

Introduction¹

This book demonstrates how social, cultural, economic and political changes – framed within the context of urbanism at the site – impacted the everyday lives of the people of Knossos, in terms of their health and diet, during the Hellenistic, Roman and Late Antique periods. This study is primarily based on the analysis of the human skeletal remains but it strives to integrate the available archaeological and historical evidence and bring in comparative studies, contextualising Knossos within the wider temporal and geographic setting.

1.1. The site

The site of Knossos in north-central Crete (Figure 1.1) was a significant centre through most of its nearly eight millennia of occupation. One of the earliest Neolithic settlements in Europe, founded c. 7000 BC, it developed into the earliest known urban centre in Europe c. 2000 BC. It is most famous for its Bronze Age ‘Minoan’ palatial society, due to over a century of intensive archaeological investigation and the plethora and wealth of finds. However, it remained a significant centre throughout much of its history through to AD 800, though it experienced cycles of urban development and decline. Following a significant decline at the end of the Bronze Age, Knossos was one of the first Greek city-states to develop early in the first millennium BC. Traditionally it was thought that there was another urban collapse, referred to as the ‘Archaic Gap’, due to the complete absence of burials assignable to the 6th or 5th centuries BC and relatively little evidence of occupation (Coldstream *et al.* 1999). However, the recent work by the Knossos Urban Landscape Project paints a picture of gradual expansion through the Archaic and Classical periods (Whitelaw *et al.* 2017; Trainor 2019). Knossos became one of the major Aegean centres during the Hellenistic period and one of a small number of dominant centres on Crete. It continued as a significant urban centre following the Roman conquest of Crete and was formally refounded as a Roman colony in 27 BC,² flourishing for several centuries as the subject of public and private building works. After the 2nd century AD there is less evidence for significant new building projects (other

than the basilica churches of the 5th and 6th centuries), though with only limited excavations, understanding of this period is restricted and occupation is known to have continued at the site. There was a continual contraction of the city limits and reduction of population at the site, until it was eventually reduced to nothing more substantial than a small village by the end of the 7th century AD (Sweetman 2004a; Trainor 2019).

The site has been intensively investigated since 1900, with major excavations focusing on the Bronze Age occupation at Knossos (Hogarth 1900; Evans 1906; Hood and Smyth 1981). This focus on the prehistoric phases, particularly the later prehistoric, palatial periods, has created long-term biases in the investigation of the site. While excavations and surveys have covered all phases of occupation in the city and the extensive cemeteries surrounding it, there has been no systematic programme of investigation of the post-Bronze Age city. There has been relatively little study and publication of these later remains, and those that do exist have largely focused on ceramics or on a few specific excavations (for example: Wardle 1972; Carington Smith 1982; Hayes 1983; 2001; Paton 1991; 1998; Sackett *et al.* 1992; Carington Smith and Wall 1994; Cavanagh and Curtis 1998; Coldstream *et al.* 2001; Cadogan *et al.* 2004; Sweetman and Becker 2005; Sweetman and Grigoropoulos 2010; Trainor 2021).

The aim of this study is to investigate how these changes in the urban environment and the associated social, political and economic factors affected the health, diet and lifestyle of the population at Knossos. It focuses on the later phase of urban development and decline using a study of the human skeletal remains from Hellenistic, Roman and Late Antique tombs from British School at Athens (BSA) excavations. This time span extends from the Early Hellenistic period when the site was at its maximum extent (c.120 ha.) since the Bronze Age ‘Neopalatial’ period, followed by a contraction in the Late Hellenistic, with the thinning or even cessation of habitation from the Gypsades hill to the south of the city (Paton 1994; Trainor 2019; Whitelaw *et al.* 2019). This appears to have been prior to the Roman invasion of 69–67 BC which served as a further blow to the city which had put up some of the greatest resistance to the Roman presence on Crete (Paton 1994; de Souza 1998; Sweetman 2007; Trainor 2019). Though the city does not appear to have expanded or the population to have grown substantially after the establishment of the Roman colony, it certainly prospered economically as demonstrated by the monumental architectural remains, elaboration of domestic spaces with mosaics, frescos and imported stone, increased diversity and monumentality in the burial sphere, and evidence for trade connections (Paton

