8-1997

Age, Status and Gender: Mortality Patterns and Mortuary Practice at Umm El-Jimal, Jordan

Melissa Cheyney

AGE, STATUS AND GENDER: MORTALITY PATTERNS AND MORTUARY PRACTICE AT UMM EL-JIMAL, JORDAN

by

Melissa Cheyney

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Master of Arts
Department of Anthropology

Western Michigan University
Kalamazoo, Michigan
August 1997

ACKNOWLEDGMENTS

I wish to express sincere appreciation to Dr. Bert de Vries and Calvin College for the financial and academic support provided during the excavation and analysis of the human skeletal remains described herein. Without Dr. de Vries' inspiration and guidance, the completion of this project would not have been possible. Appreciation also goes to my mentor Dr. Tal Simmons for the technical and methodological support that formed the foundation for this research. I am grateful to Dr. Robert Sundick and Dr. Cherie Lenzen for their consistent editing and proofreading contributions. Cherie Lenzen, Janet Brashler and Tal Simmons deserve thanks for sharing my vision and frustrations, and for their encouragement by example.

On a personal note, I wish to acknowledge my best friends Andrew Meskil and Monica Shah for their unending emotional support and intellectual camaraderie. I would also like to thank my fellow students who participated in the many seasons of field work and publication at Umm el-Jimal. You provided insight and well-timed stress relief throughout the duration of this endeavor. Finally, I wish to acknowledge the primary contributors to, and supporters of, my academic pursuits. To my parents Drs. Wendy and Frazier Cheyney, I thank you for the living examples you have set as compassionate and honest scholars. Your words of encouragement and financial investments are greatly appreciated.

Melissa Cheyney

AGE, STATUS AND GENDER: MORTALITY PATTERNS AND MORTUARY PRACTICE AT UMM EL-JIMAL, JORDAN

Melissa Cheyney, M.A.

Western Michigan University, 1997

The purpose of this study is to identify trends in both burial practice and mortality patterning at the Late Antique site of Umm el-Jimal in northern Jordan, through a combined emphasis on mortuary contexts and human skeletal evidence. Data were analyzed and interpreted in three main areas involving: (1) the demographic evaluation of biological profiles comprised of sex, age and pathology estimations; (2) life table calculations for crude mortality rates, life expectancies, probability of death and number of individuals dying in time-succesive age intervals; and (3) sex-, age- and status-specific patterns in demography and burial structure. These evaluations were conducted on remains excavated from three sections of the site. Areas AA and Z are regions of a single cemetery containing simple pit and cist burials dating to the early fourth century C.E.; area BB.1 is a monumental mausoleum roughly contemporaneous with AA and Z.

Investigation of skeletal remains provided data concerning disease, nutrition, childhood stress, reproductive patterns and mortality. These results were compared with evidence from surrounding sites and were found to broadly correlate with available demographic data. Relatively small sample sizes render the majority of specific conclusions tentative, however, preliminary interpretations are valuable for indicating directions for future research and eventual intra-site comparisons.

TABLE OF CONTENTS

CHAPTER

CHAPTER

Table of Contents--Continued

LIST OF TABLES

LIST OF FIGURES

List of Figures--Continued

CHAPTER I

INTRODUCTION

Methodological Overview of Problem

Archaeological investigations of human burial contexts have long played a significant role in the study of ancient peoples and their material remains. Because mortuary units are often visible aspects of the landscape, or at least easily recognizable when uncovered accidentally, they have dominated the study of early medieval archaeology (James, 1989) and, arguably, countless other time periods and geographical regions of study. Cemeteries and associated human remains are valuable sources in that they often provide information about both individuals and communities that might not otherwise be included in historical or ethnographic sources. Burials are analogous to written sources in that they frequently reflect social relationships and behaviors of ancient peoples. Consequently, like written texts, they provide data that are open to the difficulties and complexities of interpretation so familiar to both historians and anthropologists (see Humphreys, 1981, for a discussion of comparative perspectives in mortuary analysis).

Literature reviews of both past and current burial studies reveal two main avenues of investigation in mortuary research. The first, and the most common, involves the acquisition of information from architectural features of tomb construction and associated grave objects; these are assumed to reflect past social relationships and/or political organization (Whelan, 1991, 1991a; Eisner, 1991; Pollock, 1994; Thomas, 1993; Kirk, 1993; Damm, 1991; Shanks & Tilley, 1982). Studies of this

type tend to focus on the spatial organization or layout of structures and architectural or design elements within structures. Differences in the quality and quantity of artifacts accompanying the deceased, spatial configurations of monumental tombs and the construction of burial cists or chambers all provide a wealth of information useful for deciphering past gender, age and/or status related social hierarchies.

The second avenue of mortuary study involves the osteological analysis of human bones. Acquisition of information from the assessment of skeletal remains is relatively more recent and, although it may be less intuitively accessible to researchers investigating mortuary practice, it provides the means for evaluating relative conditions of health, nutrition, occupational stress (subsistence strategies or gendered divisions of labor represented in musculoskeletal stress markers, for example) and mortality rates for males and females in various age and status categories. In addition, skeletal remains are invaluable sources of demographic information that can add to our understanding of mortality, survivorship, life expectancy and population fluctuations and decline in ancient populations. Frier (1982) and Ery (1969), in their evaluations of the common reliance on funerary inscriptions for the estimation of demographic trends in the ancient world, stress the inaccuracy and decreased reliability of this approach and extol the value of skeletal remains for paleodemographic reconstruction. "The acquiring of factual knowledge concerning mortuary conditions in the Roman era is to be expected therefore only from the demographic elaboration of skeletal remains excavated from the cemeteries" (Ery, 1969, p. 62). Though this statement may be construed as somewhat overly optimistic, it emphasizes the improvement in potential demographic sources that systematic skeletal analysis can provide.

Both sources of information associated with mortuary studies, i.e., evaluation of tomb contexts and osteological analysis of human skeletons, provide useful information. However, as Cohen and Bennett (1993) suggest, studies of biological

well-being, including explicit measures of health and activity, are particularly valuable when they can be juxtaposed with information gathered from burial contexts. The combination of and cooperation between these methods may provide the most complete and nuanced understanding of mortuary environments.

Statement of Purpose and Research Outline

The purpose of this study is to identify trends in both burial practice and mortality patterning at the Late Antique site of Umm el-Jimal in northern Jordan, through a combined emphasis on mortuary context and human skeletal evidence. In order to investigate these questions, data will be analyzed and interpreted in three main areas. The first involves the construction of biological profiles which include the estimation of Minimum Number of Individuals (MNI), age and sex distributions, and identification of pathology/anomalies for skeletons excavated from three sections of the site (Areas AA, Z and BB.1). Areas AA and Z are cemetery locations, containing simple pit and cist burials; area BB.1 is a monumental tomb structure roughly contemporaneous with AA and Z.

Second, through the construction, analysis and interpretation of life tables, mortality patterns and life expectancy will be estimated and compared for each area. The intent is to illuminate similarities, as well as, significant differences in demographic trends within and between burial regions of the site.

Finally, sex-, age- and status-specific patterns related to demographic trends, burial structure, associated objects, grave location and orientation will also be discussed and interpreted in terms of their relationship to the larger history of site use, reuse and organization. Some initial comparisons of burial data from surrounding, contemporaneous sites will also be examined. The conclusion of this paper will attempt to synthesize and summarize the above research findings and posit preliminary

interpretations concerning mortuary practice and mortality patterns at Umm el-Jimal.

Hypotheses and Problems

I anticipate that no significant difference in burial type, grave good quantity or style, pottery chronology or demographic distributions will be found between areas AA and Z. AA and Z may be demonstrated to be part of the same cemetery, used and reused over similar periods of time. I further anticipate that analysis of architectural features and skeletal materials from both cemetery locations will demonstrate patterns of disturbance including natural alterations, sequential robbing (from antiquity through the recent past) and culturally defined mortuary practices of grave reuse.

Conversely, I expect to find significant differences between the combined areas of Z and AA, and the monumental tomb structure BB.1, in sex and age ratios, amounts and types of skeletal pathologies, and style and quantity of grave goods. Within areas Z and AA, I anticipate slight differences in individual treatment that can be associated more with location in the cemetery and MNI interred than with gender or age. Some differences may exist which are attributable to status or differential access to resources. However, I expect that differences between the combined areas of AA and Z and BB.1 will be more significant and closely associated with status differentials, access to resources and possibly subsistence strategies. AA and Z, for example, may be argued to contain the graves of semi-nomadic individuals living along the fringe of Umm el-Jimal's settled community, while BB.1's more elaborate tomb structure may be associated with the more sedentary agricultural community of the Late Roman and Early Byzantine periods. If this is the case, I would expect to see marked similarities in burial style and mortality patterns between area Z and AA and the Queen Alia cemetery located outside of Amman. This burial ground has been dated to the pre-Byzantine period and has been interpreted as a semi-nomadic, Bedouin cemetery (Ibrahim &

Gordon, 1986) based on grave good type and quantity, and burial structure and location.

Finally, I anticipate a lower age for peak mortality rate for females than for males from all three areas due to high stress placed on women during childbearing and differential access to dietary and medicinal resources.

Theoretical Orientation

The identification and interpretation of both burial and demographic patterns at Umm el-Jimal is founded on the assumption that differences in material treatment of the dead reflect the social, political and ideological orientations of the individuals performing the rituals and activities related to disposal of the deceased. The approach utilized in this study is based on concepts of gender, age and associated status as they have been theorized by post-processual and feminist archaeologists. A brief discussion of theoretical developments in mortuary archaeology and a description of this author's orientation within these developments will be discussed as they pertain to this study.

The development of post-processual techniques for the interpretation of burial contexts and the simultaneous critique of New Archaeological approaches to mortuary analysis provide the methodological context for the growth of gender conscious interpretations of funerary assemblages. Patrik's (1985) overview of prevalent material culture models discusses two distinct concepts of the archaeological record, termed the textual and physical models, which inevitably affect the outcome of material remains analyses when applied. The physical model, utilized in New Archaeological approaches to mortuary analysis, views material remains as static imprints of past behavior. Archaeological vestiges are viewed as fossil records, which record past organisms through physical laws and natural processes and transform living plants and animals into preserved patterns or imprints. This analogy is carried over into the

interpretation of artifactual evidence, the assumption being that law-like processes preserve the passive, static effects of past cultures.

Textual archaeologists would assert that, like historical accounts, material remains must be read and interpreted within their larger contexts. This approach, utilized by post-processualists, differs in that it views the relationship between the archaeological record and the events and behaviors it records as more complex. Material remains are seen as active and produced as part of a creative strategy governed by cultural rules that vary across time and space. The record actively communicates messages that must be interpreted through constructs that are more like grammar regulations than laws of nature.

As proponents of the New Archaeology, Saxe (1970) and Binford (1971) assume a physical model for the interpretation of mortuary remains as evidenced in their goal of identifying universal social factors underlying material treatment of the dead. As Brown (1995) has argued, the Saxe-Binford approach focuses on cross-cultural analyses and how specific economic conditions and levels of political organization determine a society's mortuary practice. Saxe, for example, argues that the simpler the sociocultural system, the greater the tendency for the existence of a linear relationship between the number of significant grave elements and the social significance of those artifactual components. Both Binford and Saxe approach the organization of patterned differences in disposal of the dead practices by linking them to social complexity. Binford developed a second line of reasoning which argued that uniquenesses in socio-cultural responses to the deceased were direct results of reactions of variably sized groups of individuals, who had social obligations to the deceased person. This explanation reveals a theoretical orientation that views mortuary treatment as the mirror image of structural features in the related society (Brown, 1995). For Saxe and Binford, cemetery organization is a direct reflection, a fossil imprint, of

associated social organizations and economic systems.

Hodder (1982) and other post-processualists (Shanks & Tilley, 1982) have argued against the Saxe-Binford approach and its interpretations of the relationship between social organization and burial practice. These archaeologists caution against the direct evaluation of social structure from material remains located in ritually dominated spheres of interaction. Hodder refuted Saxe and Binford's complexity argument, asserting that even when hierarchical divisions, in age and sex for example, are not represented in tombs, it does not necessarily follow that the society is less complex. When groups change burial practices and begin utilizing less differentiated or less elaborate funerary rites, this does not necessarily indicate a transition to a less complex society. Burial practice is not a fossil imprint of past socioeconomic organization, but a complex locus for the active negotiation of power relationships. Hodder and other post-processualists utilize a textual model which assumes a more complex and interactive relationship between a society and the treatment of the deceased.

Gender-conscious approaches to the study of funerary remains have relied heavily on theory developed by post-processualists. Whether explicitly discussed or implied in the application of a textual model of interpretations, feminist archaeologists have adopted (Damm, 1991), critiqued (Engelstad, 1991) and revised (Whelan, 1991) several aspects of the above approach. In a discussion of the reproduction and negotiation of gender relations and social organization in funerary rituals, Damm (1991) articulates the strengths and weaknesses of post-processual archaeology. The author describes burials as forms of social discourse where aspects of organization, including gender, are negotiated. Death, as an event, is more than either a physical transition from life to death or the communal opportunity to display and reinforce traditional social hierarchies: "Death instigates a reorganization of all social actors and

their relationships!" (Damm, 1991, p. 130). A multiplicity of factors that are particular to a time and place must, therefore, be examined in association with as many aspects of archaeological, historical or ethnographic evidence as possible. Such a theoretical basis contradicts the processual view of material culture as a direct indication or passive reflection of social organization. In line with post-processual archaeology, engendered approaches to mortuary studies view material culture as interactive, complex and participatory in nature.

A primary concern in gender approaches to material remains involves the observation that gender is only one of several possible social markers of difference affecting mortuary patterning (Whelan, 1991) and our understanding of past interpersonal relationships (Keller, 1987). Membership in kin or ethnic groups, craft guilds or other economic specializations, subsistence strategies and age or status dependent clusters may operate independently or combine to influence treatment of the dead. Whelan (1991) suggests that discrete clusters of artifacts should be considered in connection with particular individuals, irrespective of sex. Mortality patterns should be isolated and characterized prior to any attempt to associate them with groups of individuals, i.e., a specific gender or age category. This approach will be applied to the analysis of human and artifactual remains from Umm el-Jimal recognizing that a multiplicity of ordering factors may have played a role in the way this site's fourth century inhabitants were treated at death.

CHAPTER II

STUDY AREA AND SITE BACKGROUND

Internal History of Umm el-Jimal

Umm el-Jimal is a well preserved archaeological site in Northern Jordan located 20 kilometers east of Mafraq in the lava region of the Hauran (Figure 1). According to de Vries (1981, in press), its history of occupation involves three distinct periods ranging over 700 years. During the first stage (2nd-3rd c.), Umm el-Jimal was a prosperous agricultural village inhabited by indigenous (i.e., non-Roman) peoples under the political and cultural influence of both Nabataean and early Roman rule. In the second stage (4th - 5th c.), according to de Vries (1981), Umm el-Jimal may have served as one of many military bases on the Roman frontier of the Province of Arabia. These fortifications were constructed by the emperors Diocletian, Constantine and their successors in an effort to protect and defend the imperial territories of Roman Arabia. The third stage (5th - 8th c.) of Umm el-Jimal's occupation may have involved a transformation from military to civilian use. At this time, this frontier defensive site became a prosperous agricultural and trading community. As imperial strength weakened and political control became decentralized, Umm el-Jimal increased in prosperity, reaching its economic peak in the sixth century. Archaeological evidence demonstrates that Umm el-Jimal's history continued through the Umayyad period (7th - 8th c.). Towards the end of this time, a large earthquake, 747-8 C.E., dealt so severe a blow to the diminishing population that reconstruction was beyond their means. This decreased community now took the form of a disjointed, opportunistic occupation of

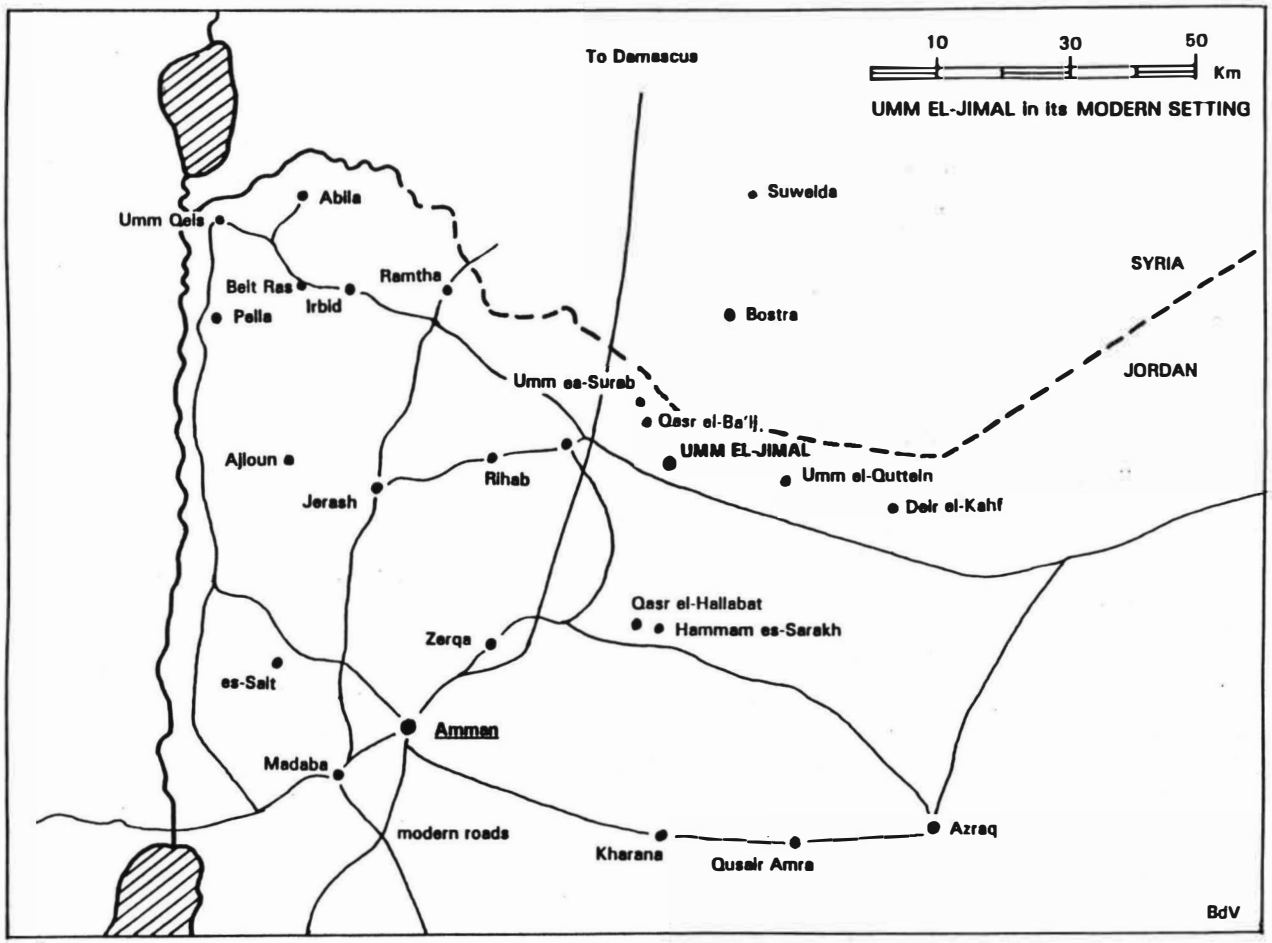

Figure 1. Umm el-Jimal in Its Modern Setting (Drawing by Bert de Vries).

the ruins until their final abandonment, apparently sometime in the ninth century. The site was later utilized by the Druze, a sect of Islam, in the 1920's. The present day town of Umm el-Jimal is built up around the ruins of the old city which function as an integral part of the modem community.

Umm el-Jimal in Its Geographical and Historical Context

Umm el-Jimal, when viewed in isolation, has been interpreted primarily as a caravan town situated at the head of the Wadi Sirhan (Glueck, 1942; de Vries, 1985). More recently, however, de Vries (1997, in press) has noted the importance of viewing the site in relationship to its surrounding rural settlements. These settlements expand from east to west throughout the southern Hauran, stretching between Deir el-Kahf and Dera`a (Figure 2). De Vries argues that once Umm el-Jimal is understood as only one of many sites in a densely populated region, "it becomes clear that caravans proceeding from Azraq to Bostra or Damascus had their choice of stopping places in between" (de Vries, 1997, in press, p. 5). It is unlikely, then, that Umm el-Jimal's economy was based solely or even predominately on trade or trans-shipment of luxury goods and the selling of livestock, agricultural products and services to the Roman imperial army. The main interest of the vast majority of Umm el-Jimal's dwellers was more likely the production and distribution of foodstuffs and subsistence items for local and regional consumption (de Vries, 1997, in press). The prevalence of stables and corrals incorporated into Umm el-Jimal's internal layout, the evidence for extensive field systems adjacent to the settlement and the detection of outlying farms from aerial photographs (Kennedy, 1997, in press) all support the notion that the site's residents were engaged in animal husbandry and agrarian production. It has also been suggested that a significant component of the economy would have revolved around the exchange of goods between nomadic and more settled populations (Villeneue, 1985).

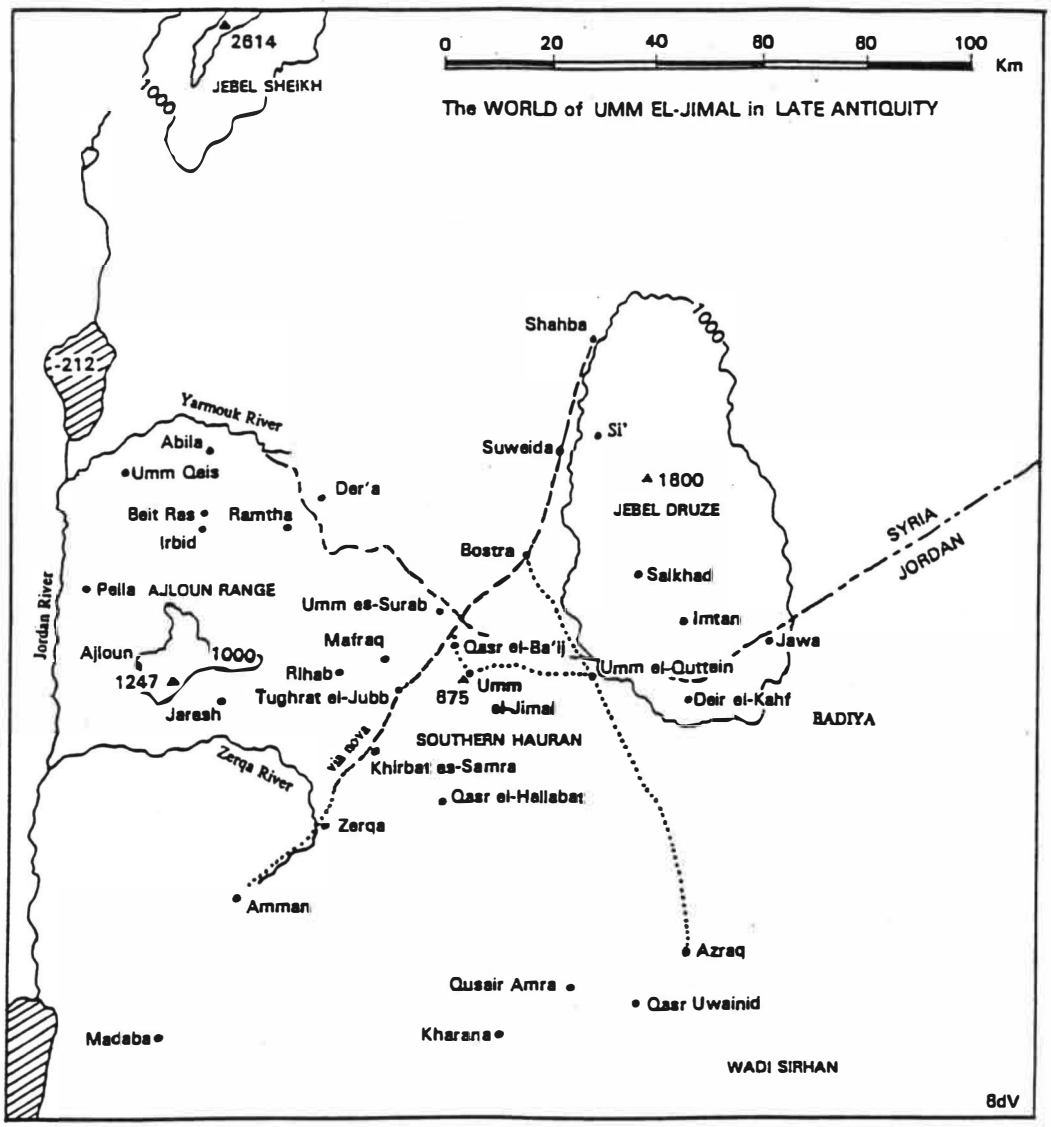

Figure 2. The World of Umm el-Jimal in Late Antiquity (Drawing by Bert de Vries).

