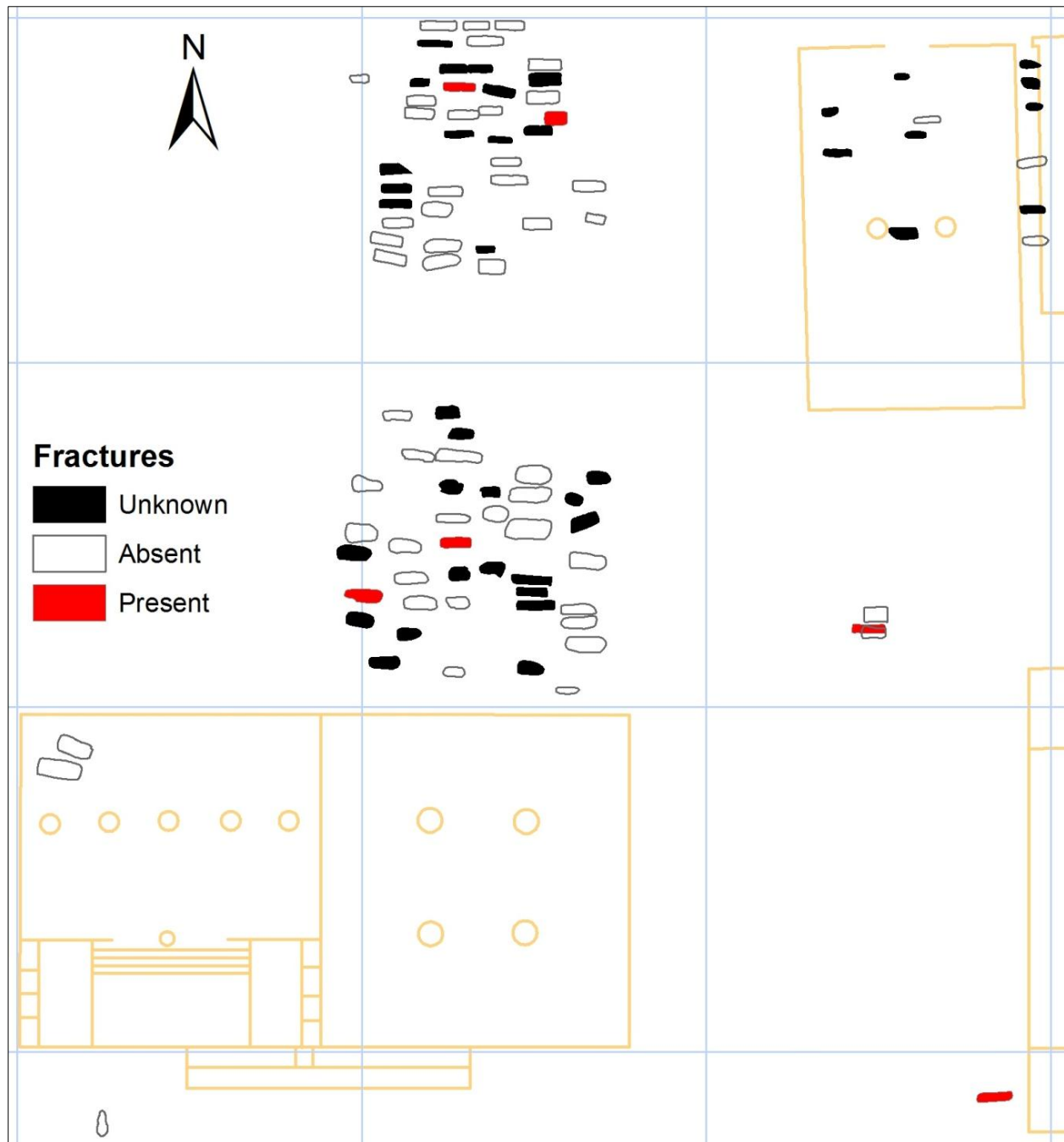
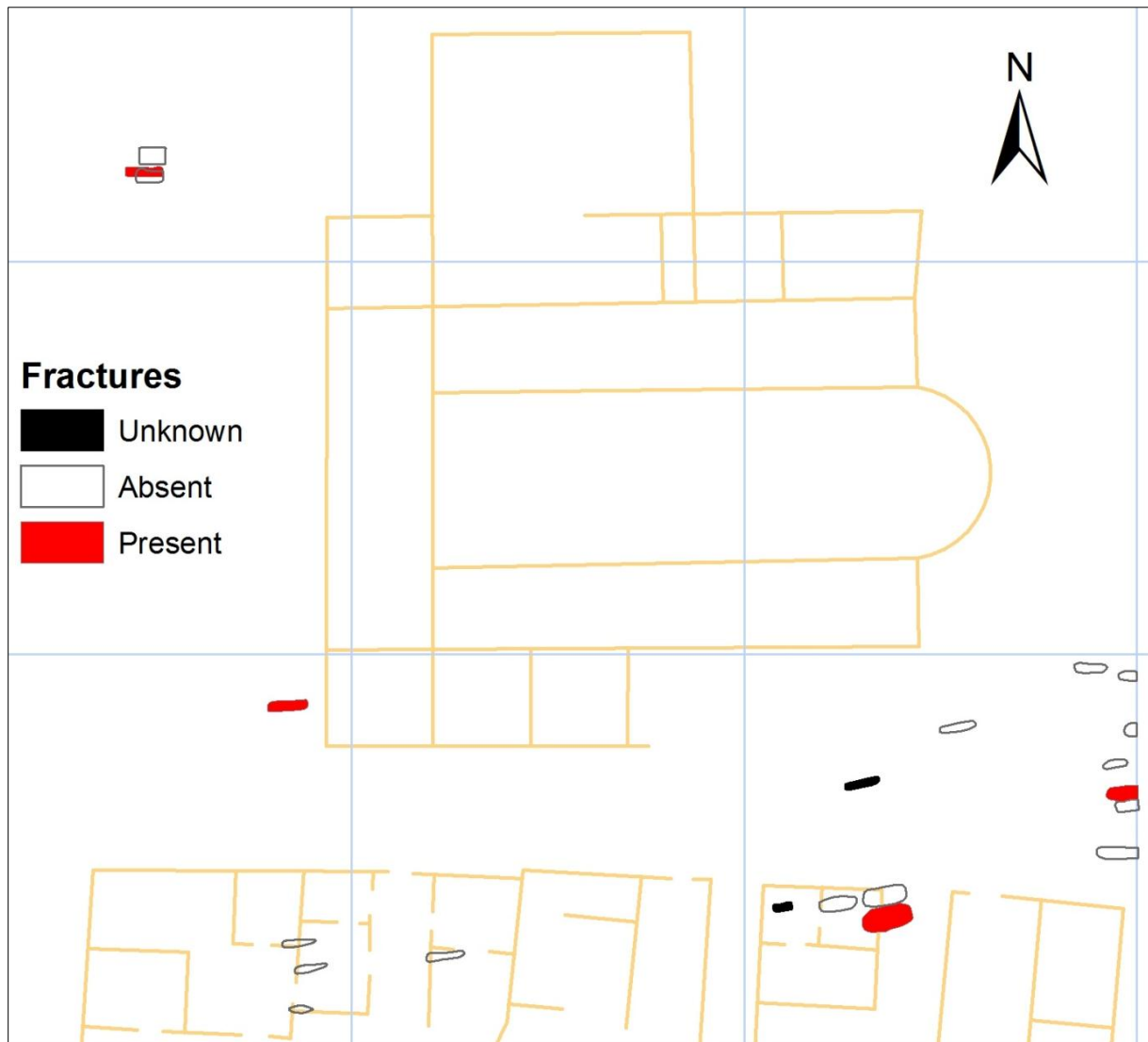


Figure 8.41: Spatial Distribution of Early Christian Bath Graves
Containing Individuals with Fractures.*



*Two graves associated with the basilica containing individuals exhibiting fractures are visible.

Figure 8.42: Spatial Distribution of Early Christian Basilica Graves Containing Individuals with Fractures.



When burial areas are compared against each other, the graves associated with the temple exhibit the greatest proportion of individuals affected by fractures (Table 8.67). Fewer graves associated with the basilica contained individuals with fractures and only a small proportion of individuals buried in graves adjacent to the bath exhibited fractures. While a chi-square test shows that the differences in the presence and absence of fractures between burial areas is statistically significant, the expected cell sizes require that those areas are compared using Fisher's exact test.

Table 8.67: Spatial Distribution of Early Christian Graves Containing Individuals with Fractures.

Temple			Bath			Basilica						
Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
7	14	33.3	5	54	8.5	4	15	21.1	7.478*	2	0.024	YES

*At least one cell has an expected count less than five.

The figures for the temple and basilica burials, which are fewer in number, are relatively similar and Fisher's exact test shows that the differences between those two areas are not statistically significant (Table 8.68).

Table 8.68: Comparison of Fractures between Temple and Basilica Burials.

Temple			Basilica								
Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No		
7	14	33.3	4	15	21.1		1	0.488	No		

*Empty cell indicates that Fisher's exact test was used instead of Pearson's chi-square test.

Similarly, no significant differences are found when the frequencies of graves containing individuals with fractures are compared between the areas of the bath and the basilica (Table 8.69).

Table 8.69: Comparison of Fractures between Bath and Basilica Burials.

Bath			Basilica								
Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No		
5	54	8.5	4	15	21.1		1	0.210	No		

*Empty cell indicates that Fisher's exact test was used instead of Pearson's chi-square test.

The only comparison for which significant differences were revealed included the areas of the temple and the bath (Table 8.70). In this case, the proportion of temple burials containing individuals with fractures is much greater than that of bath burials.

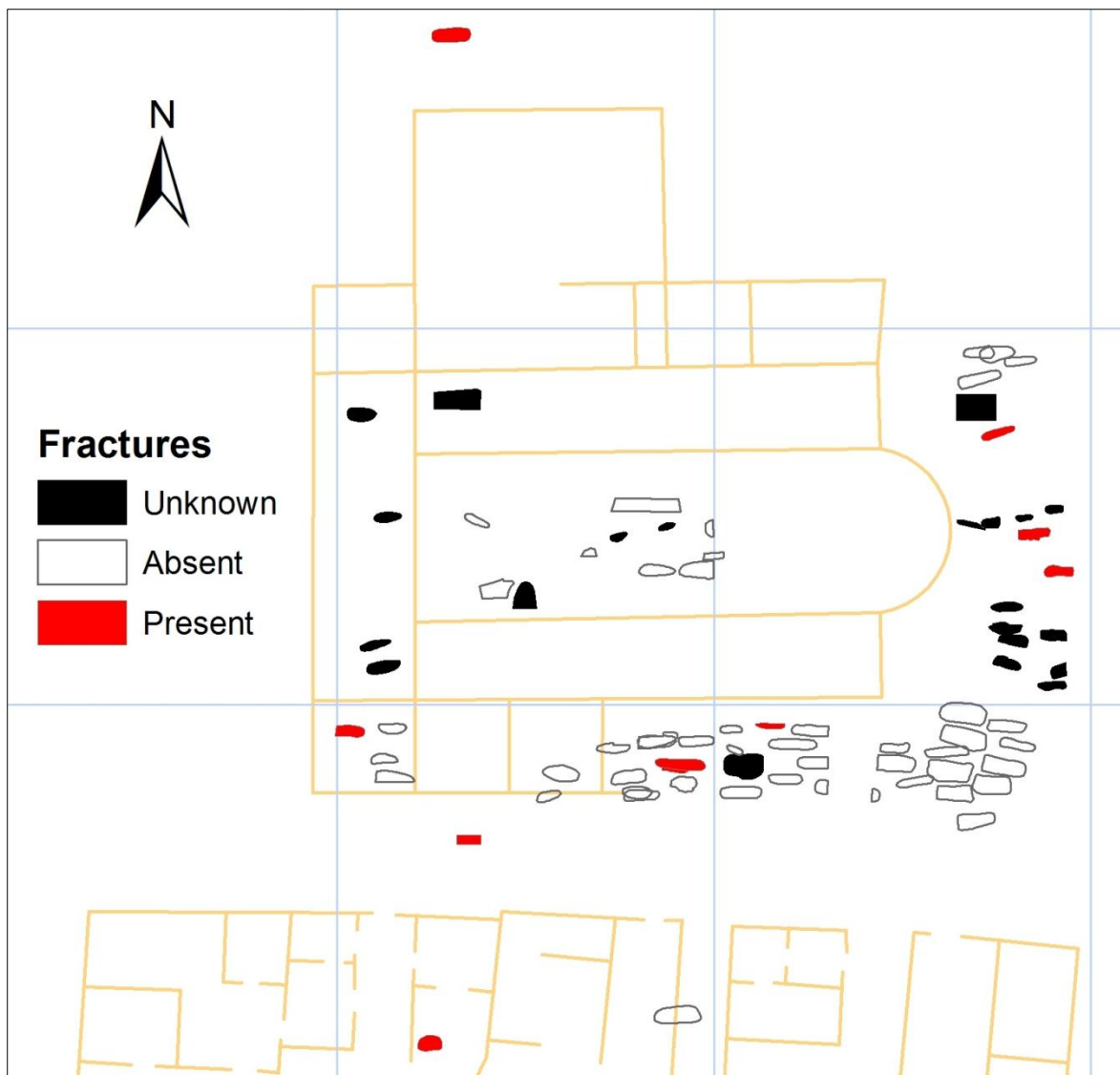
Table 8.70: Comparison of Fractures between Temple and Bath Burials.

Temple			Bath								
Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No		
7	14	33.3	5	54	8.5		1	0.011	YES		

*Empty cell indicates that Fisher's exact test was used instead of Pearson's chi-square test.

Among Middle to Late Byzantine burials, graves containing individuals with fractures show a tendency to be located around the margins of the basilica as opposed to inside of the structure (Figure 8.43). Those graves are located to the north, south, and east of the basilica and a high/low cluster analysis demonstrates that they are not clustered in space to a greater degree than would be expected by chance ($p = 0.263$, $z\text{-score} = -1.120$).

Figure 8.43: Spatial Distribution of Middle to Late Byzantine Graves Containing Individuals with Fractures.



The frequencies of Middle to Late Byzantine graves containing individuals with and without fractures are presented by location in Table 8.71. Although a larger proportion of graves

outside of the basilica contained individuals exhibiting fractures, Fisher's exact test demonstrates that there is no statistically significant relationship between grave location with respect to the basilica and the presence or absence of fractures.