¹ Appendices mentioned in the text, with supplementary data, have been made available to download - refer to table of contents for DOIs

² This date is not certain but the discussion of its likelihood is summarised by Paton (1994, 143), Baldwin Bowsky (2002, 77) and more recently by Carrier (2018, 697–98), referencing Cassius Dio (XLIX.14.5), Velleius Paterculus (II.81.2), Svoronos (1890), Grant (1946, 55, 180, 262–63), Brunt (1971, 599), Hood and Smyth (Hood and Smyth 1981), Engels (1990, 18), De Caro (1993, 310), Spawforth (1996, 169) and Rizakis (1997, 15). The absence of Knossos from the *Res Gestae* and the name *Colonia Iulia* suggest a Caesarean date, but the coinage suggests a later date and Crete being under the jurisdiction of Mark Antony from 42 BC indicates a date after the Battle of Actium. It may have been a proposal by Caesar carried out by Augustus (Baldwin Bowsky 2002, 77).

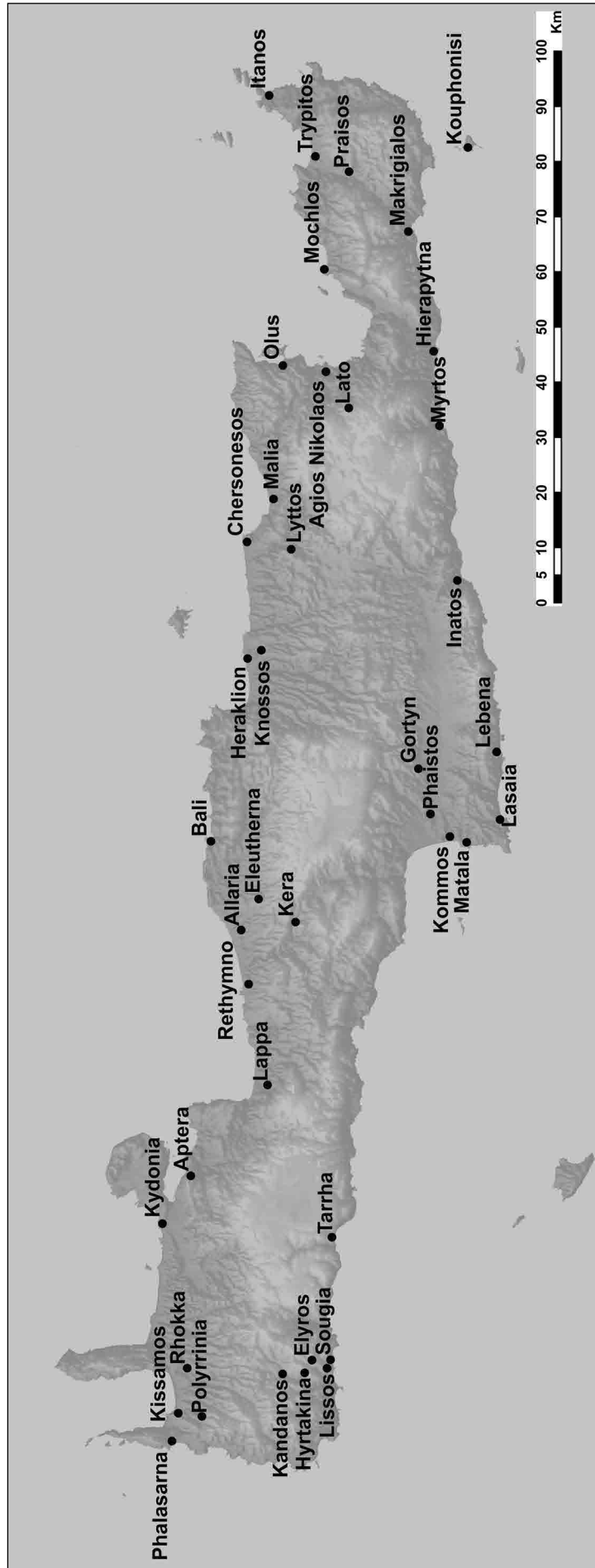


Figure 1.1. Map of Crete indicating Knossos and other important Hellenistic, Roman and Late Antique sites. Basemap: James Herbst, American School of Classical Studies at Athens (CC BY-SA 4.0).

1994; Sweetman 2006; 2007). There is little evidence for monumental public architecture (other than the Christian basilica churches), luxury elements in private dwellings,³ monumental tombs (discussed further in Section 3.5) or the same levels of activity in trade networks beyond the 4th century AD. There also appears to be a gradual decline in population from about the 3rd century onwards when coastal Heraklion begins to grow as a more significant centre (Whitelaw *et al.* 2019). This could be linked to the disturbances at this time referred to as the ‘third century crisis’ which led to a period of economic decline across the Roman Empire (Hekster *et al.* 2007; Jongman 2007a). There was a shift in the economic focus of Crete towards the eastern Mediterranean at this time, though this does not appear to reflect decline with evidence for increased imports at some sites in the later Roman period (Gallimore 2016). There was also climatic change that manifested as a period of prolonged cold and aridity beginning in the 3rd century causing landscape desiccation throughout Crete and the southwest Aegean, which may have resulted in food shortages (Moody 2016, 67, 72). These grand scale changes across these time periods, in terms of political administration, economic productivity and prosperity, intra- and off-island connectivity, population