Several authors have attempted to address ethnic identity and nomadic-sedentist interactions on the Jordanian desert frontier (Graf, 1986; Banning, 1986; Haiman, 1995). Questions concerning the nature of the relationship between settled and nomadic populations, i.e., mutualism/symbiosis or perpetual warfare, settlement dynamics and the archaeological recognizability of interactions have been discussed and debated within a conceptual framework that contrasts the desert with the sown (Lenzen, 1996; Greene, 1996; Betts, 1996).

Lenzen (1993) outlines the basic notions of, as well as the foundations for, the dichotomy between the desert and the sown as it relates to the archaeology of Jordan. She defines this concept as the "differentiation between the area which is cultivated, 'the sown', and the area which is not, 'the desert'" (Lenzen, 1993, p. 1). This dichotomy, Lenzen argues, has its roots in the historiography of earliest antiquity. It operates to make distinctive the city dweller, associated with the sown, who is dependent on and integrally connected to the sowers, from the nomad who occupies the desert and is not limited by the constructs of the city. The differentiation between the desert and the sown, as an interpretive stance, has influenced the understanding of archaeological data and, as a result, overly simplistic distinctions have tended to be applied pangeographically. While the present stance allows only for the formation of opposites, Lenzen argues for an analytical approach that takes continuity, fluid interactions and symbiosis into consideration. The identification of significant variation in elements of material remains (pottery, burial type, architectural design, site layout, etc.) need to be demonstrated and interpreted by site or between groups of sites and not simply assumed to exist because of preconceived notions of distinction between the desert and the sown.

Research on Umm el-Jimal's tombs and cemeteries may help to address questions of interaction, fluidity and distinction as they pertain to relationships along

the desert fringe. For example, if differences in burial practices like those described for cemeteries Z and AA and the BB.1 tomb can be attributed to semi-nomadic and /or settled individuals, their close proximity, both temporally and spatially, could suggest a highly integrated and perhaps mutually interdependent relationship between agriculturalists and semi-nomadic pastoralists. In addition, types and quantity of skeletal pathology might also suggest the presence or absence of interpersonal conflict.

The tentative dating of the burials at Umm el-Jimal to the early fourth century may also be significant for questions related to interactions between the desert and the sown. Bannings' (1986) argument for a symbiotic relationship between sedentists and nomads, coupled with Graf's (1989) and Kennedy's (1992) refutation of classical sources on which Parker has based many of his claims for nomadic warfare (1987, in press), all suggest that cooperation, rather than hostile raiding, may have characterized relationships in this region. Macdonald's evaluation of the nomadic evidence (mainly Safaitic graffiti), in addition, does not suggest sporadic raiding of tribes driven from Arabia by conflict and unrest, but instead, an environment of stable transhumance with regular seasonal migrations between the basaltic Harra and the desert to the east and south (Macdonald, 1993).

de Vries further notes that the timing of these interactions is significant and that both classical sources and nomadic inscriptions, dating to the period from the first century B.C.E. through the fourth century C.E., provide increased chronological precision for the casting of these debates. Because of the temporal overlap, this evidence may be significant for the interpretation of material remains uncovered in the recent excavations of Area R (1994, 1996) - the Early Roman/Late Roman village whose inhabitants are most likely buried in cemeteries AA and Z and a portion of the monumental tomb BB.1. Evidence from mortuary contexts, when combined with architectural and stratigraphic data from the Early Roman/Late Roman village, should

help to characterize the nature, chronology and manner of settlement at Umm el-Jimal.

Burial Locations and the History of Excavation

Butler and the Princeton University Expedition

Research at Umm el-Jimal began following its rediscovery in the mid 19th century with the Princeton University Expedition Survey to Southern Syria (PES II, 1905, and 1909). Reporting and study at the site, directed by Howard Crosby Butler, included a description of three distinct categories of burial architecture he considered to be "typical" for the region (PES II, Butler, 1913, p. 205): "One wholly excavated in a flat surface, one excavated in a hill side and showing a front wall, and a third only partly excavated and having a building of some height constructed in plain view above the ground level."

Butler relied heavily on inscriptions and grave goods to interpret the mortuary contexts he encountered (the first approach discussed in Chapter I, above). He, for example, dated the earliest tomb, called the Nabataean Tomb, to the 2nd century C.E. on the basis of a Nabataean inscription uncovered *in situ*. According to Butler, the location of the inscriptions suggested that the inscribed slabs were not used as tombstones but as tablets that were placed outside of the structure to provide the names of those interred within. He also used grave artifacts to ascertain that all of the tombs excavated by his team had been robbed in ancient times. The investigation of glass fragments, in addition, allowed him to analyze the quality and style of ancient vases and bottles used in funerary assemblages. Although no mention or evaluation of associated human remains is included, the detailed drawings and textual descriptions reported by Butler and his crew are helpful for understanding the funerary practices of the Nabataean/Early Romans, perhaps the earliest inhabitants of Umm el-Jimal (2nd-3rd c.).

Umm el Jimal 1984: Areas O, V and W

Extensive excavations of tombs at the site occurred in more recent times under the direction of Dr. Bert de Vries in the 1984 season. Burials were uncovered in three areas of the site designated O, V and W (Figure 3) and were all tentatively dated to the Late Roman/Early Byzantine periods (4th-7th centuries C.E.), making them roughly contemporaneous with areas AA, Z, BB.1 and the Early Roman/Late Roman village. Areas O and W contained cist and pit burials similar to those excavated in cemeteries Z and AA, while area V differed markedly in its type and scale.

The mortuary structure uncovered in area V consisted of a side chamber, main chamber and eight burial loculi. Pottery and coins found in different regions of the structure suggest a complex history of continued use from the Late Roman through the Late Byzantine periods, with extensive robbing in Late Ottoman times. A dense pile of disarticulated bone in the side chamber, or ossuary, indicate the room's use as a repository for skeletal elements removed from the main chamber's loculi to make room for subsequent burials. As yet, no formal analysis of bones excavated in the 1984 season has been undertaken.

The Area Z and AA Cemetery

Area Z is located approximately 75 meters west of the southern limit of the Byzantine town ruins, in the olive garden of Sheikh Hail es-Serour (Figures 3 & 4). Excavations began here in 1993 when a robbed cist tomb, Z.1, was accidentally discovered by the owner of the property. More systematic excavations continued in 1994 resulting in the discovery of two additional burials, Z.2 and Z.3 (Brashler, 1995). During the summer season of 1996, eight more graves containing the remains of either intact human interments or burial disturbances were uncovered. All of the

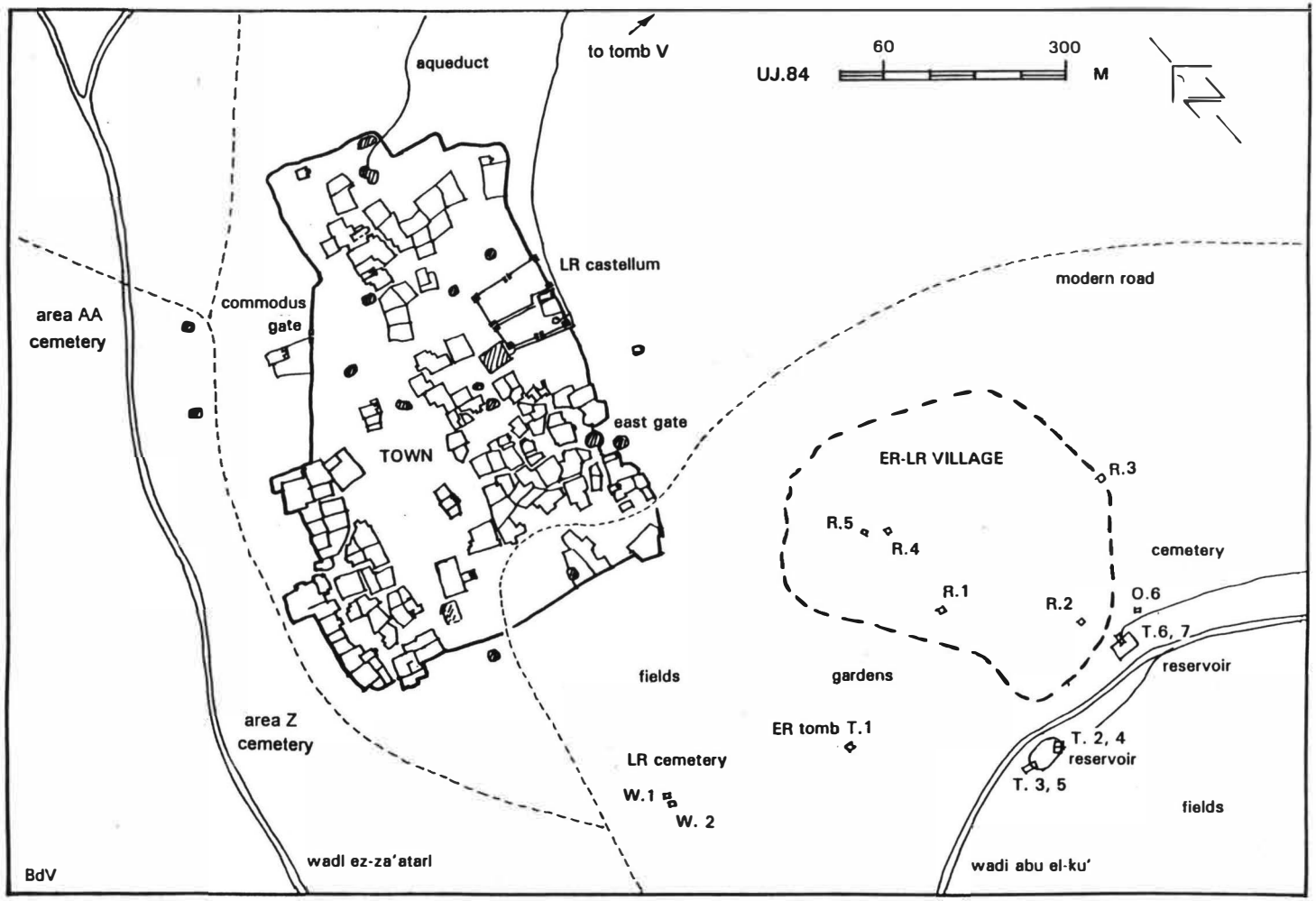

Figure 3. Umm el-Jimal Site Map With Burial Locations (Drawing by Bert de Vries).

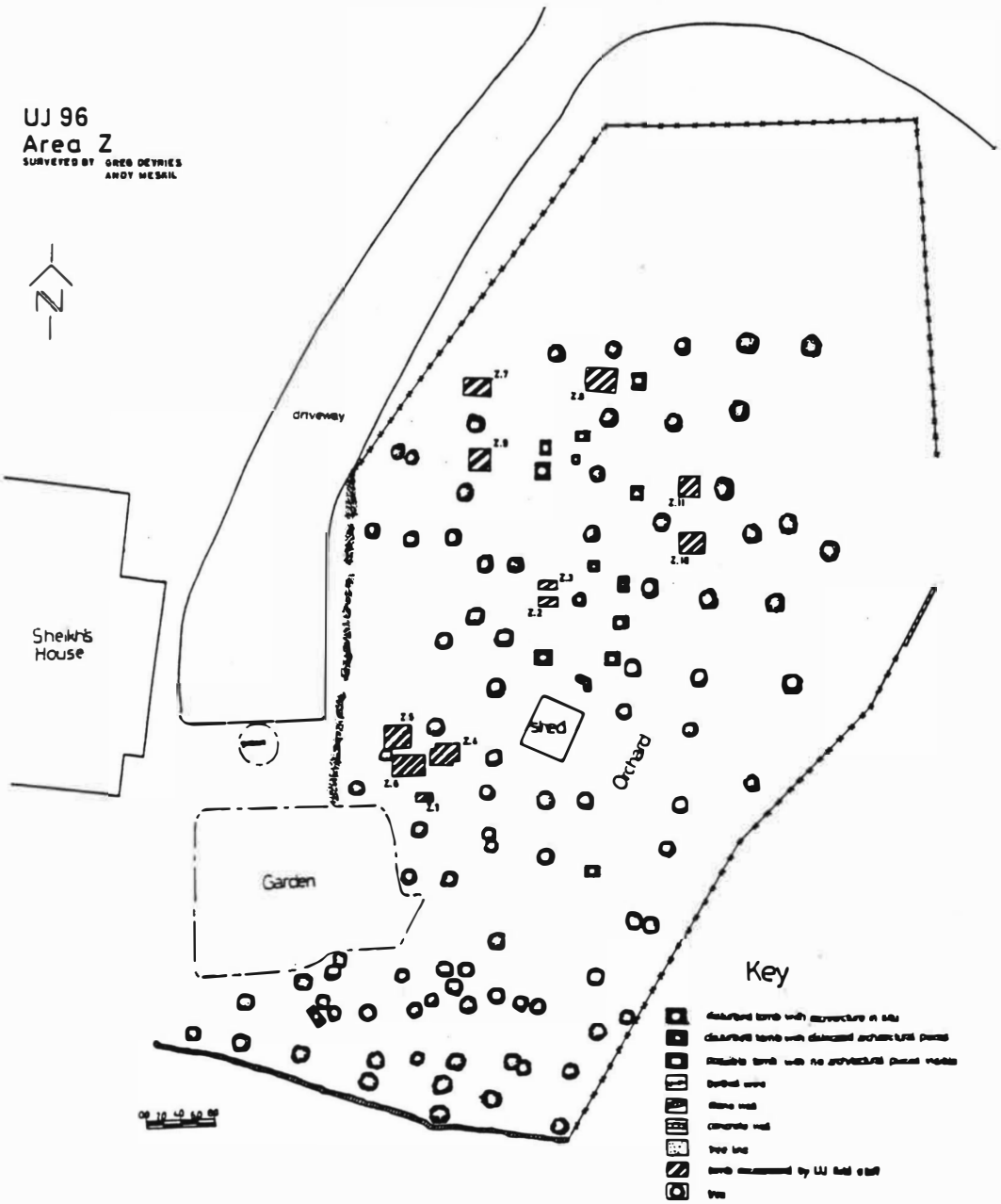

Figure 4. Area Z Overview Map (Drawing by Greg DeVries, Andy Meskil and Bert de Vries).

1996 burials underwent preliminary analysis in a field laboratory prior to shipment back to the United States.

Area AA, at the time of excavation in 1994, was located adjacent to Umm el-Jimal's girl's school approximately 200 m west of the main standing ruins (Brashler, 1995) (Figures 3 & 5). Today area AA is partly covered by several structures, including a new school building, a house built in 1993, fence rows and modern roadways. The extent of the cemetery is presently unknown. Excavation of Area AA began with a rescue operation in 1993 when digging for a house foundation uncovered and disturbed the remains of a multiple interment. More systematic excavations, carried out in 1994 (Brashler, 1995), revealed eleven tombs containing the remains of thirteen individuals. Skeletal elements were packaged and shipped to the U.S. with only tentative age and sex determinations attempted in the field.

It should be noted that as a result of the 1996 excavations in area Z and the increase in sample size, some of the distinctions made between AA and Z in preliminary field reports (Brashler, 1995) must now be reinterpreted. Prior to the 1996 season, no evidence had been uncovered for single or double human interments in area Z. Graves Z.1 through Z.3, excavated in 1993 and 1994, all contained the remains of four or more individuals. Five graves containing either one or two individuals uncovered in the 1996 season, however, suggest that multiple interments can no longer be considered the norm in area Z. Similarly, in area AA, most of the burials contained either one or two individuals with the exception of AA.1 which held the remains of a minimum of four people. It is now apparent that both areas are characterized by a certain degree of diversity in number of individuals interred.

Further excavations have also demonstrated that AA and Z share similar ceramic dates. All ceramic interpretation was provided by Dr. Cherie Lenzen, Umm el-Jimal's staff ceramicist. In area AA, four tombs contained pottery associated with burial

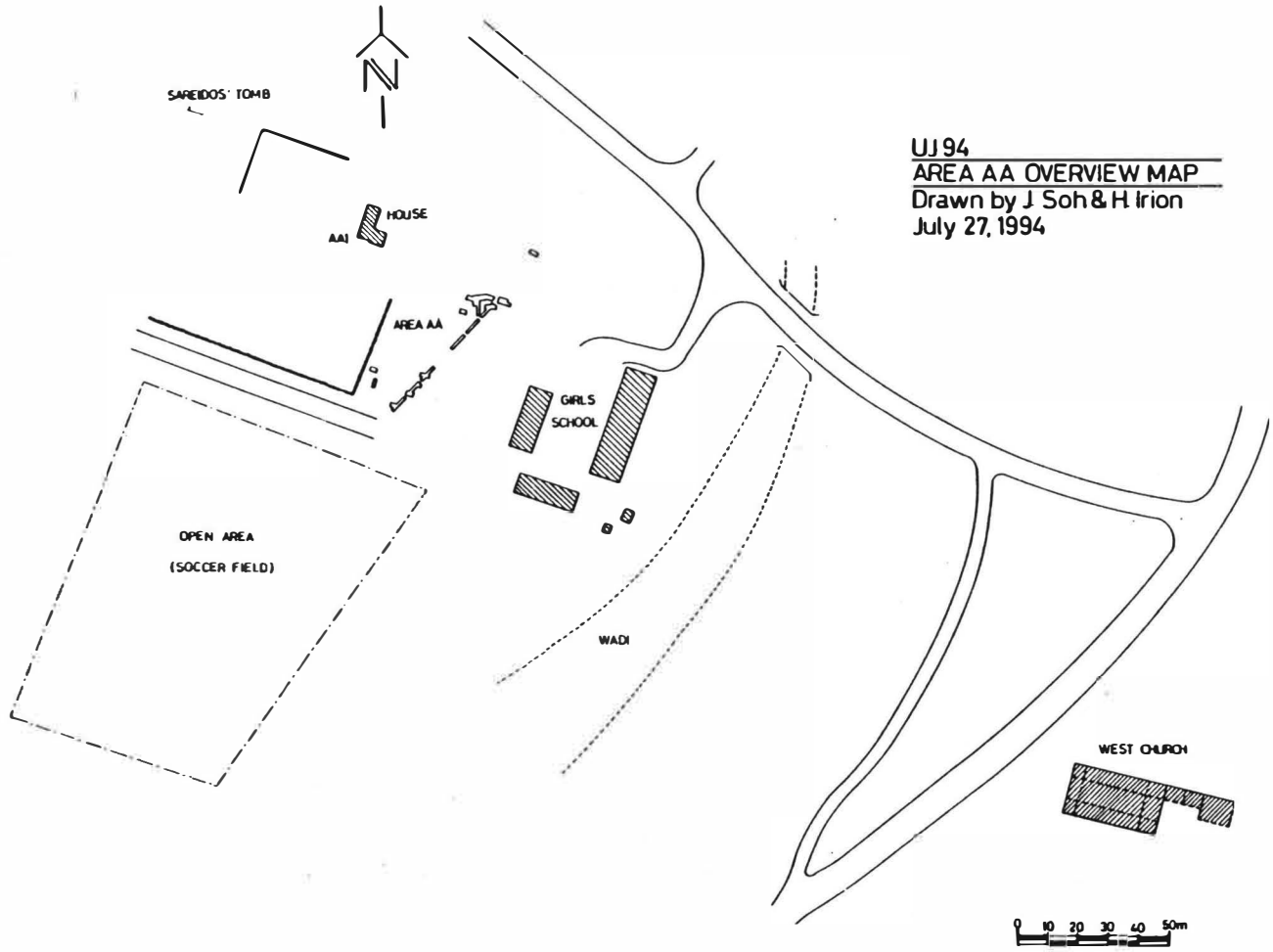

Figure 5. Area AA Overview Map.

remains. Of these, two were given Early Byzantine dates and two Late Roman. Similarly, in area Z all of the pottery uncovered in graves has been dated Early Roman/Late Roman with one Early Byzantine exception. In terms of burial structure, each area has both pits, or simple inhumations, and stone lined cists. In area AA, three cists and eleven pits were uncovered compared to area Z's five cists and six pits. Three graves in area AA and all but one burial in Z also contained wooden coffins. In both areas, there were eastern and western skeletal orientations and a variable amount of grave goods between tombs.

Finally, it is also known that burials exist and have frequently been disturbed by construction occurring between the two areas (AA.17 and AA.18, for example, Brashler in press; personal communication with Umm el-Jimal's modern residents). Overall, similarities in burial type and pottery chronology indicate such a high degree of continuity between areas Z and AA that distinctions made between them must be seen as artificial. Because archaeological evidence suggests that these two areas are actually parts of the same cemetery, skeletal data from both regions will be considered together in the construction of life tables and in statistical analysis.

The Monumental Tomb Structure Area BB.1

Area BB.1, is a monumental tomb structure located approximately one kilometer SE of the main town ruins and south of area R (Figures 6 & 7). This structure was excavated during the 1996 field school season (Brashler in press) and estimated to contain the commingled remains of numerous individuals (field estimation was 60+ individuals). The tomb itself consisted of a large vaulted ceiling, staircase, plaster floor and eight burial loculi radiating off of a central chamber. Cataloguing of human remains began in the field and was completed at Grand Valley State University before final shipment to Western Michigan University for a more

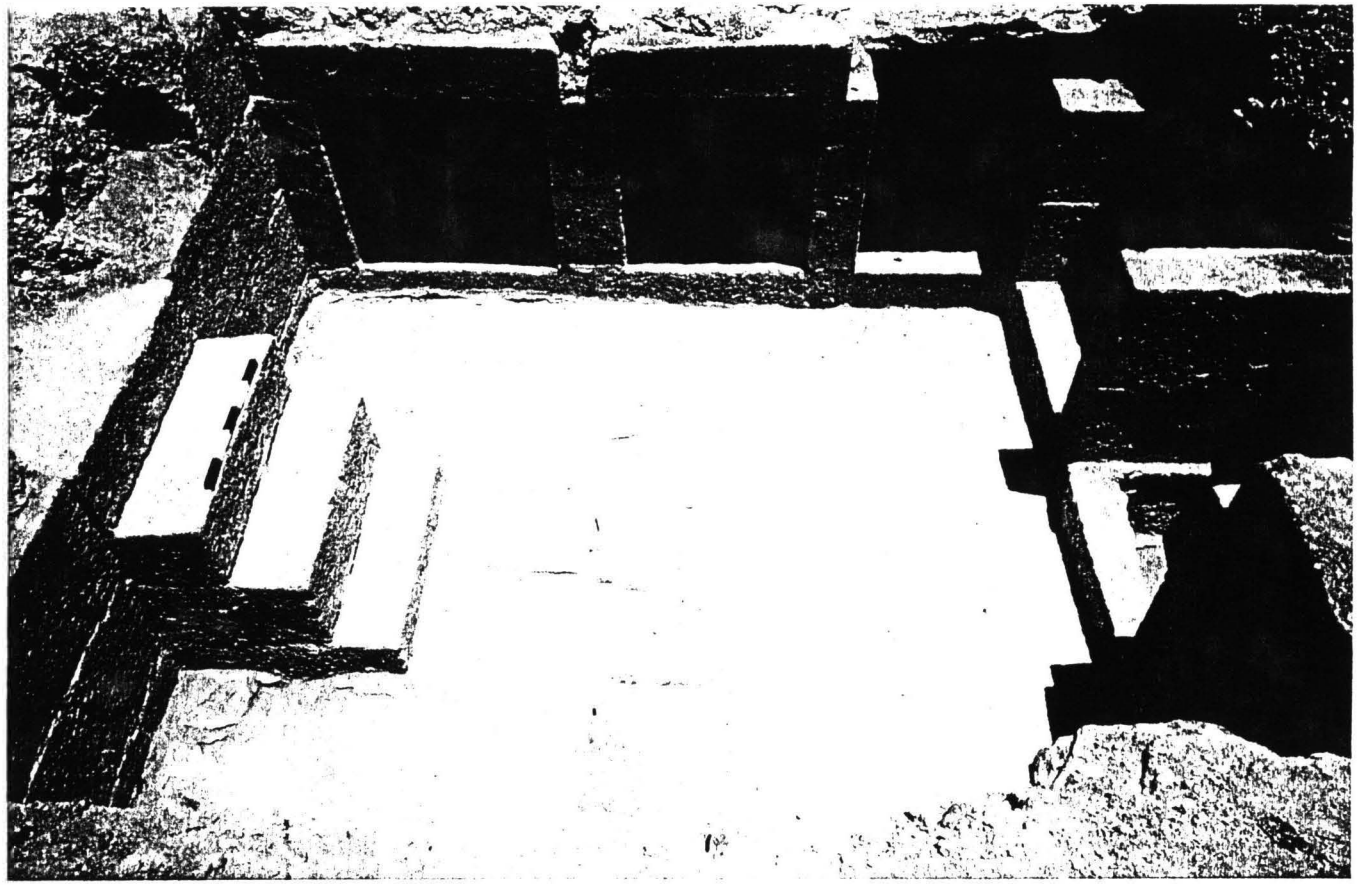

Figure 6. Photograph of the BB.1 Mausoleum (Photo by J. Brashler).