Table 8.71: Presence of Fractures in Graves Inside versus Outside of the Basilica.

Inside			Outside						
Pr (n)	Ab (n)	%	Pr (n)	Ab (n)	%	χ^2	df	Two-tail p-value	p < 0.05 Yes/ No
1	12	7.7	11	36	23.4		1	0.433	No

*Empty cell indicates that Fisher's exact test was used instead of Pearson's chi-square test.

Summary of Significant Results Pertinent to Hypothesis Three

One of the goals of this research is to examine patterns in the mortuary space of Nemea for indications that burial location may have been determined by or was at least related to social differentiation. If differences in social status contributed to health disparities and were a factor in decisions about where a deceased individual was buried, then this might be reflected in patterns of skeletal stress when groups of individuals from different burial areas are compared against each other. With this in mind, the results presented above in the second section of this chapter are used to test the third hypothesis launched in this dissertation:

Hypothesis 3: There will be significant differences in the prevalence rates of physiological stress indicators between groups of individuals based on grave location.

In some cases, significant results were found when the frequencies of the presence and absence of a particular physiological stress indicator were compared between subgroups of burials for which sample sizes were small enough to violate the assumptions of the chi-square test (expected cell counts less than five). Such results are not included here. The summary that

follows contains only significant results produced using a statistically valid test, such as Fisher's exact test in the cases of small subsamples.

The results of this analysis, which integrates the osteological and archaeological datasets, revealed very few significant differences between burial subgroups. Furthermore, there is variation in the extent to which those differences can be taken as meaningful and indicative of broader patterns of physiological stress and, by extension, spatial organization of the mortuary space based on social differentiation. The significant results are summarized in Table 8.72.

Table 8.72: Summary of Statistically Significant Results Pertinent to Hypothesis Three.

Period	Paleopathological Condition	Significant Result ($p < 0.05$) (frequencies differ from those expected by chance)
Early Christian	Antemortem Trauma	Fractures are more common in burials associated with the temple when compared to those associated with the bath.
Middle to Late Byzantine	Cribra Orbitalia	Spatial clustering of the presence of cribra orbitalia.
Middle to Late Byzantine	Osteoarthritis	Spatial clustering of the presence of osteoarthritis on the left ankle joint.

The differences between Early Christian burials associated with the temple and those associated with the bath in the frequency with which they contained individuals exhibiting fractures are of interest because temple burials do occupy a noteworthy spatial location—lying adjacent to pagan monumental architecture and simultaneously at the greatest distance from the Early Christian basilica of all burial areas. Despite the relatively small size of the temple burial subsample, it is possible that the results for antemortem trauma have significance for cemetery organization and this will be discussed in greater detail in Chapter Nine.

The implications of the significant result for the spatial clustering of the presence of cribra orbitalia among Middle to Late Byzantine burials are less clear. If the presence of cribra orbitalia is truly clustered in space, it is concentrated primarily in burials located outside of the basilica along its south wall and adjacent to the southeast corner. As discussed previously,

however, an alternative interpretation that must be considered is that this pattern is the result of the large number of individuals not included in the high/low cluster analysis due to the absence of observable eye orbits.

Finally, and also as discussed in the previous section, the significant result for the spatial clustering of the presence of osteoarthritis on the left ankle joint among Middle to Late Byzantine burials can be dismissed as an artifact of a very small subsample of observable bones recovered from graves in close proximity to one another.

Summary

This chapter had two main foci—each one using osteological and archaeological data in conjunction: (1) an examination of the relationships between attributes of the graves at Nemea and the individuals buried within them and (2) an exploration of the spatial organization of the graves and the prevalence of physiological stress indicators in the human skeletal remains they contained. While Hypothesis Three, which anticipates differences between burial areas in the prevalence rates of physiological stress indicators, cannot be completely rejected, it is certainly not strongly supported. Instead, the results of the bioarchaeological analysis demonstrate that the presence and absence of skeletal stress markers are in large part randomly distributed across the mortuary space. At the same time, the results presented in this chapter have identified important examples of variability in the mortuary space at Nemea and the interpretation of those patterns is one of the principal foci of Chapter Nine. In Chapter Nine I also review the results of the skeletal analysis and discuss their implications for health and living conditions in the Early Christian and Middle to Late Byzantine communities at Nemea.

CHAPTER 9: DISCUSSION

At the outset of this dissertation I introduced four principal goals. The first three were carried out using a comparative analysis of prevalence rates of skeletal indicators of physiological stress and activity. They are as follows: (1) to investigate the possibility that living conditions deteriorated at Nemea during the Middle to Late Byzantine period; (2) to investigate the possibility of differences in life experiences between men and women through the identification of health disparities between males and females; and (3) to provide a broader perspective on the health status of the Nemea communities using data on physiological stress from additional skeletal samples in the region. The fourth goal, an exploration of the possibility that the organization of the burials at Nemea was based on status distinctions, was met using an approach that combined a spatial analysis of the graves with comparative assessments of prevalence rates and spatial distributions of physiological stress indicators. With these goals in mind, I now reexamine and interpret the results of the skeletal and mortuary analyses presented in Chapters Seven and Eight.

This chapter is divided into two major sections. The implications of the results of the skeletal analysis are treated first. Within this section, I draw upon the paleodemographic profiles and the results of the paleopathological analysis of the Early Christian and Middle to Late Byzantine skeletal samples to reconstruct aspects of health and living conditions in each community at Nemea. The results of the tests of the first two hypotheses related to skeletal health posed in the dissertation are subsequently addressed in turn. Finally, the implications for health in a regional context are considered. The second section of the chapter is devoted to the results of the mortuary analysis. Here I use patterns of grave attributes identified in Chapter Eight together with the data on demography and skeletal stress to reconstruct aspects of burial practice in each

period at Nemea. Particular emphasis is placed on the results of the test of the third dissertation hypothesis and alternative explanations for the organization of burials at Early Christian and Middle to Late Byzantine Nemea.

Reconstructing Health and Living Conditions at Byzantine Nemea

Before addressing the first two hypotheses posed in this dissertation, it is useful to discuss in a general way the implications of the results of the skeletal analysis for each community at Nemea and whether or not those results are consistent with the historical narratives and expectations presented in earlier chapters.

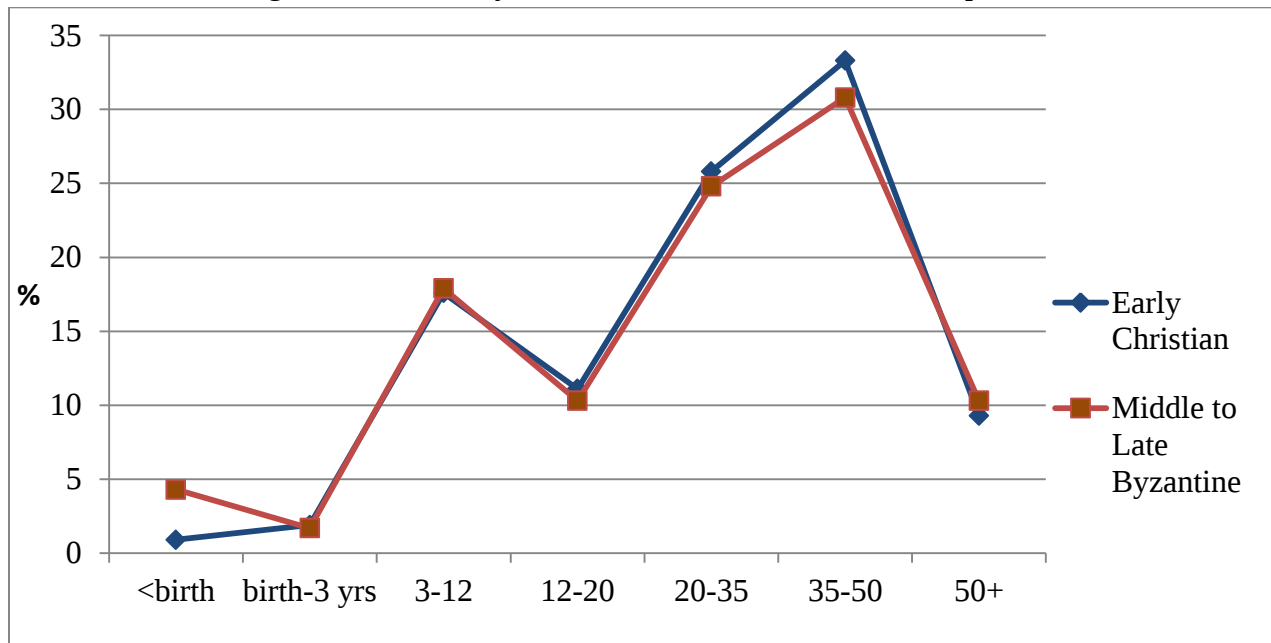
To review briefly, Greece was characterized by changing political and social landscapes as the Byzantine East took shape during Late Antiquity. But while early Byzantine communities experienced transformation on a large scale, there is also substantial archaeological evidence for the continuity of classical cultural traditions in Greece during this period (Gregory 1984, 1986; Kardulias 1995; Rothaus 2002). This was perhaps especially true in rural areas. Furthermore, although traditional narratives paint the picture of a late antique Greek countryside devastated by events such as the Slavic invasion, recent examinations of written sources and archaeological survey data (e.g., Curta 2001b; Pettegrew 2010) suggest that other interpretations are possible. Adding to this evidence, the state of the Early Christian community at Nemea suggested by the archaeology of the site is one of relative prosperity up until the abandonment of the site in the late 6th century AD.

Rural Byzantine communities of the 12th-13th centuries AD also existed during a period characterized by substantial sociopolitical transformation. While settlement patterns identified by archaeological surveys suggest that the southern Greek countryside experienced economic and

demographic expansion during the 12th century (Athanasopoulos 1993, 1997, 2010), this growth occurred against a background of increasingly strained relationships between the central and provincial administrations (Herrin 1975, 1985; Ilieva 1991). It also took place on the eve of an invasion by western powers that resulted in the rapid dismantling of the territory of the empire. At the very least, the Frankish invasion of the Peloponnese had the potential to increase levels of psychosocial stress through a real or perceived decrease in security. It is also possible that the establishment of a feudal system in the newly formed Principality of Achaia made life more physically demanding as workload increased to meet obligations to local landowners.

The results of the skeletal analysis carried out in this research provide more support for the revised narrative of late antique Greece in which conditions in the countryside were more or less favorable. What was unanticipated is the extent to which the results suggest that conditions were similar during the Middle to Late Byzantine period. The evidence from paleodemography is instructive in this regard. While the composition of a skeletal sample cannot be understood as representative of a living population because of factors such as differential preservation and variability in burial practices, the demographic profile nevertheless serves as an important means of evaluating living conditions in the past (Roberts and Manchester 2005). Figure 9.1 shows the percentage of the total number of individuals in each phase at Nemea that could be placed into each age category suggested by Buikstra and Ubelaker (1994). As presented in Chapter Seven, the mortality curves of the Early Christian and Middle to Late Byzantine skeletal samples are nearly identical.

Figure 9.1: Mortality Curves of the Nemea Skeletal Samples.



Leaving aside momentarily the underrepresentation of very young individuals, the figures for each sample are consistent with those of a preindustrial society in which life expectancy is not high. For example, Bourbou's (2010) survey of skeletal samples from Early Byzantine Crete found that mortality was high during the childhood years, fell during the teenage years, and reached another peak in adults between the ages of 30-34. Average ages at death calculated by Bourbou (2004) for Early Byzantine Crete are between 40-45 years for men and 30-35 years for women. Similarly, Rautman (2006) has suggested more generally that the average life span in the Byzantine Empire was probably around 35-40 years. As reported in Chapter Seven, most individuals recovered from Nemea had reached adulthood by the time of their death.²² That the largest proportion of those individuals died between the ages of 35 and 50 with relatively few living beyond that age is unremarkable and it does not follow that living conditions in either period were exceedingly harsh.

²² Adults make up 69.9% (79/113) of the Early Christian sample and 72.6% (106/146) of the Middle to Late Byzantine sample.

The data on age at death do suggest that childhood may have been a perilous life stage during both periods at Nemea. While very few individuals represented in this sample died as infants or neonates, this seems likely to be related to factors such as differential preservation or perhaps a preference for burying infants and young children in an as yet unexcavated area. For example, the slightly greater proportion of represented individuals who died either as neonates or prior to birth in the Middle to Late Byzantine sample can probably be attributed to the superior preservation of the skeletal material. The expectation of a greater number of individuals in the fetal and infant age groups is due mainly to the fact that infant mortality rates in Byzantine society were probably quite high (Bourbou 2010; Talbot 1997, 2009; Tritsaroli and Valentin 2008). It is possible then, that the sharp increase in the proportion of individuals who died between the ages of three and twelve is artificial—the proportion of individuals in the fetal and infant age categories could in reality also have been large. What is clear is that a substantial proportion of individuals died as children. This pattern can be explained in part by stresses related to weaning.