size and diversity, environmental conditions, settlement size, urban planning, and investment in infrastructure and monumentality, represent significant changes that would have impacted on the population of Knossos in a variety of ways. This project aims to demonstrate how these changes affected the lives of the inhabitants in terms of health, diet, longevity, activity, and – by inference – wellbeing and lifestyle.

1.2. The main questions

Using materials and methods that have rarely or never been applied to this time period on Crete, this study aims to answer questions that have thus far eluded scholars of Hellenistic, Roman and Late Antique Crete, and add to the discussion of what life was like during these centuries of change, including the nature and extent of the changes and their impact on people’s lives. Much of the value of this study comes from its contribution of new material to the fields of post-prehistoric⁴ studies of Knossos and Crete, as well as adding to the growing scholarship on human remains in historic periods in Greece (Bourbou 2005; 2009; Roberts *et al.* 2005; Bourbou 2010; Lagia 2014; 2007; Tritsaroli and Valentin 2008; Papageorgopoulou and Xirotiris 2009; Vika *et al.* 2009; Bourbou and Niniou-Kindeli 2009; Bourbou and Tsilipakou 2009; Hillson *et al.* 2009; Bourbou and Themelis 2010; Vika 2011; Lagia *et al.* 2014; Tritsaroli 2014; 2020; Tritsaroli and Karadima 2017; Dotsika *et al.* 2018; Nikita *et al.* 2019; Vergidou *et al.* 2021; 2022; Karligkioti *et al.* 2023). This project works with problematic legacy material and accompanying archival

records from old excavations and in doing so creates a model for other studies in demonstrating how much can be done with legacy material (a valuable but neglected and under-exploited resource). Scholars should feel a moral obligation to study and publish legacy material and data rather than allowing such information and cultural heritage to be lost, forgotten about or potentially even destroyed in storerooms. Not only does this study use this approach to bring new data to the discussion of these later time periods Crete, that have been side-lined due to a preference in focus on their prehistoric, and particularly Bronze Age Minoan and Mycenaean, counterparts, but it has used methods that have not previously been applied to Cretan studies of these time periods. This creates a more interdisciplinary discussion to the understanding of life and society in these periods on Crete.