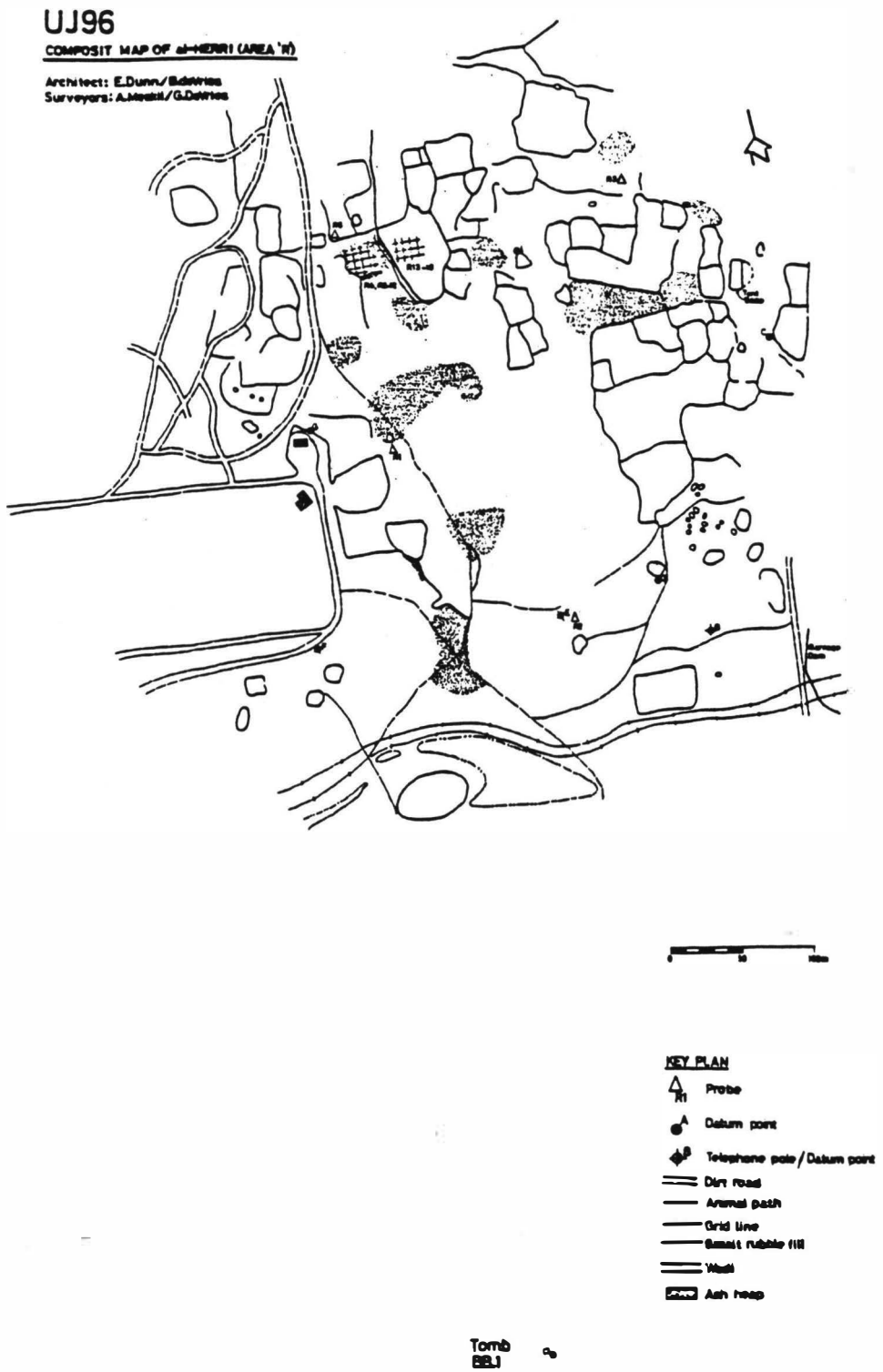

Figure 7. The BB.1 Mausoleum in Relationship to the Early Roman/Late Roman Village (Drawing by E. Dunn).

detailed demographic analysis.

Finally, it should be noted that all of the above described areas have been tentatively dated to the Roman period (with extensions into the Byzantine phase in some cases) based on preliminary stratigraphy and pottery analysis (Lenzen, 1997, in preparation). This makes the burials contemporaneous with the second period of Umm el-Jimal's occupation (4th - 5th c.), discussed above. Interestingly, to date, no burials or tomb structures have been uncovered whose original constructions correspond to later periods of known occupation at the site.

CHAPTER III

METHODS AND MATERIALS

Excavation of Human Remains

Areas AA and Z

In areas Z and AA, units were detected and defined in regions where above ground probing indicated the presence of stones occurring in a somewhat regular pattern below the surface. Attempts to locate grave structures involved the highly effective use of a metal soil probe in areas where tomb lid architecture was expected. In area Z, tomb cover slabs were visible from the surface in some locations as a result of prior disturbances. It was, therefore, unnecessary to use trenches to locate subsurface graves as approximate locations could be estimated from visible patterning. In area AA it was necessary to open large 1.0 x 6.0 m trenches because no architectural features or soil depressions associated with underlying tomb structures were visible superficially. After a few graves were located, it was then possible to estimate regions where adjacent structures were likely to be uncovered.

Once units were detected, a square was laid out, excavated and expanded to reveal all of the tomb cover slabs. The architecture and underlying stone lined cist or simple pit was then defined, drawn to scale, photographed and excavated. All of the excavated burials contained a layer of loose fill, located within the pit or cist below the cover stones. Once this was removed, the remains of either an intact human interment or a burial disturbance was evident.

Discovery of articulated human remains involved the complete excavation and

recording of skeletal elements *in situ*. Small brushes and bamboo picks were used to remove the surrounding soil matrix. In all but two units (Z.2 and Z.3) photographs were taken and the exposed remains were mapped in full before any bones were removed. This allowed for the differentiation of individuals prior to the removal of any portion of the burial. In squares Z.2 and Z.3, time constraints, combined with the large quantity of skeletal elements present, prevented the clear articulation of individuals prior to removal. In these cases, layers of bone and soil were exposed, mapped and photographed in successive random levels. Plotting of individual skeletal elements or clusters of bones and the mapping of these features with corresponding numbers allowed the majority of items to be sorted out by individual in the laboratory. All skeletal material was taken to a field laboratory where preliminary age, sex and stature estimates were calculated, pathologies and anomalies were noted and skeletal inventories were completed. Bones were then packaged for shipment to Western Michigan University where a more comprehensive examination was undertaken by the author.

Monumental Tomb Structure BB.1

The location of tomb BB.1 was clearly defined prior to the 1996 excavations largely because of the structure's partial exposure by a member of the Mafraq office of the Department of Antiquities of the Hashemite Kingdom of Jordan in 1995. The full dimensions of the tomb and associated architecture were recorded in 1996 by the Umm el-Jimal staff once soil, rubble and modern debris were cleared. A permanent datum was established at the intersection of two walls in the main chamber of the tomb, and detailed plan and elevation drawings of the structure were made as architectural features were exposed. Soil was removed until additional architectural elements, including a stairway and distinct burial loculi, were uncovered. Each loculus was then excavated

separately in an effort to locate any fully articulated human remains or *in situ* grave goods. Though the majority of skeletal elements were badly commingled and no clear stratigraphic distinctions of sequential use could be distinguished, one nearly complete individual was uncovered in one of the loculi. This individual was mapped, photographed and excavated separately.

The rest of the human remains were excavated in piles that reflected their placement after sequential robbings and reuses. All of the remains excavated from the loculi and main chamber, with the exception of the one, fully articulated individual are, therefore, commingled and their placement the result of disturbance. Distinctions made in excavation must be considered artificial as the loci designated in the field do not correspond to individuals. Human remains were inventoried in the field laboratory and at Grand Valley State University and then shipped to Western Michigan University for more detailed demographic analysis (see Brashler, 1997, in press for a more detailed description of excavation strategy and progress).

Sampling Strategies

Research strategies and sampling techniques utilized in Umm el-Jimal's cemetery excavations were severely limited by logistical and site preservation problems. Ideally, the excavation of cemeteries AA and Z would have involved the determination and definition of their extents and limits, and the establishment of a strategy for random transect sampling prior to the exhumation of a skeletal sample. This would have allowed the estimation of the percentage of the cemetery sampled and have provided a rough evaluation of the number of individuals required to represent accurately the population. Unfortunately, the massive amount of modern building over the Early Roman/Late Roman through Early Byzantine cemetery prevented this from occurring.

The 1994 and 1996 Umm el-Jimal project was able to obtain permission to excavate and curate human skeletal material from two regions of the site (areas AA and Z). Within the limits of these areas the sampling goal was simply to uncover and analyze as many intact, undisturbed burials as possible, while causing minimal damage to modern property. This included avoiding the irrigation ditches, animal pens, garden plots, modern fences and olive trees that are spaced throughout the research areas. While this goal was achieved, at present, there is still no way to estimate the proportion of the total sample represented by the research collection. In addition, the limits of the areas and the overall size of the cemeteries will, in all likelihood, never be known due to modern development.

Figure 3 indicates the relative placement of areas Z and AA with reference to various regions of the site. Umm el-Jimal's modern inhabitants report that the simple pit and cist burials uncovered in these regions occur all along the western edge of the Byzantine town ruins. In addition, reports from the modern village farmers and survey evidence collected in the 1996 season (Brashler, 1997, in press) indicate that digging for building foundations or road construction frequently reveal graves of these types. During the 1996 tomb survey, thirteen cemeteries (or regions where above ground disturbances made subterranean features visible) comprised of pit and cist burials were mapped in regions surrounding the Byzantine town ruins and the Early Roman-Late Roman village. No burials of these types were located within the perimeters of these settlements, with the exception of one cemetery (see Brashler, 1997, in press). At present, a likely conjecture is that hundreds of pit and cist graves comprising a massive cemetery surround the Byzantine town and Early Roman-Late Roman village ruins. It must, therefore, be noted that the skeletal collection from the AA and Z cemeteries is likely representative of a very small portion of those individuals interred at Umm el-Jimal (perhaps under 5%).

Tomb BB.1 is one of twenty-one monumental funerary structures surrounding Umm el-Jimal. These burial units do not appear to occur in clusters or groups and are located outside of the limits of the Byzantine town (with the exception of two structures that are found within the area of the ruins) (see Brashler, 1997, in press). Brashler has suggested that these large tombs may be extended family or kin-based mausoleums, and that their geographic situation could have been related to family land ownership patterns. Of the twenty-one monumental tombs mapped at Umm el-Jimal, three, V, BB.1 and BB.2, have been systematically excavated for the collection of human remains and architectural information. The human remains from BB.1 are the only ones that have undergone morphological investigation for demographic and health related statistics. Thus, it should be noted that the results from skeletal analyses for BB.1 are somewhat preliminary and will need to be compared to remains from additional mausoleums in order to characterize demographic distributions, patterns of skeletal pathology, etc., for these funerary units.

Analysis of Skeletal Remains: The Construction of Biological Profiles

In general, the majority of methods that were utilized for osteological analysis in this study involved visual estimation of morphological features and developmental stages. Metric techniques were used, when preservation allowed, for estimating the age of immature skeletons (fetal to one year of age) and in the calculation of stature estimates for adult remains. It should be noted that none of the methods used for calculation of age, sex or stature ranges are specific to the Umm el-Jimal population. Selection of procedures and formulae with regard to population specificity are described in detail below.

Age

In immature remains, the degree of epiphyseal closure and fissure obliteration (Schwartz, 1996; Bennett, 1993) along with dental eruption patterns (Ubelaker, 1978) provided the primary means for estimating age at time of death. For individuals at or around the age of one year, metric analysis of long bones (Johnston, 1962), dental eruption patterns and temporal (Weaver, 1979) and occipital bone (Redfield, 1970) development were used to assess the age at death.

In adult individuals, pubic symphysis morphology (Brooks & Suchey, 1990) served as the primary means for estimating age when these elements were present and well preserved. Sternal rib extremity development (Iscan, Loth, & Wright, 1984) was also used, but only as a secondary means for corroborating pubic symphyses or dental age.

For individuals whose third molars had already erupted, dental attrition patterns calculated for premedieval British skulls for three molar sequences were used (Brothwell, 1965). This is the most problematic of the methods used in this study because of the lack of evidence on dietary patterns at Umm el-Jimal available prior to the initiation of this research (see Shah, 1997, for a recent analysis of dietary data). Brothwell's formulae, however, provided relatively broad age parameters which proved useful for the minimal assessment of early, mid and late adulthood. More refined age estimates based on molar wear patterns were possible when Smith's standards (1972, 1984) were applied. However, these estimates were used only to corroborate dental age as estimated from Brothwell's charts or when individual wear patterns of specific individuals were problematic - meaning that they fell at the juncture of two age categories. Narrower age estimates offered by Smith were then used to place individuals into either the upper or lower age category.

Finally, degrees of degenerative diseases like osteoarthritis and dental health indicators such as alveolar resorption were noted and used as indicators of possible age range in conjunction with the above described approaches.

Sex

Estimation of sex was attempted only in adult remains because, although methods exist for sexing immature individuals, they are generally considered problematic or ineffective (Schwartz, 1996; Stewart, 1979). Sex estimations were based primarily on the Phenice method (sex-specific characteristics of the ventral arc, subpubic concavity, and the medial aspect of the ischiopubic ramus) where preservation allowed (Phenice, 1969). The greater sciatic notch, sacro-iliac articulation, preauricular sulcus and sacral morphology was also utilized when possible. Attributes of the skull including supraorbital tori, mandibular morphology, frontal and parietal bossing, nuchal crests and mastoid processes were evaluated in an effort to estimate sex when pubic elements were not available and as a means of corroborating pelvic evidence. Estimation of sex based on general levels of robusticity were avoided, as little is known about the occupation or life ways of these individuals at present. Magnitude of muscle attachments as well as overall size of skeletal elements was noted in an effort to characterize the levels of gracility and robusticity represented in males and females in the population.

Bio-Geographic Origin and Stature

A comprehensive analysis of cranial morphology related to ancestry or bio-geographic origin estimation was not attempted in this study because of: (a) the fragmentary nature of the cranial material, and (b) because biological race determination was not considered vital to the research goals of this project. However, it has been

noted that the few well preserved skulls excavated from areas BB.1 and Z expressed Caucasian characteristics (i.e., are of European origin) including a high rounded vault, orthognathic face, prominent chin and distinct nasal sills (Bass, 1995). This observation is related to estimation of stature discussed below.

In order to calculate a range for living stature, Trotter and Gleser's formulae for Whites (1952, 1958) were utilized. Hershkovitz, Bar-Yosef, & Arensburg (1994) report that modern Middle Eastern skulls tend to have Caucasian skeletal features. This observation, combined with the fact that average stature and stature distributions for White and Middle Eastern populations tend to be similar (Hershkovitz, et al., 1987; Hershkovitz, 1981, 1984), led to the decision to utilize Caucasian formulae. It must be noted that these calculations are only useful in so far as they provide approximate and relative indications of living stature among individuals in this population. Stature calculations based on these formulae are therefore tenuous at best and should not be considered indicative of general stature trends in antiquity.

Pathology and Anomaly

A cursory survey of skeletal remains was attempted in order to document evidence of pathologies considered to be indicative of general health and nutrition levels during life. These included enamel hypoplasia, dental caries, abscesses, alveolar resorption and osteoarthritis. A more comprehensive evaluation of skeletal pathology and the analysis of congenital anomalies and epigenetic traits were not attempted here but remain important directions for future analysis.

Perspectives on Demography and the Construction of Life Tables

The primary aim of paleodemographic analysis is to determine estimates of vital statistics from populations of human skeletal remains (Hassan, 1981). These statistics

usually include age at death, life expectancy, probability of death in particular age intervals, survivorship and death rates. Because of the nature of the materials analyzed, the main focus of demographic studies usually involves mortality statistics. Hassan (1981) notes, however, that when certain conditions can be assumed (these will be discussed in greater detail below), it is also possible to calculate crude birth rate, population growth rate and population size. The accuracy of demographic reconstruction depends on several factors including the precision with which sex and age can be estimated for a population, sample size and the level of conformity between assumptions of quantitative models and the characteristics of a given research population.

Life Table Methodology

In this study, life table methodology (Ascadi & Nemeskeri, 1970; Owsley & Bass, 1979) was applied to the demographic analysis of skeletons from Umm el-Jimal's areas Z, AA and BB.1. A life table is a mortality history of a cohort or hypothetical group which follows the members of its cohort from birth through the death of all of its members (Hassan, 1981). The cohort loses a predetermined proportion of individuals at each age and thus represents an artificially contrived situation. Reduction of behaviors into a single model facilitates comparisons between different life tables, but also introduces potential for error through reliance on simplifying assumptions (Barclay, 1958). The construction of abridged life tables used in this study (in accordance with guidelines given by Ascadi & Nemeskeri, 1970) began with the designation of time-succesive age intervals listed in Table 1. For the purposes of age interval definition it was assumed that no individuals in the population lived beyond the age of 54.

Table 1

Age Intervals Used in the Construction of Life Tables for Areas Z, AA and BB.1 at Umm el-Jimal

Interval Number	Age Span in Years
1	10 - 1.5
2	2 - 5
3	6 - 14
4	15 - 24
5	25 - 34
6	35 - 44
7	45 - 54

From the age distribution at death (D_x), the construction of life tables permitted the calculation of the probability of dying (q_x) between age x and age x + n, and the percentage of deaths or mortality (d_x) between age x and age x + n. The number of years lived by survivors at each age interval (L_x), the total number of years lived at each age interval or above age x (T_x), and the average number of years remaining for persons from birth and at each age interval, or life expectancy (e_x), were also calculated for Umm el-Jimal's skeletal population. Finally, crude mortality (m) and crude birth rates (CBR) were estimated in an attempt to assess demographic trends in population growth, decline or stable maintenance.

Life tables were constructed from all ageable individuals for BB.1 and areas AA and Z combined (see the discussion of burial locations in Chapter II for reasoning behind the collapsing of data from AA and Z). Results from calculations for males and females from BB.1 and from Z and AA combined were also compared. For life tables

where individuals were distinguished by sex, immature skeletons from specific age cohorts were assumed to consist of roughly 50% males and 50% females (Barclay, 1958; Askadi & Nemeskeri, 1970; Owsley & Bass, 1979). Statistical comparisons, however, were only attempted where calculations were based on data derived from adult individuals who could be sexed and aged using methods described previously in this paper. Table 2 contains a summary of formulae used to calculate the above described variables.

Demographic Assumptions

The demographic technique utilized in this study to estimate mortality rates involved a life table procedure based on Ascadi and Nemeskeri's (1970) model for stationary populations. Accuracy of this model relies on two assumptions: (1) that the research population was stationary or almost so, meaning that equal birth and death rates and fixed age-specific mortality rates existed for the group under examination; and (2) that the population was closed, i.e. that either there was no in or out migration or that migration exchange was reciprocal. For example, in cases where mate exchange exists between clan groups, stationary assumptions are not violated (Weiss, 1973). Because relatively little is known about demographic trends or migration patterns at Umm el-Jimal, at present it is difficult to ascertain how well this model mirrors actual behavioral and population patterns in antiquity. This study must be seen, therefore, as a point of departure for research related to the interpretation of paleodemographic trends. Results from this study and continued excavations in the Early Roman-Late Roman village may suggest more parsimonious models that can be applied in future research.

Table 2

Basic Life Table Computations and Formulae

Variable	Description	Formula
x	age interval	-
D_x	# of people dying in x	-
d_x	% dying in interval x	$d_x=(D_x/\sum D_x)x100$
l_x	% surviving in interval x	$l_x=l_{x-1}-d_{x-1}$
q_x	probability of dying in interval x	$q_x=d_x/l_x$
L_x	# of yrs lived in each interval	early intervals: $L_x=0.2xl_x+0.8xl_{x+1}$
	$L_x=0.34xl_x+1.184xl_{x+1}+2.782xl_{x+2}$	later intervals: $L_x=N_x(l_x+l_{x+1})/2$ *
T_x	# yrs lived after interval x	$T_x=T_{x-1}-L_{x-1}$
e_x	life expectancy	$e_x=T_x/l_x$
m	crude mortality rate	$m=1/e_0$ e_0= 1st interval
CBR	crude birth rate $114.93(D_{30+}/D_{5+})+127.12$	

*N is # of years in age interval

Statistical Analyses

Statistical analyses were conducted on life table data in order to determine whether significant differences existed between various subgroups in the population. For example, differences between area BB.1 and the combined areas of Z and AA, and between males and females in both regions were tested to determine whether observed

differences were statistically significant (at $p \leq .05$) or not. Two groups of tests were performed using SPSS for windows.

The first category of inquiries utilized the *Mann-Whitney U* test for two independent samples. This test is a nonparametric alternative to the t-test which allows two values to be compared and the differences between them calculated. All of the differences for the variables in a given category are then combined to create a U value, or a sum of the differences between a series of pairs of values compared. These U values are then ranked from highest to lowest and the greatest values in each category and tested for statistically significant variance.

In this study, analysis number one compared variance in d_x values (percentage of deaths) between: (1) BB.1 and the combined areas of AA and Z for all individuals, (2) males and females in areas AA and Z, and (3) values for males and females from area BB.1. Analysis number two compared differences in the probability of death in given age intervals (q_x values) for the same three subgroups listed above. Finally, variance in e_x values, or life expectancy rates, were compared for all three subgroups. Nonparametric analysis of these variables tested values for each age interval in all independent groups with the significance level ($p \leq .05$) set at 5%. The results of the analysis indicated which groups, if any, had statistically significant variances between their d_x,e_x or q_x values.

The second group of tests involved the analysis of correlation coefficients. This test examined the relationship between multiple sets of paired entities including all values calculated for life tables (for all individuals and by sex), all age intervals included, and the two areas of the site used in analyses above (AA and Z combined and BB.1). P values less than or equal to 0.05 indicated that the correlation between two variables was significant, or that the two variables were dependent on one another. An R value was also calculated for each set of two variables compared. The R value that

resulted was either positive or negative indicating a proportional or inversely proportional relationship, respectively, for the two entities tested. The majority of these calculations demonstrated the nature of the relationships between variables (e.g., life expectancy and age), and, thus, were simply indicative of the dependence of components of formulae used in life table calculations. The most important data provided by this test pertained to the significance of cemetery area as correlated to specific life table variables.

CHAPTER IV

RESULTS

Tomb Stratigraphy, Construction and Contents

Tombs Z.1 Through Z.8 and Area AA Graves

The majority of tombs excavated in areas Z and AA were of similar, standardized construction. Graves Z.1 through Z.8 and the AA burials were uncovered between 0.40 and 1.0 m below a surface layer of naturally deposited sandy, brown soil containing Late Roman/Early Byzantine pottery sherds, decayed organic material and modern debris. The lid structure was composed of between five and eight large basalt beams which varied in size and number with the scale of the tomb. Small to medium sized chinking stones were used to line the outside of the lid and were also placed in between each of the slabs. In area Z, Early Roman-Late Roman pottery, with one Early Byzantine exception in Z.6, was the only cultural material found in association with the lid architecture. In area AA, no ceramics were reported to have been found in direct association with tomb cover slabs.