The transition from breastfeeding to solid food was precarious in ancient societies. The health status of a child during this process depended upon a number of factors including the nutritional status of the mother, the quality of the weaning diet, and the possibility of nutrient malabsorption associated with diarrheal disease resulting from infections (Walker et al. 2009). Using both written evidence and data on bone stable isotope ratios, Bourbou and Garvie-Lok (2009) have suggested that weaning in Byzantine Greece was typically complete by the fourth year of life. Among the Early Christian and Middle to Late Byzantine individuals from Nemea placed into the “child” category, 26.3% (5/19) and 23.8% (5/21) respectively had age-at-death estimates of around three or four. In those cases, problems related to weaning are a likely

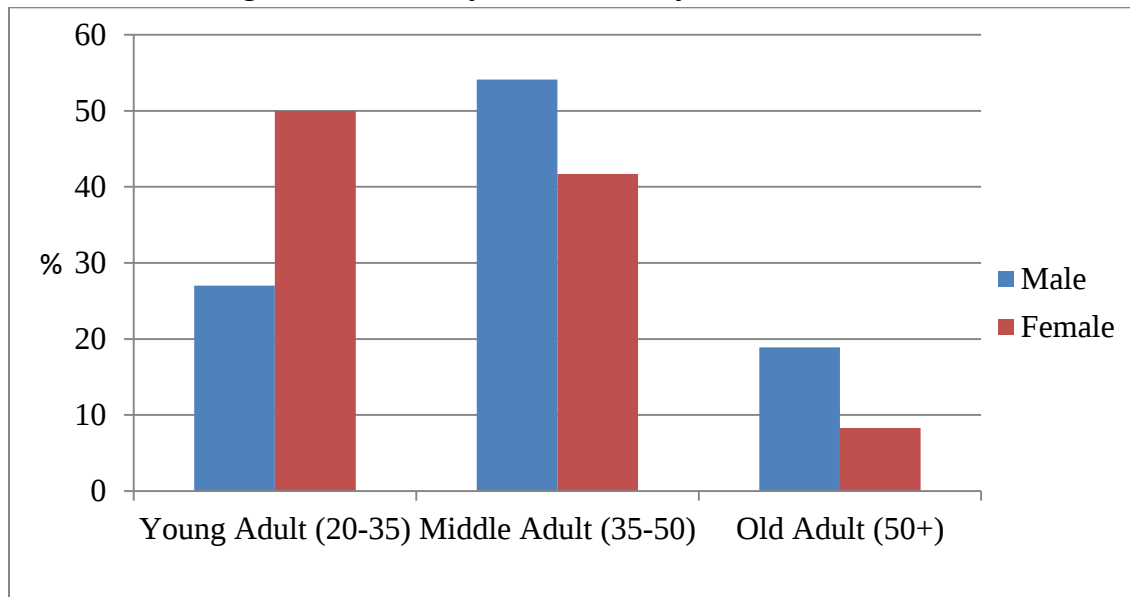
explanation for non-survival. However, the estimated ages at death of the remaining individuals ranged from around six to around eleven. The majority of childhood deaths at Nemea, then, cannot be directly related to weaning stress. The evidence from the analysis of skeletal paleopathologies, which is discussed below, sheds additional light on childhood mortality in each period.

The final point to underscore related to the mortality curve in Figure 9.1 concerns the decrease in the number of individuals who died as adolescents when compared with the child group. This pattern too suggests that surviving childhood was significant—for individuals healthy enough to do so, the risk of death declined during adolescence and the chances of reaching adulthood were good.

While subsample sizes are somewhat small, it is of interest that the combined data on age and sex at Nemea lend support to the assertion that Byzantine women faced greater health hazards than men and thus had shorter life expectancies (Bourbou 2010; Rautman 2006; Talbot 1997). When mortality rates are compared by sex in each period, it is apparent that a much larger proportion of females than males died during young adulthood (Figures 9.2 and 9.3). In the Early Christian sample, the pattern shifts with advancing age: males reached middle and older adulthood more frequently than females. The tendency for males to outlive females may have been even more dramatic in the Middle to Late Byzantine period. More than 50 percent of females in that sample died as young adults and all remaining females died as middle adults—no females had estimated ages at death of 50 years or more. These figures are in agreement with suggestions that the average life span for women in Byzantine Greece was probably around 30-35 years and that men lived longer than women by an average of 5 to 6 years (Bourbou 2004; Rautman 2006).

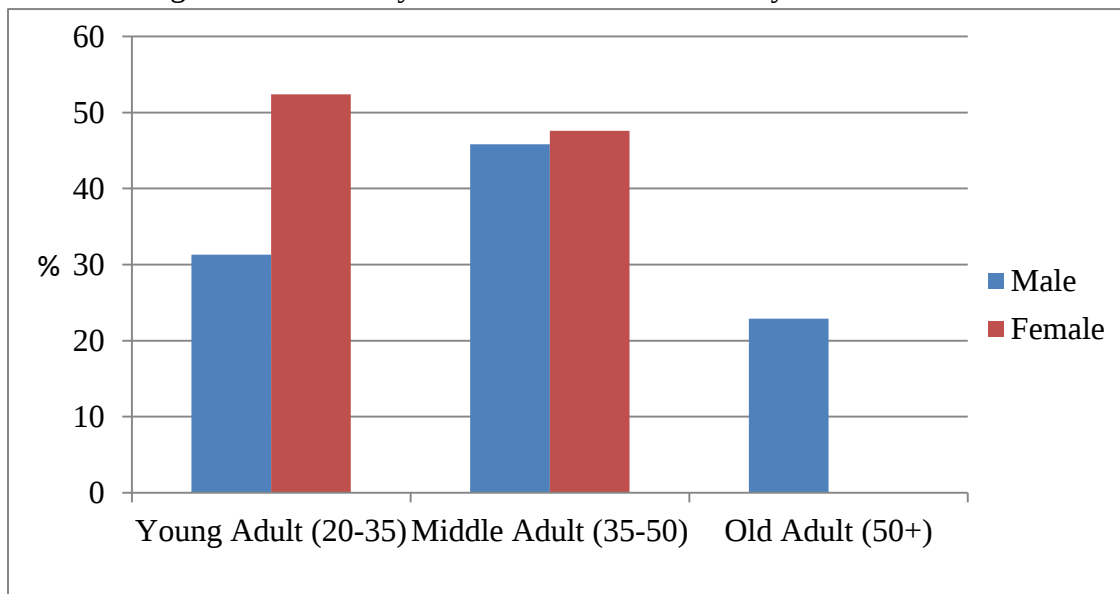
Late Antique and Byzantine historians often point out that childbirth was a significant risk for women and probably one of the main reasons for which many women died during the childbearing years (Clark 1993; Connor 2004; Rautman 2006; Talbot 1997). Although hospitals and charitable institutions with specialized female wards existed in the Byzantine Empire perhaps as early as the 5th century AD (Miller 1997), most deliveries took place at home with the assistance of a midwife and family members (Rautman 2006; Talbot 1997). Given the substantial proportion of females who died during young adulthood in both periods at Nemea, it seems possible that complications during pregnancy and childbirth (e.g., miscarriages, abnormal presentation, postpartum infections and hemorrhages) were common and that access to forms of medical intervention such as hospitalization or surgery was limited or nonexistent. However, other factors associated with gendered expectations of behavior in Byzantium could have contributed to the sex-based differences in mortality patterns identified here. Additional evidence for health disparities between men and women at Nemea and their implications are discussed below.

Figure 9.2: Mortality Profile of Early Christian Adults.*



*Includes adults who could be placed into one of the age categories recommended by Buikstra and Ubelaker (1994).

Figure 9.3: Mortality Profile of Middle to Late Byzantine Adults.*



*Includes adults who could be placed into one of the age categories recommended by Buikstra and Ubelaker (1994).

If the demographic patterns of the Early Christian and Middle to Late Byzantine skeletal samples are suggestive of relatively high levels of childhood stress in an otherwise stable community, then the results of the analysis of physiological stress indicators are in agreement.

The prevalence rates of linear enamel hypoplasias and cribra orbitalia help illustrate this interpretation. Hypoplastic anterior teeth were common in both adults and subadults in each sample. When the mandibular canines are considered, for example, prevalence rates in the Early Christian sample range from 70.6 percent to 73.3 percent in subadults and from 65 percent to 76.3 percent in adults (Figure 9.4). In the Middle to Late Byzantine sample, prevalence rates range from 70 percent to 77 percent in adults, while all observable mandibular canines from subadults were affected (Figure 9.5).²³

The high frequency of hypoplastic teeth demonstrates that early childhood at Nemea was often characterized by episodes of acute stress that were significant enough to temporarily interrupt normal enamel formation. As discussed in Chapter Two, deficiencies of enamel thickness have been linked to a large number of conditions included under broad categories such as nutritional deficiencies, diarrheal disease, and infections (Hillson 1992, 1996; Roberts and Manchester 2005). While it is not possible to attribute the enamel hypoplasias observed in this research to any specific etiology, other physiological stress indicators provide general clues. Importantly, there were no statistically significant differences between subadults and adults in the prevalence of linear enamel defects, which suggests that individuals who suffered from acute conditions during childhood were not necessarily less likely to survive to reach adulthood.

By contrast, subadults in each phase were found to exhibit cribra orbitalia much more frequently than adults—a difference that was statistically significant in the Early Christian sample (Figure 9.4). On the one hand, this finding is unsurprising. Cribra orbitalia is more closely associated with physiological stress (often related to nutritional status) experienced

²³ Unfortunately, the subsample sizes for subadult teeth in the Middle to Late Byzantine period are quite small (see Table 7.32 in Chapter Seven). The prevalence rate of 100% for the mandibular canines is a product of sampling bias.

during childhood because “active” lesions appear most often in subadults. While the reason is still unclear, this pattern is perhaps due to age-related changes in the locus of red blood cell production or to the ease with which orbital roof hematomas may result from a more loosely attached periosteum (Walker et al. 2009). On the other hand, when considering cribra orbitalia in terms of its presence or absence as opposed to active versus healed lesions, the differences between adults and subadults may have great meaning.

The debate concerning the etiology of orbital lesions is ongoing and, as discussed in Chapter Two, conditions such as scurvy (vitamin C deficiency), which can lead to subperiosteal hematomas in the orbits, have been discussed as likely causal agents. Coupled with the comparatively low levels of porotic hyperostosis, a condition that has recently been more closely associated with anemia of either hemolytic or megaloblastic origin (Walker et al. 2009), scurvy is a possibility that should be strongly considered as an explanation for the prevalence of cribra orbitalia among subadults at Nemea. In fact, juvenile scurvy has been tentatively identified in Late Roman and Frankish remains from the valley of Styμφalos, located west of Nemea, based on radiographic criteria (Stark and Garvie-Lok 2012). A confident diagnosis in the present research, however, is precluded by the absence of additional lesions characterized by abnormal porosity. Scurvy may result in porous, abnormal bone formation secondary to ruptured, weakened blood vessels in a number of areas of the skeleton including the greater wing of the sphenoid, the hard palate, the medial aspect of the mandibular ramus, and the supraspinous and infraspinous fossae of the scapula (Brickley and Ives 2008; Brown and Ortner 2011). While the preservation of the cortical bone surfaces in the Early Christian sample is often less than ideal, that pattern of lesion distribution was not observed in the analysis of the subadult material from either period.

Despite the infrequent occurrence of porotic hyperostosis in this sample, it is possible that the orbital lesions in question are associated with anemia. Walker et al. (2009) have demonstrated that diets deficient in vitamin B₁₂ and/or folic acid can lead to megaloblastic anemia, which is capable of producing cribra orbitalia as a result of marrow hypertrophy. This scenario is plausible in the case of Nemea as goat's milk, which was likely a common component of the diets of young Byzantine children, contains little folic acid (Bourbou and Garvie-Lok 2009). Later in life, a diet based on grain and containing few animal products in addition to milk could have a similar outcome. Recent evidence from the analysis of bone stable isotope ratios from a number of sites including Nemea suggests that this type of diet was characteristic of Byzantine Greek communities (Bourbou et al. 2011; Garvie-Lok 2001).

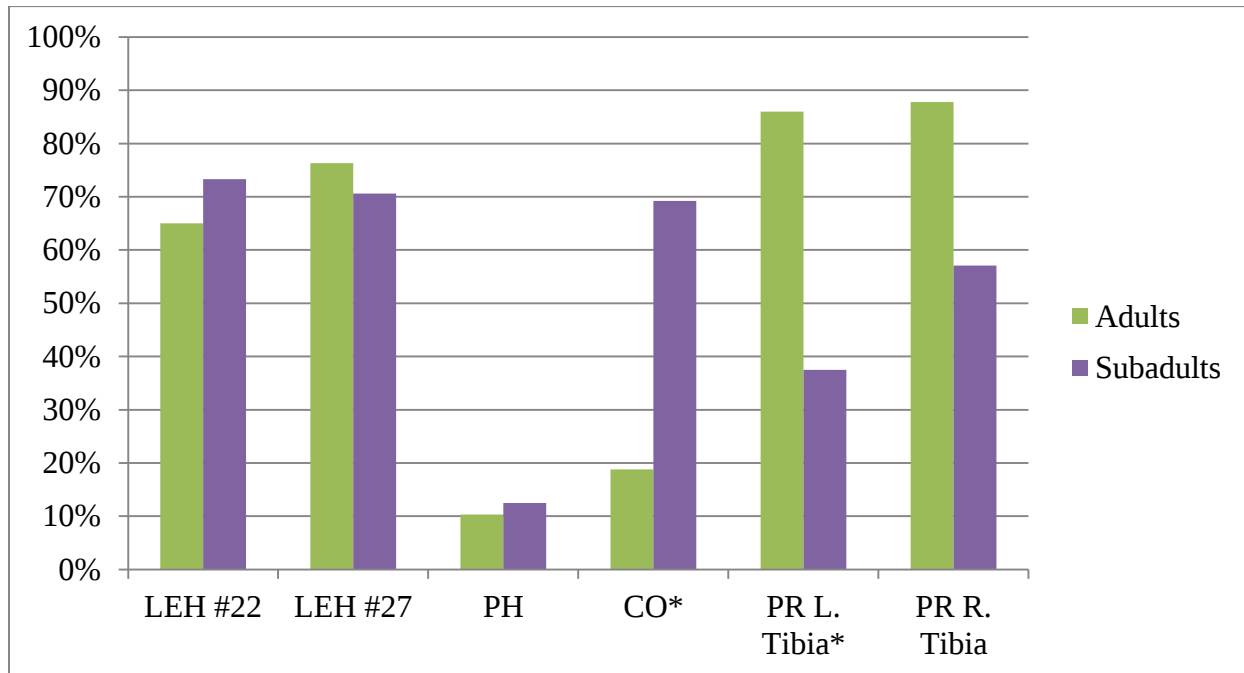
Finally, the possibility of the presence of genetic anemia cannot be eliminated. Hereditary hemolytic anemias, such as sickle cell anemia and thalassemia, also figure prominently among the potential causes of porotic hyperostosis and cribra orbitalia (Walker et al. 2006). Examples of severe porotic hyperostosis at Frankish Corinth have been attributed to thalassemia by Barnes (2003), and at least one adult individual from Early Christian Nemea exhibits extreme thickening (up to 15.4 mm) of the diploë that could be associated with the condition. This is especially interesting given the possibility that the Nemea Valley has in the past become malarial when improperly drained (Wright et al. 1990). The genes for thalassemia continue to exist in Greece today, presumably retained as an adaptation to conditions of endemic malaria. Unfortunately, the individual exhibiting diploic expansion at Nemea is represented only by a fragmentary cranium and two teeth. The facial bones, which typically show evidence of expansion in thalassemia (Lagia et al. 2007), are largely missing. Because no additional individuals exhibit signs of

thalassemia, there is much stronger support for the argument of acquired anemia at Nemea.²⁴ It is even possible that the chronic anemia of malaria may by itself lead to porotic cranial lesions (Barnes 2003).