Hellenistic Crete has been depicted as a place rife with conflict, wars, social disorder, piracy, and was an important supplier of mercenaries to the armies of the Hellenistic world by the accounts of several ancient authors⁵ (Hatzfeld 1919, 28–38, 157–60; de Souza 1998; Marshall and Towner 1999, 202; Perlman 1999; Chaniotis 2005, 108). At the same time, Knossos was considered a major Aegean centre and a key player in the Cretan *koinon* (Perlman 1992; Ager 1994). This raises the question of what the balance was between the images of war and turmoil, versus political and social stability, structure and functionality. The written sources may have exaggerated anti-Cretan biases and created stereotypes due to the conceptually marginalised position of Crete in Greek thought (Perlman 1999, 133–34; Erickson 2010, 14). A break-down of administrative order and political control in times of war can lead to interruptions in trade networks and supply chains, as occurred during the third century crisis in the Roman Empire (Nappo 2007, 237). It is not clear what the repercussions of the Hellenistic Cretan wars would have been. There are plentiful inscriptions referring to intra-island trade during this period, as well as to taxes and restrictions on trade relating to the relationship between particular poleis and often with clauses for tax exemptions between allies (Perlman 1999; Viviers 1999, 228). This would suggest that there may not have been any full interruptions to supply chains. Chaniotis (1999, 200) argues that the majority of intra-island trade was conducted by sea during the Hellenistic period. However, just as the settlement pattern through the Ierapetra isthmus supports overland trade as an important feature of the economy on the island, so too does the Mesara corridor linking Knossos with the south coast (Perlman 1999, 146–47, 149; Vogeikoff-Brogan 2004, 219; Gallimore 2015, 265). These accounts suggest that trade and communications remained successful. However, this may only have been for the larger centres while smaller settlements may have been more affected by the turmoil of wars and changing alliances. An example of this may be

³ There is little exposure of domestic evidence after the 3rd century so little can be said about this absence of evidence.

⁴ i.e. ‘historic’. Post-prehistoric is a necessarily convoluted term used to highlight how focused the scholarship has been to date on the prehistory of Crete, at the expense of the later time periods.

⁵ Strabo 10.4.9-10; Polybius 6.46.9, 6.47.5, 8.16.4-7, 33.16.4; Plutarch *Moralia* 490B, 761D; Diodorus Siculus 30.13; Homer *Odyssey* 19.173 ff.; *Anthologia Palatina* 7.654.

the short-lived settlement at Mochlos, which was occupied only for a matter of decades from the late 2nd to early 1st century. However, it is likely that there were at least short-term set-backs to trade and civic order caused by these wars which often required external arbitration to resolve (de Souza 1998, 112; Viviers 1999, 223). Disruption in the production of coinage can be observed at Knossos in c.220–140 BC due to the frequent conflicts with Gortyn (Carrier 2018, 564).

A study of the skeletal material has the potential to offer independent evidence for conflict, an exodus of the prime age males (as mercenaries), and the degree of social (dis)order these may have caused at Hellenistic Knossos. Unreliable access to food and adequate nutrition, which could have resulted from these conflicts and disruptions, can be detected by stable isotope analysis (Chapter 5) and stunted growth (Chapter 8), while types of foods being consumed can be additionally investigated in dental diseases (Chapter 6). Similarly, a lack of waste management, and poor upkeep of sewage systems, waste disposal, and water sources results in unsanitary living conditions and the proliferation of infectious diseases, detectable by increased mortality (Chapter 4), and increased morbidity can also be detected through shorter bone lengths being attained (Chapter 8).