Beneath the cover stones, either a narrow pit of slightly softer soil or a stone lined shaft consisting of two courses of roughly hewn basalt blocks and intermittent chinking stones were uncovered. *In situ* human remains, remnants of disturbed burials, plaster chunks, coffin wood, metal nails and brackets, metal rings, bone artifacts and beads were found in varying quantities within the pits and cists. In AA.15a and in Z.6 gold earrings were uncovered (Figure 8). Grave Z.3 contained the highest number of grave goods including a full Byzantine cook pot plastered over to

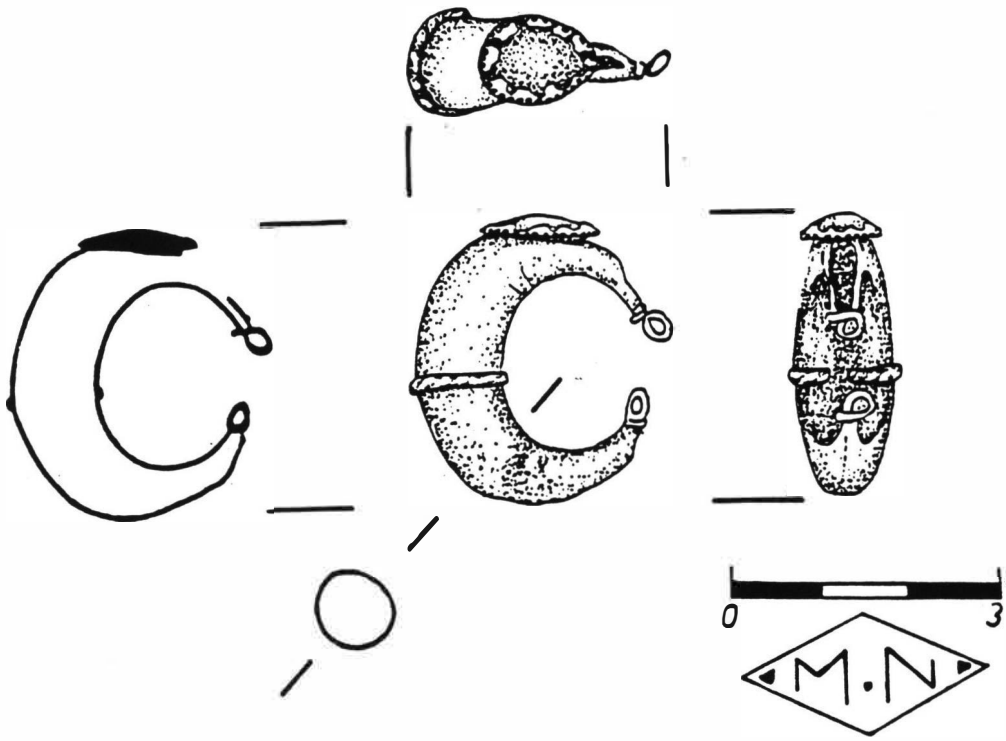

Figure 8. Gold Earrings From the AA.15a Child's Burial (Drawing by M. Nasir) (from Brashler 1995: 463).

form a chalice, a ceramic juglet with a copper wand or spatula, a mirror and makeup palette, a glass bottle with a serpentine neck decoration and a bone cosmetic bottle with a copper wand or spatula (Figure 9). A large number of beads were uncovered in association with infant and subadult remains. A lump of plaster resembling a human bust was uncovered near the east wall of the tomb along with a badly decayed braided metal and bead hair ornament. This hair piece was found in association with a subadult skull. Finally, two coins were found that have not yet been dated.

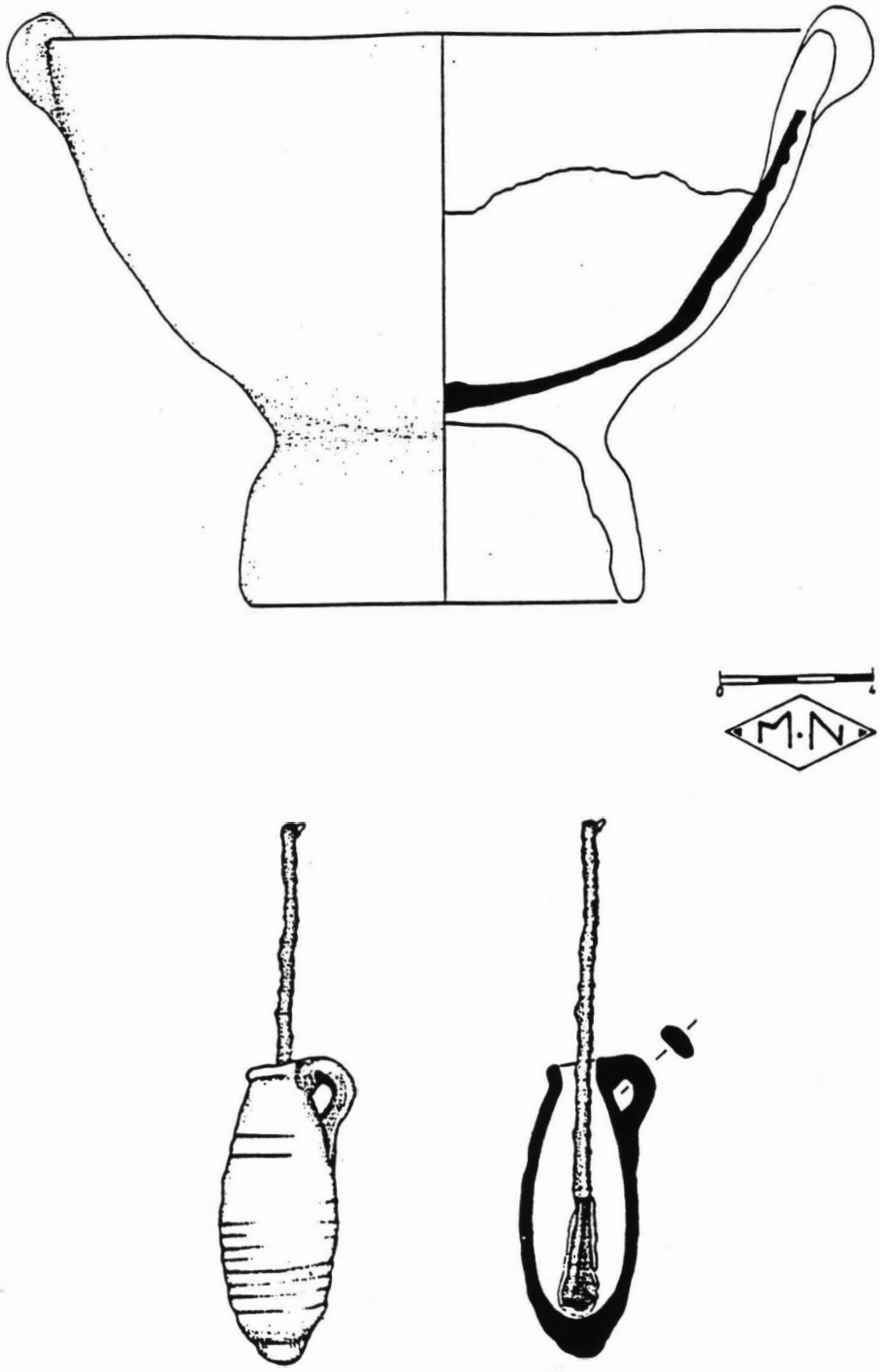

Figure 9. Plaster Chalice and Ceramic Juglet With Copper Wand/Spatula from Tomb Z.3 (from Brashler 1995: 466) (Drawings by M. Nasir).

All of the pottery found within the burial pits and cists in area Z was dated to the Early Roman/Late Roman period. The only deviation from this pattern was in Z.2 and Z.3 (Brashler, 1995). Z.2 contained a few sherds dated Early Byzantine, though the majority of estimates from pottery found within the burial pit were Late Roman. Z.3 was given field dates of Late Roman/Early Byzantine for pottery associated with human remains. The presence of a Byzantine cook pot plastered over to resemble an imported fineware chalice pushes the date into the Early Byzantine time period. In area AA very little pottery was uncovered within the pits or cists of intact burials with four out of the fourteen graves excavated yielding datable pottery. Of these, two were given Late Roman dates and two Early Byzantine. Essentially, pottery evidence suggests then that both pits and cists from areas Z and AA are early fourth century burial structures (Table 3).

Undisturbed soil was encountered below these levels. Burial data and associated grave goods for areas Z and AA are summarized in Tables 4, 5 and 6. Figures 10 and 11 show standardized tomb constructions for simple pit and cist graves.

Table 3

Stratigraphy Based on Ceramic Dates From Areas Z and AA Graves

Soil/Architectural Layer	Ceramic Dates
Topsoil	Late Roman/Early Byzantine, modern
Tomb lid architecture	Early Roman/Late Roman (1 Early Byzantine exception)
Cist or pit	Early Roman/Late Roman/Early Byzantine -> early 4th c.
Sterile Soil	

Table 4

Summary of Burial Data From Tombs Z.1, Z.2 and Z.3

Tomb	MNI	Sex	Age	Pathology/ Anomaly	Stature	Objects
Z.1	7	M	20-30 yrs	*	*	coffin, beads,
		F	25-35 yrs	alveolar resorption	*	bone figurine,
		*	20±3yrs	*	*	nail, animal bone,
		*	15-18yrs	*	*	bone tool,
		*	3±12mos	*	*	EByz pottery
		*	3±12mos	*	*	
		*	10±3yrs	*	*	
Z.2	4	M	25-35yrs	osteoarthritis, dental caries, abscess	163-171cm	bead, coffin, metal frags,
		M	30-40yrs	osteoarthritis, ante-mortem fracture	161-170cm	nails, LR/EByz pottery
		*	1yr±4mos	*	*	
		*	9mos±3mos	*	*	

Table 4-Continued

Tomb	MNI	Sex	Age	Pathology/ Anomaly	Stature	Objects
Z.3	16	M	25-35yrs	alveolar resorption, dental caries	165-173cm	chalice, juglet, copper wands,
		M	25-35yrs	*	172-179cm	mirror, cosmetic
		M	17-25yrs	osteophyte, congenitally absent 3rd molar?	165-173cm	palette, glass bottle, bone bottle, coffin, nails, beads,
		M	45+yrs	alveolar resorption, dental caries	*	jewelry, hair piece, plaster figurine, coins,
		*	3yrs±12mos	enlarged *pronater teres* origins	*	LR/EByz pottery
		*	8yrs±24mos	none	*	
		*	5yrs±16mos	none	*	
		*	8yrs±24mos	none	*	
		*	9yrs±24mos	none	*	
		*	6mos±3mos	none	*	
		*	7yrs±24mos	none	*	
		*	7yrs±24mos	none	*	
		*	6yrs±24mos	none	*	
		*	9yrs±24mos	none	*	
		*	9mos±3mos	none	*	
		*	4yrs±12mos	none	*	

*Indeterminate

Table 5

Summary of Burial Data From Tombs Z.4a Through Z.11

Tomb	MNI	Sex	Age	Pathology/ Anomaly	Stature	Objects
Z.4a	2	*	1 adult 1 subadult	*	*	Late Roman pottery, metal frags (foot adornment?),
Z.4b	1	*	7yrs±24mos	none	*	coffin
Z.5	*	*	*	*	*	glass, nail, copper bead, coffin remains, ER/LR pottery
Z.6	1	*	15yrs±36mos	*	*	beads, floral deposit, earring, metal frags, coffin remains, LR pottery
Z.7	2	F M	14-16yrs 27-35yrs	none osteoarthritis, enamel hypoplasia	146-154cm 165-174cm	nails, ring, coffin, Roman pottery
Z.8	1	M	30-40yrs	dental caries	165-173cm	nails, coffin, LR pottery
Z.10	1	*	35-45yrs	alveolar resorption, osteoarthritis	*	LR pottery
Z.11	1	*	4-6yrs	none	*	LR pottery

* Indeterminate

Table 6

Summary of Burial Data From Area AA Tombs

Tomb	MNI	Sex	Age	Pathology/ Anomaly	Stature	Objects
AA.1	4	F	25-35yrs	*	*	none
		*	35+yrs	alveolar resorption	*	
		M	35+yrs	alveolar resorption, ankylosing spondylitis	*	
		*	<18yrs	*	*	
AA.2	1	F	45+yrs	osteoarthritis, alveolar resorption, caries, antemortem fracture, osteomyelitis, sternal foramen, robust radial tuberosities	*	Early Byzantine pottery
AA.3a	2	*	9mos±3mos	none	*	Early Byzantine pottery
		*	1yr±4mos	none	*	
AA.3b	1	F	25-35yrs	dental caries, 3rd molars congenitally absent	150-157cm	ring, shell, bead
AA.4	1	F	45+yrs	osteoarthritis, alveolar resorption, dental caries	*	beads

Table 6-Continued

Tomb	MNI	Sex	Age	Pathology/ Anomaly	Stature	Objects
AA.8	1	M	45+yrs	osteomyelitis, fusion of sacrum and *os coxae*, osteoarthritis, dental caries, lytic lesion, alveolar resorption	*	none
AA.9	1	*	9yrs±24mos	enamel hypoplasia, dental caries	*	coffin
AA.11	2	F	17-25yrs	abscess, dental cary, enamel hypoplasia	*	coffin, LR pottery
		F	17-25yrs	dental caries	*	
AA.14	1	*	45+yrs	dental caries, enamel hypoplasia, osteophyte	*	none
AA.15a	1	*	≤2yrs	*	*	gold earrings, beads
AA.16	2	*	6yrs±24mos	none	*	Late Roman pottery
		*	5yrs±16mos	none	*	

*Indeterminate

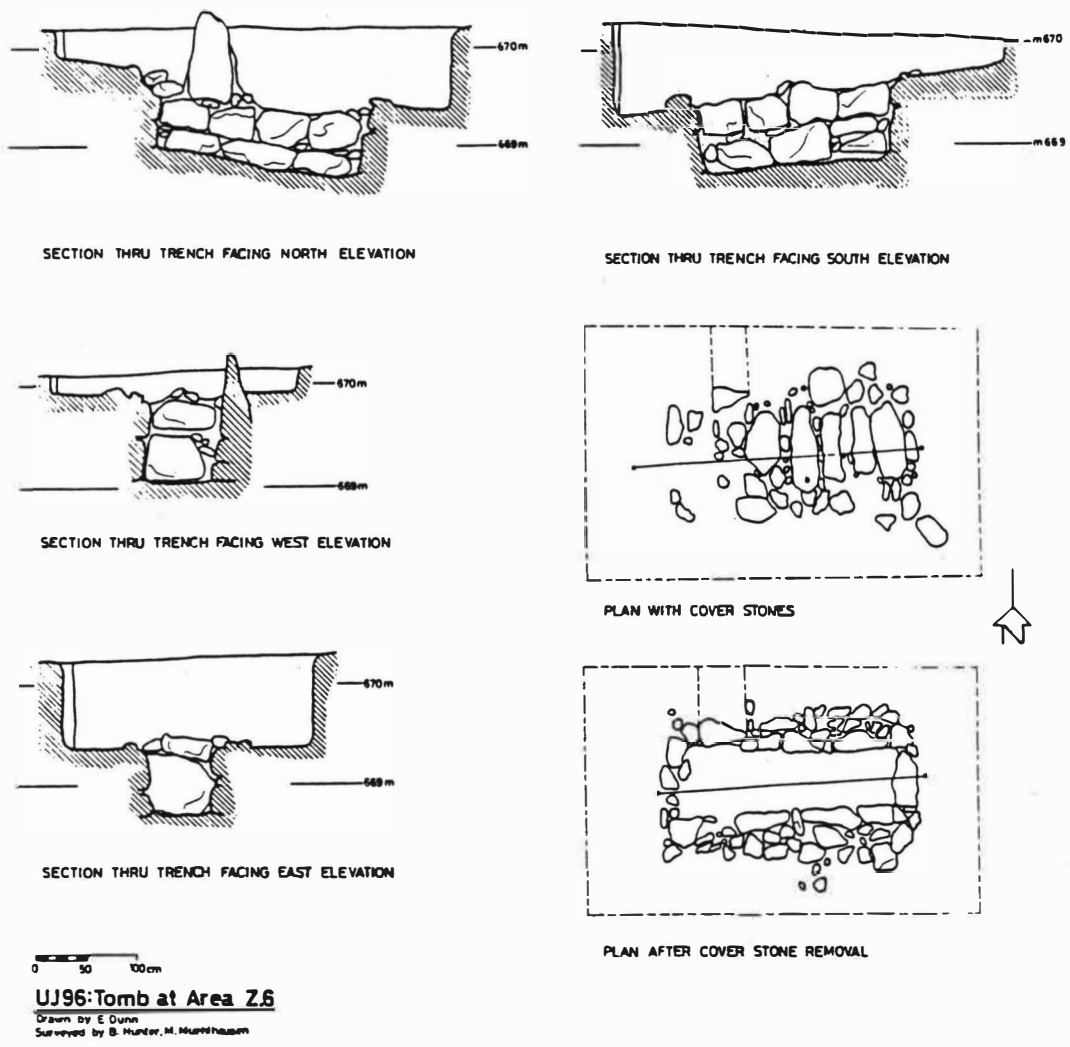

Figure 10. Cist Tomb Z.6 Plan and Elevation Drawings.

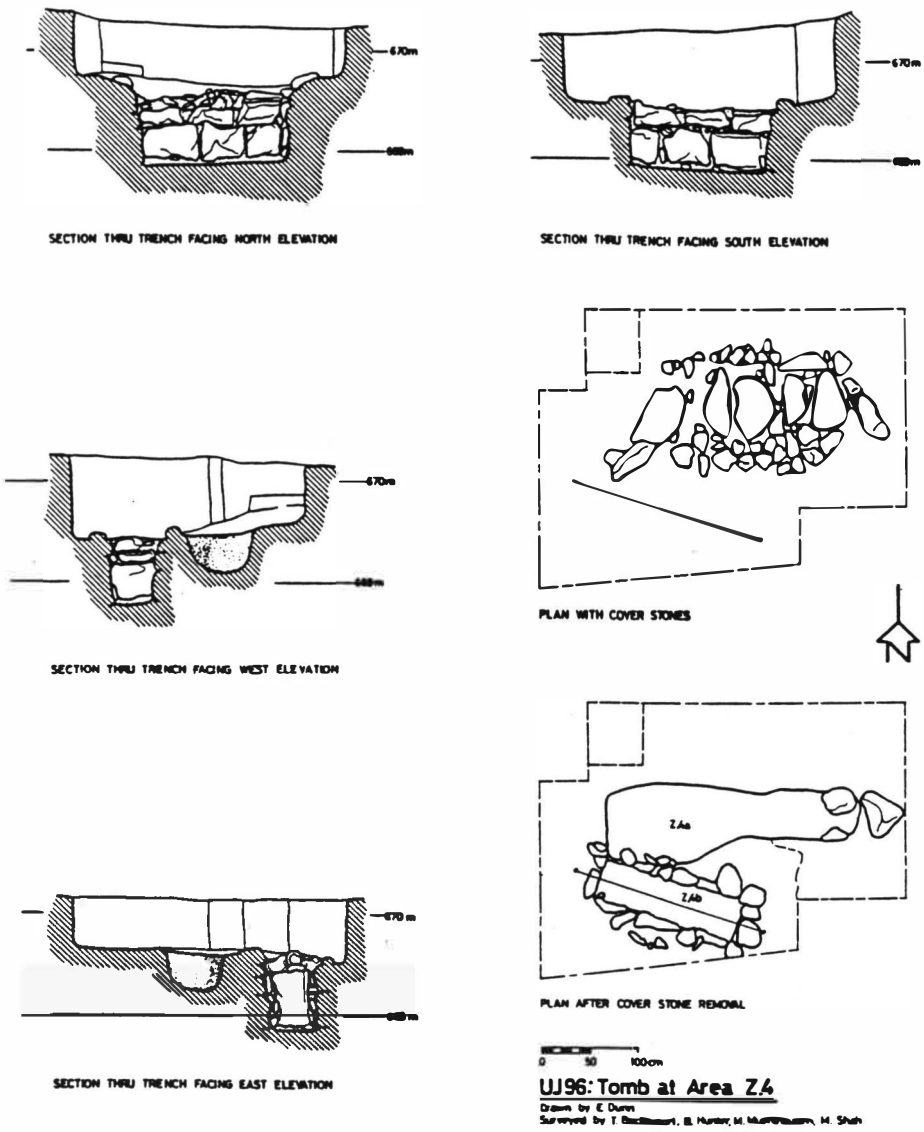

Figure 11. Elevation and Plan Drawings of Pit and Cist Burials Z.4a and Z.4b.

Tombs Z.10 and Z.11

The removal of topsoil above tombs Z.10 and Z.11 revealed the presence of cover slab architecture that varied to some degree from the typical plan described for areas AA and Z. A large ring of cobble stones was found above the cover slabs, encircling a pit of soft, dark soil. Pottery removed from this locus was dated to the Late Roman period. The removal of these rocks and the soil inside revealed horizontal cover slabs that did not appear to have fallen in. In addition, there was a complete absence of chinking stones between cover slabs. A burial pit was visible around and contiguous with the outer edge of the basalt beams used to construct the tomb lid. This is unlike the plan for the rest of the lid architecture in areas Z and AA where cover slabs were placed over the top of a narrower pit or stone lined cist. Beneath the cover slab and cobble ring structure, the pits continued down to a soil layer containing the skeletal remains of single individuals and no associated objects or pottery sherds.

Monumental Tomb BB.1

The following description of BB.1's stratigrahy is summarized from Brashler's (1997, in press) report on Umm el-Jimal's monumental tomb excavations. Datings of all loci are relative, and dependent on ceramic evidence, as no carbon dates have been made available yet for this structure.

The eleven loculi uncovered in tomb BB.1 surrounded a main chamber on three sides (E,S and W) and were excavated into basalt bedrock along cardinal directions. Basalt stones used to construct the interiors of the main chamber and adjacent loculi were finely dressed, while the exteriors of exposed blocks and ceilings were more roughly finished. None of the roofing system or evidence for a second floor or door were recovered, and Brashler (1997, in press) has argued that the original roof

structure and entrance to the tomb were located above ground prior to their disturbance. The basalt flagstone floor of the main chamber was covered with plaster which was also used to point the joints of the stairway and those between the floor and walls of the main chamber and loculi. Pointing was also visible in some places between the walls and ceiling. Below the plaster floor, two Greek inscriptions were uncovered between the stairs and the entrance to one of the loculi (BB.1:006) and in the the NW corner of the main chamber.

A probe dug beneath the flagstone and plaster floor revealed Late Roman pottery, two small glass beads and a copper bracelet and bead fragment. Brashler (1997, in press) hypothesizes that these small objects were introduced through cracks in the floor during various periods of tomb use and reuse. Fill within the main chamber contained a variety of objects that may have been disinterred from burial loculi during periods of reuse or robbing. Several concentrations of Early Roman, Late Roman, and Early Byzantine ceramics, glass fragments, a bronze cross, iron and copper fragments, a bone bead, two carved bone hair pins and a bone object (possibly a remnant from a cosmetic container) were all uncovered in this area. Excavation of burial loculi revealed Late Roman pottery in 13 of the 15 loci, Early Byzantine sherds for 5 loci and 3 Umayyad ceramic fragments.

When pottery dating is combined with evidence from the tomb architecture and the reused inscriptions, it seems likely that BB.1 was constructed in the Roman period with its heaviest period of use occurring in the 3rd and 4th centuries CE. Reuse most likely continued through the Early Byzantine period, with a single burial episode in the Umayyad period (7th - 8th c.). The loculus where Umayyad sherds occurred (in the most superficial layer of fill, loci 006 and 015) evidenced very little interruption of deeper layers and are, therefore, not likely to be indicative of robbery or other heavy disturbance. In sum, stratigraphic evidence indicates that BB.1's main period of use is

contemporaneous with the Z and AA cemetery, as well as, the Early Roman-Late Roman village. Because of the differences in scale and construction of the cist and pit burials and the BB.1 mausoleum and the similarity of chronology, the comparison of these units provides important evidence pertaining to the effects of status and resource availability on 4th century burial practice at Umm el-Jimal.

Biological Profiles

Analysis of human skeletal material uncovered from mortuary contexts resulted in a set of biological profiles including estimations of Minimum Number of Individuals (MNI), sex, age, stature and pathology/anomaly by tomb for each area. In areas AA and Z, these were calculated separately, but then collapsed in order to provide a larger sample for the construction of life tables and statistical comparison of demographic distributions.

Human Remains From the Areas AA and Z Cemetery

In area AA, an MNI of 17 individuals was calculated from the remains excavated from eleven pit and cist graves. An MNI of 33 individuals uncovered in eleven burials was estimated for area Z. The combined sample size from this portion of the early fourth century cemetery (areas AA and Z combined) is 50 individuals. Orientation, positioning of skeletons and basic demographic information are described below. Biological profiles for area AA and Z are summarized along with pertinent burial data in Tables 4, 5 and 6.

The designations of early, middle and late adult were used interchangeably with the broad age categories of: (a) 17-24, (b) 25-34, and (c) 35-44 and 45 and over, respectively. Two categories of old adult were applied, 35-44 and 45+, to allow distinctions to be made for individuals with extremely worn dentition and very late

pubic symphyses estimates. Though in many cases more precise aging was possible (from pubic symphyseal face morphology, for example), larger ranges were maintained in order to better insure accuracy of estimates. When evaluations of age overlapped with more than one of these categories, as in an early phase III estimate for the pubic symphysis (about 20-30 years), for example, evidence from other skeletal elements was used to place the individual in either the early or middle adult category. Molar wear patterns, fusion of the medial clavicle and sternal rib extremity phase estimates were the criteria most frequentlyiemployed to place individuals in one of the age categories described above.

Tomb AA.1

Tomb AA.1 contained the remains of a badly disturbed cist burial. This grave was uncovered by workmen while digging a house foundation and reported to the excavation staff the following day after a back hoe and curious local workers had taken their toll. The majority of human remains were uncovered in a loose pile, with fresh breakage, in the western end of the cist (suggesting that they had been placed there recently). Some elements were uncovered *in situ* including a complete vertebral column and some phalanges. The orientation and placement of these remains revealed that at least one individual was interred oriented east to west with his/her feet at the eastern end. A few small pottery sherds were the only objects uncovered in the grave.

