

Continuity or Decline:
A bioarchaeological analysis of the quality of life
at the Roman city of Sanisera during the Vandal occupation

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HONOR PLEDGE

On my honor, I have neither given, nor received, any unauthorized aid on this honors thesis. Honor Code upheld.

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Table of Contents

Acknowledgements	ii
Abstract	iv
Introduction	1
Figure 1: Map of Menorca	6
Figure 2: Map of the Mediterranean	7
Roman Spain	8
Vandals	12
Sanisera	15
Figure 3: Aerial photo of Necropoleis 4 and 6	17
Figure 4: Variety of burial goods	18
Methods	18
Figure 5: Cist tomb in Necropolis 6	20
Figure 6: Multiple interments in Necropolis 6	21
Results	23
Table 1: Preliminary demographics in Necropolis 6	24
Figure 7: Mortality by age group in Necropolis 6	24
Figure 8: Adult mortality by age group and sex in Necropolis 6	25
Table 2: Prevalence of key pathologies in Necropolis 6	26
Table 3: Prevalence of key pathologies in Necropolis 4	27
Figure 9: Mortality by age group in Necropolis 4	28
Figure 10: Adult mortality by age group and sex in Necropolis 4	28
Discussion	28
Figure 11: Evidence of periodontal disease.....	29
Figure 12: Evidence of dental caries.....	30
Figure 13: Evidence of trauma	32
Figure 14: Evidence of osteoarthritis	35
Conclusion	37
Appendix	39
Glossary	40
References Cited	41

Abstract

For centuries scholars have assumed that a ubiquitous deterioration in quality of life occurred throughout the former Western Roman Empire following its collapse in the 5th century AD. This presumption is largely the result of a lack of understanding of the common people and the so-called “barbarians.” My research addresses this gap in the literature through the bioarchaeological analysis of the impact of the Vandal occupation of the Roman city of Sanisera on the island of Menorca, Spain during the 5th-6th centuries AD. The frequencies of osteological indicators of pathological conditions are calculated and compared to frequencies at other sites throughout the Empire dated to before, during, and after the barbarian invasions and collapse of the Western Roman Empire. This data is used to determine relative quality of life and the level of continuity in health between Roman and Vandal rule. The indicators analyzed are dental caries, dental calculus, abscesses, antemortem tooth loss (AMTL), periodontal disease, dental enamel hypoplasias (DEH), traumas including fractures and dislocations, periostitis, osteomyelitis, degenerative joint disease, osteophytosis, osteoarthritis, and osteoporosis.

The results indicate a high rate of disease at Sanisera, likely as a result of the plague that swept the region during this period. The diet was relatively balanced and nutritious, and the level of mechanical stress was normal for a rural, non-mechanized society. Overall, these results indicate that the average level of health at Sanisera was relatively good for a rural, non-mechanized society from antiquity. The level of health seen at Sanisera is consistent with other sites prior to the collapse of the Empire, implying that the Vandal occupation of the island did not result in a decline in the quality of life of its inhabitants.

Introduction

The decline of the Western Roman Empire has been a contentious issue for centuries, and historians remain divided as to the most critical factor(s) which led to the downfall of one of the greatest empires in history. What has largely remained unquestioned, however, is the assumption that the disintegration of the Empire inevitably resulted in a widespread deterioration in the health and quality of life of once-Roman citizens. This presumption is largely based on a lack of understanding of the common people and the “savage” image of the barbarian tribes whose invasions into Roman territories, and subsequent occupations therein, were instrumental in the fall of the Empire.

Historically, classical archaeology has been narrowly focused on the lives of the elite in the Roman world, leaving modern scholars with a biased and incomplete understanding of the Empire. Less affluent Roman civilians and the so-called “barbarians” have been left on the periphery either completely without voice or, perhaps worse yet, misrepresented. A more comprehensive and accurate understanding of the collapse of the Roman Empire requires a greater understanding of how its fall impacted all of its citizens and how their relationships with their conquerors developed. Due to their illiteracy and consequential lack of contemporary texts, the study of non-elites and barbarians is in some ways more complex than that of the elites. To study these groups requires a different methodology, with a stronger emphasis on archaeological analysis.

In order to address these gaps in the modern historical literature, archaeologists have begun excavating liminal sites from the Roman Empire, focusing on those from lower socioeconomic classes (e.g. Belcastro et al. 2007; Contreras Rodrigo 1998).

Ceramic distribution, material culture, and architecture of both domestic and civic structures are typically analyzed in order to determine details such as economic prosperity, based on the amount of trade and the quality of the materials used in the construction of buildings and artifacts. Yet much more can be revealed if we augment such research with an in-depth osteological analysis of the human remains excavated from the necropoleis associated with these sites. Skeletal remains have the potential to offer considerable information that supplements material culture analyses and hence our understanding of non-elites, with data regarding health, diet, and quality of life (Larsen 1997). In spite of its utility, the majority of the osteological data that have been recorded from classical contexts are primarily descriptive and surprisingly basic, often being limited to a simple documentation of sex, age at death, and a list of the bones present (Larsen 1997; Buikstra and Beck 2006).

The development of the field of bioarchaeology has brought this dearth of research to the attention of archaeologists, and begun to address this vacancy in the archaeological method. Now, bioarchaeologists seek not only to diagnose pathological conditions and record demographic data, but also to explain the cultural and environmental contexts that caused the development of such osteological records (Larsen 2000). Bioarchaeology has thus become the “discipline that bridges the biological and social sciences” (Knudson and Stojanowski 2008:397). This research is particularly vital to the study of the common people, who often leave little behind in terms of architecture, material culture, and texts. Thus, the analysis of human remains has the potential to play a crucial role in broadening the scope of classical archaeology to

encompass the lives of the masses and the relative health of less affluent populations throughout the Roman Empire during and after its collapse.

Bioarchaeological methodology is in accordance with processual archaeology in the sense that it follows scientific archaeological procedures. Yet it is important to note that this approach acknowledges that the background of the researcher to some extent shapes the research, and the interpretation of the data is never considered beyond refute. Although osteological indicators provide quantitative evidence, the interpretation of that evidence is subjective. It is impossible to prove beyond a doubt what caused a specific osteological response, largely because a multitude of environmental factors can cause similar osteological reactions (White and Folkens 2005).

Despite the inherent subjectivity of bioarchaeological interpretation, reliable results can be attained with the creation and application of an interpretive framework based on previously conducted cultural-historical research. Previous literary and archaeological research, based on the material culture and architecture of a site, are vital to the construction of a framework for understanding the pathologies, nutritional deficiencies, and traumas present in the osteological record. For instance, ceramic evidence can supply not only the chronology of the site, but also evidence of the extent of trade and dietary sources, which may account for the nutritional deficiencies, or lack thereof, in the population of study. Without such context, the reliability of any bioarchaeological analysis is greatly reduced.

This research project is based on a two-fold approach that incorporates both the cultural-historical research acquired via literary sources and material culture, and an analysis of the human remains associated with the site in order to determine the impact of

the Vandal occupation on the quality of life of the inhabitants of the city of Sanisera on the island of Menorca, Spain during the 5th-6th centuries AD. Quality of life at Sanisera during this period would have been determined by two major historical factors: the extent of “Romanization” at Sanisera, and the intentions of the Vandals in conquering the Balearics. “Romanization” is here defined as being a part of the Roman Empire, sharing in its technological advances and consequently higher quality of life, and as a result typically feeling some amount of loyalty to the Empire. The extent of “Romanization” would impact the level of resistance to Vandal occupation (Keay 1988) and therefore determine the likelihood of armed conflict and an at least briefly decreased quality of life. Perhaps more importantly, however, the objectives and character of Vandal leadership would determine the treatment of the Roman citizens at Sanisera.

Following a brief historical background of the site, I situate Sanisera within the historical and archaeological context of the Romanization of Spain and the state of the Roman Empire during the 5th-6th centuries AD. I then explore popular characterizations of the Vandals in order to understand the relationship between conquerors and conquered. This background information will then be used as a framework for understanding the changes or consistencies in quality of life according to osteological indicators in the population.