Whether the ultimate cause was related to dietary insufficiency or problems with absorption due to diarrheal disease or parasitic infection, it seems to have been common for subadults at Nemea to suffer from chronic nutritional deficiencies severe enough to be manifest as cribra orbitalia. It is important to note that the lesions exhibited by many of the subadults were active at the time of death. This was especially true in the Early Christian sample. The fact that so many of the affected individuals died as subadults suggests that nutritional status was a critical determinant of one's chances of surviving to adulthood in each period.

²⁴ Other skeletal manifestations of thalassemia include diffuse marrow hyperplasia and osteopenia, enlarged nutrient foramina, and anomalies in growth and epiphyseal union (Hershkovitz et al. 1991; Lagia et al. 2007; Ortner 2003; Tayles 1996).

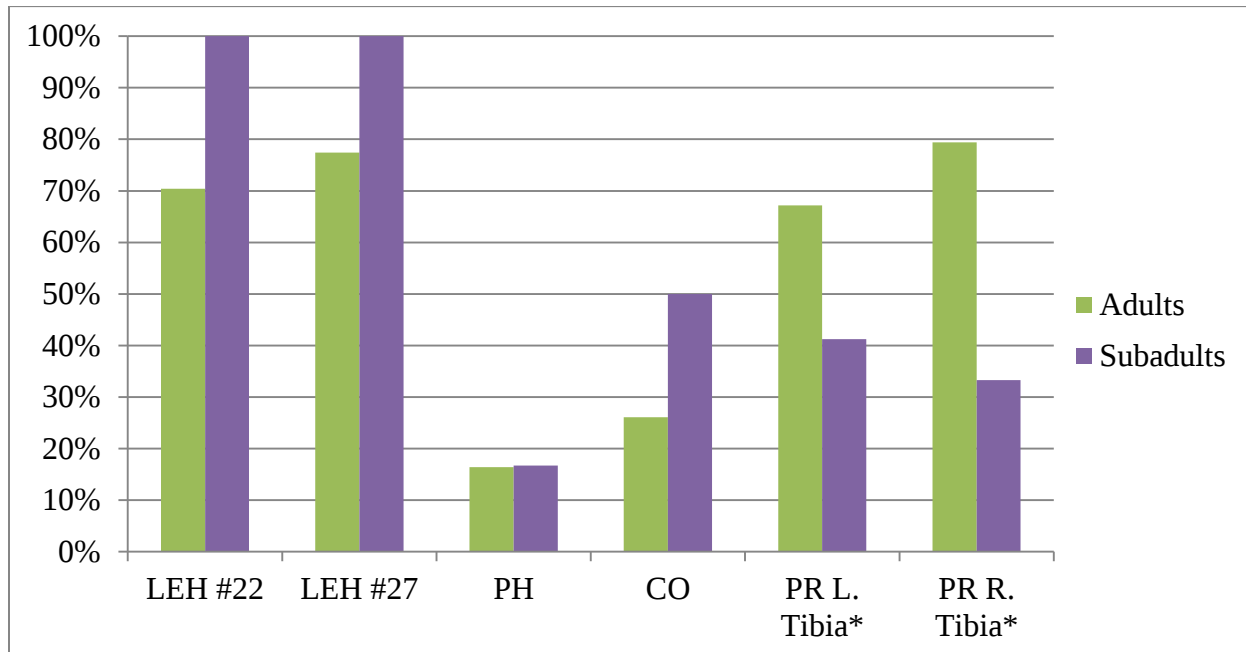
Figure 9.4: Prevalence Rates of Physiological Stress Indicators in Early Christian Adults and Subadults.



LEH = linear enamel hypoplasia, PH = porotic hyperostosis, CO = cribra orbitalia, PR = periosteal reaction.

*Difference is statistically significant.

Figure 9.5: Prevalence Rates of Physiological Stress Indicators in Middle to Late Byzantine Adults and Subadults.



LEH = linear enamel hypoplasia, PH = porotic hyperostosis, CO = cribra orbitalia, PR = periosteal reaction.

*Difference is statistically significant.

The results for periosteal reactions may support the notion of a relatively pathogenic environment at both Early Christian and Middle to Late Byzantine Nemea—one interpretation of the data on linear enamel hypoplasias. High prevalence rates of periosteal reactions were noted in both adults and subadults, although they were far more common in the former with the difference reaching statistical significance in the case of the left tibia in the Early Christian sample (Figure 9.4) and both the left and right tibiae in the Middle to Late Byzantine sample (Figure 9.5). As was noted in Chapter Seven, while periosteal reactions were extremely common in each sample, the vast majority of them were scored as “markedly accentuated longitudinal striations,” the mildest form of expression on the scale suggested by Steckel et al. (2006). An example of this lesion type is shown in Figure 9.6 below. Furthermore, most lesions were characterized by sclerotic bone, meaning that they were healed at the time of death. The minimal expression and the extent of healing of the periosteal reactions observed in these samples

together suggest that if they were caused by frequent infections, then those infections did not typically exceed the capacity for biological resistance of most individuals in the community.

Figure 9.6: Accentuated Striations on the Medial Aspect of the Left Tibia Near Midshaft. SK 066. Scale in Photographic Image Cannot be Enlarged.



It is important to keep in mind, however, that periosteal reactions may be caused by a number of conditions unrelated to infection (Ortner 2003; Weston 2008). Scurvy is one example that has already been discussed. In adults, subperiosteal hemorrhages caused by vitamin C deficiency can produce areas of irregular bone deposition on the joint surfaces and shafts of long bones (Maat 2004). In fact, the tibia may be particularly predisposed to abnormal bone formation in scurvy because it is a weight bearing bone and because it has limited overlying soft tissue protection (Garvie-Lok 2010; Maat 2004; Van der Merwe et al. 2010). It is certainly possible, then, that some of the subperiosteal bone deposition observable in these samples can be attributed to scurvy. Other possibilities need to be considered, however, as it seems very unlikely that greater than 80 percent of Early Christian adults and greater than 65 percent of Middle to

Late Byzantine adults suffered from chronic vitamin C deficiency. Even if the diet at Nemea was in both periods largely dependent on grain and supplemented with a minimal amount of animal products, the latter may have contained enough vitamin C to prevent symptoms of deficiency (Brickley and Ives 2008).

Another explanation for the extremely high prevalence rates of periosteal reactions in the Early Christian sample is repeated minor trauma (Ortner 2003; Roberts and Manchester 2005). Weston (2008:49) has recently pointed out that even relatively subtle forces—“anything that breaks, tears, stretches, or even touches the periosteum,”—can stimulate the subperiosteal deposition of new bone. Studies of skeletal trauma in past communities have demonstrated that intensive agriculture was a hazardous activity (Judd and Roberts 1999; Lovell 1997), and the archaeological evidence discussed in Chapter Three leaves little doubt as to the agricultural character of the Early Christian community at Nemea. Repeated minor injuries to the lower limbs could have been produced by myriad sources such as accidents using foot-operated plows or other implements, working in close proximity to potentially dangerous animals, or falls on uneven terrain (Judd and Roberts 1999; Rautman 2006). Scurvy, if present, could have increased the chances of new bone formation subsequent to minor trauma because individuals with vitamin C deficiencies would have been more susceptible to subperiosteal hemorrhaging. Once vitamin C was reintroduced into the diet those hemorrhages would ossify, forming plaques of bone (Van der Merwe et al. 2010). If most individuals at Nemea were participating in arduous agricultural labor, then the widespread presence of mild periosteal reactions on the tibiae should perhaps come as no surprise.

The results for osteoarthritis and antemortem trauma are certainly suggestive of general participation in physically demanding and potentially dangerous activities. For example, while

the prevalence rates of osteoarthritis among adults are either low or moderate for most joints, all joints examined in the Nemea samples show at least some evidence of degenerative changes.

That the shoulder and hip were the most frequently affected joints in the Early Christian sample and were among those most frequently affected in the Middle to Late Byzantine sample is an interesting finding. Jurmain (1991) has argued that alterations to those joints are highly correlated with advanced age. However, the fact that most adults died as young or middle aged adults suggests that mechanical stress played a substantial role in the development of osteoarthritis at Nemea. It has also been suggested that participation in strenuous activity from an early age is an important factor in the appearance of osteoarthritis (Weiss and Jurmain 2007). Historical evidence indicates that it was common for poorer individuals in the Byzantine countryside to be engaged in agricultural work while still children (Kazhdan 1997; Rautman 2006; Tritsaroli and Valentin 2008). Especially given that osteoarthritis of the shoulder joint is uncommon in modern clinical settings (Waldron 2009) and that high prevalence rates of hip osteoarthritis have been associated with participation in farming (Larsen 1997; Weiss and Jurmain 2007), the patterns observed in each sample are consistent with the mechanical demands of an agricultural lifestyle.

The high prevalence rate of osteoarthritis of the knee joint in the Middle to Late Byzantine sample (around 40%) may also be attributed to long-term participation in physically demanding activities common in farming such as lifting and knee bending (Sandmark et al. 2000; Weiss and Jurmain 2007). However, because both communities at Nemea were engaged in agriculture, the substantial increase through time in the frequency with which this particular joint was affected suggests that other processes were at work during the later period. The differences between the two samples in the prevalence rates of knee osteoarthritis was one of the few that

reached the $p < 0.05$ level of statistical significance. Possible explanations are presented in the discussion of Hypothesis One below.

Reviewing the evidence of antemortem trauma, the postcranial fractures observed in the Early Christian and Middle to Late Byzantine samples are, for the most part, consistent with accidents such as falls. For example, falls onto the shoulder or onto an outstretched hand are a common mechanism of injury for oblique fractures of the clavicle, the most frequently fractured bone in the Early Christian sample (Judd 2004; Lovell 1997). Similarly, the oblique fractures on the proximal shaft of a right femur and near midshaft on a right ulna were likely to have resulted from indirect trauma associated with a fall (Judd 2008; Lovell 1997).

Many of the postcranial fractures recorded in the Middle to Late Byzantine sample were observed in one set of remains. This middle adult male individual exhibits bilateral impacted fractures of the articular portions of the distal humerus and proximal radius and ulna, a pattern rare in the modern clinical literature and almost certainly due to a fall onto both outstretched hands (Leonard and Reidy 2008; Nithyananth et al. 2008; Schindler 2003). Fractures observed in other individuals that are consistent with indirect forces from falls include an oblique fracture of the distal radius of a young adult female and possibly the oblique fractures of a left tibia (proximal shaft) and a left fibula (near midshaft) that were recovered from a commingled burial and may belong to the same individual. Other fractures in this sample were probably caused by direct forces such as kicks from animals or falls onto hard surfaces. These include the comminuted fracture of the lateral end of a left clavicle from a middle to older adult female, the midshaft transverse fracture of a left clavicle from a middle adult male, and the compression fracture of the proximal right fibula of a middle to older adult male.

It is also likely that some of the fractures observed in the Nemea samples can be attributed to interpersonal violence. This is most apparent when the cranial fractures are considered. In the Early Christian sample, males were affected in four of the five cases. These consisted of depressed fractures probably caused low velocity blows from blunt objects or, in one instance, a penetrating fracture likely caused by an instrument with an edge. Similarly, the two cranial fractures observed in the Middle to Late Byzantine sample were depressed fractures affecting males. All examples of cranial fractures exhibited by males occurred on the left side of the cranium, suggesting that they were produced by objects or implements wielded by right-handed assailants.²⁵

It is noteworthy that nearly all of the aforementioned injuries, both cranial and postcranial, were well healed at the time of death.²⁶ This indicates that the intent in the cases of interpersonal violence was usually non-lethal, and also that a reasonable degree of care was available to those injured in both periods at Nemea. The latter point is well illustrated by the case of an Early Christian adult male who survived a depression fracture that penetrated the inner table of the cranial vault long enough for a substantial degree of healing to take place (Figure 9.7).

²⁵ Additional evidence of interpersonal violence at Early Christian Nemea has been identified by Garvie-Lok (2010). She describes a well-healed lesion on the left parietal of a middle adult male that was likely caused by a sharp-edged implement. This individual was on display at the Nemea Museum and was not analyzed in this research.

²⁶ A right clavicle from a middle adult male exhibits an oblique fracture with only partial healing.

Figure 9.7: Endocranial View of Healed Depression Fracture on Left Parietal. SK 076.



Taken together, the demographic patterns and prevalence rates of physiological stress indicators that characterize the Early Christian and Middle to Late Byzantine skeletal samples suggest that living conditions in both periods at Nemea were neither extremely harsh nor extremely favorable. The early childhood years were probably characterized by frequent infections or nutritional deficiencies, perhaps during weaning, which temporarily disrupted normal growth and development. While most individuals survived the transition to the later childhood years, some continued to struggle with chronic nutritional problems due either to intrinsic or extrinsic factors. For those individuals the risk of dying was much greater. Adults in both periods probably had to cope with mild infections, the possibility of poor nutrition status, and a physically demanding agricultural lifestyle that placed repeated stress on the lower legs as

well as on the upper body. The presence of postcranial trauma that can be attributed to accidental injury adds to this evidence, while the presence of cranial trauma indicative of intentional injury suggests that interpersonal violence was not uncommon.

Sociopolitical Change and Physiological Stress at Nemea

Hypothesis One: Discussion and Implications

The first hypothesis presented in this dissertation anticipated that the Middle to Late Byzantine skeletal sample from Nemea would exhibit greater prevalence rates of physiological stress indicators than the Early Christian skeletal sample. With only a few exceptions, the results presented in Chapter Seven argue in favor of the rejection of Hypothesis One. Among adults, the prevalence rates of certain conditions such as porotic hyperostosis, cribra orbitalia, and osteoarthritis do show a tendency to increase through time. However, the figures for periosteal reactions, one of the two stress indicators for which differences between the samples reached the $p < 0.05$ level of significance, show the opposite pattern. In fact, the statistical comparison of frequencies of the presence and absence of the paleopathological conditions examined in this research by period between adults, males, females, and subadults revealed a surprisingly small number of significant differences.

The results for only osteoarthritis of the knee joint provide clear support for the expectations of Hypothesis One. The prevalence rates of knee osteoarthritis are much greater in the Middle to Late Byzantine sample and the differences in the frequencies of its presence and absence are statistically significant for adults (left and right knee) and for males (right knee only). As discussed in Chapter Two, the development of arthritis in this joint could be related to a variety of factors such as genetics, sex or population-based variation in joint structure, body size, and age (Weiss and Jurmain 2007). At Nemea, genetic predispositions or population

variation are certainly possible causes as there is no assumption of population continuity between the Early Christian and Middle to Late Byzantine communities. Similarly, differences in body size cannot be ruled out, although it seems unlikely that many more people suffered from significant weight-related problems such as obesity in the later period. The possibility that the elevated prevalence of knee osteoarthritis was related to differences in the average age of the individuals in the Middle to Late Byzantine sample *can* be ruled out because the mortality curves of the two samples are nearly identical.