Analysis of the commingled skeletal elements indicated the presence of a minimum of four individuals, three adults and one subadult. Diagnostic bone elements including pelvic and dental remains, could be attributed to the following individuals: (a) an adult female in the middle adult age range, i.e., approximately 25-35 years old; (b) a late adult (35 years or older) of unknown sex; and (c) a late adult male. An additional individual, a subadult, was distinguished from the adults by the presence of

an immature, billowed vertebral centrum. It should be noted that although there were many bones excavated from AA.1 that could not be identified due to poor preservation, only one skeletal element definitively belonging to a subadult could be distinguished. It is possible that the immature vertebra was left in the tomb from a previous burial that was removed in conjunction with culturally defined practices of removal and reburial or in relationship to an early grave robbery (see tomb Z.7 discussed below for a similar occurrence).

With regard to pathology, alveolar resorption was noted in both late adult individuals. The left mandibular third molar of one individual and the left first and second molars of a second person reflected this condition. Extremely uneven dental wear was also noted in these adults. Finally, three thoracic vertebrae (T10-T12) were found completely fused at the anterior edges of the centra as well as in parts of the pedicle and transverse processes. Uniform formation of syndesmophytes (ossified soft connective tissues like ligaments or tendons) bridging the vertebrae is indicative of the condition ankylosing spondylitis, which is the most frequently diagnosed class of inflammatory arthritides known as spondyloarthropathies (Schwartz, 1995). This malady is frequently confused with another condition, termed Diffuse Idiopathic Skeletal Hyperostosis (DISH), which also involves the aggressive ossification of soft tissues. DISH, however, can be distinguished from ankylosing spondylitis by examining the areas where the anterior longitudinal spinal ligaments would have occurred prior to decomposition. In DISH, ossification will be asymmetrical, usually affecting the region of the right longitudinal spinal ligament. In the AA.1 individual, ossification was observed to be symmetrical which suggests ankylosing spondylitis as the most likely diagnosis. Because this disease occurs three times more frequently in males than in females, the pathological bones may be associated with the late adult male distinguished above.

Tomb AA.2

This simple pit burial contained the remains of one adult individual interred in the extended supine position oriented west to east from head to feet. The arms were stretched out at the sides with the left lower arm running beneath the pelvis and the right forearm above it. The narrow width of the pit apparently made it necessary to place this individual's arms closely against her sides. In addition, the skull was tipped forward because the pit was not large enough to hold the fully extended individual. Brashler (1994) has suggested that this individual may have been wrapped in a shroud in order to hold the remains in a compressed position. No grave objects were uncovered.

Morphological analysis of the AA.2 adult indicated a female over the age of 45 years. Pubic symphysis morphology, and full ossification and fusion of the xiphoid process and coccyx indicate an old individual perhaps close to 50 or 55 years of age. The prevalence of pathology, discussed below, and evaluations of the sternal rib extremities were consistent with this age estimation.

Severe osteoarthritis of the vertebral bodies, patellae, hips, hand phalanges and the right trapezium were noted. In addition, antemortem tooth loss with associated alveolar resorption was present in the left mandible for all molars and in the second premolar. The beginning stages of alveolar resorption were visible in the right maxilla, and dental caries and a healed fracture of the sternum were noted. The right femur showed signs of cortical bone thickening, irregular bone growth and possible cloacae associated with osteomyelitis. This condition is caused by the introduction of bacteria locally (through an adjacent wound, for example) or via the blood stream from a trauma located elsewhere in the body (Schwartz, 1995). Osteomyelitis ultimately results in cortical bone death because pus and other exudates expand in the medullary canal,

cutting off blood supply. Pus may also erupt through the surface of the bone from small openings called cloaca in the involucrum (reactive bone formation).

Finally, skeletal anomalies, including the presence of a sternal foramen and extremely robust radial tuberosities (primary insertion sites for the biceps brachii which acts primarily as a powerful flexor and secondarily as a supinator of the forearm), were observed in the AA.2 adult.

Tomb AA.3a

This tomb contained the remains of two infants buried in a small unlined pit, covered by a miniature version of a typical grave lid structure measuring .65 by 1.35m. Burial position was extended supine with skulls to the west in both cases. Pottery sherds were the only materials found in association with the infant remains. These were given dates in the Late Roman and Early Byzantine periods.

The first infant was estimated at 9 months $\pm$ 3 months based on dental eruption patterns, temporal bone development and the metric evaluation of various skeletal elements. Individual number two, buried directly above the deepest infant, was estimated to be approximately 1 year $\pm$ 4 months through analysis of incisor and molar eruption patterns, along with temporal bone developmental stage estimation. No evidence of pathology was visible in either skeleton.

Tomb AA.3b

Tomb AA.3b contained the remains of an intact single interment within a simple pit. The burial position was extended supine with the left arm flexed at a 45 degree angle across the chest. The right arm was positioned such that the right hand was resting on the left shoulder. The skull was tilted forward with the chin tucked against the sternum in order to allow for the accommodation of the individual within a

relatively small burial pit. Three grave objects, a ring, a shell and a bead, were found on a left phalange and under the chin associated with the right carpals, respectively. Because of the placement of the right hand in the vicinity of the neck, it is difficult to ascertain whether the bead and shell were originally fragments of a bracelet or a form of neck adornment. The AA.3b skeleton was oriented east to west from head to feet.

Skeletal morphology indicated an adult female at the early end of a 25 - 35 year age range. This estimation was based on the preservation and morphological development of the left pubic symphysis (late phase three), dental wear patterns, complete fusion, but lack of full fissure obliteration, of the medial clavicle, and sternal rib extremity evaluation. Pathologies included a dental caries located mesially on the right first mandibular molar adjacent to the second premolar. The right second premolar was missing a large portion of the crown due to severe dental decay. Interestingly, the third molars had either not yet erupted, or were congenitally absent, even though all other skeletal indicators suggest an age of well over 18 years for this individual. Finally, living stature was estimated at a range of 150 to 157 cm from the right tibia measured without the medial malleolus.

Tomb AA.4

This grave contained the remains of an adult single interment facing east with the skull at the western end of an unlined soil pit. The burial position was extended supine with the left forearm running beneath the left *os coxae* and the right arm resting on top of the right side of the pelvis. Grave objects included a series of frit core, glass and limestone beads encircling the cervical vertebrae and indicating the presence of a necklace interred with this adult.

Morphological evaluation suggested that the AA.4 individual was a female aged 45 years or older at the time of death. Age was estimated from pubic symphyseal face

morphology (late phase V for the right and early phase four for the left) and dental attrition patterns. Osteophytic lipping of the vertebral centra and severe antemortem tooth loss support an age estimate of late adult for this individual. The AA.4 individual evidenced the most extensive case of alveolar resorption for all skeletons observed in areas AA and Z, with closure of alveoli occurring in the regions of nine teeth. In addition, a large dental caries was noted in each of the following teeth: a mandibular premolar, a maxillary incisor, the third left mandibular molar and the right second mandibular premolar.

Tomb AA.8

Excavation of this tomb yielded the remains of one adult placed in an extended supine position, skull towards the west, within the confines of a stone-lined cist. Although this individual was very poorly preserved, it was possible to partially decipher the placement of the humeri tightly against the sides of the rib cage and some phalanges occurring in the neck and thoracic regions. No grave objects were uncovered in association with this individual.

Morphological evaluation of the AA.8 skeleton indicated the presence of a late adult male estimated at 45 years or older at the time of death. Age evaluation was based on pubic symphyseal morphology (early phase VI), sternal rib extremities and dental attrition patterns. In terms of pathology, extremely dense cortical bone in the femora, tibiae and fibulae, and some possible cloacae in the right fibula may indicate osteomyelitis. Osteophytic lipping of the vertebral bodies, patellae and phalanges were noted as evidence for osteoarthritis. In addition, the sacrum had fully fused to both os coxae at the auricular surfaces in this individual, a condition not uncommon in relatively old adults. Three occlusal surface dental caries in the mandibular molars and alveolar resorption of the right maxillary second molar were also observed. Finally,

irregular bone growth was detected on the anterior surface of the manubrium. The normal morphology of the cortical bone was visibly disturbed by reactive, irregular growth which was diagnosed as a lytic lesion of the cortex exposing the trabeculae (Schwartz, 1995). Stature for this individual was estimated at a range of 171 to 179 cm from the left femur.

Tomb AA.9

Tomb AA.9 contained the remains of one subadult buried in a simple pit. The skull and vertebrae through the fourth thoracic were articulated and aligned approximately north to south across the width of the coffin. Most of the remains below the fourth thoracic vertebra were only partially articulated and piled in the far eastern end of the tomb. This indicates that the disturbance of this individual, most likely due to robbing, must have occurred before the connective tissue had fully decayed. No grave objects were uncovered in this tomb and no evidence for an additional burial or second individual could be detected.

Skeletal analysis of this individual revealed a subadult aged 9 years $\pm$ 24 months on the basis of dental eruption patterning and epiphyseal closure. All visible permanent dentition showed signs of enamel hypoplasia which indicates a prolonged period of disease or dietary stress for this individual. Two dental caries were observed in the deciduous teeth, one located on the occlusal surface of a mandibular molar and the other in a maxillary molar.

Tomb AA.11

This burial contained the remains of two individuals interred during two separate episodes. The uppermost early adult/late subadult was uncovered on the surface of a coffin which contained the remains of the primary burial. Both individuals

were located below tomb lid architecture that appeared to have been disturbed in antiquity to allow for the depositing of the second individual. The top person was placed on the coffin in a semi-flexed position with the skull towards the eastern end of the grave. The deepest burial, or first individual interred, was also placed in a partially flexed position, head towards the east and lying on her left side. No grave goods were uncovered in association with either individual.

Morphological evaluation of the deepest burial, or individual number one, revealed a relatively well preserved female aged 17 -25 years based on incomplete fusion of the medial clavicle, partial eruption of the right maxillary wisdom tooth and full eruption of the other three third molars. In addition, the first and second molars showed some wear of the enamel on the occlusal surfaces with exposure of the dentin below it. In terms of pathology, a small abscess was detected above the maxillary first molar and a dental caries was present in the lateral maxillary incisor. Enamel hypoplasia was visible on the maxillary incisors although the banding was not severe. This indicates a period of disease or dietary stress during the formation of these teeth (between the ages of one and four years) for this individual. This time period corresponds to common weaning ages and may therefore indicate dietary stresses related to poor weaning foods or contaminated water supply.

The second individual, or the uppermost burial that was uncovered above the coffin lid, was highly fragmentary with only about 25% of the skeletal elements identifiable. The dentition and fragments of the skull and mandible were, however, well enough preserved to indicate a female between the ages of 17 and 25 years of age. Third molars were fully erupted although no attrition or wear facets had developed at the time of death. Long bones and clavicles were too poorly preserved to provide age information from epiphyseal closure. Finally, two dental caries were observed in a premolar and in the first mandibular molar.

Tomb AA.14

Two tombs were uncovered in square AA.14, 14a and 14b, but 14a was not excavated. Tomb AA.14b contained the remains of one very poorly preserved individual oriented with the skull towards the east facing west and extended supine. No grave objects were found associated with this individual.

Skeletal analysis indicated an adult of unknown sex near the age of 45 years or older. Age estimation was based on dental attrition patterns. Two dental caries were detected in fragments of molars along with one in an upper premolar. In addition, enamel hypoplasia could be distinguished on a maxillary canine, and one osteophyte was visible on a thoracic vertebral arch. No vertebral centra belonging to this individual were present.

Tomb AA.15a

This simple pit contained a few fragmentary remains of an infant skeleton, though most of the bones had decayed beyond recognition. A few teeth and some skull fragments were the only remains mentioned in field notes. Brashler (1994) estimated an age of 2 years or under based on tomb and bone fragment sizes. Grave objects from this burial included gold, boat-shaped earrings with red gem stones and four beads. It is interesting to note that the only evidence of gold jewelry uncovered in an undisturbed tomb context was associated with a small infant. This may indicate that status in this population was ascribed in some cases, as it is highly unlikely that this child lived long enough to achieve status or prestige through recognition of accomplishments.

Tomb AA.15b

This tomb was of similar size and construction as compared to 15a, although no

remains of any kind were found within the burial pit beneath the intact cover stones. Whether an immature individual was buried here and had completely decayed or whether a burial was removed or disturbed some time in antiquity is difficult to ascertain.

Tomb AA.16

Excavation of AA.16 revealed the skeletal remains of two subadults buried in a well constructed stone lined cist. Both individuals were interred in extended supine positions oriented west to east from skulls to feet. The skull of the deepest individual was located off to the side of the vertebral column and facing north. This was the only evidence of disturbance and it may indicate that the two individuals were buried at separate times with the first person's skull being moved during the second episode. However, Brashler (1994) has suggested that the well constructed tomb lid architecture may indicate that the burial was not reopened a second time and that both individuals were buried simultaneously.

Morphological evaluation of the deepest burial indicated the presence of a subadult age 6 years $\pm$ 24 months based on dental eruption and epiphyseal union of the squamous and lateral portions of the occipital. The basilar portion had not fused at the time of death (occurs around 6 years), although the advanced development of the premolar and second adult molar buds suggests that this individual was close to six years of age at the time of death. It was noted that two vertebral arches from adjacent thoracic vertebrae had fused to one another.

The uppermost individual interred was estimated to be a subadult 5 years $\pm$ 16 months old. This estimate was based on dental eruption patterning and the complete union of squamous and lateral portion of the occipital. The basilar portion was not fused. The dental development of this subadult was slightly less advanced than the

first individual interred, although all other skeletal elements were slightly larger. This could indicate the presence of a male and female child because, while dental development rates tend to be nearly the same for girls and boys of the same age, skeletal growth is usually somewhat accelerated in female children (Saunders, 1992).

Tomb Z.1

Tomb Z.1 contained the remains of a badly disturbed cist burial with multiple individuals. The placement of tomb cover slabs indicated that the lid structure had been removed some time in antiquity in order to allow individuals access to the contents of the cist. The majority of bones found in this grave were located in a large pile in the western half of the tomb above the remains of a decayed wood coffin base. It was, therefore, impossible to estimate the original orientation or placement of the individuals interred.

Analysis of skeletal material revealed the presence of a minimum of 7 individuals - four subadults and three adults. This assessment was based on the duplication of skeletal elements as well as on the degree of fusion in epiphyses of long bones, pubic symphysis morphology, and dental eruption and attrition patterns. One early adult male (about 20-30 years) and a middle adult female (25-35) were distinguished based on dental wear patterns and mandibular and pubic symphyseal morphology. Alveolar resorption in the location of the left mandibular first molar and right mandibular second premolar of the adult female were noted. In addition, one early adult (20 $\pm$ 3 years) and a late subadult age 15 - 18 years were distinguished from one another and the two adults by duplication and developmental stage of the glenoid fossa and epiphyseal closure of long bones.

Two subadults aged 3 years $\pm$ 12 months were identified based on the developmental stage of mandibular dentition and duplication of pelvic bones. One

subadult was slightly larger than the other, however, both were at the identical stage of dental development and eruption. This is either indicative of normal human variation or the presence of a male and female child of the same age (Saunders, 1992). A third subadult aged 10 ± 3 years was distinguished from the younger juveniles by the presence of long bones that were too large and well developed to belong to the 3 years olds, and too small and underdeveloped to be associated with the 15 - 18 year old. All other skeletal elements uncovered in the Z.1 burial could be attributed to one of the seven individuals identified.

Tomb Z.2

Z.2 contained the remains of four individuals - two subadults and two adults, oriented east to west from head to foot. The two juvenile skeletons were located in the eastern end of the tomb on top of one another. The uppermost subadult was interred in the extended supine position with arms extended at the sides. The lower child was placed in the tomb on his right side and flexed in the fetal position. Both adults were fully articulated, with the exception of their crania, in the extended supine position. The adult skulls were moved to the uppermost individual's pelvic region apparently to make room for the two subadults buried at the eastern end of the tomb. This event must have occurred after complete decomposition of soft tissue because the mandibles and cervical vertebrae appeared undisturbed. Both adult individuals' arms were flexed across their abdomens and the uppermost person's legs were crossed at the knees.

Analysis of immature remains indicates the presence of one infant, approximately one year ± four months old, differentiated by a mandible, maxilla, long bones, vertebrae and various cranial and pelvic fragments. A second discrete infant could also be distinguished based on unique color and size of duplicate remains. Subadult number two evidenced a similar, although slightly younger, stage of dental

development (9 months ± 3 months), but was larger and more advanced in terms of skeletal development than the first subadult described. This, again, may either be attributed to sex difference or the range of normal human variation (Saunders, 1992).

The adult remains from tomb Z.2 indicated two adult males, one approximately 25-35 years and the other 30-40 based on pubic symphysis morphology and dental wear patterns of their three molar sequences. Each possessed some degree of osteophytic lipping in the regions of the vertebral bodies and pedal phalanges. Individual number one exhibited dental caries, a maxillary abscess and alveolar resorption in the upper jaw. A distal foot phalange displaying an antemortem fracture was associated with the second adult. Stature ranges for adults number one and two were estimated at 163-171 cm (from the right femur) and 161-170 cm (from the left humerus) respectively.

Tomb Z.3

Z.3, another cist tomb, contained the largest number of individuals and grave goods of any of the burials excavated in areas Z or AA to date. Four adults and twelve subadults were uncovered within the confines of one wooden coffin. The deepest burial, or the first individual interred, was an adult deposited in an extended supine position running east to west from head to foot. The three other adults were buried in extended supine positions aligned with their heads in the west facing east. Twelve subadults were interred off to the sides, in between and above the adults in extended supine and fetal positions oriented both east to west and west to east. Many of them were apparently buried in shrouds or wrapping decorated with numerous tiny metal and glass beads. The precise positioning of each individual was not possible to ascertain because complete skeletons were not distinguished as individuals in plan drawings.

Adult number one was a male aged 25 - 35 years on the basis of dental wear

patterns. Pelvic, cranial and mandibular features were used to evaluate sex, and stature range was estimated at 165-173 cm from the right femur. Noted pathologies included alveolar resorption in the regions of the mandibular right first molar and maxillary right and left first and third molars. One cervical caries was present in the maxillary second molar. No other pathologies or anomalies were identified.

Adult number two was designated male based on pubic morphology, a narrow and deep sciatic notch, large mastoids and a square mandible. Both pubic symphyses were complete and well preserved. The right pubic symphysis indicated a late phase III rating (25-35 years), while the left element was at a slightly earlier stage of development (early phase III, 20-30 years). Dental wear patterns indicated an age at the low end of a 25-35 years range. The clavicles were completely fused, although the the line of fusion had not completely obliterated by the time of death. This evidence, combined with sternal rib extremities estimates, suggested an age range of 25 - 35 years for this individual. No evidence of pathology was found in any of the bones that could be associated with this individual from plan drawing reconstructions. Finally, living stature was estimated at 172-179 cm from the left femur.

Adult number three was sexed male on the basis of cranial, pelvic and mandibular morphology. Both pubic symphyses were intact and indicated early phase III stages of development (20-30 years). Dental wear patterns suggested an age estimate towards the upper end of the 17-25 years age range. Wear on the first and second molars was consistent with this age category although the third molars were not erupted. No X-rays were taken and it is, therefore, impossible to ascertain whether the third molars were absent congenitally or if they were simply late in erupting. In terms of pathology, a large osteophyte was visible on the right side and in the center of the centrum of the sixth thoracic vertebra. Stature was estimated at 165-173 cm from the left femur.

Individual number four, the uppermost adult in the burial, was estimated as male from the large size of the mastoids, rounded supraorbital margin, robust superciliary arches and the similarity in massiveness of long bones to the other adult males buried in Z.3. The pelvis and mandible were too fragmented to provide reliable sex information. Age was estimated at 45 years or over for this individual based on the extremely uneven wear of the molars and the amount of dentin exposed in all of the associated dentition. One dental caries in a mandibular molar and alveolar resorption in the region of the first and third maxillary right molars were the only evidence of oral pathology that could be attributed to this individual. It should be noted that this individual was very poorly preserved and only about 75% complete. Stature could not be estimated for adult number four as no long bones were fully present.

In addition to the four adults interred in Z.3, twelve subadults near or under the age of ten years were also identified. Ages of these individuals were calculated from dental eruption patterns and are listed in Table 4. Very little pathology was observed in the skeletons, although subadult number four exhibited extremely large *pronater teres* muscle origin sites on both distal humeri. Because these are one of two sets of muscles used to pull the radius over the top of the ulna, or to pronate the forearm and hand (Aiello & Dean, 1990), the overgrowth of attachment sites may indicate extensive use of these muscles in household, other subsistence, or craft related activities such as grinding grains or milking animals. This is especially interesting because of the young age of this individual (3 years $\pm$ 12 months).

Tomb Z.4a

Tomb Z.4a contained the remains of a disturbed burial located beneath intact cover slabs and within a simple pit. A total of ten identifiable bone pieces resulted in a Minimum Number of Individuals (MNI) calculation of two, based on the presence of a

humerus fragment of an immature individual, as well as, several adult bone segments.

Tomb Z.4b

A second tomb, Z.4b, was uncovered running parallel and to the south of Z.4a (Figure 11). The disturbed nature of the upper body, due to a recent robbing, made it impossible to decipher the position of the arms, head and torso. The preservation of the legs and feet *in situ*, however, suggested that this individual was buried in an extended supine position with the head at the eastern end of the tomb facing west.

The cist contained the remains of one subadult individual aged at 7 years ± 24 months on the basis of dental development and incomplete fusion of epiphyses. The neural arches, as well as, the complete vertebral arch and centrum of the vertebrae were fully fused suggesting that the age at death was probably closest to the middle of the given range.

Tomb Z.5

Within Z.5's stone lined cist, the badly fragmented remains of a disturbed burial were uncovered. Because small pieces of unidentifiable bone were the only osteological evidence obtained, no demographic data could be estimated.

Tomb Z.6

Beneath the cover slabs of tomb Z.6, a stone lined shaft contained the remnants of a burial no longer intact. A total of 46 osteological fragments were identified and from these remains, a minimum number of one subadult individual, age 15 years ± 36 months, was calculated.

Tomb Z.7

The articulation of human remains *in situ* revealed the presence of two individuals oriented east to west from head to foot buried in a simple pit. In addition, three diagnostic bone fragments belonging to a third immature individual were found beneath the fully articulated skeletons. Both complete individuals were uncovered in the extended supine position. Individual one, the uppermost burial, was interred with legs extended, the left hand placed across the pelvis and the right arm completely flexed at the elbow joint, with the right hand resting on the right shoulder. Individual one's skull was uncovered turned north, face prone and separated from the mandible which was located with the mandibular symphysis facing west. Individual two's right arm was flexed at a 90 degree angle across the lower thoracic vertebrae. The left arm was fully extended and lying adjacent to the left innominate. The skull of this individual was turned to the side and facing south.

Laboratory analysis revealed that individual one was a female of approximately 14-16 years of age at the time of death. Age estimation was based on degree of fusion in long bones, anterior iliac crests and medial ends of the clavicles. Living stature was estimated at 146-154 cm from the right tibia.

Individual number two was an adult male who was between the ages of 27 and 35, or middle adulthood, at the time of death. Age was calculated from pubic symphysis morphology, dental attrition patterns, sternal rib extremity development and medial clavicle fusion. A living stature of 165-174 cm was estimated from the right femur. Primary osteoarthritis was noted in the thoracic vertebrae in the form of minor osteophytic lipping of the centra. The presence of degenerative pathology may indicate that individual number two was closer to the upper range of the age estimate given. Finally, extensive enamel hypoplasia was noted in all of the mandibular and maxillary

dentition, indicating either prolonged or severe periods of disease and or dietary stress during the years of permanent tooth formation.

Tomb Z.8

One adult individual was uncovered within Z.8's burial pit in the supine extended position facing west. The left arm was flexed at a 90 degree angle with the hand laying across the thoracic vertebrae. The right arm was flexed 110 degrees with the hand lying across the pelvis. The skull, located in the east end of the tomb, was turned north with the mandible tucked towards the sternum.

Morphological analysis of skeletal remains indicated that this individual was a male between the ages of 30 and 40 years at the time of death. Age estimation was based primarily on sternal rib extremity phase, metamorphic changes in pubic symphyses and dental attrition patterns. Stature estimation based on the length of the right femur suggests a range in height between 165-173 cm. Two severe occlusal caries were present in the left first molars of the mandible and maxilla. One smaller interproximal caries was located in the right third mandibular molar. No other forms of pathology or skeletal anomaly were observed in this individual.

Tomb Z.10

The Z.10 burial pit contained the remains of one adult individual interred in an extended supine position facing west. The head was turned to the north and the legs were crossed at the tibiae. The right arm was uncovered fully flexed with the hand resting on the shoulder, while the left arm was found lying across the individual's waist.