Although the major trade centres of Hellenistic Crete were along the south coast, Knossos was nevertheless a major power within Hellenistic Crete, well connected physically through overland trade via the Mesara with these southern ports as well as through treaties (Chanotis 1999; Perlman 1999). It is still uncertain how significant the change was between these periods in connectivity within wider networks, as determined by the material culture, architecture, and written record. The study of the diet of Hellenistic population may contribute to knowledge of connections with Knossos. The detection of new and distinctive foodstuffs, such as millet or fish, being incorporated into the diet could indicate an expansion of trade, knowledge or technology surrounding food. There are also cultural factors that may have resulted in a change in both food types consumed and the adequacy of nutrition. For example, the *syssitia* (communal meals) are attested to have existed in Hellenistic Crete, which may have influenced what foods were available to different segments of society (such as by age, sex, citizen status, social affiliation or lineage) (Chanotis 1999, 193–94; Lewis 2015, 19).

A question that has long been at the centre of discussions of Crete in this time period, is how Crete changes (if at all) on becoming part of the Roman Empire, and specifically, how (and whether) Knossos changes with its formal refoundation as a Roman colony (Paton 1994; 2004; Baldwin Bowsky 1995; 2004b; 2006; 2011; Sweetman 2007). Crete was an important acquisition for Rome, with its strategic position for shipping networks and with a diversity of tradeable resources, including herbs, wine, honey, cypress wood and purple dye (Sanders 1982;

Marangou-Lerat 1995; Haggis 1996; Francis 2016). The mythical past of Knossos may also have been incentive to found a colony there, renaming it the *Colonia Iulia Nobilis Cnosus* to make connections to that glorious past as a sort of vanity project. Internal peace and cooperation amongst the cities and the quashing of piracy were assured by Crete's incorporation into the Empire after the conquest of the island by Metellus (69–67 BC), thus enabling Crete's harbours and resources to be capitalised on (Blackman and Branigan 1975; de Souza 1998). Crete was able to thrive as a commercial centre and Knossos, along with many other cities experienced a period of economic prosperity.

Roman intervention in most cities was unlikely to have been very pervasive; a governor would have been installed to ensure the system already in place for running the city was successful and that taxes were paid (Sanders 1982; Sweetman 2013). There were visible changes to the cities of the island, in terms of the forms of houses, appearance of mosaics, investment in public buildings, cemetery locations, tomb forms and types and provenance of imports. These changes are initially seen in the port cities along the south coast due to the intensified trading connections along the Alexandria-Rome grain route, but the changes gradually spread throughout the island during the 1st century AD (Sanders 1982; Baldwin Bowsky 1994; Gallimore 2015). The earliest of the new style of built barrel-vaulted style tombs are known from Lissos, Sougia, Lasaia and Ierapetra, demonstrating changes in burials along the south coast from the 1st century BC (Savignoni 1901, 443–48; Davaras 1968, 405; Markoulaki 1996; Apostolakou 1997, 1047; 2011; Guyon 2008, 112). There is real evidence of prosperity during the 2nd century, with a booming trade in local imitation wares, elaborate polychrome mosaics, major investment in public buildings, infrastructure and private houses, dedications and honorific inscriptions attesting to a variety of achievements from infrastructural development to athletic success (Hayden 2005, 58; Sweetman 2013, 142). This evidence comes from many centres on the island, including Knossos, Chania, Kissamos, Ierapetra, Eleutherna, Gortyn, Chersonissos, and many more, demonstrating that change throughout the 1st century and prosperity in the 2nd century was an island-wide phenomenon and not a Knossos-specific development due to its colony status. Details of the changes at Roman Knossos and across Crete are outlined in Section 2.2.