The remaining explanations are related to biomechanical stress. For example, osteoarthritis of the knee joint has been linked with regular participation in activities that involve weight bearing, repetitive flexion or knee bending, and jumping (Klaus et al. 2009; Sandmark et al. 2000). While both communities were intensively farming, an increase in the frequency of those types of activities and movements is probably not related to alterations in farming methods as Byzantine agricultural techniques were dictated largely by local conditions and seem to have changed little through time (Kazhdan 1997; Rautman 2006). It is more likely that the greater prevalence of knee osteoarthritis in the Middle to Late Byzantine skeletal sample provides confirmation that agricultural workload intensified and/or began earlier in life during this period. The fact that non-weight-bearing joints such as the elbow and wrist show increased prevalence rates of osteoarthritis provide additional support for this interpretation.

Another interesting possibility is that many of the individuals in this period were living on or at least frequently moving back and forth between a hilltop settlement and the Nemea sanctuary. Athanassopoulos (1997, 2010) has demonstrated that, beginning in the late 13th century AD, the settlement pattern in the Nemea Valley shifted from dispersed farmsteads to fortified villages as a response to deteriorating security. The dominant settlement in the region of

Nemea at that time was located near the fortified summit of Polyphengi (Figure 9.8). Regular climbing over the steep, irregular terrain of this mountainside would have entailed more frequent bending and loading of the knee joint and could explain the significant increase in osteoarthritis in the Middle to Late Byzantine sample. While the settlement on Polyphengi represents activity in the region that in large part postdates the 12th-13th century community at Nemea, this finding might speak to a need to seek out additional safety from turbulent conditions earlier in the 13th century than has previously been suspected.

Figure 9.8: View of the Mountainside of Polyphengi. The Arrow Shows the Location of the Late Byzantine Settlement.



Although there were no significant differences between the Early Christian and Middle to Late Byzantine samples in the frequency of injuries suggestive of accidental trauma, some of the injuries in the latter sample were more severe. The middle to older adult female with a comminuted fracture of the lateral left clavicle and the middle adult male with multiple, bilateral fractures are good examples. These injuries, which are consistent with serious falls, provide corroborating evidence for the argument that individuals in the Middle to Late Byzantine period were more regularly engaged in travel over difficult terrain.

It is worth noting that the accidental injuries in this period may have received medical intervention. For example, the aforementioned clavicle fracture resulted in significant deformation of the lateral end upon healing. However, Lovell (1997) points out that this is not uncommon even in modern settings because treatment is often no more complicated than the use of a sling. There is also a strong likelihood that the middle adult male received medical attention or, at the very least, a significant degree of care by members of the community. Fractures of the articular areas of the distal humerus and proximal radius and ulna are complicated injuries that may be associated with elbow dislocation (Leonard and Reidy 2008; Ruchelsman et al. 2008). Clinically, complex surgical procedures are usually necessary to stabilize and restore full range of motion to the joint (Giannicola et al. 2010; Nauth et al. 2011; Ruchelsman et al. 2008). That this individual very likely injured both elbow joints simultaneously means that he would have needed assistance performing almost any activity involving the arms in the short term. Importantly, while the articular surfaces show some displacement and clear development of posttraumatic arthritis, there is no evidence of ankylosis or disuse atrophy, suggesting that the injury did not permanently inhibit the use of the arms—albeit with a reduced range of motion—subsequent to healing (Figure 9.9). Based on this evidence, it is plausible either that the reduction of fractures (and possibly dislocations) could be performed with some degree of success by regular members of the community or that attention from someone with medical training was a possibility at Nemea. While there was almost certainly no medical facility at Nemea, it has been suggested on the basis of archaeological and osteological evidence that a hospice was functioning at Corinth during the Frankish period (Barnes 2003; Snyder and Williams 1997; Williams and Zervos 1996; Williams et al. 1998).

Figure 9.9: Anterior View of Right (a.) and Left (b.) Distal Humeri Showing Displacement and Remodeling of the Trochlea and Capitulum. Scales in Photographic Images Cannot be Enlarged.



As stated earlier, periosteal reactions were the only other stress indicator for which prevalence rates showed significant differences through time. While prevalence rates were significantly greater among Early Christian adults and among Early Christian females, this was true only for the left tibia. The absence of a similar pattern in the corresponding right tibia along with small female subsample sizes makes this result difficult to interpret. If the data on periosteal reactions are picking up on meaningful differences that might have been clearer if sample sizes were larger, then attention should be focused on the fact that all Early Christian females with observable left tibiae exhibited periosteal reactions. This might suggest that early Christian females were more predisposed to infections, nutritional deficiencies, or minor trauma than were Middle to Late Byzantine females. In fact, additional evidence from the intraphase comparison,

which is discussed below, indicates that Early Christian women may have had poor nutritional status relative to men. So while the results for periosteal reactions must be interpreted with extreme caution, they may suggest that aspects of women's health actually improved during the Middle to Late Byzantine period.

Gender and Physiological Stress at Nemea

Hypothesis Two: Discussion and Implications

The second hypothesis in this dissertation anticipated that in both phases at Nemea the prevalence rates of most physiological stress indicators would be greater in females, while the prevalence rates of activity related stress indicators would be greater in males. The results presented in Chapter Seven provide partial confirmation of this hypothesis, but only for the Early Christian sample.

Perhaps the most interesting result of the intraphase comparison between Early Christian males and females was that the prevalence of cribra orbitalia was significantly greater in females.²⁷ As previously discussed, cribra orbitalia is a non-specific indicator of stress that has been linked with a number of different conditions. Most recently, Walker et al. (2009) have argued convincingly that orbital lesions are frequently caused by problems with nutritional status, especially during childhood. While they can also be caused by hereditary hemolytic anemias, those have been demonstrated to be unlikely in this sample (see discussion on pp. 308-309). Furthermore, there is no reason that a hereditary anemia such as thalassemia would have disproportionately affected females.²⁸ Other potential factors contributing to nutritional status,

²⁷ The prevalence rate for females was 36.4% and the prevalence rate for males was 11.5%.

²⁸ In fact, recent evidence suggests that males may show skeletal involvement more frequently than females in thalassemia (Kyriakou et al. 2008).

such as parasitic infection, are also likely to have affected males and females with equal frequency.

Social factors that influenced the diets of men and women are the most likely source of differential susceptibility to nutritional problems in this sample. As discussed in Chapters Three and Five, Byzantine females might have been at a health disadvantage from an early age. For example, Talbot (1997) points out that weaning might have taken place earlier for girls. This may have predisposed them to nutritional problems, especially if weaning diets were inadequate, and may also have exposed them to infections earlier than males. However, the absence of significant differences between males and females in the prevalence of linear enamel hypoplasias may suggest that their dietary patterns diverged during the later childhood and adolescent years. Changes in the dietary regimens of girls around the age of puberty were viewed as necessary by Early Christians because of the belief that withholding food helped control sexual desire (Alberici and Harlow 2007; Grimm 1995). If we keep in mind that the diet at Early Christian Nemea was probably focused on grain and, to a lesser extent, dairy products (Bourbou et al. 2011; Garvie-Lok 2001), the community in general was probably at a constant risk of developing deficiencies in vitamin B₁₂, folic acid, and possibly vitamin C. It is possible that only minor deviations from the normal dietary pattern would have been necessary for symptoms of deficiency to appear in females. It is important to note, then, that Early Christian physicians recommended that women avoid some of the very food items necessary to stave off deficiency. Oribasius, writing in the 4th century AD, offers a telling passage in which he quotes Rufus of Ephesus, who practiced medicine three centuries earlier:

When they are older and growth has all but stopped, and when young girls out of modesty no longer want to play childish games to the full, then one must give much more continuous attention to their regimen, *regulate and moderate their intake of food, and not let them touch meat at all, or other foods that are very nourishing* (Rufus of Ephesus, in Orib. *Coll. Med.* 4: *Lib. inc.* 18.10; emphasis mine).²⁹

The removal of meat from a grain-based diet would not only have severely limited vitamin B₁₂ intake, but would also have eliminated one of the only sources of vitamin C. Chronic deficiencies of those vitamins can result in megaloblastic anemia and scurvy, the synergistic effects of which are precisely what has recently been proposed by Walker et al. (2009) as a likely cause of cribra orbitalia in human skeletal samples. While the dietary recommendations of physicians are, of course, only prescriptive in nature, the results of this research are consistent with what one would expect if that type of advice was actually being followed at Early Christian Nemea. Furthermore, if Early Christian females at Nemea regularly struggled with nutritional status during their childhood and adolescent years, it would help explain why they died in young adulthood almost twice as frequently as males.

While small subsample sizes among both males and females complicated efforts to compare activity-related stress indicators in the Early Christian sample, a statistically significant difference was found for the prevalence of osteoarthritis of the hip. Males were more frequently affected on both anatomical sides, although the difference only approached the $p < 0.05$ level of significance for the right hip. It is tempting to explain the elevated prevalence of hip osteoarthritis in Early Christian males as a result of more regular participation in heavy agricultural labor. This is because although women in the Byzantine countryside probably also worked in the fields, they are usually characterized as having normally participated in less

²⁹ Translation cited in Alberici and Harlow (2008:196).

intensive agricultural activities such as gardening and animal care (Cameron 2006; Laiou 1981; Talbot 1997). However, in addition to the fact that the subsamples are small, there is a strong possibility that age differences played a role in this pattern because males in this sample lived longer on average than females. In the absence of larger sample sizes and more strict control over differences in age at death, this result must be interpreted with extreme caution.

As discussed previously, the results of the skeletal analysis do seem to confirm that Early Christian males engaged in potentially hazardous activities more frequently than their female counterparts. Cranial trauma was not rare in the Early Christian sample and most examples (5 out of 6 including the individual analyzed by Garvie-Lok [2010]) occurred in males. Similarly, males were affected in all postcranial fractures that occurred on bones for which sex could be determined. The postcranial fractures are consistent with accidents suffered while farming or walking over uneven terrain. However, the cranial trauma observed in this sample is much more consistent with interpersonal violence (see discussion on p. 316). Given that military service was probably mandatory for those living in the countryside prior to the 11th century AD (Schreiner 1997), it is possible that these cranial injuries were received during participation in organized conflict. However, because none of those injuries were extensive and all had healed without complications at the time of death, it is more likely that they resulted from interpersonal aggression subsequent to disputes with other individuals in the community.

*A Regional Perspective on Physiological Stress in the Byzantine Period:
Nemea and Central Greece*

The final aspect of the skeletal analysis that must be addressed is the extent to which the results from Nemea compare to patterns of physiological stress identified at contemporaneous sites in central Greece. This analytical component helps to contextualize health and living conditions at Nemea within a larger regional framework during the Early Byzantine and Middle

to Late Byzantine periods. The comparative data were collected by Tritsaroli (2006) on skeletal samples recovered from the following sites:

1. Akraiphnio (6th century AD)
2. Thebes (12th-13th centuries AD)
3. Spata (11th-14th centuries AD)

The results from Nemea were much more consistent with those from Akraiphnio and Spata, which were also rural sites. For example, when prevalence rates were compared between Early Christian Nemea and Akraiphnio, significant differences were identified only for periosteal reactions and for linear enamel hypoplasias on the mandibular teeth (Table 9.1). The elevated prevalence of periosteal reactions at Nemea might suggest that the living environment was more highly pathogenic, that nutritional problems predisposing adults to subperiosteal hemorrhage as a result of scurvy were more common, or that individuals at Nemea were more regularly exposed to minor trauma during agricultural labor.

Interestingly, the prevalence rates of periosteal reactions were found to be significantly greater at Nemea when the Middle to Late Byzantine sample was compared with the contemporaneous samples from Thebes and Spata (Tables 9.2 and 9.3). This pattern exists despite the fact that levels of physiological stress as measured by this variable appear to have increased in central Greece during this period. While a more stressful living environment in both periods at Nemea cannot be ruled out, the possibility of differences between observers in scoring the presence of a periosteal reaction also must be considered. As discussed above, minor subperiosteal alterations resulting in accentuated longitudinal striations were scored as periosteal

reactions in the present research. Those relatively subtle changes may not have been recorded by Tritsaroli.

The data on enamel hypoplasias produced inconsistent results that are difficult to interpret in the case of Akraiphnio. The prevalence rate of 90.5% for the mandibular incisors is unusual because that tooth type is not as susceptible to hypoplasia formation as the mandibular canines (Goodman and Armelagos 1985; Goodman and Rose 1990; Saunders and Keenleyside 1999).³⁰ It is possible that a relatively small subsample size is the explanation for that result. The figures for the mandibular canines seem more reasonable and suggest that early childhood stress was greater at Early Christian Nemea. This interpretation may be corroborated by the difference between the two samples in the prevalence of cribra orbitalia in subadults (greater at Nemea), which approaches the $p < 0.05$ level of significance. Larger sample sizes from each site, but particularly from Akraiphnio, would help to elucidate these patterns.

Table 9.1: Summary of Statistically Significant Results:
Early Christian Nemea versus Akraiphnio.

Sample Subgroup	Condition	Nemea Prevalence (%)	Akraiphnio Prevalence (%)	Two-tail p -value
Adults and Subadults	LEH Mand. Incisors	25.1	90.5	<0.0001
Adults and Subadults	LEH Mand. Canines	70.9	47.4	0.043
Adults	PR L. Tibia	86.0	24.0	<0.0001
Adults	PR R. Tibia	87.8		<0.0001

LEH = linear enamel hypoplasias, PR = periosteal reaction.

The greatest number of statistically significant differences between the Nemea samples and those from central Greece were found when the data from Middle to Late Byzantine Nemea and Thebes were compared (Table 9.2). Prevalence rates were greater in the Nemea sample for nearly all of those significant results, which suggests that conditions in the 12th-13th centuries

³⁰ The “susceptibility” of a tooth type to enamel hypoplasia formation may due in part to variation in crown morphology (Hillson and Bond 1997; King et al. 2005).