Skeletal morphology indicated that this was an adult of indeterminate sex between the ages of 35 and 45 at the time of death. Sex could not be determined

confidently because of the poor state of preservation in all bones used for sex estimations including the pelvis, skull, mandible and sacrum. Age estimation was based on sternal rib extremity phase and dental wear patterns. Pubic symphyses were too poorly preserved to provide evidence for aging. Extensive alveolar resorption, resulting from antemortem tooth loss, was observed in both the mandible and maxilla. An arthritic phalanx of the right hand was the only other form of pathology observed.

Tomb Z.11

The Z.11 pit burial contained the remains of a child oriented east/west in an extended supine position with the head turned toward the south. The left arm was flexed at the elbow, lying across the waist and the right arm was fully extended at the individual's side.

Skeletal analysis of the immature remains indicated an individual between the ages of 4 and 6 years. This estimation was based primarily on the degree of occipital and vertebral epiphyseal union and dental development and eruption. No indication of pathology could be determined from the skeletal remains.

Monumental Tomb Structure BB.1: A Case of Commingling

Tomb BB.1 contained the remains of several individuals buried in eleven loculi surrounding a main chamber. Skeletal material in all but one locus (015) was badly disturbed, and, thus, very few articulated elements could be deciphered during excavation. Locus 015, however, located within the center loculus of the eastern wall of the tomb, contained the remains of a relatively well preserved and undisturbed skeleton. A single adult was uncovered fully articulated, with the exception of the cranium, at the bottom of the loculus. This individual was buried in the extended supine position, arms at his sides with palms facing up, and aligned west to east from

head to foot. The almost completely articulated skeleton was interred in a wooden coffin so extensively decomposed that only a large rectangular stain attested to its presence. No evidence for a coffin lid was recovered. The loculus chamber was lined with well dressed basalt masonry and a cobble floor, both of which exhibited remnants of plaster pointing.

Morphological and metric evaluation of this individual indicated a male adult between the ages of 35 and 45 years based on the angle of subpubic concavity, the curvature of the sacrum, the absence of a preauricular sulcus and sternal rib extremity and pubic symphyseal phase estimates. In terms of pathology, osteoarthritis of the vertebral bodies was evidenced in the form of horizontal osteophytic lipping. Bony spicules were observed on sternal rib extremities and one perimortem cut mark, or sharp force trauma, was indicated on the inferior surface of a right rib. This wound may have been directly related to this adult's demise as very little visible healing or remodeling of bone had taken place at the time of death. Finally, living stature was estimated at a range of between 164 and 172 cm from the right femur.

The majority of the remaining individuals in BB.1 were profoundly commingled due to disturbances in antiquity and in the recent past. These factors, combined with the massive amount skeletal material recovered, compounded to make the calculation of MNI fairly complicated. As a consequence, three methods were used to estimate MNI, each of which took various assumptions into consideration. First, MNI was calculated by locus, or discrete units of features or elements distinguished during excavation. These calculations were based on duplication, sex determination and developmental stage of bones. This approach assumed that no bones from a single individual were represented in more than one locus.

Because of the high levels of disturbance evidenced in the presence of modern artifacts and in the nearly complete disarticulation of the majority of skeletons, this

assumption was considered highly unlikely. A second approach was applied where loci were collapsed and MNI calculated from duplicated remains for the entire tomb. Mandibles proved to be diagnostic for this approach because they were the most frequently occurring element for most of the loci.

Finally, the possibility that a greater number of individuals were actually buried in BB.1 than was indicated by mandibles, was taken into consideration. This was prompted by the poor preservation and fragmentary nature of most of the remains as well as by the evidence for extensive robbing (Brashler, 1997, in press). For these reasons, it was considered highly likely that not all individuals buried in the tomb would have had preserved mandibles. For adults, sex and age information acquired from other skeletal elements was combined with the data already collected from mandibles. Pelvic remains, for example, indicated a greater number of females than had been suggested by mandibular morphology. This observation did not expand the MNI estimation, however, because some of the females indicated by pelvic remains could be subsumed under mandibles where sex could not be evaluated. Burnt remains of adults were considered separately under the assumption that complete individuals, as opposed to fragments of skeletons, were cremated. These individuals were added to the value calculated from the most frequently occurring element for non-cremated individuals. Moreover, when maxillary dental wear patterns were considered with the evidence from mandibles, additional individuals were indicated by a greater number of extremely late adult molar attrition patterns than were observed in the mandibular dentition alone.

Similarly, for subadults, when long bone lengths and maxillary dental ages were compared to dental ages and MNI as estimated from the mandibles, additional individuals were indicated. The majority of new individuals were suggested by a greater number of long bones in some age groupings (2-5, 6-14 years, etc.) than was

indicated by mandibles alone, i.e., there were more individuals represented by femurs and humeri in certain age categories than the most conservative estimate indicated.

These approaches yielded values that ranged from 124 individuals calculated from uncollapsed loci to 66 adults and subadults based on the number of mandibles present. A total of 90 individuals comprised of 53 adults and 36 subadults resulted when long bones, mandibles and cremations were taken into consideration. Life tables were constructed for the low and middle MNI values with no significant differences in calculations. Age distributions based on the estimate of 90 individuals were used for statistical analyses and have been included in the following section. Table 7 illustrates the number of males and females in each age category as far as could be determined from the diagnostic bone fragments present.

Several pathological indicators were noted in the human remains from BB.1 including osteoarthritis, enamel hypoplasia, dental caries and calculus formation, and alveolar resorption. In addition, a fragment of an adult long bone with metal embedded in it was also noted and may be indicative of a perimortem trauma involving interpersonal violence. Finally, one subadult calvaria showed evidence of cortical bone thickening (hyperostosis) and perforation (porotic) which suggests the presence of porotic hyperostosis or cribra crania (Schwartz, 1995) due to iron deficiency. This condition is generally the result of expansion of the diploe in response to an increased production of red blood cells from bone marrow. Most studies indicate that iron deficiency anemia can result from one of two factors including blood loss, related to parasitic infection or menstruation, for example, and/or dietary factors like prolonged reliance on iron- poor foods or the intake of substances which interfere with the availability or uptake of iron nutrients. While the scope of this study did not allow for more systematic and comprehensive analysis of pathology, this remains a vital direction for future research in BB.1 and in the areas AA and Z cemetery.

Table 7

Distribution of Males and Females in Each Age Category From Tomb BB.1

Age Category (In Years)	Number of Males	Number of Females
15-24	4	3
25-34	6	2
35-44	7	6
45-54	1	2

Finally, in terms of anomalies, BB.1 contained the remains of several cremations intermingled with simple inhumations. While the vast majority of skeletons in this tomb structure showed no evidence of burning, those that were, indicate that males, females and subadults were all cremated. The disturbed nature of the remains makes it impossible to estimate whether the cremated remains represent a stage of tomb use where cremation became the standard means of disposal, or whether burning of remains was related to status, ethnicity or an intrusive cultural practice. These ideas will be addressed further in Chapter V.

Mortality and Survivorship

Areas AA and Z Combined

Out of the 50 individuals excavated from these areas, several were not well preserved enough for age (in two skeletons) and/or sex (in seven skeletons) to be estimated. These individuals were not included in life table constructions. Population vital statistics were, therefore, derived from 48 and 43 skeletons, respectively (see

Tables 8-10). No corrections were made for the missing data as the unaged specimens included both adults and subadults (Owsley & Bass, 1979). A total of 7 variables were calculated for each life table (see Tables 8-13), although only three of these were chosen for more in depth analysis and evaluation (d_x, q_x and e_x values). These will be discussed in greater detail below along with calculations of crude mortality and birth rates for all individuals, and for males and females, in tomb BB.1 and areas AA and Z.

The value d_x expresses the percentage of people dying in a given age interval and, thus, forms the mortality curve for Umm el-Jimal's Z and AA cemetery. Calculations for the AA and Z composite life table demonstrated a high number of deaths (22.9%) occurring between the ages of 6-14 years (Table 8 & Figure 12). Mortality then decreased for individuals in the early adult/late subadult category (15-24 years) and increased for persons between 25 and 34 years of age. When percentages of death by age interval were compared by sex, males and females evidenced a similarly high rate of death for the 6-14 age duration, although only males retained a high mortality rate between the ages of 25 and 34 (Table 9, Table 10, & Figure 13). Less than ten percent of males survived to the age of 45 years. Deaths for females were fairly evenly distributed throughout the adult age categories with an equally high mortality value for intervals 15-24 and 25-34. The percentage of deaths for females between 15 and 24 years of age is almost twice the value for males and may be indicative of increased stress related to early child bearing. Approximately ten percent of females survived to the age of 45 years.

The probability of death (q_x), as an indicator of age-specific mortality, expresses the risk of dying during a given interval for individuals in each age category. This index, therefore, allows determination of the age, or groups of ages, most

Table 8

Life Table for All Individuals From Areas AA and Z

x	D_x	d_x	l_x	q_x	L_x	T_x	e_x
0-1.5	6	12.5	100	0.125	90	1858.6	18.59
2-5	7	14.58	87.5	0.167	340.46	1768.6	20.21
6-14	11	22.92	72.92	0.314	553.14	1428.1	19.59
15-24	7	14.58	50	0.292	427.1	875	17.5
25-34	8	16.67	35.42	0.471	270.85	447.9	12.65
35-44	5	10.42	18.75	0.556	135.4	177.05	9.44
45-54	4	8.33	8.33	1	41.65	41.65	5

Table 9

Life Table for Females From Areas AA and Z

x	D_x	d_x	l_x	q_x	L_x	T_x	e_x
0-1.5	3	15	100	0.15	88	1444.2	14.44
2-5	3.5	17.5	85	0.206	322.43	1356.2	15.96
6-14	5.5	27.5	67.5	0.407	483.75	1033.8	15.31
15-24	3	15	40	0.375	325	550	13.75
25-34	3	15	25	0.6	175	225	9
35-44	0	0	0	0	0	0	0
45-54	2	10	10	1	50	50	5

Table 10

Life Table for Males From Areas AA and Z

x	D_x	d_x	l_x	q_x	L_x	T_x	e_x
0-1.5	3	13.04	100	0.13	89.57	1854.4	18.54
2-5	3.5	15.22	86.96	0.175	336.56	1764.9	20.3
6-14	5.5	23.91	71.74	0.333	538.07	1428.3	19.91
15-24	2	8.7	47.83	0.182	434.8	890.25	18.61
25-34	5	21.74	39.13	0.556	282.35	455.45	11.64
35-44	2	8.7	17.34	0.502	129.9	173.1	9.98
45-54	2	8.7	8.64	1.01	43.2	43.2	5

Table 11

Life Table for All Individuals From Area BB.1

x	D_x	d_x	l_x	q_x	L_x	T_x	e_x
0-1.5	7	9.2	100	0.092	92.64	2101.8	21.02
2-5	14	18.42	90.8	0.203	342.87	2009.2	22.13
6-14	12	15.79	72.38	0.218	580.37	1666.3	23.02
15-24	11	14.47	56.59	0.256	493.55	1086	19.19
25-34	10	13.16	42.12	0.312	355.4	592.4	14.06
35-44	15	19.74	28.96	0.682	190.9	237	8.18
45-54	7	9.2	9.22	0.998	46.1	46.1	5

Table 12

Life Table for Females From Area BB.1

x	D_x	d_x	l_x	q_x	L_x	T_x	e_x
0-1.5	3.5	11.86	100	0.119	90.51	1437	14.37
2-5	7	23.73	88.14	0.269	317.55	1346.5	15.28
6-14	6	20.34	64.41	0.316	230.52	1028.9	15.97
15-24	3	10.17	44.07	0.231	389.85	798.4	18.12
25-34	2	6.78	33.9	0.2	305.1	508.55	15
35-44	6	20.34	27.12	0.75	169.55	203.45	7.5
45-54	2	6.78	6.78	1	33.9	33.9	5

Table 13

Life Table for Males From Area BB.1

x	D_x	d_x	l_x	q_x	L_x	T_x	e_x
0-1.5	3.5	10.14	100	0.101	91.89	1901.6	19.02
2-5	7	20.29	89.86	0.226	333.94	1809.7	20.14
6-14	6	17.39	69.57	0.25	547.88	1475.8	21.21
15-24	4	11.59	52.18	0.22	463.85	927.9	17.78
25-34	6	17.39	40.59	0.428	318.95	464.05	11.43
35-44	7	20.29	23.2	0.875	130.55	145.1	5.54
45-54	1	2.9	2.9	0.997	14.55	14.55	5

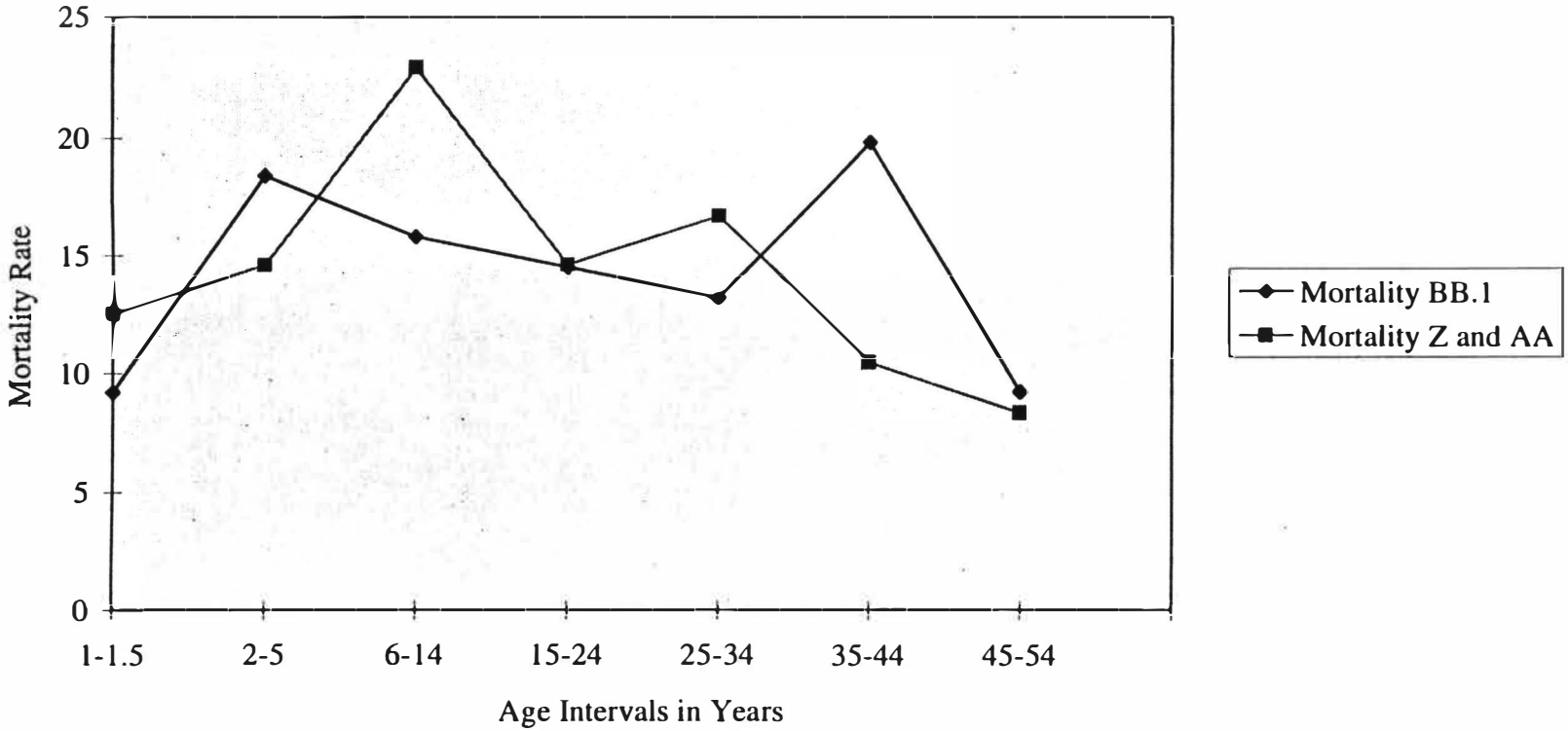

Figure 12. Comparison of Mortality Curves for Tomb BB.1 and Areas AA and Z.

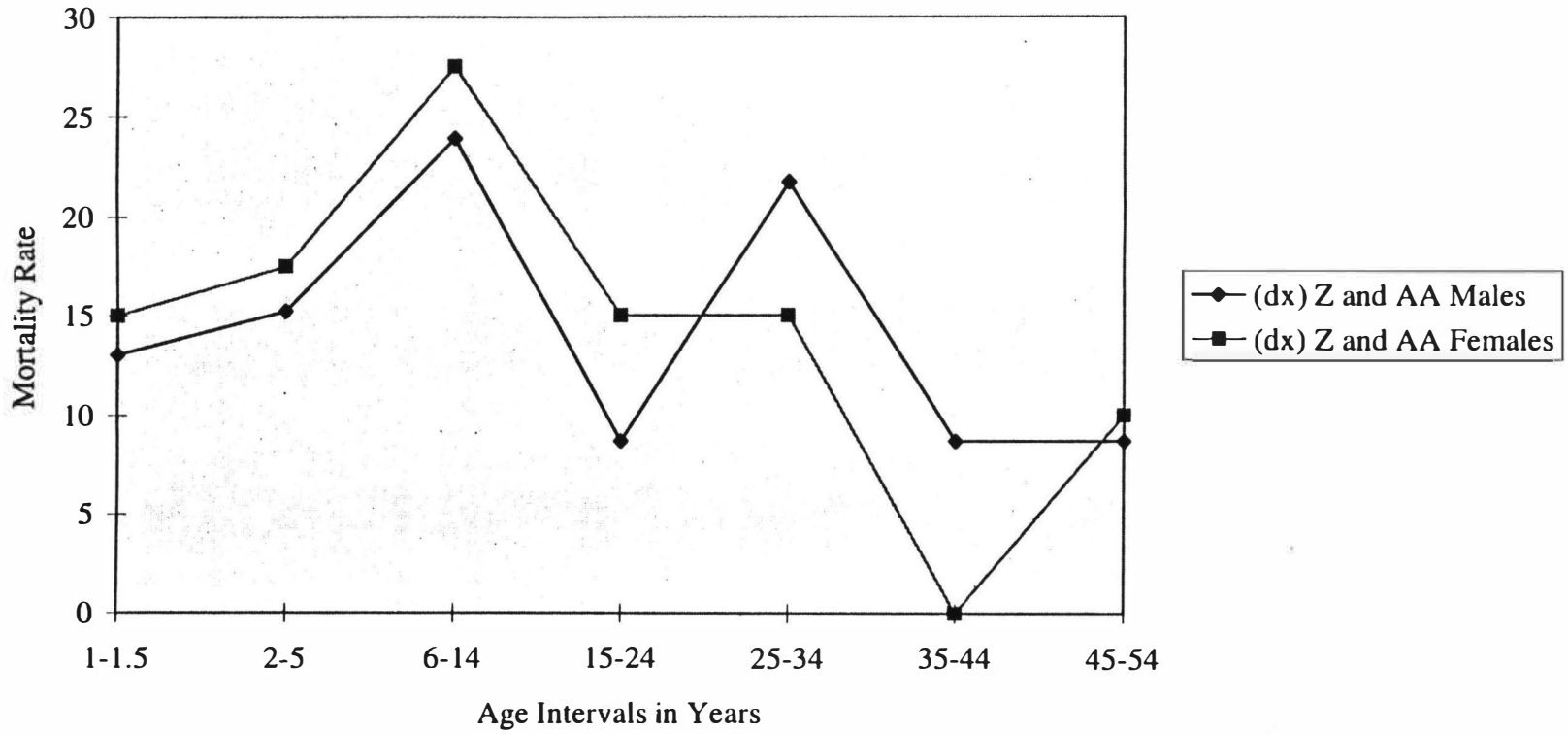

Figure 13. Comparison of Mortality Curves (d_x) for Males and Females From Areas AA and Z.

susceptible to death and disease (Swedlund & Wade, 1972). In areas AA and Z combined, the highest probability of dying occurred at middle and late adulthood (Figure 14). Infants formed the healthiest segment of the population with the probability of death increasing steadily with each age interval. It should be noted, however, that infant mortality at Umm el-Jimal may be underestimated for this sample because of differential preservation and taphonomy of fragile, immature skeletal material (see descriptions of tombs AA.15a and 15b). Although chance of death increased proportionally with age, it should be noted that approximately 30% (q_x=.314) of all subadults died by 6 to 14 years of age. Values for age specific mortality must, therefore, be considered relatively high for both subadult and adult age categories. Sex related differences in q_x values occurred in all age intervals with the most marked variance indicated in the 15-24 year range (Figure 15). Males had a lower probability of death during adolescence and early adulthood than females. For example, 37.5% of women died before the age of twenty five compared to only 18.2% of men in the same age category.

Life expectancy (e_x values), or the average remaining years to be lived by individuals in a given age grouping, was also analyzed by sex (Figure 16). Male life expectancy calculated for areas AA and Z was greater than that of females in all age intervals. Life expectancy at birth in males, for example, was four years longer than values predicted for females. Once individuals reached adolescence or early adulthood, life expectancies became more similar for all individuals regardless of sex (Figure 17). In both subgroups, life expectancy did not increase significantly once boys and girls survived the period of infant mortality (0-1.5 years).

Finally, crude death rate was calculated for all individuals in areas Z and AA and for males and females independently. The crude death rate (m) expresses the total number of individuals dying per 1,000 per one year, and provides a general assessment

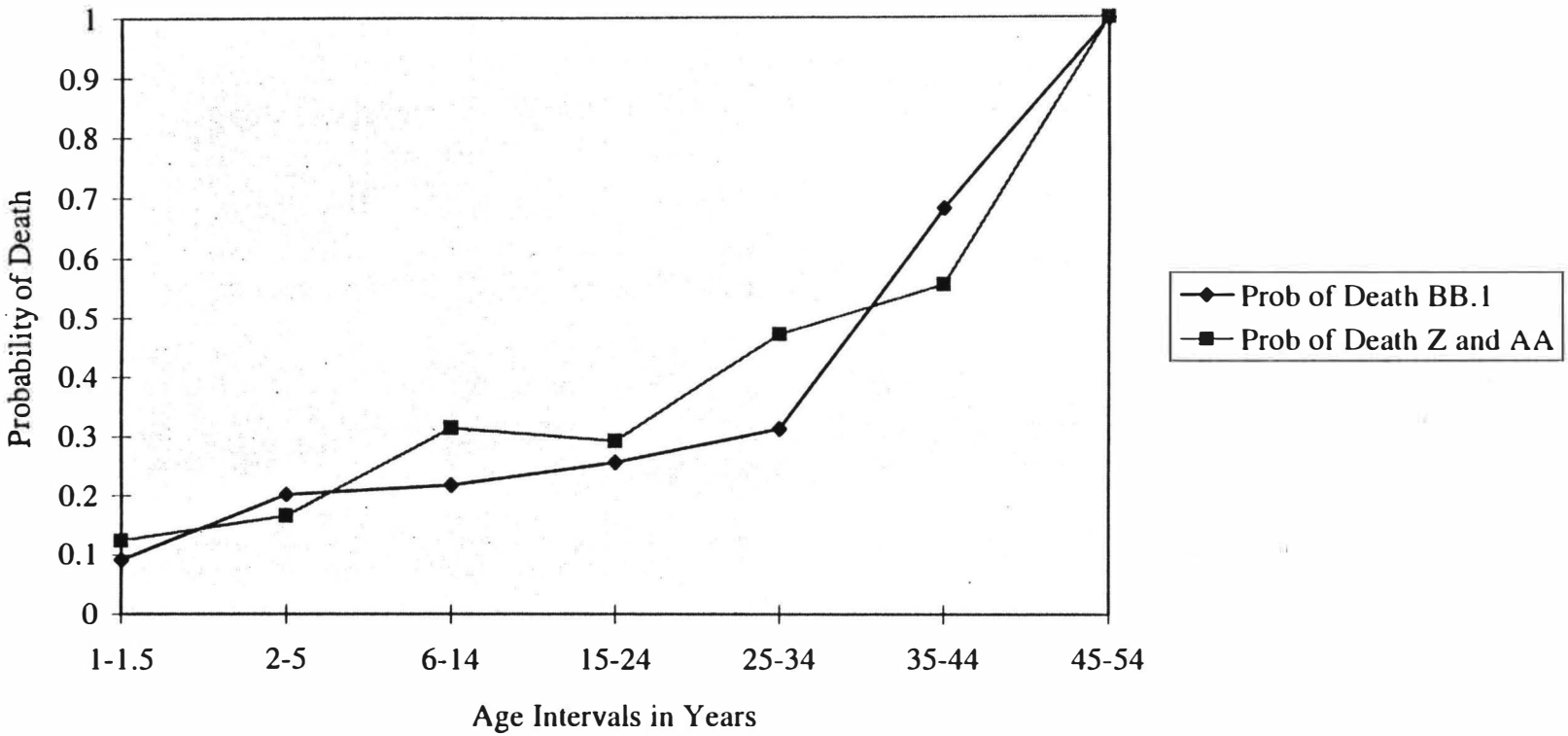

Figure 14. Comparison of Probability of Death in Each Age Interval for Tomb BB.1 and Areas AA and Z.