While changes can be detected in the architecture and material culture, the question remains to what the extent this new type of urban status – with its external connections, integral position within the Roman Empire, and economic prosperity – impacted on people's lifestyles. An investigation of mortality, morbidity and developmental conditions (Chapters 4 and 8) can give insight into living conditions and act as a basic proxy of wellbeing. A study of diet (Chapters 5 and 6) can demonstrate whether the socio-economic changes on the island extended to the choice of foodstuffs being imported or grown. The economic prosperity and increased trade

connections in the early Roman period are likely to have affected what types of food were consumed and in what quantities foodstuffs were readily available. Evidence for luxury additions to the diet and a consideration of tomb type as a proxy for social status could demonstrate the levels of inequality in society at this time. There is evidence for such items in the Spanish garum amphorae (Hayes 1983, 146) and a total of fifty different types of amphorae from the Villa Dionysus excavations, a good representation of amphorae found on Crete in c.150–250, from various Eastern and Western locations including Gaul, Northern Italy, Spain, North Africa, Upper Egypt, as well as local types demonstrating the strong export market (Hayes 1983, 140). The export trade would have required a significant increase in production of items such as wine and honey which may have resulted in these items being more readily available locally as well as for export. The observation of activity levels (Chapter 7) and patterns can demonstrate changes in physical labour levels and diversity or division of labour in aggregate terms. In addition to the changes in health and diet over time, differences between demographic (age, sex) and social sub-groups of the population may be distinguishable. Identifying how socio-economic conditions may have affected, for example, females and males differently in the different time periods, can enable changes in societal attitudes to be identified. Changes in the distribution of wealth in the population can be identified from a comparison of the health profile and diet of different social groups (using tomb type and cemetery as a potential proxy for social status) and demonstrate whether there was ‘extensive’ or ‘intensive’ economic growth (Scheidel 2009b).⁶ The latter is the expectation for the Roman Empire as numerous sources attest to social inequality (Huskinson 2000; Griffin *et al.* 2011; Garnsey and Saller 2014), therefore an elite group may be identifiable through distinguishing differences in life expectancy, diet, stature or activity between their different social groups identified from the burial contexts.

As the only formal colony on Crete, the question is what the significance was of having colony status and to what extent Knossos differed from other major centres on Crete which also had a Roman presence. An important consideration that has caused great consternation in the past for scholars of Roman Crete is whether there is any evidence of changing populations at Knossos with the foundation of the colony. The names of *Duoviri* (magistrates) on coin legends and a small number of official inscriptions in Latin (Svoronos 1890; Guarducci 1935; Chapman 1968; Sanders 1982) attest to at least a small number of colonists seeing to the official running of the colony, though it is also likely that there was some Latinising of names (Baldwin Bowsky 1999; 2004b). The archaeological evidence known to date cannot identify a substantial influx of settlers at Knossos

(Sweetman 2011a, 2). In the private sphere a preference for Greek was maintained in the inscriptions and there appear to be fewer Latin inscriptions than would normally be expected of a colony (Baldwin Bowsky 2004b). There was no new investment in monumental architecture for about a century after the foundation of the colony, though this has also been observed at the colonies at Catania and Syracuse in Sicily, with others seeing a shorter delay in such investment, such as approximately 30 years at Corinth (Korhonen 2011; Scotton 2011; Sweetman 2011a). Additionally, there were no changes in burial architecture identified until the second half of the 1st century AD and the Roman practice of cremation is never adopted, nor are the affiliated architecture and accoutrements, such as *columbaria* and cinerary urns (Dijkstra and Moles forthcoming). *Columbaria* were not common outside the city of Rome but they were present at the colonies of Patras and Corinth (Walbank 2005, 255–56; Rife 2007, 114; Borbonus 2014, 146; Dijkstra 2015, 167; 2019). There was evidence of increased contacts with Rome, such as a short-lived (late 1st century BC–mid 1st century AD) increase in preference for Italian sigillata as opposed to eastern tablewares (Eiring 2004; Baldwin Bowsky 2011), but this was evident in many cities throughout the provinces and is not a distinctive sign of colonists or even colonial identity. Additionally, the adoption of Roman material culture was less evident at Knossos than at Gortyn, which had been more accepting than Knossos of being incorporated into the Empire from the outset, but Gortyn had also already had a considerable resident population of Roman merchants prior to the Roman invasion (Baldwin Bowsky 2004a; Chevrollier 2016; Lippolis 2016).