AD were generally more difficult for individuals living in the countryside of southern Greece than for individuals living in an urban context in central Greece. On the other hand, better skeletal health in the sample from Thebes might be due to other factors. For example, the Latin conquest of central Greece seems to have been less disruptive than that of the Peloponnese, due at least in part to the Franks being viewed as a liberating and stabilizing presence by prominent local officials (Lock 1995). The presence of various types of local and imported pottery provides corroborating evidence that Thebes remained a prosperous urban center despite Frankish occupation following the Fourth Crusade (Armstrong 1993). Additionally, some of the burials at Thebes may have been those of wealthy individuals descended from aristocratic families (Tritsaroli 2006; Tritsaroli and Valentin 2008), and it is possible that those individuals experienced relatively low levels of physiological stress.

Only porotic hyperostosis showed a significantly greater prevalence rate at Thebes, a pattern that is difficult to explain when considered together with the results for the other stress indicators. Nevertheless, urban environments in antiquity were often associated with sanitation problems and high rates of disease transmission (Manchester 1992), and it is possible that the community at Thebes was exposed to parasitic infections and/or diarrheal disease more frequently than individuals living in the countryside. Especially in infancy or young childhood, both conditions could have led to nutritional losses sufficient to cause porotic hyperostosis as a result of megaloblastic anemia (Walker et al. 2009).

Table 9.2: Summary of Statistically Significant Results:
Middle to Late Byzantine Nemea versus Thebes.

Sample Subgroup	Condition	Nemea Prevalence (%)	Thebes Prevalence (%)	Two-tail <i>p</i> -value
Adults and Subadults	LEH Max. Canines	74.6	40.9	0.004
Adults and Subadults	LEH Mand. Canines	76.9	40.5	0.0001
Adults	PH	16.4	37.9	0.004
Adults	CO	26.1	8.5	0.025
Adults	PR L. Tibia	67.2	50.0	0.027
Adults	PR R. Tibia	79.4		<0.0001

LEH = linear enamel hypoplasias, PH = porotic hyperostosis, CO = cribra orbitalia, PR = periosteal reaction.

The results for Middle to Late Byzantine Nemea are much more similar to those from Spata. The possibility that childhood stress, perhaps related to nutritional problems, was greater at Nemea is suggested by the figures for enamel hypoplasias and cribra orbitalia (Table 9.3). The implications of the results for periosteal reactions are less clear as the differences between the samples are statistically significant only for one anatomical side. Again, the greater similarity in the patterns of physiological stress indicators between these samples is perhaps unsurprising because they each represent relatively poor agricultural communities. However, the fact that prevalence rates of physiological stress indicators are generally greater at both Spata and Nemea when compared to Thebes could mean that conditions were more difficult for individuals living in the countryside during Frankish rule, regardless of whether they resided in the Peloponnese or in central Greece.³¹

³¹ Subadult mortality was also higher at both Nemea and Spata than at Thebes (Tritsaroli and Valentin 2008).

Table 9.3: Summary of Statistically Significant Results:
Middle to Late Byzantine Nemea versus Spata.

Sample Subgroup	Condition	Nemea Prevalence (%)	Spata Prevalence (%)	Two-tail <i>p</i> -value
Adults and Subadults	LEH Mand. Incisors	23.3	53.6	<0.0001
Adults	PR R. Tibia	79.4	55.6	0.002
Subadults	CO	50.0	10.0	0.026

LEH = linear enamel hypoplasias, PR = periosteal reaction, CO = cribra orbitalia.

Reconstructing Mortuary Practice at Byzantine Nemea

I now turn to the evidence for mortuary behavior at Early Christian and Middle to Late Byzantine Nemea. As discussed at the outset of this dissertation, it is only through the examination of human skeletal remains in conjunction with their contexts that we can adequately address questions that involve the intersection of health and sociopolitical processes. A fascinating result of this study is that, while indicators of mortality and physiological stress suggest that life experiences probably changed little between the Early Christian and Middle to Late Byzantine communities, the burial patterns contain good evidence of behavioral and ideological differences. Before discussing the results of the tests for an association between burial location and social status, it is useful to review the results of the mortuary analysis and discuss what they reveal about mortuary practices and broader cultural patterns in both communities.

Death and Burial at Early Christian Nemea

As Rautman (2006) points out, cemeteries were a critical part of the identity of a village in the Byzantine period. This was perhaps especially true for the Early Christian community at Nemea. While the Early Christian basilica has been recognized as having been the focal point of the community, the way in which the cemeteries that developed around it helped shape the religious topography of the site has generally been overlooked. Early Christians at Nemea would

have existed in continuous close proximity to the dead, whether working in the fields and gardens, which were in many cases located very near to the cemeteries, or when attending church services. Especially given that a second basilica was constructed on a nearby hill in the same period, the local landscape for those living at Early Christian Nemea would have been dominated by sacred space.

In broad terms, the organization of the burials themselves is consistent with the Early Christian emphasis on the community, of which the dead were considered to be part (Paxton 2005; Yasin 2005). The Early Christian graves at Nemea were placed in multiple areas across the site, all of which were within or adjacent to the space of daily activities. Furthermore, the incorporation of the dead into the physical landscape of the living means that they could have been involved in public forms of worship, such as outdoor liturgies, that were common in the Early Byzantine period (Krueger 2006; Yasin 2005). The increasing role that the dead played in daily and religious life during Late Antiquity is underscored by Fontaine:

The Christian Dead, since their *dies natalis* alive in God, have a presence as real as the living, and they come to play a larger and larger part in the liturgies of the community. In this sense, what we see is ‘the procession of the dead into the cities of the living’, an interpenetration of the two cities, that of the dead and that of the living... (Fontaine 1989: 1, 152).³²

The graves at Nemea also show a great deal of uniformity in most respects. For example, they shared an east-west orientation with only a single exception. Additionally, the graves generally contained very few grave goods and the frequency with which either mortuary artifacts or items of personal adornment were included in the graves of adults and subadults and in those of males and females were nearly identical. The fact that more than half (61.4%) of the burials were single inhumations does demonstrate that effort was made to maintain personal identities,

³² Cited in Davies (1999:192).

but the arrangement of the graves within the larger spatial context of the site probably served to emphasize the place of individuals within the united communities of the living and the dead. In this way, the identity of the deceased was not necessarily exchanged for the expression of the identity of the community, as may be the case in forms of secondary burial in which many disarticulated individuals are placed together in communal tombs (Alexiou 2002; Danforth and Tsiaras 1982; Shanks and Tilley 1982).

An interesting possibility suggested by the burial evidence at Early Christian Nemea is that individuals were included in the community of the dead even in instances when their physical remains were not present. Given that military service was compulsory at this time (Schreiner 1997), it is conceivable that the unusually large proportion of Early Christian graves that were empty upon excavation (21.4%) represent cenotaphs. With this in mind, it is noteworthy that most of the empty graves were among those associated with the bath. The burials in this area are the most numerous and perhaps this portion of the cemetery represents Early Christian Nemea at its largest population level. It is possible, then, that at that time males were frequently being recruited for military duty and that they were normally commemorated with a grave if they did not return.

An alternative and more likely explanation, however, is that the empty graves at Nemea reflect the practice of exhumation and reuse of graves. As discussed in Chapter Eight, there are examples of Early Christian graves that apparently contained either single inhumations or multiple primary interments but, during skeletal analysis, were found to include teeth and bone fragments from additional individuals. The fact that small skeletal elements could easily be missed during exhumation makes a strong case for the existence of that practice. The practice of exhumation would also explain the curious feature within the burials adjacent to the bath that

was designated as an osteotheke in this research. This three-chambered stone structure, which contained bone fragments from a minimum of three individuals in addition to pieces of lime, perhaps functioned as a secondary disposal area following primary interment in a regular grave. While it is unclear why the practice of exhumation would have occurred regularly at Early Christian Nemea, a practical explanation is that the community chose to reuse graves rather than to extend the cemetery into valuable cultivable area.

Although the organization of the burials in the Early Christian period can be interpreted as emphasizing the community as a whole, there is good evidence for the expression of family and other group identities within the mortuary space. The representation of family identity within the context of the community should probably not come as a surprise given that family members seem to have been intimately involved in funerary rituals during the Early Christian period (Rush 1941) and because families probably exercised greater control than the Church over the burial of its members (Rebillard 2009; Samellas 2002). If family identity was being expressed during this period, it was accomplished through spatial distinction and differences in grave construction. For example, there is a tendency for grave types to cluster together, often in rows, within the larger burial areas (Figure 9.10). The identification of a family plot seems especially likely in the case of the spatially segregated small group of burials located to the south of the temple that contained both males and females arranged in two neat rows.

The clear differences in the composition of grave construction types *between* burial areas could reflect the expression of different social elements within the community. For example, Al-Shorman (2004) has demonstrated that multiple cemeteries and religious architecture at Yaseleleh, Jordan in the 6th century AD were carefully arranged to maintain social distinctions between members of the community. The burials associated with the temple provide the best case for this

argument at Nemea. Their proximity to a pagan monument at a distance from the basilica is by itself interesting, but even more intriguing is the fact that the location of most of the graves to the north of the temple effectively segregates them from the rest of the burials in the sanctuary. A number of the features of these burials are of additional interest, including their alignment with the temple (not precisely east-west), the uniformity of grave construction (plain pit and roof tile graves), and the more frequent inclusion of mortuary artifacts in the graves. As discussed in Chapter Eight, the unique burial of a young woman with a variety of grave goods in this area strengthens the possibility that the temple burials are the earliest at Nemea and represent a transitional phase between pagan and Christian practices. If the temple graves do represent transitional burials, then the differences in grave construction between burial areas may shed light on the development of cemetery over time in addition to the expression of group identities.

Figure 9.10: Spatial Distribution of Early Christian Grave Types.



Aspects of mortuary practice at Nemea also provide insight into attitudes toward children and the conception of life stages in the Early Christian community. While there were no

statistically significant differences between adults and subadults in the presence of grave goods, it is noteworthy that items of personal adornment, most often earrings, were the only items included in the graves of subadults. This finding is consistent with observations that jewelry is found more commonly in the graves of Byzantine children than in those of adults (Iverson 1993; Pitarakis 2009; Talbot 2009; Tritsaroli and Valentin 2008). Based on the results of the skeletal analysis, death in childhood was a common phenomenon in both periods at Nemea and the frequent adornment of children at burial can be viewed as an expression of intense grief, affection, and compassion on the part of the parents (Pitarakis 2009). Similarly, the evidence that subadults began to be buried like adults during adolescence is consistent with the likelihood that Byzantine children attained adult status during the teenage years (Rautman 2006; Tritsaroli and Valentin 2008). At Nemea, adults and adolescents were associated with roof tile graves, while subadults were more often buried in field stone covered graves.

Finally, it is important to point out that the absence of burials in the liturgical space of the basilica suggests that it was functioning as a place of worship throughout this period (Caraher 2010). If high status individuals were being distinguished from other members of the community in death, it was accomplished through burial nearer to, but not within the basilica. Two pieces of evidence support this assertion. First, grave goods are present more often in the burials adjacent to the basilica and the difference is statistically significant when compared to bath burials. Second, a small number of individuals of both sexes dating to the Early Christian period were found to have received grave elaboration in the form of tile “pillows” or enclosures associated with the head. These Early Christian burials were found only south of the basilica and were more highly clustered in space than would have been expected by chance. Interestingly, it has been argued that this type of attention to the head of the deceased was introduced to Byzantium from

the West in the 13th century AD (Iverson 1993). Assuming that the chronology of the graves associated with the basilica at Nemea is accurate, this practice may have begun earlier than previously believed and may not necessarily indicate western influence.

Death and Burial at Middle to Late Byzantine Nemea

It seems unlikely that the members of the Middle to Late Byzantine community at Nemea shared a close relationship with the dead as did the members of the Early Christian community. There is good evidence that in this period the entire community was living at a site outside of the Sanctuary of Zeus. Additionally, the sanctuary basilica was probably not functioning as a place of worship. Instead it took part in a common phenomenon whereby damaged or neglected Early Christian basilicas were reused in later periods for religious purposes that did not include the traditional liturgy (Caraher 2010). Together with the small chapel that was constructed on or near its remains, the basilica functioned primarily as a mortuary site. Furthermore, it seems unlikely that the chapel served as the religious focal point for the Middle to Late Byzantine community in the same way that the basilica did for the Early Christians.

The changes in the religious topography of Nemea at this time are consistent with the notion that Byzantine society turned inward during the Middle to Late Byzantine period. As Krueger (2006) and Ousterhout (2008) have indicated, public worship in large basilicas became less common and was replaced widely by more private forms of devotion. Another transformational process that seems to be reflected in the mortuary space at Nemea is the development of a more intense focus on the nuclear family as social a unit (Laiou-Thomadakis 1977). Together, double burials and commingled burials make up 48.2% of the burial types observable in the Middle to Late Byzantine period. The same figure for the Early Christian period is 7.6%. While burials containing multiple individuals cannot automatically be assumed to

represent family graves, the absence of statistically significant differences between males and females and between adults and subadults in the frequency with which they were included in such burials indicates that neither age nor sex were determining factors. The presence of children together with adults of both sexes certainly points to the possibility of family tombs (Gerstel and Talbot 2006; Talbot 2009).

Additional evidence from the burial type classification suggests that burial practices during the Middle to Late Byzantine period aimed to preserve the collective identity of families rather than the identities of individual family members (Alexiou 2002; Brown 2003; Danforth and Tsiaras 1982). For example, at least some degree of commingling of the remains was apparent in 70 percent (28/40) of the graves containing multiple individuals. Additionally, the presence of at least two graves containing multiple disarticulated individuals makes a strong case for the practice of secondary burial during this period. Each of those tombs, categorized as ossuaries in this research, was located in the *naos* or nave of the basilica. Graves containing multiple commingled individuals were often quite large—containing up to a minimum of sixteen individuals—and are suggestive of extended periods of use.

The possibility of western influence in burial practice during this period is an intriguing question that has been explored most directly by Ivison (1993). He identifies examples of “cephalic burials” in which the head is propped up by a stone pillow and enclosed with stone at nine sites in Greece (including Corinth), Cyprus, and Turkey, all of which postdate 1204 AD and were generally in territories under Frankish possession. As discussed previously, some form of this practice was recorded in a small number of burials at Nemea for which an Early Christian date has been suggested. For the most part, however, cephalic burials at Nemea were dated to the Middle to Late Byzantine period and were generally located at the east end of the basilica outside

of the apse. This form of burial treatment was not exclusive to males or females, but may have been exclusive to adults. Given that the castle associated with the Late Byzantine settlement on the hilltop of Polyphengi was for the most part under Frankish control (Athanasopoulos 1997, 2010), there is good reason to believe that these burials do in fact represent western influence in mortuary behavior at Nemea. Especially as a small portion of the Nemea graves has been dated as late as the 14th-15th century AD by Miller (1988), it is even possible that some of the individuals buried adjacent to the Early Christian basilica were Frankish members of the Polyphengi settlement.