Here I must pause to consider the use of the terms “barbarian” and “Romanization.” The word barbarian comes from the Latin *barbarus*, meaning foreigner, but the term has acquired the stigma of a culture that is savage and base (Krebs 2011). The interchangeable use of the terms “barbarian” and “Germanic” during the period under investigation has conjured images of dirty, brutish, incompetent warriors with

unkempt hair, and misleads readers to assume these are the characteristics of every Germanic tribe. The term “Germanic” is similarly problematic, as no single Germanic cultural entity existed at any point in Rome’s long history (Goffart 2006). I use the terms barbarian and Germanic throughout this paper exclusively to refer to the multitude of foreign tribes from the north of the Rhine and Danube rivers. The assumption should not be made that these groups were inherently savage or united; the character of the specific tribe in question, the Vandals, will be addressed in detail below.

Likewise, the concept of Romanization is also controversial due to its assumption of the universal adoption of the dominant Roman culture without considering the cultural exchange that occurs whenever two societies meet (Woolf 1997). Rather than an immediate subjugation followed by the disappearance of an entire culture as they “Romanized,” the process of Romanization consisted of a gradual incorporation of Roman values at the same time that the Roman colonizers integrated aspects of the local culture into their own (Woolf 1997). Eventually, a sort of middle ground was reached, giving each region of the Empire a unique culture, unified under the political and economic structure of the Empire (Wickham 2009). Thus, the use of the term “Romanization” throughout this paper is not in reference to a hegemonic imposition of Roman culture and the death of all local customs, but to the gradual cultural exchange that occurred between the indigenous and the colonizers throughout Spain until a common culture within a Roman political structure was eventually created. The extent to which this culture maintained strong attachments to Rome itself is a question that will be addressed following a brief discussion of the site.

The population of my study is currently being excavated from the 5th-6th century AD necropoleis associated with the Roman town of Sanisera, located next to the natural port of Sanitja beside the Cap de Cavalleria on the northern coast of the island of Menorca, Spain (Figures 1 and 2; Contreras Rodrigo 1998). Quintus Caecilius Metellus, ‘the Balearic,’ conquered the Balearics and established a Roman fort at Sanitja in 123 BC with the city of Sanisera cropping up soon after and remaining occupied by various groups until the 9th century AD (Contreras Rodrigo 1998).

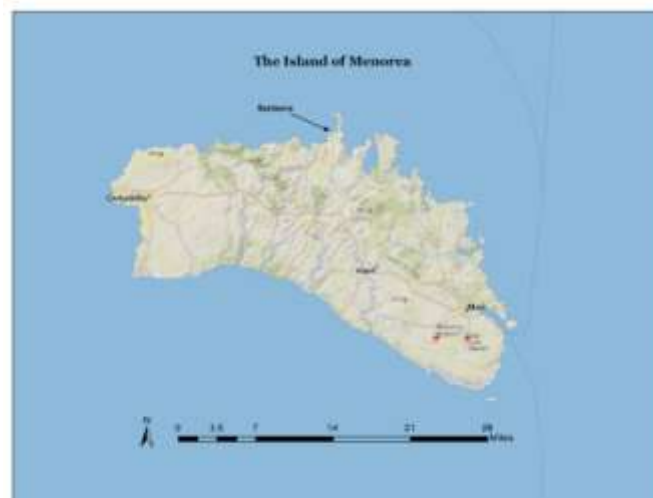


Figure 1. The approximate location of the site of Sanisera is indicated with an arrow on this map of the island of Menorca.

The Balearics were conquered in order to quell the piracy that became rampant after the Romans defeated Carthage in the Third Punic War in 146 BC, leaving a power vacuum in the Mediterranean (Contreras Rodrigo 1998; cf. Strabo 3.5.1). Yet this conquest was also a strategic decision, as Rome was expanding its empire and attempting to assert control over the Mediterranean (Contreras Rodrigo 1998). The central location of the Balearics made them vital both militarily and commercially, as they provided much needed intermediate ports on long journeys between Italy, Spain, Gaul, and North Africa

(Figure 2; Horden and Purcell 2000). Recent archaeological research has revealed that for the Romans, the Port of Sanitja was one of these crucial ports (Contreras Rodrigo 1998).



Figure 2. Sanisera is circled on this map of the Mediterranean, indicating its centrality in marine trade routes.

During the 5th and 6th centuries AD, political and social turmoil dominated the Mediterranean as the western half of the Roman Empire slowly collapsed (Goffart 2006). Although this disintegration was the result of a multitude of factors both internal and external, the mounting pressures of invading barbarian tribes, including the Visigoths, Vandals, Alans, and Suevi, played a significant role (Goffart 2006; Heather 2006). The Vandals, a Germanic tribe from north of the Danube, settled on the island of Menorca in AD 455 after establishing themselves in North Africa during the first half of the 5th century (Keay 1988).

Historically, the Vandals have been considered a barbarous group whose name has become synonymous with conquest and destruction. Such traits were seen in their

devastation of the city of Rome in AD 455, yet archaeologists and historians are beginning to question this general image of the brutish barbarian that has been perpetuated for centuries. Scholars are now demonstrating that our modern understanding of Germanic tribes like the Vandals has been tainted by the sources from which it was constructed (e.g. Heather 2006; Goffart 2006). Several of the major authors that documented the Vandal invasion, notably Procopius and Victor Vitensis, were members of a Christian sect known as the Trinitarians, whom the Arian Vandals mercilessly oppressed (Moorhead 1992).

By documenting only the most gruesome acts of religious persecution committed by the Vandals during their rule, Procopius and Victor presented them as ruthless brutes incapable of the enlightened and civilized rule of their Roman predecessors. Subsequently, modern historians have portrayed the Vandals as excessively vicious and destructive conquerors. While the Vandals were certainly brutal in their treatment of Trinitarians, the assumption that they always behaved in such a way is inaccurate. The archaeological record at Sanisera itself shows that there were periods of looting and destruction during the 8th and 9th centuries, but there is no evidence of either during the Vandal period, indicating that Vandal pillaging was not an issue at Sanisera (Contreras Rodrigo 1998). Such evidence lends support to the new vision of the Vandals as more than savage warriors destroying whatever lay before them.

Roman Spain

The present research aims to approach the question of the Vandal impact upon their arrival and conquest of Menorca from a different perspective by analyzing the human remains associated with Sanisera to determine quality of life during this period. In

order to do so, I first examine the development of Roman Spain in an effort to determine the extent of the cultural ties that the people felt towards the Empire. Cultural and political loyalties are important to consider when determining the likelihood of the population to retaliate against the Vandals. This would in turn influence the level of violence required to occupy the city and hence the quality of life. I then discuss the political and economic conditions of the Roman Empire directly prior to the Vandal invasion in order to establish a context for the invasion and understand the probable reactions of the inhabitants of Sanisera to the declaration of Vandal authority on the island.

Until Augustus' rise to power and subsequent campaign in Hispania in 26 BC (Dio Cassius 53.22.5), Roman presence in the Iberian Peninsula was almost entirely military, with only rudimentary administrative organization and minimal interference in local politics (Kulikowski 2004). Under Augustus, administration throughout the Empire was restructured to be more efficient and effective (Kulikowski 2004). His reign saw the incorporation of local elites, thereby drastically reducing the number of imperial officials required to administer the provinces (Kulikowski 2004). Residents of the Iberian Peninsula therefore began to adopt Roman customs in order to advance in the new political climate (Kulikowski 2004).

Vespasian expedited the process of Romanization when he issued the Flavian municipal laws, rewarding the entire peninsula with *ius Latii* for their service to him during the civil wars of AD 68-69 (Kulikowski 2004). In essence, this granted the inhabitants of the Spanish provinces a status that was not quite Roman citizenship, but placed them above the *perigrini* (foreigners) in Roman law (Kulikowski 2004). This

status provided the people at large with greater access to the judicial and economic benefits of the Empire, and a greater opportunity to eventually become full citizens (Kulikowski 2004). Even the island of Menorca was included, with Magona (modern Mahon) being granted *municipium* status (Marti 1970). The relatively early formal integration of Hispania into the Empire led the Iberian provinces to become exceptionally urbanized and Romanized (Kulikowski 2004).