Ideally, a study of non-metric traits, aDNA, or strontium and oxygen isotope analysis would be undertaken to identify migrants. This would require the clear identification of the remains of first-generation migrants, which are not easily identifiable from the available evidence in the present sample. However, a comparison of the health and dietary status with other sites on Crete for which there are studies of contemporary skeletal remains could help assess the impact of Knossos’ colonial status and in comparison with other cities on Crete. A further comparison with other colony sites is needed, particularly with Corinth where mortuary and skeletal research has been conducted (Wesolowsky 1973; Fox Leonard 1997; Barnes 2003; Fox 2005; Kyle McIlvaine 2012; Kennedy 2016; Kyle McIlvaine *et al.* 2016; Slane 2017; Petry 2020), and in the future with Dion, where research is currently being carried out (Tritsaroli 2020). A broader comparison of the available archaeological evidence from a range of Roman colonies would also enable further discussion of what it meant to be a colony and the impact of colonisation on people’s lives.

There is an expectation of urban decline in the Late Antique period in line with the economic depression and constant threats to security from invading forces across the Empire from the 3rd century onwards, but this is not easily discernible at Knossos or elsewhere in Crete from

⁶ Extensive economic growth would mean increased income and prosperity relatively equally throughout the population. Intensive economic growth would mean the creation of greater differences in wealth and consequently in social standing.

the evidence. Is there any indication of urban decline at Knossos beyond the absence of substantial signs of new civic buildings or private dwellings? Alternatively, can a dwindling urban centre be substantiated by the available evidence? The absence of settlement evidence led Sanders to conclude that the site must have been abandoned in the 4th century AD after the earthquake of 365 (Sanders 1982). Sadly Ian Sanders (1949–1977) did not live to see the 1978 excavation of the Knossos Medical Faculty (KMF) basilica church, constructed in the early 5th century, and the associated tombs of the North Cemetery, dating from the 5th–7th centuries. Prior to this discovery, the Sanatorium basilica (constructed in the early 6th century), another basilica church below the modern church of Agia Sofia, and the KFF/74 osteotheke (likely dating to the 7th or even 8th century) were considered extra-urban features of the settlement at Heraklion. There is also now evidence for habitation which proves that Knossos continued to be a prosperous centre throughout the 4th and 5th centuries. This presumably continued into the 6th century, given that there were the incentive and means to construct a new martyrion basilica while the nearby earlier basilica continued in its function as a mortuary church as well as a martyrion into the 7th century. There is now substantial evidence for new 4th and 5th century constructions and occupation into the 6th century in the area around and to the south of the Villa Dionysus (Hayes 1983, 99; French 1994, 75; Tomlinson 1996, 41; Sweetman 2004b, 483; Forster 2009, 230–36), described in further detail in Section 2.3. The recent intensive urban survey documents continued occupation with a gradual contraction of the settlement. The survey evidence suggests that Knossos remained a substantial settlement until the 7th century, but fewer than ten sherds have been identified as dating to the 8th century (Whitelaw *et al.* 2017, 12). Not only did the city continue to exist but, from the evidence of mosaics and religious architecture, it also appears to have prospered. The presence of over 90 basilicas, many luxuriously decorated, across Crete demonstrates the security and prosperity on the island, in at least some social spheres. For the first time the mosaics demonstrate conformity with fashion and even innovation, particularly in the case of the KMF basilica, rather than lagging behind much of the rest of the Empire as had sometimes been the case in earlier Roman times (Sweetman 2004b, 485). With the introduction of Christianity, known at Knossos from the 2nd century AD (Eusebius *Historia Ecclesiastica* iv.21 and 23.7, discussed in Frend and Johnston 1962, 186; Sweetman 2004a, 315), though not monumentally commemorated at Knossos or elsewhere in Crete until the 5th century, the strict regimens of the religion may have influenced dietary practices.