A Frankish presence at Nemea would also help explain one of the more interesting features of the Middle to Late Byzantine skeletal sample: the substantial overrepresentation of males. In the years immediately following the conquest of the Peloponnese, the majority of western settlers would have been knights or other members of the military who were unlikely to have been accompanied by women and children (Ilieva 1991; Jacoby 2008). It is possible, then, that at least toward the end of its existence the Middle to Late Byzantine community at Nemea took on a character that differed greatly from that of the Early Christian community.

Despite the substantial differences in many aspects of burial practice between the two Nemea communities, there was no change in the frequency with which grave goods were present. Although the subsample sizes are quite small, the association between subadults and items of personal adornment is also consistent with the Early Christian pattern. The only potentially striking distinction between periods related to the presence of grave goods is that they were found only in the graves of females when single inhumations were considered. However, it is difficult to evaluate the significance of this pattern, due again to small subsamples.

The spatial distribution of grave goods also provides few clues as to the possibility of social differentiation during this period. While grave goods appeared more often in burials located in the same area as those receiving head treatment, they were also present in burials located within the basilica and south of that structure. Upon statistical analysis, grave goods were found to be randomly distributed in space. That social status was expressed in other ways at Nemea was hypothesized in this research and the results pertinent to that hypothesis are the subject of the final section of this chapter.

Burial Organization and Physiological Stress at Nemea

Hypothesis Three: Discussion and Implications

The third hypothesis in this dissertation anticipated that there would be significant differences in the prevalence rates of physiological stress indicators between groups of individuals based on grave location. This expectation was based on historical and archaeological evidence that social status in Byzantine burials was frequently expressed through one's place of burial relative to others. It was also based on the possibility that higher social status was associated with better access to adequate nutrition, a lower risk of infections, and lower levels of psychosocial stress. As was discussed in Chapters Four and Five, the practice of *ad sanctos* burial has been suggested to have encouraged competition among community members for privileged burial locations, culminating in the notion that the mortuary space should be organized according to the social hierarchy (Iverson 1993, 1996; Paxton 2005, 2008).

The results of the mortuary analysis presented in Chapter Eight show that there are very few spatial patterns of physiological stress indicators that would support the possibility that burial location was related to the social hierarchy at Nemea. In fact, there is only one example in each burial phase and both have alternative interpretations.

Among Early Christian burials, fractures are present more frequently in graves associated with the temple than in graves associated with either the bath or the basilica. The difference was found to be statistically significant when the temple and bath graves were compared. The temple graves are located farthest from the Early Christian basilica and, as discussed above, it is possible that they reflect a mix of Christian and pagan traditions. It is conceivable that the absence of a firm Christian outlook among the individuals represented in those burials gave them a marginal status in the community. However, both archaeological and written evidence from late antique Greece suggests that the relationship between pagans and Christians was not necessarily antagonistic (Bowersock 1990; Gregory 1986; Rothaus 2002; Trombley 1985). Furthermore, it is difficult to imagine exactly why this would have resulted in a greater risk of fractures that in large part can be attributed to accidents.

It is worth pointing out that the temple burials also show non-significant but nevertheless elevated levels of other stress indicators such as porotic hyperostosis. There are also multiple individuals buried adjacent to the temple that exhibit more severe expressions of periosteal reactions than were observed in individuals from burials in other areas of the site. Perhaps these patterns (fractures included) make more sense if the temple burials are viewed in light of the discussion concerning the chronology of the Nemea burials rather than in terms of possible differences in social status. Wright et al. (1990) have pointed out that establishing an agricultural system and, presumably, a permanent settlement at Nemea after a period of abandonment would have been a considerable undertaking. If the temple burials are in fact the earliest at Nemea, then the individuals they contained might have faced challenges such as adequately draining the valley for agricultural purposes, establishing the fields and gardens necessarily for a subsistence base, and constructing domestic and possibly ecclesiastical architecture. These additional

demands certainly could have placed the early members of the community at risk for nutritional deficiencies and infections, in addition to accidents resulting in fractures.

The only additional piece of evidence that could be interpreted as supporting a relationship between burial organization and social status at Nemea is the statistically significant spatial clustering of cribra orbitalia among Middle to Late Byzantine burials. Graves that contained individuals exhibiting cribra orbitalia were concentrated in the area outside the southeast wall of the basilica and also in the area adjacent to the southeast corner of that structure. Interestingly, individuals with observable eye orbits in burials located primarily outside of the apse of the basilica do not exhibit cribra orbitalia. This is also the location of many of the burials containing grave goods as well as most of the graves exhibiting elaboration in the form of head treatment. Taken together, this evidence points to the possibility that individuals buried outside of the apse were of higher social status and were buffered against the nutritional problems and/or infections that are the most likely explanations for cribra orbitalia in this sample.

However, there are two problems with this interpretation. First, as was discussed in Chapter Eight, a number of Middle to Late Byzantine individuals buried in locations farther away from the basilica did not have observable eye orbits and this places artificial spatial limitations on the distribution of high and low values included in the statistical analysis. In this way, the indication that the presence of cribra orbitalia is clustered to a greater degree than would be expected by chance is to an extent an artifact of the burials that were observable. The second issue is that, because cribra orbitalia is more often associated with childhood stress, the ages of the individuals included in the analysis must be considered when evaluating its spatial distribution. In this case, it is apparent that many more subadults were buried in the area south of

the basilica than in the area outside of the apse. Especially because *cribra orbitalia* is present much more frequently in subadults than adults in this sample, the significant result for clustering probably says as much about the distribution of age at death as it does about a health disparity that could have been related to social status.

The absence of strong paleopathological evidence for differences in health status based on burial location suggests a few possibilities. One of those is that marked differences in social status simply did not exist in either period. On one hand, that scenario seems quite plausible at a place like Nemea, where relatively small communities existed in a provincial, rural setting. On the other hand, Kazhdan (1997) has pointed out that wealth differences were a reality even in countryside villages. If status differences did exist and were expressed in burial, perhaps those differences were not associated with cultural mechanisms that would have buffered some members of the community against levels of physiological stress sufficient to cause skeletal changes. For example, Krueger (2006) and Laiou (2009) have suggested that, in rural areas, members of the clergy probably engaged in the same agricultural activities as the laity and could even be dependent peasants. It is certainly possible, then, that the Nemea burials *were* organized by social distinction—if only in limited instances such as in the case of Early Christians buried in close proximity to the basilica—but the realities of everyday life in the countryside meant that all community members had similar experiences with physiological stress.

For the most part, however, the forces that shaped the spatial organization of the burials at Nemea were probably those associated with the broader sociocultural patterns discussed in the previous sections. Early Christians placed burials across the site, within the space of both secular and religious activity in order to stress the link between the communities of the living and the dead. The spatially distinct burial areas in this period likely reflect either social distinctions that

were largely horizontal, such as religious outlook or family identity, or the development of the mortuary space through time. In the Middle to Late Byzantine period, the concentration of burials, many of which contained multiple individuals, in and around the Early Christian basilica suggests primarily the recognition and reuse of that structure as a sacred space and a heightened emphasis on private worship and maintaining family identity.

Summary

Using the data on physiological stress at Nemea together with archaeological and historical context, this dissertation has compared patterns of health in both diachronic and regional perspectives, examined sex-based differences in experiences with physiological stress, and shed light on the organization of cemeteries in the Byzantine countryside.

Very little evidence supports the argument for a decline in the quality of life of the Middle to Late Byzantine community relative to the Early Christian community. In fact, the two skeletal samples exhibit such similarity in age-at-death profiles and patterns of physiological stress that it is difficult to believe that they represent distinct communities that existed at very different moments in Byzantine history. The only clear exception is an increase through time in the prevalence of osteoarthritis affecting the knee joint. Although intrinsic factors cannot be ruled out, this pattern is probably related to greater mechanical stress as a result of increased workload and/or more frequent travel over uneven terrain. It is noteworthy that, despite the possibility that work intensity increased and security decreased as a result of sociopolitical processes, the results for the Middle to Late Byzantine skeletal sample are much more consistent with a stable Byzantine community than with one that was severely stressed. These results strongly suggest that health status as measured by physiological stress indicators is more

dependent on local resources and conditions than on instability caused by large-scale sociopolitical transformations.

The life experiences of men and women living at Nemea during the Early Christian period were probably not vastly different, but there is some evidence for a gendered division of activities. Based on patterns of osteoarthritis and trauma, it is possible that men more regularly carried out physically demanding agricultural activities that put them at greater risk of osteoarthritis and trauma when compared to women. Young women seem to have struggled with nutritional status more than men, possibly due to gendered expectations of behavior in this period. This disadvantage may have carried over into adulthood, as mortality patterns suggest that men were able to negotiate the challenges of life in this period more successfully than women.

There is no convincing evidence that similar sex-based health disparities existed in the Middle to Late Byzantine period, although this result must be treated as tentative because of the small size of the female subsamples. The results from the paleodemographic analysis certainly suggest that women were also at a health disadvantage in this period.

Living conditions at Nemea seem to have been broadly similar to those in rural areas of central Greece, though the differences that were found indicate that childhood stress was greater at Nemea. When compared to a contemporaneous urban site in central Greece (Thebes), the results from Middle to Late Byzantine Nemea are consistent with greater levels of physiological stress in both childhood and adulthood. However, this does not necessarily suggest that living conditions at Nemea were poor as the sample from Thebes contained high-status individuals and the city does not seem to have suffered decline after falling under Frankish control.

Finally, the combined analysis of the spatial distribution of physiological stress indicators and grave attributes suggests that social status was not a significant factor in the spatial organization of the burials at Nemea. Instead, cemetery organization can be viewed as strongly tied to Byzantine socioreligious notions of the community and the family in each period.

CHAPTER 10: CONCLUSIONS

This dissertation has used evidence gleaned from the samples of burials and human skeletal remains from Nemea to examine questions about the consequences of large-scale sociopolitical changes for the Byzantine Greek countryside. In this chapter, I present the conclusions of this research along with their broader implications and the considerations they suggest for future studies focusing on Byzantine Greece. I also discuss the limitations of this study and the plans for future research that will help to address some of those limitations and to expand the scope of this dissertation.

Contributions of this Dissertation

The multidisciplinary bioarchaeological approach of this dissertation provides results that are broadly informative to physical anthropologists, classical archaeologists, and historians working in the Early Christian and Byzantine periods. One of the most valuable contributions of this study is that it sheds light on the daily lives and living conditions of individuals who are largely ignored in historical sources and for whom there is often scant archaeological evidence. This research takes advantage of the fact that mortuary evidence—human burials and the skeletal remains they contain—provides a wealth of information about the peasant communities that made up the majority of the population of the Byzantine Empire. While bioarchaeological studies focusing on small-scale communities in Byzantine Greece are becoming more commonplace, this research provides much needed data from two important time periods in the northeastern Peloponnese.

This dissertation also makes several methodological contributions to the field of bioarchaeology in the eastern Mediterranean. First, this research avoids a traditional pitfall of osteological research in classical archaeology whereby the evidence from skeletal biology and

archaeology are treated separately. The integrative framework of this dissertation makes it possible to analyze the ways in which health, social relationships, and mortuary behavior intersected in the countryside of late antique and Middle to Late Byzantine Greece. In addition, this research has applied new techniques to the analysis of Byzantine graves, their spatial contexts, and the biological attributes of their occupants. While GIS has been used effectively by previous researchers to examine the spatial distribution of paleopathological conditions (e.g., Jenny 2011; Soler 2011), the present research has utilized spatial statistics to test specific, archaeologically derived models of mortuary behavior in the Byzantine period.

Finally, the results of this dissertation add to the growing body of historical and archaeological evidence that is currently being used to challenge traditional historical narratives of post-classical Greece. Because human skeletal remains provide the most direct evidence of the life encumbrances of those who lived through important sociopolitical transformations, the integration of osteological data should continue to be pursued in this endeavor. The sections that follow evaluate some of those historical narratives in light of the results of this research.

Sociopolitical Change and Skeletal Stress

The first research question of this dissertation was aimed at determining whether or not historically documented processes and events such as the Frankish invasion of the Peloponnese resulted in the deterioration of living conditions and quality of life at Nemea during the Middle to Late Byzantine period. The results of the comparative analysis of physiological stress indicators demonstrate that levels of stress remained constant through time with only one obvious exception: osteoarthritis of the knee. While other explanations are possible, the increase through time in the prevalence of osteoarthritis on this and other joints may be viewed as evidence of an increase in workload—a potential outcome of the decline in the social position of

dependent peasants following Frankish conquest. Any effect this may have had on the overall health and well-being of the Middle to Late Byzantine community must have been minimal, however, given the great similarity in the mortality curves and prevalence rates of physiological stress indicators of each skeletal sample.

It is concluded here that the Byzantine peasant communities at Nemea shared similar life stresses despite the vicissitudes of the state administration and possibly even more direct forms of social upheaval. The living conditions experienced by the members of the Middle to Late Byzantine community would have been largely recognizable to the members of the Early Christian community. Furthermore, the similarities in the prevalence rates of physiological stress indicators between the skeletal samples from Nemea, Akraiphnio, and Spata suggest that living conditions may have been comparable among peasant communities throughout the Byzantine Greek countryside. However, the analysis of additional samples from rural areas in central Greece and the Peloponnese would be necessary to make a strong case for this argument.

The conclusions associated with this research question have multiple possible implications for the historical narratives of this period. First, it is possible that areas of the southern Greek countryside were in large part physically removed from the social and political upheaval described in historical sources. In this scenario, life in the Nemea region continued virtually uninterrupted, perhaps until the late 13th or 14th century AD when a preference for fortified settlements is clear throughout the valley. A second possibility is that the events of the Middle to Late Byzantine period *did* have an immediate impact on the Nemea community, but that the hardships associated with administrative instability, Frankish conquest, and the feudalization of the Peloponnese are exaggerated in the written sources. In this interpretation, those processes and events probably meant little more for the daily lives of the local peasantry

than the redirection of its taxes. A final consideration that is not mutually exclusive to either possibility is that skeletal health as it is measured by bioarchaeologists using physiological stress indicators may be more dependent upon local conditions, local resources, and activity patterns than on state-level sociopolitical changes.