Perhaps the greatest testament to the complete Romanization of Hispania is demonstrated by the ascension of Spaniards Trajan and Hadrian to the emperors of Rome in the beginning of the 2nd century AD. Trajan in particular was praised by ancient historians for both his exceptional character and his method of rule (e.g. Dio Cassius 68.7.1-19); such excellence in leadership reflected well on the province as a whole. Mention of the Spanish provinces themselves are few during this period, but this is likely due to the general prosperity and peace in the Iberian Peninsula throughout their rule, making it an uninteresting topic for discussion amongst contemporary authors (Kulikowski 2004). Even during the political chaos of the 3rd century AD, which saw a rapid succession of emperors in Rome, Spain suffered relatively little disruption in the political sphere (Heather 2006). Yet the Iberian provinces were still included in Diocletian's reorganization of provincial administration in the late 3rd century AD (Kulikowski 2004). These reforms placed a major emphasis on the bureaucracy of government. As a result, imperial rule became directly linked with the presence of imperial officials and administration (Kulikowski 2004).

Roman rule and consequently Romanization therefore came to be essentially defined by the presence and implementation of imperial bureaucracy; what does this

mean for the towns on the outskirts, which had little contact with bureaucrats? Although the city of Magona was given *municipium* status, with its accompanying *curia* (local government) during the Flavian dynasty, the level of bureaucracy and number of civil servants on the island paled in comparison to those on the peninsula (Marti 1977). This was especially true in the small town of Sanisera, where the Roman fort was abandoned in 45 BC, leaving few direct reminders of Roman rule (Ecomuseo de Cap de Cavalleria). The lifestyle and town organization were likely Roman, but the tangible presence of Roman rule and therefore the feeling of “being Roman” was almost certainly much less pronounced than on the Iberian mainland. Given the probable lack of Roman political influence and loyalty at Sanisera due to minimal bureaucratic presence, the arrival of the Vandals may not have incited much resistance from the residents.

Archaeological evidence throughout the Balearics supports this assertion. Specifically, there is a notable lack of defensive settlements or structures built during the Vandal invasion, which presumably would have been constructed if the inhabitants were resisting occupation (Mas and Cau 2011). Furthermore, as previously mentioned, Sanisera itself reveals no signs of looting or destruction during this period (Bravo Asensio and Contreras Rodrigo 2012). Although a confrontation almost certainly occurred to some extent, it does not appear to have been severe, destructive, or prolonged. Without a militant resistance, there would be no other reason for a significant disruption to daily life unless the island were simply being raided, plundered, and destroyed, rather than occupied. Yet we have evidence of a prolonged Vandal occupation of the city, including Vandal coins and ceramics indicating a strong Vandal presence at Sanisera for a period of 150 years (Bravo Asensio and Contreras Rodrigo 2012).

The Vandals

It is largely assumed that barbarian rule was tantamount to the utter destruction of civilized and sophisticated society, inevitably resulting in a serious depreciation of quality of life. Archaeological evidence, like that at Sanisera, is beginning to contradict this paradigm. Although devastation and pillaging certainly did occur to an extent, particularly early in the 5th century before various tribes established kingdoms throughout the former Empire, barbarian tribes such as the Vandals were not simply brutes taking advantage of an opportunity to rape and pillage in the face of a failing empire (Goffart 2006; Heather 2006). The assumption of the destructive nature of the Vandals is derived from a long history of rhetorical hyperbole by means of which Roman politicians employed a barbaric image of the tribes north of the Danube and the Rhine rivers to justify their political maneuvering.

Julius Caesar was the first Roman to consolidate the multitude of northern tribes into a single and distinct *ethnos* when he briefly discussed the inhabitants of the area east of the Rhine in *de bello Gallico*, following his conquest of Gaul in 58 BC (Krebs 2011). The *Germani*, as presented by Caesar, are characterized by an exceptional proficiency in battle as a result of their lifelong commitment to honing their skills as hunters and warriors (Krebs 2011; cf. Caesar 6.21.3). Recent research has shown it was likely that the land north of the Rhine was simply not lucrative enough to justify the expense of conquering and maintaining it as a province, but by portraying the *Germani* as the ultimate warriors, Caesar was able to justify his failure to conquer this area along with Gaul (Heather 2006).

Over time, however, authors such as Tacitus recreated the image of the *Germani*, making them formidable warriors not as a result of their dedication, but rather due to their irrational and impulsive nature (Krebs 2011; cf. Tacitus 15.1). The *Germani*, or “*barbari*,” thus came to represent the quintessential embodiment of Seneca’s *homines iracundi* (Krebs 2011; cf. Seneca 3.29-30). The inherent impulsivity of the *homines iracundi* made them the antithesis of Roman civilization and sophistication, closer to animals than they were humans (Krebs 2011). Roman politicians could therefore use the threat of the encroaching *Germani* to justify tax increases, military expansions, and the exclusion of certain peoples from the Empire (Krebs 2011).

Even after the fall of the Western Roman Empire, religious and political opponents used the disrepute of the Germanic tribes to portray their new rulers as barbarians and hence inferior. Authors such as Victor Vitensis, bishop of North Africa, wrote chronicles of barbarian rule fraught with hyperbolic anecdotes intended to remind the reader of the base and animalistic character of the brutish barbarian tribes that swept through once civilized Roman regions. When writing on the Vandal persecution of Trinitarians like himself, Victor repeatedly describes the Vandal administration as being in a “barbaric frenzy¹,” thereby evoking the stereotypical images of the *homines iracundi* in the minds of his readers.

In his detailed account of the martyrdom of various Christians and the ineptitude of the Vandal king Geiseric, Victor neglects to mention the significant political and economic continuity and prosperity in North Africa during the Vandal occupation (Moorhead 1992). As bishop of North Africa, his views were indisputably colored by his

¹ *Barbarici furoris* (e.g. Victor Vitensis 1.9.32).

experience of religious oppression. Yet as his manuscript is now the only remaining firsthand account of the Vandal invasion of North Africa, modern historians have heavily relied upon his work in order to develop their understanding of the impacts of the Vandal occupation (Moorhead 1992).

The other source from which historians have reconstructed the Vandals was written by Procopius, who only arrived in North Africa after Justinian's general, Belisarius, had vanquished the barbarian kingdom and claimed the lucrative North African provinces for the Byzantine Empire in AD 533 (Moorhead 1992). Not only was Procopius not physically present during the Vandal occupation of North Africa and the Balearics, but he was also the historian for the Byzantine emperor who destroyed the Vandal kingdom (Moorhead 1992). Thus, his political allegiance determined the way in which he depicted the Vandals.

In order to portray his emperor in the most flattering light, the Vandals had to be seen as a brutal force and hence a worthy foe, but at the same time one whose rule was unacceptable to the civilized senses of the Byzantines. Procopius followed a typology laid down before him by Caesar, Tacitus, and Victor Vitensis, depicting the Vandals as an irrational horde, excellent in battle, but horrific in political and religious rule. "Thus without any cause [Geiseric] kept making invasions wherever chance might lead him" (Procopius 3.5.25). Geiseric and his successors rapidly expanded their empire through such chance invasions, but historians like Procopius provide us with an image of an empire that would inevitably fall due to the impulsive nature of Vandal rule.

This essentialist and negative view fails to take into account the cultural exchange that had been occurring between the barbarians and the Romans for centuries. The

Vandals were not in fact as distant or distinct as Roman historians would have us believe. Living on the border of the Empire, their proximity to Roman settlements necessarily resulted in cultural exchange, and to some extent, the incorporation of various Roman values, ideas, and lifestyles (Goffart 2006). After centuries of such interaction, the Vandals had seen the benefits of the reliable economy that the Romans had established (Goffart 2006). The Vandal creation of a maritime kingdom was not impulsive and destined to fail, but a methodical and strategic effort to obtain an empire for themselves.