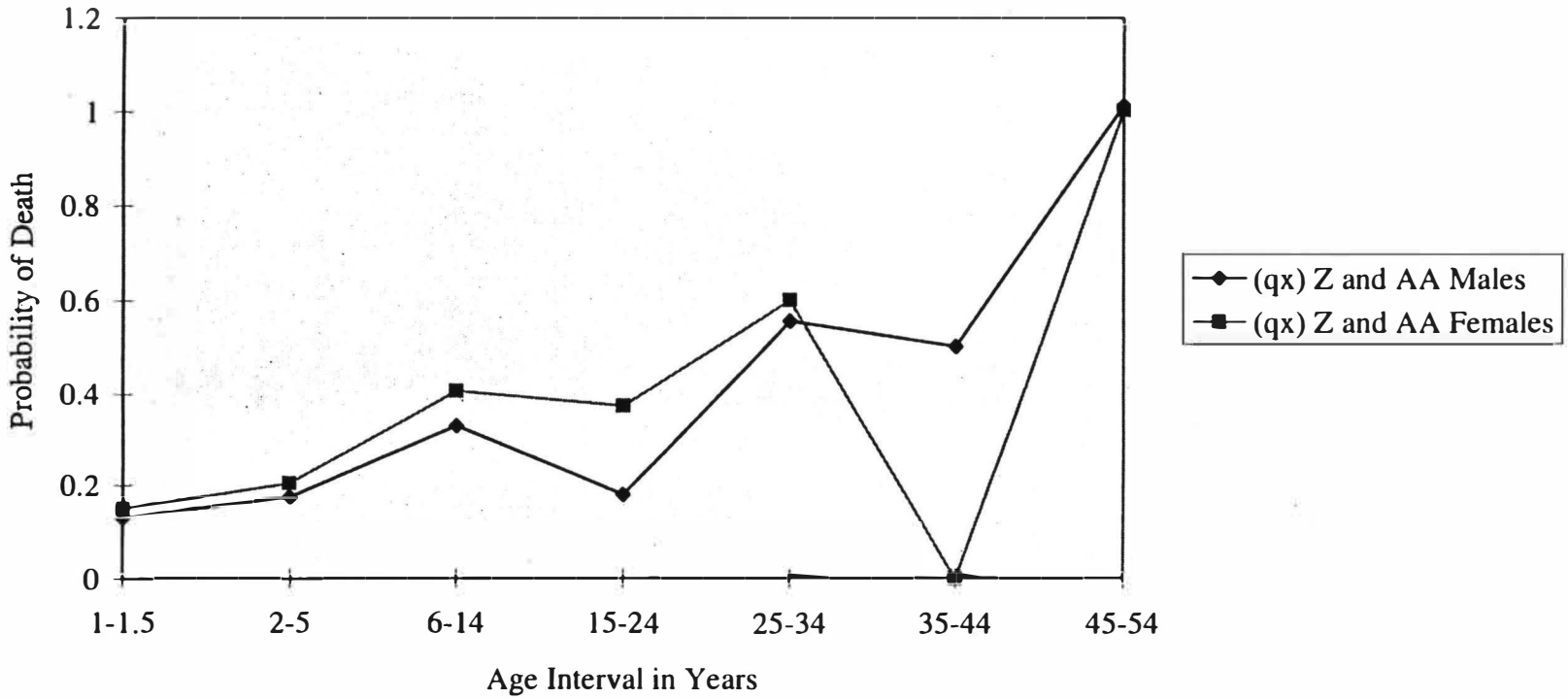

Figure 15. **Comparison of Probability of Death (q_x) in Each Age Interval for Males and Females From Areas AA and Z.**

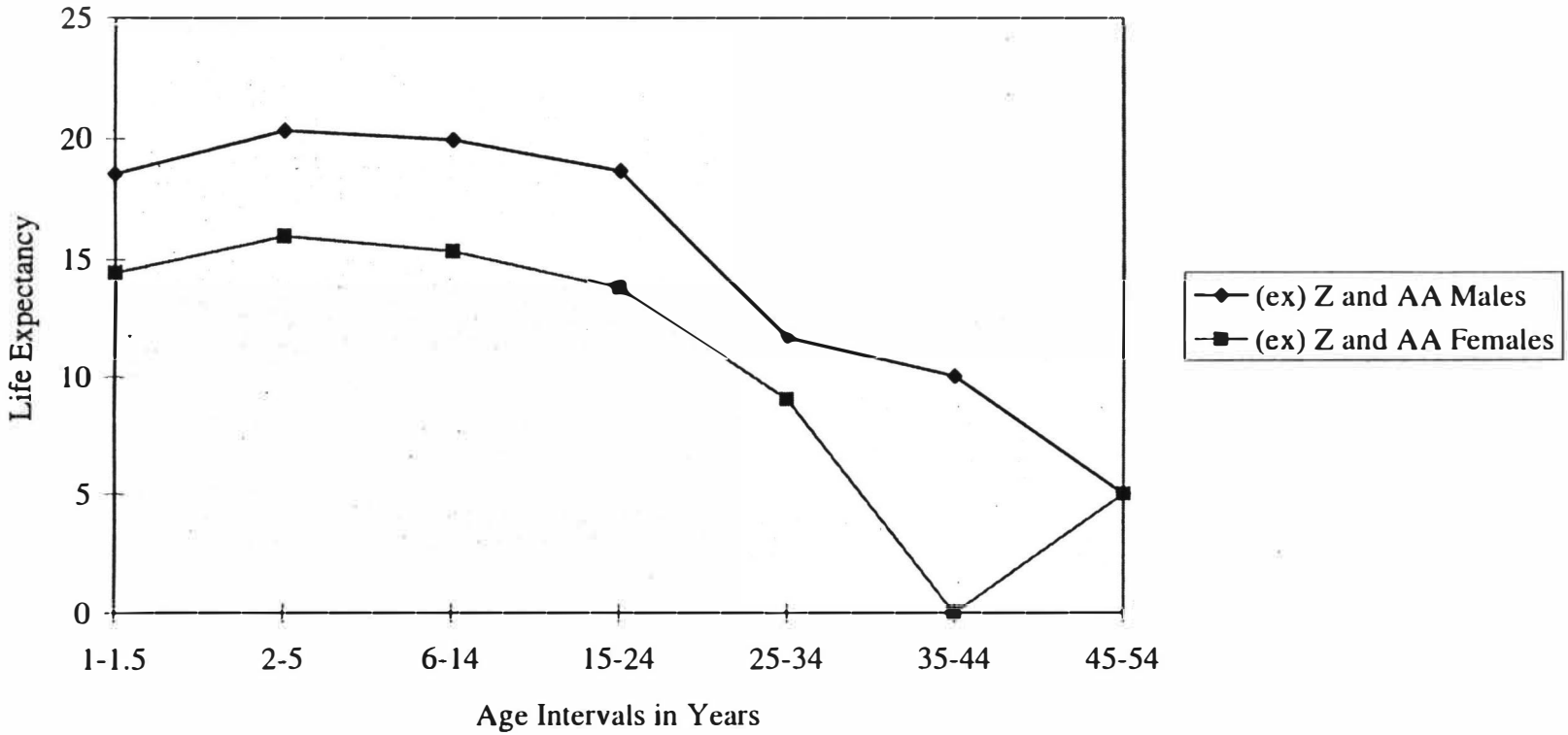

Figure 16. Comparison of Life Expectancies (e_x) for Males and Females in Areas AA and Z.

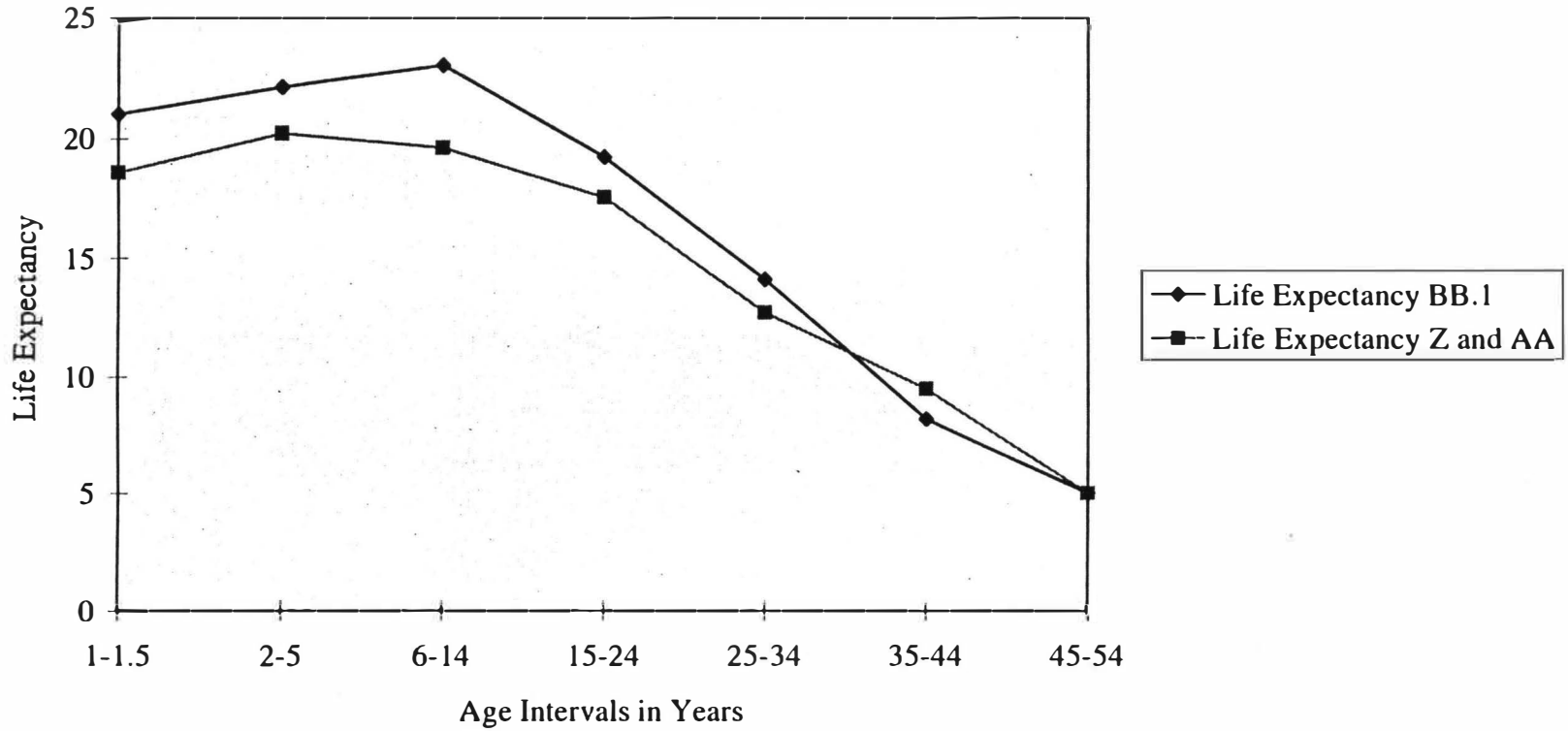

Figure 17. Comparison of Life Expectancies for Tomb BB.1 and Areas AA and Z.

of population mortality. The m value for the AA and Z cemetery was calculated at 53.79. Females (m=69.25) evidenced a higher death rate than males (m=53.94). Crude birth rate (CBR) was also calculated for all individuals in AA and Z in order to estimate fluctuations involving either population increase or decrease. CBR was estimated at 71.30 compared to a death rate of 53.79 which indicates a period of population growth for these inhabitants of Umm el-Jimal.

Area BB.1

In BB.1, d_x values expressing the percentage of the population dying in each age interval indicated that mortality peaks were bimodal for Umm el-Jimal's inhabitants represented in this monumental tomb structure (Table 11 & Figure 12). Close to 20% of deaths occurred between the ages of 2 and 5 (d_x=18.42) and 35-44 years of age (d_x=19.74). Mortality did not increase with age as seen in AA and Z, but peaked during early childhood, declined between 6 and 34 years, and then increased again in the middle adult age range (35 -44 years). When mortality curves for males and females were compared, sex specific differences occurred and were largest between the ages of 25 and 34 (Table 12, Table 13, & Figure18). For example, females demonstrated a much lower percentage of deaths (6.78%) compared to males (17.39%) during this age period.

Calculations of the probability of death (q_x) as an age-specific indicator of mortality revealed that the highest chance of dying occurred in middle and late adulthood for all individuals in BB.1 (Figure 14). Values of 68.2% and 99.8% were estimated for the age ranges of 35-44 and 45-54 years, respectively. Probability of death in each age interval was similar for males and females in all categories except for the range between 25 and 34 years of age (Figure 19). The q_x value for males was twice that of females in the same age period - 20% and 42.8% comparatively. Infants

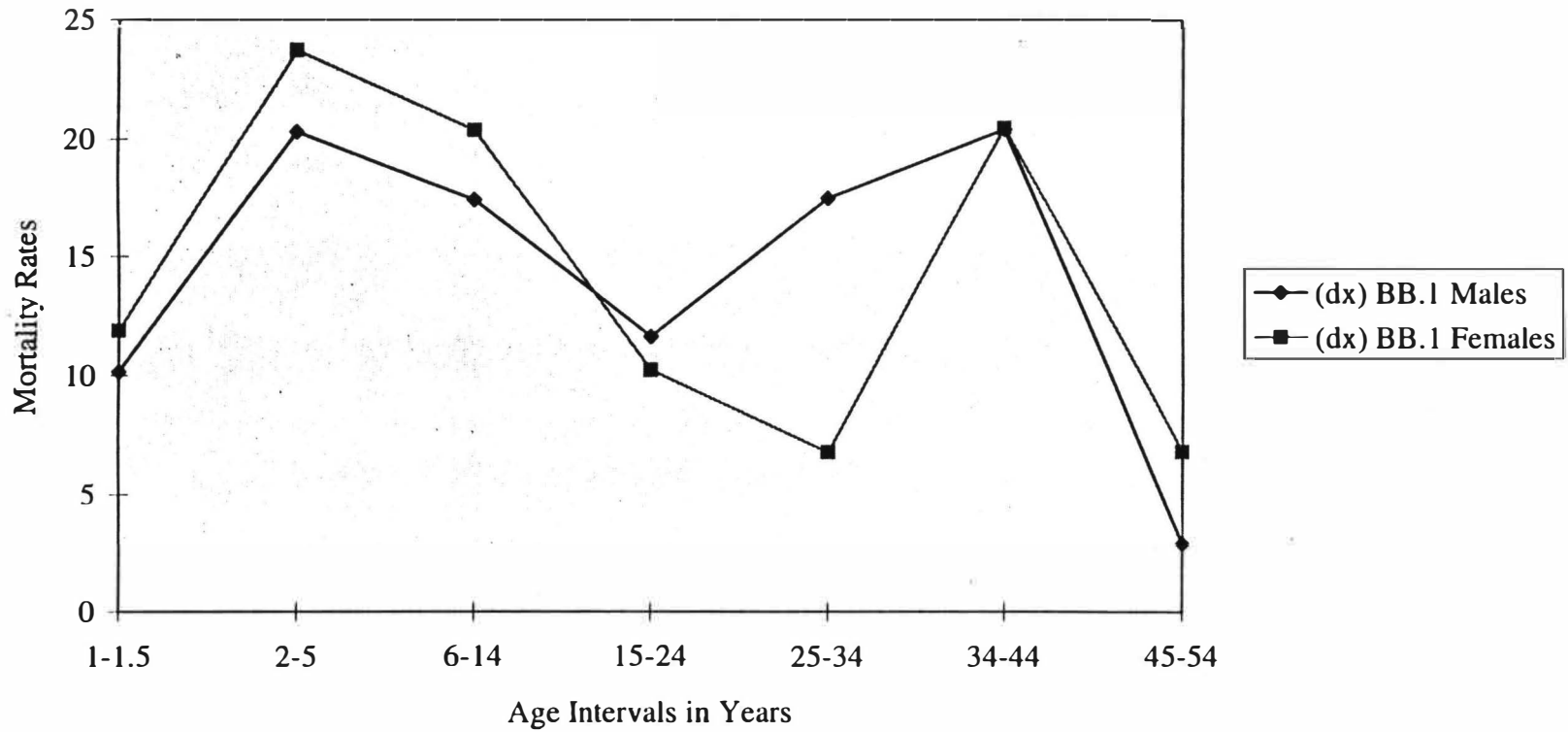

Figure 18. Comparison of Mortality Curves (d_x) for Males and Females From Tomb BB.1.

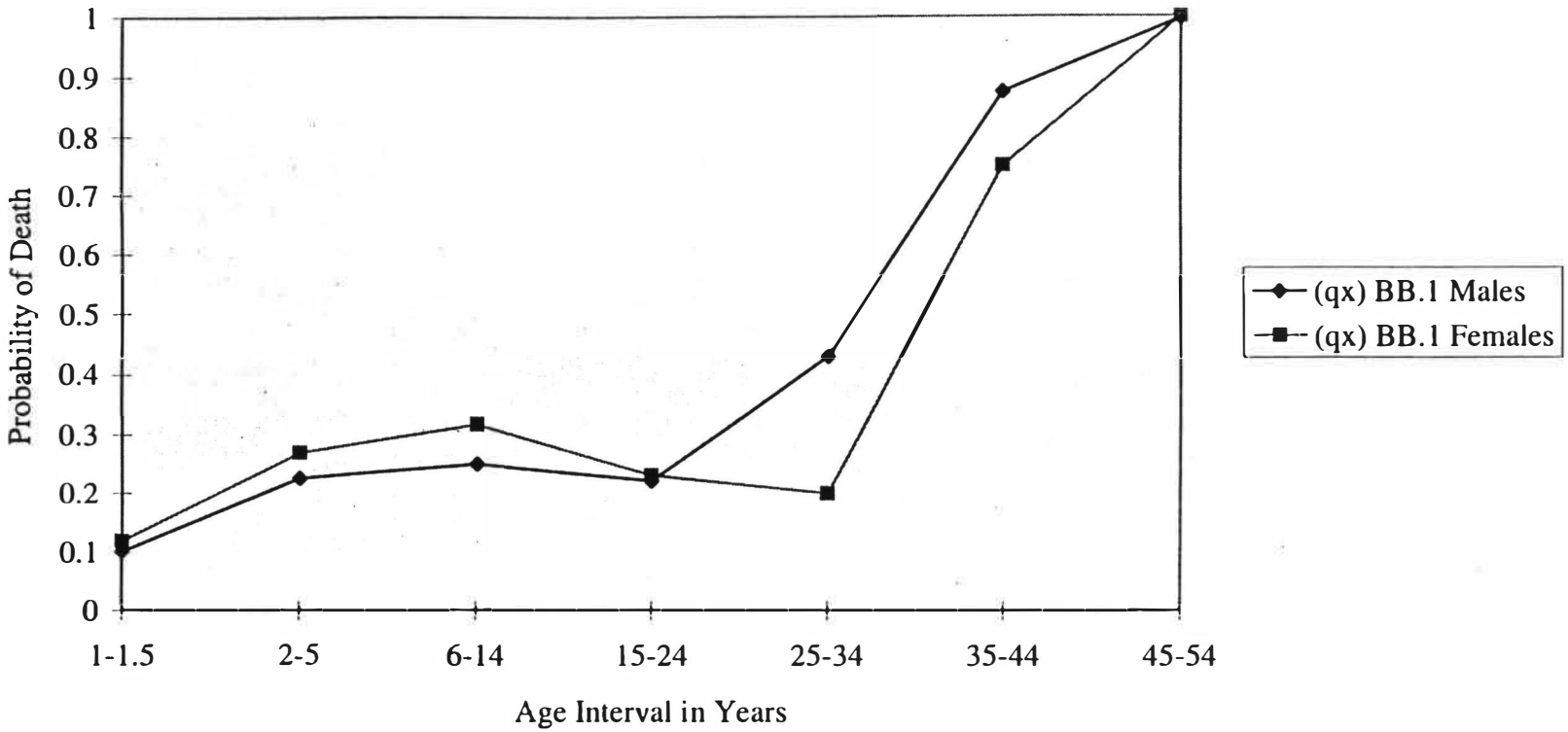

Figure 19. Comparison of Probability of Death (q_x) in Each Age Interval for Males and Females From BB.1.

were the least likely to die, contrasted with the nearly 100% chance of death in the 45-54 age interval. In males, chance of death rose as age intervals increased, whereas in females the relationship between age and probability of death was more variable. In females, the chance of dying in a given interval increased between birth and the 6-14 year category, then decreased in the 15-24 and 25-34 year ranges, and finally increased for ages 35 and up.

The average number of remaining years to be lived by individuals, or life expectancy (e_x), was highest in the subadult age categories for area BB.1. For the first three intervals, 0-1.5, 2-5 and 6-14 years, life expectancy grew slightly (Figure 17). This indicates that years remaining to be lived increased as individuals passed through successive periods of infant and young childhood mortality. From adolescence up, life expectancy decreased with age and the associated, increased risk of death. Sex-specific differences in life expectancy indicated that e_x values for females began very low with only 14.37 years expected at birth, and increased slightly with each category until 35-44 years when life expectancy began to decline with age (Figure 20). Males evidenced a similar increase in life expectancy once the first interval of infant mortality was survived. Values dropped slightly earlier than they did for females at 15-24 years of age (compared to 25-35 years for females). From this interval, e_x values declined with increased age. Comparisons of males to females revealed higher life expectancy values for male children during the first three age intervals. At the ages of 15-24, the trend reversed, and males evidenced a higher life expectancy until the last age interval where values were equal for males and females. This may indicate greater parental investment in male children during subadult years.

Finally, crude mortality rates (m) were calculated for all individuals in area BB.1 and for males and females independently. The death rate for all individuals in BB.1 was 47.57, compared to rates of 52.58 and 69.59 for males and females,

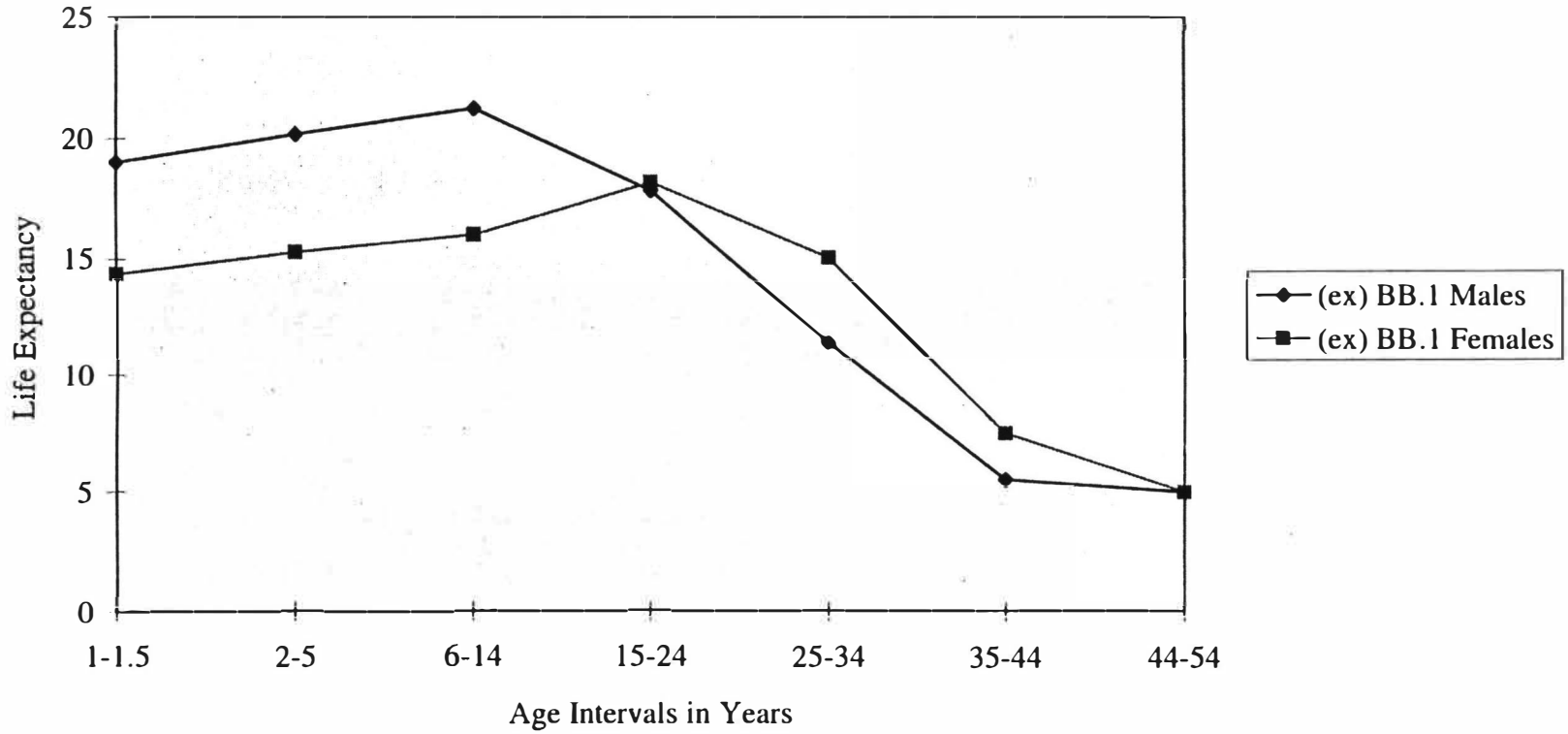

Figure 20. Comparison of Life Expectancies (e_x) for Males and Females in Tomb BB.1.

respectively. As in areas Z and AA combined, males demonstrated a decreased crude mortality rate when compared to females from the same region of the site. Because the crude birth rate (CBR) of the BB.1 sample, 60.23, is higher than the crude mortality rate, 47.57, this population was increasing.