Women and Men in the Byzantine Countryside

The second research question in this dissertation was concerned with identifying sex-based health disparities within each skeletal sample at Nemea and examining the possibility that those disparities reflect a gendered division of labor or gendered variation in cultural practices. While most skeletal indicators of stress and activity showed no statistically significant differences between males and females, several results suggest that health disparities did exist during the Early Christian period. The elevated presence of cribra orbitalia among females suggests that it was more common for women to struggle to maintain adequate nutritional status than it was for men. The fact that women in both skeletal samples died at a young age more often than men may be a reflection of the serious, long-term health consequences of different experiences with nutritional stress in the Early Christian community. Another possible explanation for the mortality patterns revealed in this research is that many women died as a result of complications of pregnancy or childbirth. The greater prevalence of osteoarthritis of the hip joint in males along with the tendency for males to exhibit trauma consistent with accidental injury also provide evidence, albeit less clear, for the existence of a gendered division of activities.

Based on these results, it is concluded that while men may have more frequently engaged in more physically demanding and potentially dangerous activities, women were more at risk of nutritional deficiencies that had a greater influence on mortality. This conclusion is in agreement

with the assertion made frequently by Byzantine historians that women's lives were more precarious than those of men in Byzantine Greece. Interestingly, the absence of differences between males and females in the prevalence of linear enamel hypoplasias may suggest that the nutritional disparities between men and women tended to arise during the later childhood or adolescent years. This finding runs counter to the idea that females received less care from a very early age, but it is consistent with the possibility that gendered expectations of behavior, such as restrictive female diets, predisposed women to health problems as they continued to develop.

Firm conclusions about gender relationships in the Middle to Late Byzantine countryside cannot be offered in the absence of larger female subsample sizes from Nemea or the examination of additional skeletal samples in the region.

The Organization of Byzantine Burials

The final research question posed in this dissertation examined the possibility that burial location at Nemea was organized according to the social hierarchy. It was anticipated that skeletal analysis would provide support for that organizational scheme through the identification of meaningful patterns in the distribution of the presence and absence of physiological stress indicators across the mortuary space. Upon visual inspection and statistical analysis, most physiological stress indicators were found to be randomly distributed both within and between spatially distinct groups of burials. The two exceptions—the elevated presence of fractures in Early Christian temple burials and the significant clustering of cribra orbitalia among Middle to Late Byzantine burials immediately southeast of the basilica—have been demonstrated either to be analytically problematic or to have alternative interpretations that are more plausible than social factors having influenced the location of burial.

It is concluded here that the burials at Nemea were organized not according to status distinctions, but in accordance with each group's conceptions of the community and the family, the nature of religious worship, and the relationship between the living and the dead. The widespread distribution of the Early Christian burials across the site united the communities of the living and the dead in daily activity and public worship. By contrast, the placement of the dead in the Middle to Late Byzantine period in multiple burials localized around a small chapel and the remains of the Early Christian basilica functioned to emphasize the family as a unit in a more personal form of devotion.

The variability of mortuary behavior through time at Nemea cautions against applying generalizations to Byzantine burial practices. While at least some of the socioreligious concerns of Byzantine communities probably derived from broad themes that were common across the empire, this study demonstrates that such themes changed over time and also that they were likely shaped by regional or local factors. Additionally, the results of this study suggest that there may have been distinctions between rural and urban sites in the extent to which social status was a factor in decisions about burial location. For example, the model put forth by Ivison (1993) in which grave location and social status were highly correlated was developed and tested using basilica burials primarily from larger, urban centers. It is possible, then, that competition for high status burial locations was encouraged in urban areas where social distinctions were probably more exaggerated. Future studies concerned with the spatial organization of Byzantine graves—at least those in rural locations—should not assume that a relationship existed between burial location and social status.

Limitations of this Study

While this dissertation makes a number of contributions to the study of health and mortuary practices in Byzantine Greece, it is necessary to state its limitations clearly. Perhaps the greatest limitation of this study is the relatively small size of the skeletal samples from Nemea. All individuals available for analysis were included in this study. However, subsample sizes were generally small when the data was partitioned by age and sex. In order to maximize the number of individuals included in a given analysis, statistical evaluations of differences in physiological stress indicators were made only between the collapsed age categories of “adults” and “subadults.” Additionally, the small size of the total samples exacerbated the problem of the underrepresentation of females in the Middle to Late Byzantine sample. As discussed above, the absence of meaningful differences in skeletal health between males and females in that sample must remain a tentative result.

An additional methodological limitation of this study concerns the approaches that were necessary to address the issue of commingled burials. Examining paleopathological conditions by bone rather than by individual allows unassociated skeletal elements to be incorporated into the analysis. However, it must be acknowledged that this approach has the potential to bias the interpretation of those conditions. For example, linking the presence of periosteal reactions to systemic versus localized conditions was generally precluded because of the inability to distinguishing between lesions that were expressed bilaterally or unilaterally.

The analysis of the burials at Nemea, particularly those dating to the Middle to Late Byzantine period, was sometimes complicated by the dependence on excavation notebooks produced by a number of different researchers working during very different periods in the history of classical archaeology. The descriptions of graves at Nemea frequently vary in their

level of detail, a problem that occasionally made their attributes or, in a few cases, even their specific location difficult to discern. It should also be reiterated here that the bones recovered from many burials at Nemea were not kept and, furthermore, that burials most likely dating to the Middle to Late Byzantine period were probably not recorded at all during the earliest excavations. Both of those issues affect the representativeness of the samples and must be understood as potential sources of bias in the picture of health, demography, and mortuary practices argued for in this dissertation.

Finally, Nemea is the only site in the Peloponnese used in this research. Analyses of skeletal indicators of physiological stress and burial patterns at additional contemporaneous sites in southern Greece are necessary to confirm the extent to which the patterns at Nemea are consistent with the experience of other communities in the region.

Future Research Directions

A possibility that should be explored in future archaeological research at Nemea is that the cemetery areas, especially those utilized during the Early Christian period, have not been fully excavated. The discovery of additional burials may help to increase the size of the skeletal samples at Nemea. More importantly, however, defining the limits of the cemetery areas would help to confirm that some of the patterns apparent in the spatial distribution of the graves are not simply artifacts of the areas that have been excavated to date. Furthermore, additional burials—depending on their location, arrangement, and other attributes—have the potential to confirm or give cause to revise the interpretations of burial organization presented in this research.

With regard to the extant human skeletal material, the hypothesis that families were buried together at Nemea should be tested through the analysis of skeletal and dental non-metric traits that may be suggestive of biological affiliation or through the sampling of bone for the

purposes of investigating ancient DNA. This study has already taken the first step by identifying groups of Early Christian burials and multiple burials dating to the Middle to Late Byzantine period that should be sampled.

There is also opportunity at Nemea to use new approaches and analytical techniques to investigate different types of questions. For example, the Peloponnese likely experienced population movement on a large scale during both Late Antiquity and the Late Byzantine period. However, exactly how this affected the composition of the communities at Nemea is unknown. Especially as the present study has identified burial patterns suggestive of western influence, the question of whether or not at least some of the members of the Middle to Late Byzantine community were immigrants as opposed to local Greeks is highly significant. This research problem could be investigated through the analysis of oxygen stable isotope ratios in dental apatite, which has already been carried out successfully at Corinth (Garvie-Lok 2009). Again, the mortuary analysis presented in Chapter Eight has already identified individuals that would be appropriate to sample.

Finally, as discussed above, the results from Nemea must be compared with those from additional sites in southern Greece to provide a more complete understanding of the health consequences of the sociopolitical changes addressed in this dissertation. Ideally, samples of burials and human skeletons from both rural and urban sites should be examined. This would not only permit a broader investigation of the effects of different living environments on health during the Byzantine period, but would also provide a means to determine whether or not burial organization was more frequently tied to social status in urban centers. The skeletal material from Frankish Corinth, for example, would present a unique opportunity because of its proximity to Nemea, the importance of the city in the region, and the potential to explore how the

transformative processes of that period affected rural versus urban communities in the Peloponnese.

APPENDICES

Appendix A:
Data Coding Scheme

Table A.1: Data Codes.

Variable	Code in SPSS Database
Sex	0 = undetermined 1 = female 2 = ambiguous 3 = male
Age Category	1 = fetal 2 = infant (birth-3 yrs) 3 = child (3-12) 4 = adolescent (12-20) 5 = young adult (20-35) 6 = middle adult (35-50) 7 = old adult (50+) 8 = adult (20+)
Period	1 = Early Christian 2 = Middle to Late Byzantine
Burial Location	1 = temple 2 = bath 3 = basilica
Grave Type	0 = unknown 1 = plain pit 2 = roof tile 3 = field stone cover only 4 = field stone with sides 5 = combination of field stones and roof tiles 6 = osteotheke
Bodies Present	0 = unknown 1 = single burial 2 = double burial 3 = commingled 4 = truly empty 5 = bones not kept
Grave Orientation	0 = unknown 1 = east-west 2 = north-south
Head Treatment	0 = unknown 1 = no treatment 2 = stone pillow 3 = enclosed with stone 4 = tile pillow 5 = enclosed with tile 6 = mixed tile and stone

Table A.1 (cont'd)

Head Treatment Presence	0 = absent 1 = present
Grave Goods	0 = unknown 1 = absent 2 = items of personal adornment 3 = mortuary artifacts 4 = items of personal adornment and mortuary artifacts
Grave Goods Presence	0 = absent 1 = present
Linear Enamel Hypoplasia Presence	0 = LEH absent 1 = LEH present
Porotic Hyperostosis Presence	0 = absent with at least one observable parietal bone 1 = present
Porotic Hyperostosis Expression	1 = barely discernible 2 = porosity only 3 = coalescence of foramina 4 = coalescence and expansion
Cribra Orbitalia Presence	0 = absent with at least one observable eye orbit 1 = present
Cribra Orbitalia Expression	1 = barely discernible 2 = porosity only 3 = coalescence of foramina 4 = coalescence and expansion
Periosteal Reaction Presence	0 = no reaction present 1 = reaction present
Periosteal Reaction Expression	1 = markedly accentuated longitudinal striations 2 = slight discrete patches of reactive bone involving less than 1/4 of surface 3 = moderate involvement less than 1/2 of surface 4 = extensive reaction greater than 1/2 diaphysis with cortical expansion, deformation 5 = osteomyelitis 6 = associated with a fracture
Osteoarthritis Presence	0 = joint present with no evidence of degenerative changes 1 = OA present
Osteoarthritis Expression	1 = slight marginal lipping, may include porosity 2 = severe marginal lipping, may include substantial porosity, eburnation 3 = complete or near complete destruction of articular surface, including ankylosis 4 = joint fusion

Table A.1 (cont'd)

Trauma Presence	0 = absent 1 = present
Fracture Type	1 = transverse 2 = penetrating 3 = comminuted 4 = depression 5 = compression 6 = oblique 7 = spiral 8 = greenstick 9 = impacted 10 = burst 11 = avulsion 12 = pathologic
Fracture Healing	1 = well healed 2 = partially healed 3 = possibly perimortem
Fracture Complications	1 = well aligned 2 = partially aligned 3 = significant deformity 4 = pseudarthrosis 5 = joint fusion 6 = associated infection

Appendix B:
Demarking Points for the Nemea Skeletal Samples

The Early Christian Sample

Table B.1: Number of Early Christian Femora and Demarking Point for Midshaft Circumference.

Sex	Number (n)	Mean Femur Midshaft Circumference (mm)	Demarking Point (mm)
Male	45	90.113	Males > 83.842 > Females
Female	28	77.571	
Total	73		

The Middle to Late Byzantine Sample

Table B.2: Number of Middle to Late Byzantine Femora and Demarking Point for Maximum Head Diameter.

Sex	Number (n)	Mean Femur Maximum Head Diameter (mm)	Demarking Point (mm)
Male	49	48.941	Males > 45.062 > Females
Female	12	41.183	
Total	61		

Table B.3: Number of Middle to Late Byzantine Femora and Demarking Point for Midshaft Circumference.

Sex	Number (n)	Mean Femur Midshaft Circumference (mm)	Demarking Point (mm)
Male	31	95.032	Males > 87.653 > Females
Female	11	80.273	
Total	42		

Table B.4: Number of Middle to Late Byzantine Tibiae and Demarking Point for Circumference at the Nutrient Foramen.

Sex	Number (n)	Mean Tibia Nutrient Foramen Circumference (mm)	Demarking Point (mm)
Male	22	100.727	Males > 93.935 > Females
Female	7	87.143	
Total	29		

Table B.5: Number of Middle to Late Byzantine Humeri and Demarking Point for Epicondylar Breadth.

Sex	Number (n)	Mean Humerus Epicondylar Breadth (mm)	Demarking Point (mm)
Male	19	64.895	Males > 61.241 > Females
Female	7	57.586	
Total	26		

Table B.6: Number of Middle to Late Byzantine Humeri and Demarking Point for Vertical Head Diameter.

Sex	Number (n)	Mean Humerus Vertical Head Diameter (mm)	Demarking Point (mm)
Male	29	47.428	Males > 43.639 > Females
Female	10	39.850	
Total	39		

Table B.7: Number of Middle to Late Byzantine Humeri and Demarking Point for Minimum Circumference.

Sex	Number (n)	Mean Humerus Minimum Circumference (mm)	Demarking Point (mm)
Male	23	66.130	Males > 62.065 > Females
Female	10	58.000	
Total	33		

Table B.8: Number of Middle to Late Byzantine Radii and Demarking Point for Tuberosity Circumference.

Sex	Number (n)	Mean Tuberosity Circumference (mm)	Demarking Point (mm)
Male	20	55.350	Males > 52.738 > Females
Female	8	50.125	
Total	28		

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Fig. 1. Restored plan of the Sanctuary of Zeus, Archaic to Hellenistic periods.

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Effie Athanassopoulos, Ph.D.
Associate Professor of Anthropology and Classics
University of Nebraska Lincoln
Department of Anthropology
935 Oldfather Hall
Lincoln NE 68583-0218

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Fig. 1. Map of the Nemea Valley Survey with Medieval Sites (Rosemary J. Robertson)

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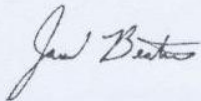
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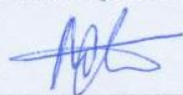
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