Recent archaeological evidence has given credence to a new, less “savage” and irrational image of the Vandals by demonstrating that the lands they occupied actually flourished under their rule. Ceramic evidence demonstrates a fifth century Mediterranean in which the Vandals expanded trade, with new eastern exports reaching Hispania, and the Balearic Islands “emerg[ing] as an important trading point tying Gaul to points south and west” (Bowes and Kulikowski 2005:366). Destruction of port towns in particular would have been counterproductive to the Vandal establishment of a maritime kingdom that relied upon sea trade routes. Ceramic, numismatic, and architectural evidence at Sanisera has thus far supported this new vision of the Vandals (Bravo Asensio and Contreras Rodrigo 2012).

Sanisera

The site of Sanisera was chosen based on my previous excavation experience at the site in the 2011 field season. During this time, several pathologies were observed in the remains from Necropolis 6, triggering my interest in research concerning the quality of life of the population. Sanisera itself has been the location of notable archaeological excavation (Bravo Asensio and Contreras Rodrigo 2012; Nicolas 1985), but in

accordance with the classical approach, the focus has remained on the military fort and the domestic structures of the settlement. Although excavations are ongoing at the necropoleis, with several unpublished progress reports, the assessment of the demographics and quality of life has remained cursory, largely due to the amount of material still yet to be excavated.

Excavations began at the port of Sanitja in 1979. Since that time, the entirety of the Roman fort beside the port has been revealed and studied, excavation has begun in several of the necropoleis that surround the city, and 1250 m² of the city of Sanisera has been uncovered, including Buildings 10 and 11 (Bravo Asensio and Contreras Rodrigo 2012). Excavations in both buildings have demonstrated that the Vandal Period was the most prosperous moment in Sanisera's history (Bravo Asensio and Contreras Rodrigo 2012). For Building 10, this analysis is based on the abundance of fine ware and the numismatic evidence, which includes 46 Vandal coins so far, the largest amount found from any period at Sanisera (Bravo Asensio and Contreras Rodrigo 2012). Building 11 showed six distinct constructive phases, with the most significant being at the time of the Vandal occupation when the basilical layout was constructed (Bravo Asensio and Contreras Rodrigo 2012). It is common for basilicas to attract inhabitants and increase the size and prosperity of a settlement, which seems to have been the case at Sanisera (Bravo Asensio and Contreras Rodrigo 2012; Mas and Cau 2011).

There are seven necropoleis associated with Sanisera. Thus far, the Ecomuseum has excavated the entirety of Necropolis 6, and begun excavations in Necropolis 4 (Figure 3). Necropolis 4 is believed to be directly related to the basilica, which is only 65 meters east of the necropolis (Bravo Asensio and Contreras Rodrigo 2012). There are a

variety of situations that may have led the people of Sanisera to separate the burials into seven separate necropoleis, including socioeconomic or familial segregation. It appears unlikely that it was simply a result of a need for more space over time as there are several unused tombs in Necropolis 6 that presumably would have been filled prior to expanding to an entirely new necropolis (Pacheco et al. 2012). The evidence currently indicates that both Necropoleis 4 and 6 belong to the High Imperial/Late Roman period (Pacheco et al. 2012). Both are placed at about the fifth to sixth century AD (Pacheco et al. 2012). This chronology is based on the burial goods found throughout both sites (Figure 4), which are associated with the High Imperial period, and the cist type tombs that face east-west which are typical of Christian burials from this period (Pacheco et al. 2012).



Figure 3: Locations of Necropoleis 4 and 6 in relation to the Roman city of Sanisera (Ciudad romana) at the Cap de Cavalleria (adapted from Pacheco et al. 2012).



Figure 4: Variety of associated grave goods from Necropolis 6 (adapted from Pacheco et al. 2012).

Methods

The measurement of quality of life amongst living populations typically emphasizes the average health of individuals as the “chief component” for determining quality of life (Buikstra and Beck 2006:361). My quantitative research therefore focuses on the analysis of the presence and extent of biological indications of health imprinted on the skeletal remains. Specifically, the dentition, skull, long bones, vertebrae, and the bones of the feet were examined. The feet were included because previous reports indicated that there is a high rate of trauma in the feet of the population at Sanisera. Data collected from the bones were recorded in a table such as that seen in Appendix A, with extensive additional notes.

The specific osteological indicators of pathologies and nutritional deficiencies analyzed are dental caries, dental calculus, abscesses, antemortem tooth loss (AMTL),

periodontal disease, dental enamel hypoplasias (DEH), traumas including fractures and dislocations, periostitis, osteomyelitis, osteophytosis, osteoarthritis, osteoporosis, and degenerative joint disease. Analyses of these stress indicators are conducted using a biocultural theoretical framework based on a population perspective (White and Folkens 2005; Larsen 1997). Due to the limited amount of time available for research, each indicator is analyzed based simply on presence or absence, which is then used to calculate prevalence within the population. More detailed notes were taken on the severity and location of each pathology, but these were not recorded according to a specific methodology.

The research looks solely at the remains removed from area two of Necropolis 6 and Tombs 401, 403, and 406 from Necropolis 4. These specific areas were selected because both are believed to correspond to approximately the 5th-6th centuries AD, which correlates with the period during and following the Vandal occupation (Pacheco, personal communication; Key 1988). The small number of tombs from Necropolis 4 is the result of limited time and resources. The Ecomuseum and students of their field school conducted all excavation in both necropoleis under the supervision of a trained biological anthropologist. Standard archaeological methods were used for the excavation of all of the remains analyzed in this paper (Pacheco et al. 2012). Each bone was removed carefully and individually, with extensive mapping, photographing, and drawing.

The tombs from both necropoleis are cist tombs, meaning that tegula, local limestone, sandstone, or slate were used to line the coffin-like tombs set in the ground in which the deceased were buried (Figure 5; Pacheco et al. 2012). Reused *opus caementicum* has also been found in association with the lids for the tombs, although the

preservation of this material is poor (Pacheco et al. 2012). The majority of the tombs are systematically distributed in approximately straight rows with east-west orientation. The head of the corpse is always aligned to the west in accordance with Christian burial practices (Pacheco et al. 2012). Associated funerary goods are not extensive considering the number of tombs or individuals excavated, but include such finds as a bronze bracelet, Punic glass beads, ceramic amphora fragments, a bronze button, and several notable glass flowers from Tomb 9 (Pacheco et al. 2012). The exact grave goods associated with Necropolis 4 are currently unknown to the researcher, but according to the biological anthropologist working for the Ecomuseum, consists of finds similar to those from Necropolis 6 (Pacheco, personal communication 2012).



Figure 5: Example of a cist tomb, excavated to the level of the earliest burial (adapted from Pacheco et al. 2012).

Preservation was variable both within and between tombs. Many tombs were impacted by bioturbation and looting, resulting in much more fragmentary remains in some tombs than in others (Pacheco et al. 2012). All of the tombs contained multiple interments, which led to the differential preservation of the individuals within each tomb as they were affected by the sequence of burials (Pacheco et al. 2012). Earlier burials

often showed worse preservation due to the fact that they were typically pushed aside to make room for later interments (Pacheco et al. 2012). As a result, a substantial amount of skeletal material was not articulated. Nonetheless, many of the remains could be easily and accurately resorted by individual because when the partially decomposed remains were pushed to the sides of the tombs, they often remained semi-articulated, or were at least clumped in distinguishable groupings (Figure 6; Pacheco et al. 2012).



Figure 6: Example of a tomb from Necropolis 6 with multiple burials. There are three skulls at the top of the tomb and a pile of humeri to the right of the femurs. Photo taken by the author.