There is no clear division between the Roman and Late Antique periods, but the archaeological evidence suggests a shift in focus of investment in art and architecture from the private to the public sphere and from the secular to the religious realm (Sweetman 2004b, 487). There is this image of an economically secure and thriving Crete, and of a prosperous Christian community at Knossos, but there

is also a clear and significant long-term trend of people leaving Knossos for coastal Heraklion throughout the later Roman and Late Antique periods (Whitelaw *et al.* 2019). Was prosperity enjoyed by all or only by certain members of society? The available evidence gives us little insight into the private sphere and everyday lives of the people of Knossos, which can be investigated through the present study of health status. Changes to diet (Chapters 5 and 6), activity (Chapter 7), and the environmental conditions affecting childhood development and life expectancy (Chapters 4 and 8) can elucidate how these social, economic and religious changes impacted people's lifeways in comparison with the preceding Roman period. This can indicate whether the people's wellbeing prospered alongside the religious investment. It may also be possible to discern socio-economic differences within the society, such as identifying an elite class or clergy.

1.3. Urbanism and its impact on human health

Urbanism is referred to in both the title and introductory paragraph of this book, but what is meant by 'urbanism'? Defined as a way of life associated with living in cities in geographical and social science disciplines, urbanism encompasses everything from the social elements, including the nature of the social bond, the impersonal nature of urban social life, human nature's need for power divisions leading to hierarchical power structures, through to the urban planning and the physical divisions of land-use, with residential, political, religious, commercial and civic foci (Wirth 1938; Bridge 2009). For this study of urbanism and its impact on human health, a broad meaning of the term is applied. These include the more obvious impacts from the urban environment, such as population size, housing density, economic connectivity and movement of people with trade and migration, but also the more indirect environmental factors, such as natural disasters. The effects of such environmental factors are not exclusive to an urban environment but their impact on the population of an urban environment is different to that of a rural environment, where the population tends to be more self-sufficient. Natural disasters can lead to a breakdown of networks, secondary effects can include resource deficits, famines, disease and social conflict which are more easily initiated and spread in crowded living conditions (Scheidel 2009a; 2013).

For this study urbanism is used to mean characteristics or processes within the urban environment with a direct or indirect impact on human health, that could leave any physical markers or indicators in the human skeletal record. It is the relationship between the physical environment and its exploitation, and the economic, political, social and cultural institutions that create the urban environment that people interact with and live in. Urban planning can have a very direct impact on health as it defines the density of living conditions and can control access to a clean and adequate water supply and an efficient waste disposal or sewage system. These are all important factors in the occurrence and spread of disease.

Infectious diseases could always pose a risk to life and impact health but with urbanism and its associated population growth, higher density living conditions, changes in food production, poor community hygiene, and a lack of knowledge of the causation of disease, the manifestation and spread of disease were more pervasive than in rural populations, impacting heavily on urban communities and even capable of causing major social changes. Rapid population growth could increase pressure on resources, while increased density of living conditions could result in deteriorating hygiene and the easier spread of disease. Although Knossos was large, it was not an exceptional urban centre and does not appear to have had a dramatic influx of newcomers during the period under study. It is, therefore, unlikely to have experienced the demographic stress of Imperial Rome which suffered from seasonal diseases and epidemic outbreaks which could in some extreme cases have killed a significant proportion of the urban population, in the region of hundreds of thousands of lives (Scheidel 2009a, 7). Similarly, the studies of the expansion of the cities of medieval Europe demonstrate the pressures imposed and the toll taken on human health and diet (Bassett 1992). The analysis of the skeletal remains of its residents can determine whether urbanisation at Knossos would have levied similar costs.