However, since this was not possible in all cases and time was limited, the frequencies of all non-dental pathologies have been recorded according to total number of occurrences rather than number of individuals affected. The number of occurrences in all of the remains was then divided by the minimum number of individuals (MNI) in the sample in order to calculate an average frequency within the population. Dental pathologies were calculated according to number of teeth affected rather than number of individuals. Frequencies were then calculated by dividing the number of occurrences by the total number of teeth studied. The comparative studies used in the analysis of the data

also recorded frequencies based on the number of teeth affected (Roberts and Manchester 2005).

Tomb 403 is sorted by individual, but Tombs 401 and 406 are instead labeled according to excavation zones within each tomb (Pacheco et al. 2009). Excavation of the latter two tombs was incomplete at the end of the 2012 field season when I conducted my analysis of the remains. As a result, the sample from Necropolis 4 is not only minimal, but also contains incomplete representations of these two tombs. However, when used in conjunction with the evidence from Necropolis 6, the sample size is sufficient for a preliminary analysis of the population at Sanisera during the fifth and sixth centuries when these necropoleis were in use.

The reliability of the analysis is limited by the current lack of skeletal evidence from the period prior to the Vandal occupation at Sanisera. As a result, it is not yet possible to perform a direct comparative analysis of the population before and after the invasion, which would be the most reliable method by which to determine continuity or decline in the health of the people at Sanisera. The results are instead compared with the analyses of remains from other sites in the Roman Empire that were of a similar socioeconomic status from various time periods. These time periods include Roman Imperial (1st-4th centuries AD) and Early Medieval (7th century AD), so information can be obtained about health both before and after the barbarian invasions and collapse of the Western Empire. This type of comparative study is less reliable than a direct comparison at the site, particularly since the methods for determining health by osteological indicators are inconsistent across studies. Nevertheless, this preliminary analysis will

provide important baseline data, which can be utilized comparatively in the future as the necropoleis associated with earlier periods are excavated and analyzed.

The results from the remains can thus be analyzed comparatively with other Roman pre- and post-barbarian sites in order to determine if the health of the population at Sanisera during the 5th-6th centuries AD is relatively greater or poorer than their earlier and contemporary Roman counterparts. General patterns are established for a preliminary understanding of the comparative health of Sanisera. Extensive statistical analysis was not conducted for the present research due to insufficient sample size, particularly for Necropolis 4, as well as the differences in the recording methods between the two samples and the comparative studies.

Results

Necropolis 6

All information concerning Necropolis 6 is from the 2009 report provided by the Ecomuseum. The age groups were defined by the Ecomuseum's resident biological anthropologist, Georgina Pacheco, as follows: Perinatal I (2 months prior to birth – 2 months postpartum), Perinatal II (2 – 12 months), Infant I (13 months – 6 years), Infant II (7-12 years), Juvenile (13-20 years), Young Adult (21-30 years), Adult (31-40 years), Mature Adult (41-59 years), and Elderly Adult (60+ years). Although the separation of both the perinatal and infant periods into two subcategories is unusual in bioarchaeology, the same age groups were used in the analysis of Necropolis 4 for consistency. The sample from Necropolis 6 has a minimum of 81 individuals, ranging from infants to mature adults (Table 1). According to Pacheco's calculations, there was a general pattern of a high birth rate, high infant mortality, and low life expectancy (Figure 7). An

expected dramatic increase in mortality is evident during early childhood (Pacheco et al. 2012). Mortality rates were similar between males and females (Figure 8; Pacheco et al. 2012).

Table 1: Table of preliminary demographics from the 2009 report on Necropolis 6 (adapted from Pacheco et al. 2009).

Group	Subgroup/Sex	#	% of Group	% of total	TOTAL %
Subadult	Perinatal I (2 months prior to birth – 2 months postpartum)	0	0	0.00	34.57
	Perinatal II (2-12 months)	1	3.57	1.23	
	Infant I (13 months – 6 years)	10	35.72	12.35	
	Infant II (7-12 years)	8	28.57	9.88	
	Juvenile (13-20 years)	9	32.14	11.11	
Adult	Male or possibly male	15	28.30	18.52	65.43
	Female or possibly female	14	26.42	17.28	
	Indeterminate	24	45.28	29.63	
TOTAL		81	200	100	100

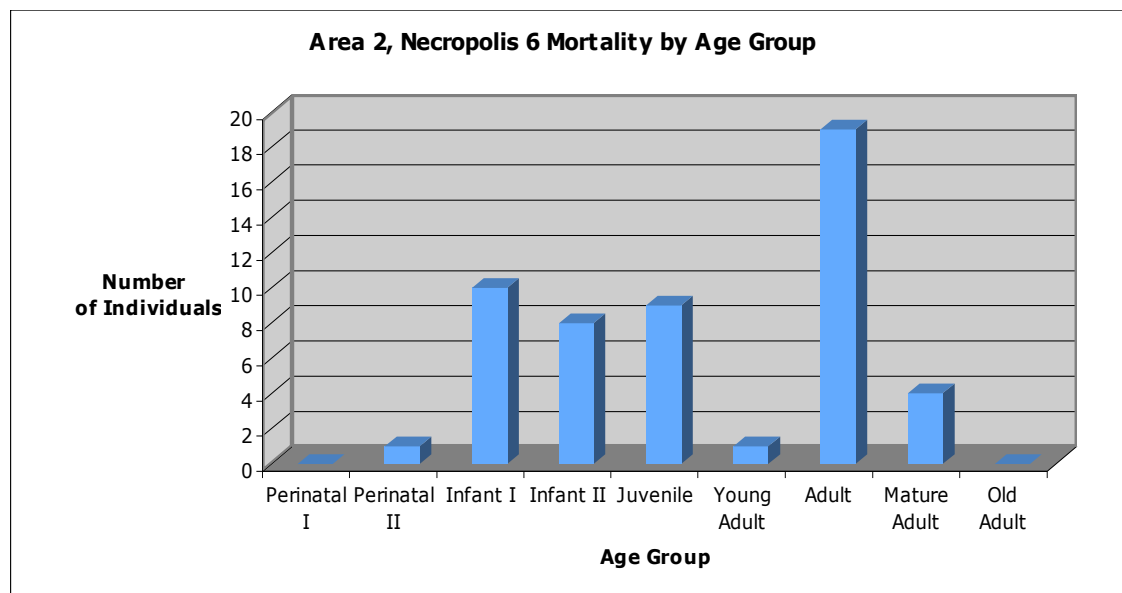


Figure 7: Mortality of individuals (not counting adults of unknown age) recorded in each age group in Necropolis 6 (adapted from Pacheco et al. 2009).

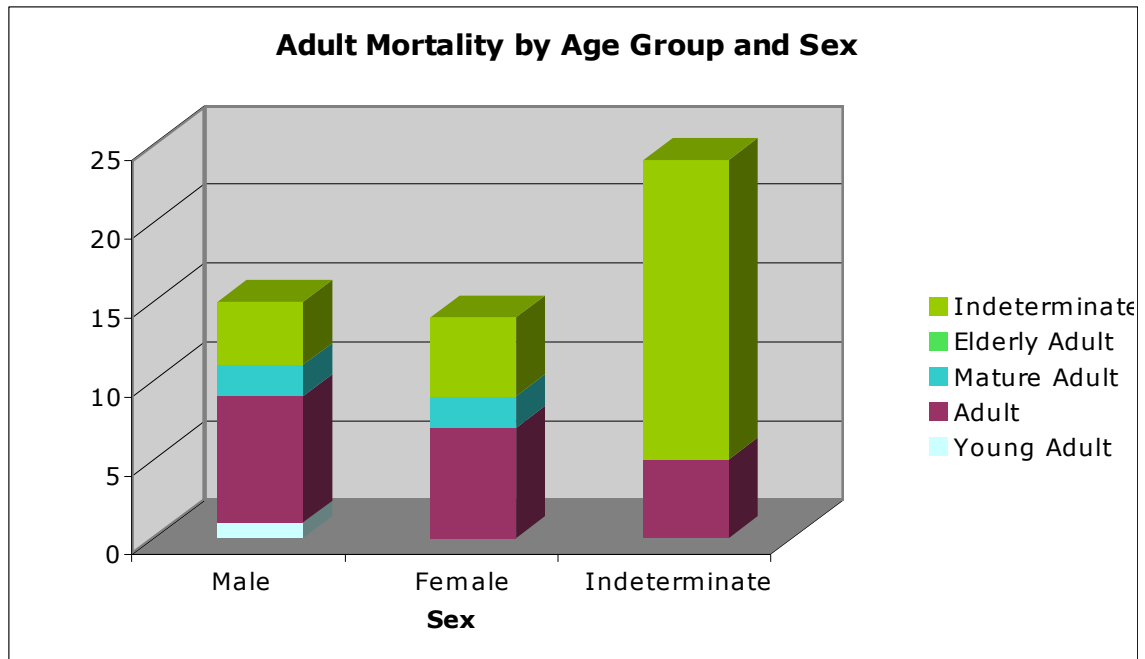


Figure 8: Adult mortality by age group and sex for Necropolis 6
(adapted from Pacheco et al. 2009).

The most common pathologies present in the sample from Necropolis 6 are dental calculus (16.33%), non-specific infections (18.52%), and degenerative joint disease (16.05%) (Table 2). Although dental calculus is the most common dental pathology, the cases recorded are not severe, and other dental health indicators such as caries, abscesses, and AMTL are not prevalent. Furthermore, although not recorded in Table 3, there are more than 10 cases of dental enamel hypoplasias recorded in both deciduous and adult teeth from Necropolis 6. Evidence of trauma is present in 4.94% of the individuals in this necropolis.

Table 2: Prevalence of the key pathologies within the Necropolis 6 assemblage from the 2009 report (adapted from Pacheco et al. 2009).

Paleopathology	No. of individuals/ teeth analyzed	No. of cases observed	% prevalence
Dental caries	780 teeth	9	1.14
Dental calculus – total	780 teeth	129	16.33
Dental abscess	780 teeth	2	0.25
Antemortem tooth loss	780 teeth	23	2.91
Trauma	81 individuals	4	4.94
Non-specific infection (Periostitis, osteomyelitis and otitis)	81 individuals	15	18.52
Osteoarthritis, septic arthritis, Degenerative Joint Disease, and enthesopathy	81 individuals	13	16.05
Individuals with platycnemia in tibias	78 individuals	4	5.13

Necropolis 4

The minimum number of individuals for Necropolis 4 is 12, ranging from infant to mature adult. Like Necropolis 6, the pathologies with the highest frequencies in these three tombs are dental calculus (10.29%), non-specific infection (18.18%), and degenerative joint disease (63.63%) (Table 3). Dental calculus is less prevalent in Necropolis 4 than Necropolis 6, while dental caries occur at a higher rate in Necropolis 4. Rates of dental abscesses and AMTL remain minimal. The rate of trauma in Necropolis 4 is 9.09%, almost double the rate present in Necropolis 6. Osteoarthritis, osteophytosis, and degenerative joint disease are also considerably more common in Necropolis 4, with 63.63% of the sample exhibiting these conditions, versus 16.05% in Necropolis 6. Unfortunately, there are several pathologies that were evaluated by the researcher but not the Ecomuseum, and vice versa, so the results for these conditions cannot be compared between the two samples.

Table 3: Prevalence of the key pathologies within the Sanisera assemblage from Tombs 401, 403, and 406 in Necropolis 4, analyzed by the researcher.

Paleopathology	No. of individuals/ teeth analyzed	No. of cases observed	% prevalence
Dental caries	204 teeth	45	22.06
Dental calculus – total	204 teeth	21	10.29
Dental abscess	204 teeth	1	0.49
Antemortem tooth loss	204 teeth	3	1.47
Periodontal disease	204 teeth	8	3.92
DEH	204 teeth	17	8.33
Trauma (fractures and dislocations)	11	1	9.09
Non-specific infection (Periostitis, osteomyelitis and otitis)	11	2	18.18
Osteophytosis, osteoarthritis, Degenerative Joint Disease, and enthesopathy	11	7	63.63
Osteoporosis	11	4	36.36

The mortality rates in Necropolis 4 are unreliable due to the small sample size, but the results seem to indicate that mortality is high in early childhood (Figure 9). However, early adult and early childhood mortality rates appear similar. As seen in Necropolis 6, the mortality rates are similar between adult males and females (Figure 10). The lack of elderly adults seems to indicate that the life expectancy was relatively low.

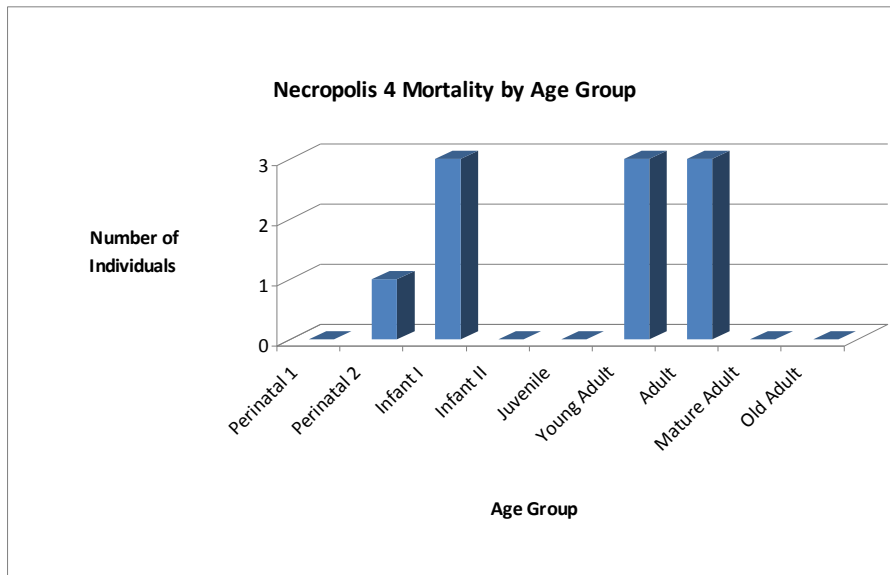


Figure 9: Mortality by age group at Necropolis 4, excluding individuals with indeterminate ages.

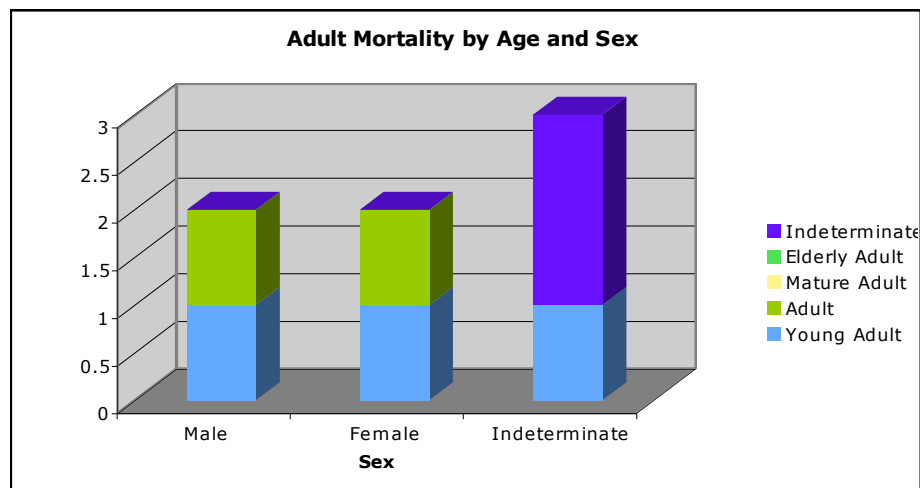


Figure 10: Adult mortality rates by age group and sex in Necropolis 4.

Discussion

The study of other sites both pre- and post-barbarian rule has shown that the frequency of abscesses typically increased during the Early Middle Ages (Belcastro et al. 2007). Yet in the High Imperial period at Sanisera, the rates of abscesses were already incredibly low, with 0.25% in Necropolis 6 and 0.49% in Necropolis 4, compared to 3.9% in Romano-British populations (Roberts and Manchester 2005). It is therefore

probable that the rate of abscesses at Sanisera either went down or remained consistent during the Vandal invasion, as rates lower than 0.25% are unlikely. Similarly, antemortem tooth loss (AMTL) was low in both necropoleis at Sanisera. AMTL in Romano-Britain has been recorded at 14.1% (Roberts and Manchester 2005), compared to 2.91% in Necropolis 6 and only 1.47% in Necropolis 4. AMTL can be the result of abscesses, caries, or periodontal disease (Figure 11), all of which were uncommon at Sanisera. The combination of these factors indicates that dental health was relatively good in Sanisera, in comparison to both other sites from the High Imperial period and sites dated to before the barbarian invasions of the Empire.



Figure 11: Example of periodontal disease causing the resorption of bone around the alveoli on a left mandible from Necropolis 4. Photo taken by the author.

Dental caries (Figure 12) are usually the most common dental disease found in archaeological contexts (Roberts and Manchester 2005). Although recent research has demonstrated that the development of dental caries is the result of a combination of factors, such as epigenetics (Wright 2010), studies have also shown that this pathology is strongly linked to a diet high in carbohydrates (Roberts and Manchester 2005). It is thus particularly common in the lower classes in Rome whose main source of sustenance was

often bread (Belcastro et al. 2007; Roberts and Manchester 2005). High rates of caries and AMTL at other sites throughout the Empire from both the High Imperial and Early Medieval periods have therefore been interpreted as indicative of heavy carbohydrate consumption and relatively poor, unbalanced nutrition (Belcastro et al. 2007; Manzi et al. 1999; Salvadei et al. 2001).



Figure 12: Example of a dental carie on the lower left first molar (LM₁) from Necropolis 4. Photo taken by the author.

For example, studies have shown that the rate of dental caries in a Roman British population averaged 7.5%, compared to Sanisera's 1.14% in Necropolis 6 (Roberts and Manchester 2005). The low rate of caries from Necropolis 6 most likely indicates that they consumed fewer carbohydrates on average than many of their contemporaries throughout the Empire. The rate of dental calculus at Sanisera corroborates this interpretation. Dental calculus can be the result of carbohydrate or protein heavy diets (Roberts and Manchester 2005). Other sites in Italy have shown rates at about 15%, both before and after barbarian occupation, indicating a level of continuity in diet between the High Imperial period and the Early Medieval period (Belcastro et al. 2007). At Sanisera, Necropolis 6 had a 16.33% rate of dental calculus, which is comparable to the sites in the Italian peninsula, both prior to and during barbarian rule. Thus, it appears that the

consumption of protein-rich foods remained consistent between Roman and Vandal rule. The low prevalence of caries indicates that a carbohydrate-centered diet is unlikely, therefore the rates of calculus at Sanisera suggest that the diet included relatively frequent consumption of protein-rich foods. This makes sense based on the location of the city at a port, where marine food supplies would have been readily available (Pacheco et al. 2012).

The individuals in Necropolis 4, however, do not seem to have fared as well as those in Necropolis 6. Necropolis 4 had a 22.06% caries rate, which is radically higher than the 1.14% prevalence in Necropolis 6. Calculus, on the other hand, was much less common in Necropolis 4, with only 10.29% of the population affected versus 16.33% in Necropolis 6. A higher prevalence of caries and lower rate of calculus may indicate that the diet of the individuals buried in this necropolis was less rich in protein and instead contained a higher percentage of carbohydrates. The difference between the two necropoleis may be the result of a segregation of the necropoleis according to socioeconomic status, so that those of a higher class and therefore access to better foods would be buried in Necropolis 6. Although the differences in dental calculus and caries may simply be the result of a small sample size for Necropolis 4, when analyzed alongside several other differences in pathological frequencies between the two necropoleis, it appears to be indicative of a general pattern of divergence between the two burial sites. The substantial increase in degenerative joint disease, for instance, indicates that the work being performed by the individuals from Necropolis 4 was more arduous and taxing (Figure 13). The drastically higher rate of trauma in Necropolis 4 also supports this interpretation.

Alternatively, with most of the traumas being found in the feet (Figure 13), Pacheco has hypothesized that these individuals may have been pilgrims traveling to Sanisera's basilica, which briefly contained a relic (personal communication 2012). This hypothesis would also explain why these seemingly lower class individuals were buried in the necropolis associated with the new basilica. Further research in Necropolis 4 is required to confirm these pathological patterns. If the patterns persist with a larger sample size, this future research may reveal the reason for the separation of the population into different necropoleis.



Figure 13: Example of trauma typical of Sanisera's population. A dislocated distal phalanx of the foot from Necropolis 4. Photo taken by the author.

The prevalence of disease in a population can be estimated through the analysis of non-specific infectious diseases that have impacted the bone (Roberts and Manchester 2005). For my research, the presence of periostitis was used for this purpose. By only using one osteological indication of non-specific infection for the analysis of the disease load in the population, the reliability is significantly reduced, yet it will suffice as a preliminary estimate. The rates of periostitis at the comparative sites were calculated per bone, specifically for the femur and the tibia (Belcastro et al. 2007). For my research, the

rate of periostitis was calculated based on the total number of occurrences in all of the long bones. A direct comparison is therefore, once again, difficult. However, in this case, the figures are still rather telling. 8.5% of the population at Quadrella, a Late Roman period site in Italy, were found to have femoral periostitis, and 63.4% had tibular periostitis (Belcastro et al. 2007). Of the population at the corresponding Early Middle Ages site of Vicenne, 25.5% had femoral periostitis, and 52.1% had tibular periostitis (Belcastro et al. 2007). All of these figures aside from the rate of femoral periostitis in Quadrella are higher than the total rate of periostitis found on all long bones in the Sanisera population.

Somewhat counterintuitively, the low rate of osteological indications of non-specific infection implies that Sanisera most likely had a high rate of infection and disease. In order for periostitis to be evident in the remains, the individual must survive long enough to allow the bone to react to the infection. Hence, signs of periostitis actually indicate that the individual was initially healthy enough to survive an infection for an extended period of time (Goodman 1993). However, many diseases leave little to no osteological trace, so it is difficult to accurately assess the level of disease present in past populations (Roberts and Manchester 2005).

Some dental pathologies, such as dental enamel hypoplasias (DEH) can also be used to address disease load within a population. DEH records events of malnutrition, injury or disease during childhood (White and Folkens 2005). The evidence of DEH was extremely low in Necropolis 6, with only 10 recorded cases out of 780 teeth analyzed. DEH was much more common in Necropolis 4, with 8.33% prevalence. Compared to other sites throughout the Empire, even the higher rate in Necropolis 4 is still strikingly

low (Belcastro et al. 2007; Manzi et al. 1999; Salvadei et al. 2001). Between seven sites ranging from the 1st to the 7th centuries AD in the Italian peninsula, the average prevalence of DEH was 31.9% (Belcastro et al. 2007). Although Sanisera's low rate of DEH could indicate that children were not experiencing high levels of stress, it is more likely that the majority of the children that experienced serious pathological conditions did not survive long enough for these events to be recorded in their enamel. When considered in conjunction with the low rate of periostitis at Sanisera, it appears that the population was contending with a relatively high rate of disease. A high rate of infection does make sense within the context of the period, however. During this time, Sanisera was probably exposed to the plague that ran rampant through Europe in the High Imperial period (Pacheco 2012; Roberts and Manchester 2005). Consequently, the rate of disease may have been unusually high during this period whether or not the Vandals had occupied the island.

Osteoarthritis, osteophytosis (Figure 13), and degenerative joint disease were grouped together for the present research, with septic arthritis and enthesopathy also included for Necropolis 6. As a result, it is difficult to make comparisons to other populations from this period. Pacheco et al. noted, however, that the rate of these pathologies at Sanisera is high by modern standards, but not unusual for "a non-mechanized, rural society" (2012:10). The low life expectancy at Sanisera is also normal for a rural community from this time period. With the Roman Empire encompassing such a vast range of climates, environments, and socioeconomic classes, it is inappropriate to calculate an "average Roman lifespan" due to the extreme regional and class variation (Scheidel 2010).



Figure 14: Example of osteophytosis, evidence of osteoarthritis, on a cervical vertebrae from Necropolis 4. Photo taken by the author.

That being said, in order to make a comparison, Scheidel (2010) has calculated average lifespans for several different Roman classes and sites, all of which generally center around an average lifespan in the mid 20s. Although I have not calculated Sanisera's life expectancy due to the incomplete and small sample, the largest age group in Necropolis 6 was Adult (31-40 years), and the lack of Mature Adults suggests that life expectancy was relatively low, similar to the averages calculated by Scheidel. One must recognize, however, that skeletal remains from older individuals in the population may be underrepresented in the sample due to the fact that they are generally more porous and therefore are less likely to be preserved (White and Folkens 2005). Infants are also often underrepresented for several reasons. First, infants were typically not yet considered a part of the community, and so were often buried separately (Roberts and Manchester 2005). Second, the skeletal remains of infants are both fragile and small, making them easy to miss during excavation (White and Folkens 2005). Life expectancy calculations can therefore be deceptive.

Mortality rates were approximately the same in males and females in both Necropolis 4 and 6 throughout all age groups (Figures 8 and 10). Based on this, it appears

that both sexes experienced roughly the same amount of stress, regardless of age, which may indicate a relatively egalitarian division of labor. There was a dramatic increase in mortality in Infant I, which corresponds to ages 13 months to 6 years. Children would typically be weaned during this period, at which time it can be difficult for infants to continue to obtain enough nutrients as they transition to less protein and fat-rich foods (Langdon 2005). It is therefore common to see a substantial increase in childhood mortality at this phase (Pacheco et al. 2012). Necropolis 6 also showed relatively high mortality in the Infant II and Juvenile periods, ages 7-12 and 13-20 respectively, which as previously mentioned, may explain the low occurrence of most dental pathologies and periostitis. With such a large portion of the population dying so young, there may not have been time for their bone to respond to infection before they died.

Overall, although the health of the people at Sanisera during the 5th-6th centuries AD was not good by modern standards, the rates of all of the pathological conditions considered in this study were either consistent with or lower than that of other populations, or expected based on the time period. There are several possible explanations for the health of the people of Sanisera during the 5th-6th centuries. One possible argument may be that the health at Sanisera was generally consistent with previous periods not because the overall quality of life was maintained, but as a result of population decline that would in turn reduce density and therefore the disease load (Scheidel 2010).

However, this kind of Malthusian interpretation does not correspond to the other evidence at the site. According to numismatic and ceramic evidence, the Vandal period at Sanisera was in fact the most prosperous, although the population was certainly still

under economic and physical pressures due to the nature of being a part of a non-mechanized society (Bravo Asensio and Contreras Rodrigo 2012). With the construction of the basilica during the Vandal occupation and ceramic evidence showing an expansion of trade, this period may have even been one of growth for Sanisera (Bravo Asensio and Contreras Rodrigo 2012; Reynolds 2010). Furthermore, analysis of Necropolis 6 has indicated a high birth rate, meaning that Sanisera's population was not in decline (Pacheco et al. 2012).

The consistent level of health at Sanisera, in comparison to other sites, is most likely the result of continued prosperity under Vandal rule rather than population decline reducing disease. Health is strongly impacted by the diet, economy, and living environment of a population (Roberts and Manchester 2005), all of which are heavily influenced by the success of the political power that is responsible for the area. Political instability is often followed by heavier taxes, collapse of trade and agriculture, and in the case of the Western Empire, the spread of epidemic disease due to "increased contacts with other populations following wars and barbarian invasions" (Belcastro et al. 2007: 381). Studies have shown that there is a link between socioeconomic crises and a general decline in health and stature (Larsen 1997). The consistency of the quality at Sanisera with other sites of earlier and similar time periods indicates that such a decline did not occur, therefore implying that the prosperity of Sanisera was not jeopardized by the Vandal occupation.

Conclusion

The quality of life at Sanisera based on the prevalence of pathologies implies relative prosperity during the Vandal period. Although the rate of pathologies appears to

be higher than in other areas in the Empire, this is likely the result of a plague rather than a depreciated quality of life caused by the Vandals. Levels of osteoarthritis and trauma were normal for a rural, non-mechanized society, but the level of nutrition is significantly better than that of comparative sites throughout Roman history. These results uphold my hypothesis and reinforce the current interpretation of the numismatic, ceramic, and architectural evidence at Sanisera. This consensus indicates that the quality of life for the people of Sanisera was stable, rather than in decline, which supports the burgeoning research arguing that the Vandals were not as barbaric as historians have long believed.

Nevertheless these findings are preliminary, as the sample is still small and incomplete. Following the excavation of necropoleis from earlier periods in the site's history, future research ought to include an analysis and comparison of the health of the population during different periods at Sanisera in order to more definitively assess the level of continuity and quality of life during transitional periods such as the Vandal occupation. Other possible avenues for future research include a more detailed analysis of pathologies to provide insight as to possible differences in frequencies based on sex, age, and socioeconomic status. As the sample size from Necropolis 4 increases during excavation, future research should also attempt to confirm or deny the preliminary pattern of divergence in quality of life between Necropoleis 4 and 6. Such research could help to determine if the population was separated into seven separate necropoleis based on socioeconomic status. Additional work at Sanisera, and other sites, extending from this study could also further inform modern interpretations of the Vandal incursion into Hispania.

Appendix

Appendix A: Recording table for post-cranial pathologies observed in Necropolis 4 at Sanisera.

Skeleton or Zone # _____

Tomb # _____

Age _____

Sex _____

Table 1.1: Dental Pathologies

Nutritional Stress Indicator	Yes/No	Skeletal Element	Notes
Dental calculus			
Antemortem tooth loss			
Dental enamel hypoplasias			
Dental caries			
Abscesses			
Periodontal disease			

Table 1.2: Post-cranial Pathologies

Disease Indicator	Yes/No	Skeletal Element	Notes
Periostitis/Osteomyelitis			
Degenerative Joint Disease			
Osteoporosis			
Trauma			

Glossary

- Abscess** An accumulation of pus within tissue; evidenced by the disintegration of the bone, forming a hole through which the pus can escape.
- Antemortem tooth loss (AMTL)** Tooth loss prior to death; evidenced by a gap in the dentition in which the alveolar bone shows signs of healing.
- Degenerative joint disease** Disintegration of the cartilage in the joints; common in elderly adults as part of the normal aging process. Also: osteoarthritis.
- Dental caries** Tooth decay caused by a multitude of factors, including epigenetics and a diet heavy in carbohydrates. Also: cavity.
- Dental calculus** A mineralized buildup of plaque on the surface of a tooth; often caused by a diet high in either protein or carbohydrates.
- Dental enamel hypoplasia (DEH)** A defect in enamel growth, generally caused by period of extreme stress during childhood temporarily halting enamel formation, that results in the formation of transverse lines, pits, or grooves across the enamel.
- Osteomyelitis** An inflammation of bone caused by a bacterial infection; evidenced by the presence of woven bone on the surface of a bone and the formation of a cloaca, or cavity, in the bone.
- Osteophytosis** The development of abnormal bony outgrowths, often found on the edges of articular surfaces; often a sign of osteoarthritis.
- Osteoarthritis** See Degenerative joint disease.
- Osteoporosis** An abnormally excessive porosity and loss of density of a bone.
- Periodontal disease** The inflammation of the alveolar tissue, evidenced by a receding bone line around the teeth, resulting in the exposure of tooth roots. Also: periodontitis.
- Periostitis** An infection of the periosteum resulting in inflammation, evidenced by the presence of woven bone on the surface of the bone.
- Periosteum** The connective tissue that covers the majority of the bones in the body.

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