The AA and Z Cemetery Compared to the BB.1 Mausoleum

A comparison of mortality curves (d_x values) between the combined areas of AA and Z and BB.1 indicated differences between the age intervals where peak numbers of deaths occurred. The composite life table for AA and Z revealed that the highest percentage of deaths, 22.92%, ensued between the ages of 6 and 14 years. In BB.1, nearly 20% of deaths (d_x=19.74) were associated with the age interval of 35-44, along with 18.42% for the 2-5 year category. Males in areas AA and Z, and BB.1 also show differences in mortality curves. In AA and Z, peak death percentages for males were observed at 6-14 (d_x=23.91) and 25-35 years of age (d_x=21.74) compared to BB.1's highest values which occurred at 2-5 (d_x=20.29) and 35-44 (d_x=35-44) years.

In a comparison of percentages of the population dying in given intervals, females from AA and Z, and BB.1 exhibited peaks in similar age categories, although absolute values differed by region. In BB.1, peaks occurred at 2-5, 6-14 and 35-44 years, while in AA and Z heightened levels were detected at 2-5 and 6-14 years of age. No comparable peak existed in the 35-44 age range for Z and AA because the sample size for that age category was zero. At present, it is not possible to distinguish whether the absence of individuals from this interval was a reflection of sampling error or whether the value of zero actually reflects the relatively low number of females dying in this age range.

Comparison of the probability of death (q_x), indicated differences in age-specific mortality between the two regions of the site. For example, the probability of dying in Z and AA was greater than in BB.1 for all age intervals, except in the 2-5 year grouping. Between 2 and 5 years of age, individuals in BB.1 were more likely to die than individuals of the same age buried in Z and AA. The reverse is the case for all other age categories with the exception of the oldest interval, where both areas demonstrated a similar probability of death. A comparison of males between each region indicated that the probability of death increased as age increased, with both areas evidencing a decline in the middle of the graph associated with the 15-24 age interval. There was also a slight decline in q_x values for area Z and AA males between the age ranges of 25-34 and 35-44, but it was not present in BB.1. However, overall trends in probability of death by age interval are similar for males in both areas, even though absolute values differed by region. For females, q_x values indicated that the highest probability of death occurred at an earlier age interval for AA and Z than for BB.1. Probability of death was 60% for Z and AA between the ages of 25 and 34 compared to BB.1's 75% value for ages 35-44 years.

BB.1 had higher life expectancies (e_x) than Z and AA in all but one age interval. For ages 35-44, areas Z and AA had a slightly higher e_x value (e_x=9.44) than BB.1 (e_x=8.18). For the oldest age category, both areas were equivalent. Male life expectancies in both regions were very similar, although (as in the overall trends), BB.1 evidenced a slightly decreased e_x value (e_x=5.54) for the 35-44 years category when compared to the Z and AA cemetery individuals (e_x=9.98) from the same age range. Female life expectancies for both regions of the site were comparable for all subadult categories, although adolescent and early adult values differed. For example, in the 15-24 and 25-34 year age intervals, BB.1 females evidenced increased average

numbers of remaining years when compared to the same subgroup in areas Z and AA.

Finally, crude mortality rates (m), 53.79 for Z and AA combined, and 47.57 for BB.1 indicate somewhat decreased values for individuals in the higher status burial. Similarly, crude birth rate (CBR) was higher in Z and AA combined (CBR=71.30) than in BB.1 (CBR=60.23). Comparisons of birth and mortality rates indicated that both areas were experiencing population increase. Because the difference between the two rates was larger for areas Z and AA than for BB.1, the rate of growth was higher in that area. Finally, when crude mortality rates were compared between males and females in each area, it was noted that males and females from both regions had nearly identical values. Crude mortality rate estimates of 53.94 and 52.58 were calculated for males, compared to 69.25 and 69.59 for females from Z and AA combined, and BB.1, respectively.

Statistical Evaluation

Nonparametric evaluation (tests where parameters of a population are not assumed, also called distribution-free methods) of independent samples revealed that none of the differences observed between life table values were statistically significant at 5% ($p \leq .05$). The first group of analyses tested variance in the U values, or largest differences, between percentages dying in successive age intervals (d_x values), life expectancies (e_x) and probability of death (q_x) for all individuals in BB.1 and Z and AA combined. These results were based on the highest sample sizes and are, therefore, the most likely to provide a valid outcome. All p values for these tests were larger than .05 indicating that the differences observed between these areas for these variables were not statistically significant.

The next series of tests examined the same variables (e_x, d_x and q_x) for males

and females excavated from the BB.1 mausoleum. Once again, variance was tested for significance at 5%. P values greater than .05 were calculated for all variables indicating that variance was not statistically significant. These results were somewhat less conclusive because the sample size was extremely low for the subgroups of the population compared. Differences were calculated between specific age and sex groupings which effectively divided the overall skeletal sample into multiple, small units like females from 2-5 years of age, or males between 15 and 24, etc. Comparisons averaged between 0 and 7 individuals for all pairs of subgroups tested. For these reasons, results must be interpreted as tentative and not conclusive.

The final series of variables examined with nonparametric analysis involved d_x, q_x and e_x values for males and females from areas AA and Z combined. Once again, sample size was too small to provide conclusive results. However, it was interesting to note that when all p values were compared for all pairs analyzed for variance, the variable and subgroup that came closest to being significant was the U value, or ranking of variance, calculated for life expectancies from males and females buried in areas Z and AA. It is highly likely that an increased sample size would have resulted in statistically significant differences between males and females from this cemetery. Table 14 contains all U and p values for nonparametric analyses attempted.

Finally, one way analysis of variance used to calculate correlation coefficients indicated that area of the site, BB.1 or Z and AA combined, did not correlate significantly with probability of dying in successive age intervals (q_x), life expectancy (e_x) or percent dying in a given age category (d_x).

In summary, statistical analyses indicate, first, that a larger sample size is needed to produce more reliable results. The most reliable results, based on the largest sample size, suggest that for all individuals buried in tomb BB.1 and the Z and AA

Table 14

Comparison of U and p Values for all Nonparametric Analyses Attempted

Variable	Area	U values	p values
e_x	all BB.1/Z and AA	18.5	.4428
d_x	all BB.1/Z and AA	24.0	.9489
q_x	all BB.1/Z and AA	21.0	.6547
e_x	M/F in Tomb BB.1	18.5	.4428
d_x	M/F in Tomb BB.1	21.0	.6533
q_x	M/F in Tomb BB.1	24.0	.9491
e_x	M/F in AA and Z	13.5	.1594
d_x	M/F in AA and Z	22.0	.7472
q_x	M/F in AA and Z	24.0	.9491

cemetery, life expectancy, probability of death and percentages of deaths in successive age intervals were not significantly different. In addition, area of internment cannot be correlated with d_x,e_x or q_x values for any of the subgroups represented in this skeletal collection. Finally, the subgroups closest to being significantly different at present, and the comparison most likely to yield significant results if sample size were increased, involves life expectancy variations between males and females in areas Z and AA.

CHAPTER V

DISCUSSION

Mortuary Practice

Location, Dating and Contents of Funerary Installations

As discussed previously, areas AA and Z have been dated to the early fourth century through ceramic evidence from burial cists and pits. Dating by grave goods is consistent with a Late Roman/Early Byzantine designation but is not helpful for refining the dates. A literature review of contemporary funerary installations indicates a relatively long and somewhat non-specific chronology of beads, nails and gold earrings from Early Roman through Late Byzantine times (Ibrahim & Gordon, 1986; Waterhouse, 1973; Stirling, 1976, 1978; McNicoll, Edwards, Hanbury-Edwards, Hennessy, Potts, Smith, Wamsley, & Watson, 1992; Winnett & Reed, 1964; Tushingham, 1972). Wooden coffins have also been uncovered in burial units from similar time periods at several sites including the Queen Alia Airport cemetery (Ibrahim & Gordon, 1986), the early 4th c. cave tomb from Jabal Jofeh El-Sharqi in Amman (Bisheh, 1972), a shallow cist tomb at Petra (Zayadine, 1982), late 3rd c. vaulted chamber tombs in western Galilee (Tzaferis, 1969), and the Roman tombs at Pella (McNicoll, et al., 1992).

More elaborate mausolea frequently contain lead coffins (Gath & Rahmani, 1977; Rahmani, 1960, 1976) and stone or lead sarcophagi (Reisner, Fisher, & Lyon, 1924; Harding, 1950, 1951; Bisheh 1973; Hadidi, 1979, 1982). It is interesting to note that the BB.1 mausoleum at Umm el-Jimal did not contain intricate stone or lead

sarcophagi, but a simple wooden coffin similar to those found in the cist and pit burials from areas AA and Z. Though the possibility remains that sarcophagi or lead coffins were removed during episodes of reuse or robbery, the lack of even small, fragmentary remains along with the presence of the wooden coffin makes this unlikely.

The most obvious difference between the burials at Umm el-Jimal and other Late Roman/Early Byzantine mortuary units is the complete absence of lamps from the cist and pit burials in AA and Z (one Late Roman lamp fragment was found in BB.1). Ibrahim and Gordon (1986) describe a similar deficit at the Queen Alia cemetery. They note that the absence of these objects is striking given that torches, lamps and the oil-filled vessels used to fuel them were essential inclusions in Graeco-Roman and Syrian funerary rituals. They are among the most common objects from tombs and cemeteries throughout the region (Tzaferis, 1969; Rowell, 1931; Zayadine, 1982; Rahmani, 1976; Hadidi, 1979, 1982; Bisheh, 1972, 1973; Hamilton & Husseini, 1934), as well as, among the Nabataeans (Ibrahim & Gordon, 1986). In addition, at the Queen Alia airport, only the wealthiest grave contained ceramics and perfume bottles (also common occurrences in Roman tombs). This situation may be paralleled at Umm el-Jimal in grave Z.3 if the bone container and juglet assumed to contain cosmetics (Brashler, 1995) are reinterpreted as perfume bottles or scented oil containers. A chemical analysis of residues may be able to better indicate use in antiquity. Regardless, it is significant that Z.3 was the only pit or cist burial excavated from areas AA or Z at Umm el-Jimal that contained grave goods of these types, in addition to the more common objects of beads, coffin wood and metal fragments.

Tomb Z.3 also contained the bottom portion of an early Byzantine cook pot plastered over to form an imitation fineware chalice. This item was interred near the surface of the soil layer containing human remains in the eastern half of the cist. A glass bottle was uncovered in association with the chalice and may have been employed

as a container for the offering of libations for the dead. The only other potential evidence for this practice at Umm el-Jimal was found in the disturbed cist burials Z.6 and AA.17. Grave Z.6 contained the remains of a large jar handle, which was excavated with decayed floral material. In AA.17, the painted rim fragments of plaster chalice similar to those from Z.3 were uncovered, though no ceramic form was found in association (Lenzen, 1997, in preparation). These items may tentatively be interpreted as remnants of funerary oblations. The use of ceramic vessels for offerings or libations has been suggested at Pella (McNicoll, et al., 1992) and other sites (Boraas & Horn, 1973) in Roman mortuary units.

In addition to data gained through the comparison of intra-site grave contents, tomb structures may also be analyzed with reference to contemporary sites. Reports from Dhiban and Carthage, for example, suggest that pit and cist burials are roughly contemporaneous and Byzantine (Tushingham, 1972; Winnett & Reed, 1964; Ellis & Humphrey, 1988). At Umm el-Jimal, pottery dates support the interpretation of concurrence. However, there seems to be more evidence, at least for the tombs excavated in areas AA and Z, that use began as early as the Late Roman period and continued through Early Byzantine times. This is further substantiated by the similarity in burial type reported for the pre-Byzantine graves at the Queen Alia Airport Cemetery (Ibrahim & Gordon, 1986) and the Roman tombs at Jericho (Kenyon, 1965). The differences in tomb structure in areas AA and Z are most likely attributable to the status or ability of individuals to acquire resources, and not to changes in burial construction over time.

Finally, the locations of the area Z and AA cemetery and tomb BB.1 must be evaluated in relationship to dated architectural remains from the Early Roman-Late Roman village and from the Byzantine town (Figure 21). The situation of mortuary units around or outside inhabited spaces, with a few exceptions (see Chapter III),

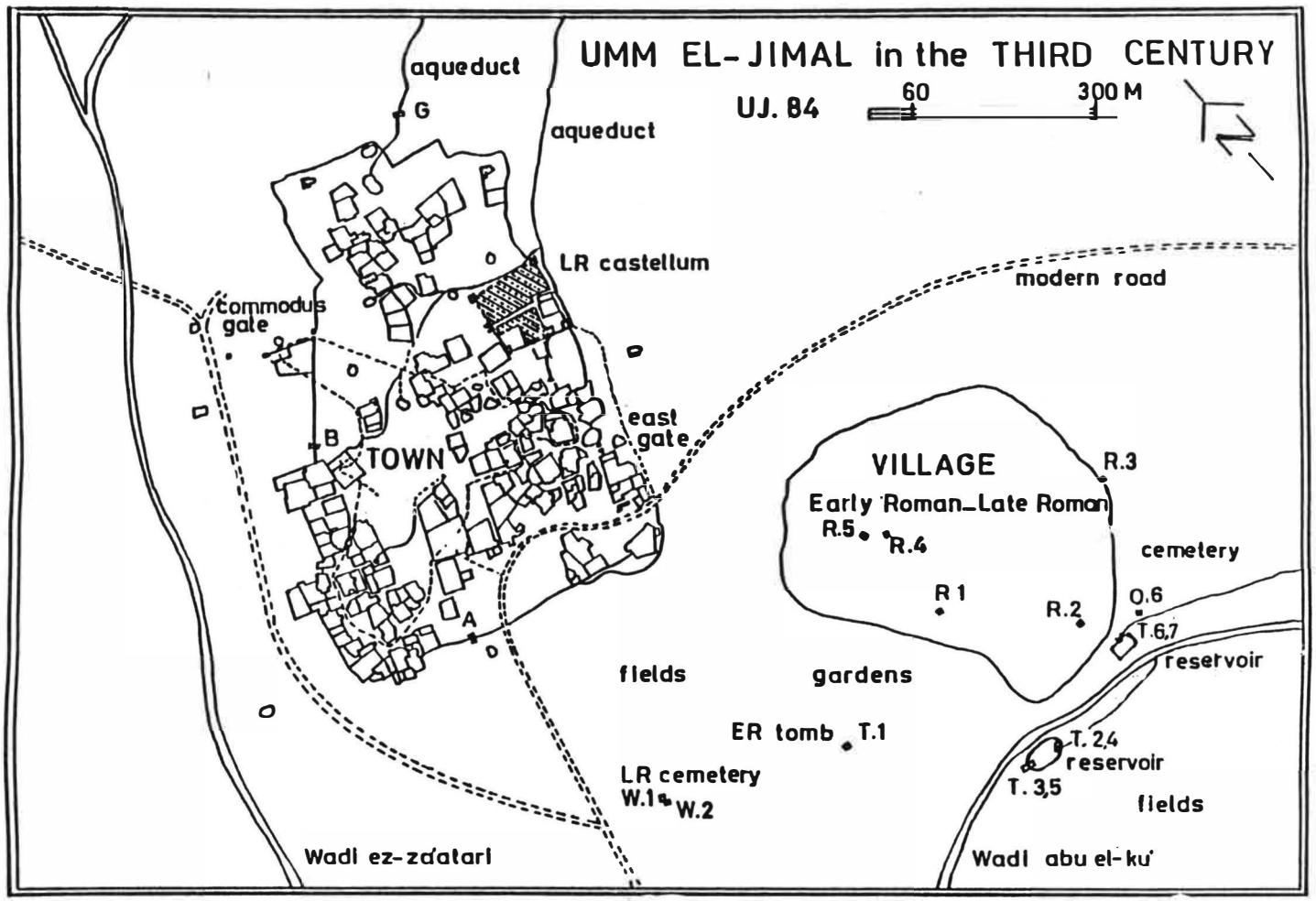

Figure 21. Umm el-Jimal in the Third Century (Drawing by Bert de Vries).

raises questions about intra- and extramural burial at Umm el-Jimal. In the Roman period, according to historical documentation, intramural burial, or burial within the town or city wall limits, was strictly prohibited (Ellis & Humphrey, 1988). *The Corpus Iuris Civilis,* promulgated by the Emperor Justinian between 529 and 534 CE reiterated ancient attitudes towards the dead by forbidding interments in cities, towns and places of worship (for examples, see *Codex Theod.* IX.17.6; *Corpus Juris Civ., Digesta* 47.12.3; *Codex Just.* III.44.12; *Epitome Legume* XI.39.43). Archaeological and primary historical sources, however, indicate that intramural burial occurred prior to the sixth century in both the East and West following the Peace of the Church (Ivision, 1996). Ellis and Humphreys (1988) note that the standard of extramural burial declined in late antiquity, although the circumstances leading to this change are poorly understood. Dragon (1977) and Aries (1987) argue that once relics were moved within city walls in order to protect and sanctify communities, it was logical that burials should follow. This may explain the burial of bishops, clergy members and leading lay persons inside town or city perimeters and within ecclesiastical structures, but it does not address how this practice spread to everyday people in non-religious contexts. In order to assess questions of intra- versus extramural burial patterning at a given site, accurate dates for burial units and settlement areas must first be acquired. The chronology of Umm el-Jimal's contemporaneous settlements will be summarized below.

The Early Roman/Late Roman village, or area R, underwent at least two phases of utilization (de Vries, 1986) between circa 50 and 350 C.E. These included the use of structures as domestic dwellings followed by their employment as dumps for extensive occupational debris. Destruction of the village and the quarrying of masonry for the Byzantine town occurred between approximately 270 and 350 C.E. This time period overlaps with a second distinct phase of Umm el-Jimal's occupation between the

2nd and 4th c. when a defined urban, military space was established (Figure 21). This occupation involved the construction of a praetorium, a castellum, a large reservoir and the Commodus gate dated by an inscription to 177-180 C.E. Lenzen (1996) has argued for a gradual abandonment of the Early Roman/Late Roman village as this population of the badiya made accommodations to Roman military dominance. This model suggests a certain degree of intra-site variability which may be evidenced in the types of burial units, monumental tomb BB.1 and the cist and pit inhumations uncovered in the AA and Z cemetery. These overlap at least partially with this transition from the Early Roman/Late Roman village to a more urban and military definition of space.

If the relative proximities of settlements and funerary installations are taken into consideration, it seems likely that areas Z, AA and BB.1 contained the remains of the Early Roman/Late Roman village's inhabitants along, perhaps, with members of the earliest dwellings of the 3th - 4th c. military settlement. At Umm el-Jimal in the early 4th c., it is apparent that extramural burial was the norm, although many of the cists and pit interments that have been excavated occur quite close to the location of the 4th-5th c. urban, military settlement (Figure 21). Proximity may be explained by noting that distinctions between ideal and actual behaviors frequently exist and may develop in response to the practical needs of a community for resources and space devoted, for example, to the disposal of the deceased.

There is some evidence that extramural burial may have continued into later periods at Umm el-Jimal. In 1984 a series of probes were excavated inside the enclosure of the West Church located adjacent to, and south of, area AA (UJ84 Field Notes) in order to test the hypothesis that the West Church had served a funerary function in antiquity. Research in this region failed to expose any burials. In sum, while it is certainly possible that intramural burial occurred in other locations at Umm

el-Jimal, the evidence that is presently available suggests that extramural burial was the norm and that it continued through Byzantine times.

Diversity of Burial Type and Cemetery Organization: Continuity or Division?

Areas AA and Z can be characterized as highly variable in burial style, a matter further complicated by the disturbed nature of many of the graves. For example, although all of the skeletons uncovered in the 1996 season in area Z were facing west with skulls positioned in the east, 1994 excavations of graves in the Z and AA cemetery revealed individuals facing both east and west (Brashler, 1995). The presence of grave goods varies from complete absence to several beads and gold and copper jewelry remaining in robbed or disturbed tombs. In addition, burials range from single interments in simple pits and well-constructed cists to 16 individuals in a large block lined shaft. Pit and cist burials are interspersed in what appears to be a random pattern throughout the cemetery, and are not concentrated in clusters or discrete regions of the areas. Square Z.4 is the best example of this with a disturbed pit burial abutting a subadult single interment with well-constructed side wall architecture (Figure 11).

Differences in the type and contents of interments in AA, Z and BB.1 provide clues concerning social stratification and organization. If it is assumed that death, and the behaviors associated with it, provide opportunities for discourses about life, then differential treatment of the dead may suggest something of an individual's or a family's relative status while living. Molleson (1981) states that as a generality, individuals who live together are also buried together either in local cemeteries or in family tombs. However, exceptions and variations of this pattern exist and must be examined in view of specific material remains and archaeological evidence. For example, females marrying into an outside family may be returned to the natal village to

be buried with members of the father's lineage at the time of death. During epidemics or famines when large numbers of people are dying, family burial may be abandoned and replaced by mass burial of distantly or unrelated individuals. In addition, the concept of what constitutes a "family" differs by several factors including time period, ethnicity and region.

In area Z at Umm el-Jimal, a variety of burial patterns are evident. For example, tomb Z.3, which contained 16 individuals and a relative wealth of grave objects, is surrounded by single interments with no grave goods (Z.10 and 11), single, double and quadruple burials with few grave goods (Z.2, 7 and 8) and the disturbed remains of what may have been more elaborate multiple interments with numerous associated objects (Z.1 and Z.6). Z.3 stands out as the most elaborate and wealthiest of the burials noted, yet the individuals interred in this grave were not distinguished to the extent that a mausoleum, like BB.1, was erected. This seems to suggest that while the Z.3 individuals were set apart through higher status grave goods, they were still intimately connected to the lower status individuals by virtue of their close proximity and the similarity of burial structure.

What then was the relationship between the individuals or groups of persons buried in the Late Roman/Early Byzantine cemetery? Because none of the burials are rich in the context of the Roman world, the distribution of graves and their contents seems to suggest relatively slight stratification within what may be an extended family, kin- or clan- based community cemetery. All interments, with the exception of a few subadults in Z.3, are buried in extended supine positions, arms either at their sides or across the chest or abdomen, and oriented east and west. Overall, there seems to be a significant amount of continuity throughout areas AA and Z in terms of wealth, placement of remains and tomb structure (stone capped pit or cist), while a great deal of diversity exists in the number of individuals interred. A similar pattern has been noted

in the Queen Alia Airport Cemetery (Ibrahim and Gordon 1986).

At Pella and Jericho, tombs were excavated which contained the remains of multiple individuals (McNicholl, et al., 1992; Hachlili & Smith, 1979). Skeletons were analyzed for epigenetic traits, or indicators of familial relationship, and both studies suggested evidence for patrilocal kin groupings. The number of people interred, combined with the assumption that the relationship of those buried together reflects relations that existed during life, suggests that Z.3 and monumental burial structures like BB.1 should be interpreted as kin-based units. Analysis of epigenetic traits will eventually help to clarify the relationships suggested by the material remains of burial patterning.

The presence of both cremations and simple inhumations in tomb BB.1 must be addressed with reference to the diversity of burial practices evident at Umm el-Jimal. The skeletal remains in BB.1 were thoroughly cremated from the cortical bone through to the core of the medullary canal. The extent of the burning precludes the possibility that remains were altered in an accidental fire. The presence of cremated remains commingled with unburned bone material is particularly interesting when comparative sites associated with Umm el-Jimal both spatially and temporally are taken into consideration. In the majority of skeletal analyses cited thus far no incidences of burning are reported; simple inhumations in mausolea or simple pit and cist graves are apparently the norm. The Queen Alia Airport Cemetery study is an exception with evidence for a single cremated adult male uncovered in the same cemetery as pit and cist interments. Ibrahim and Gordon (1986) interpret this anomaly as evidence for foreign burial practice. They argue that the cremated individual, and those who performed the burial practice, could have come from the north, possibly as soldiers. These people would have altered their funerary practices by collecting the burnt remains and interring them in the burial grounds of a community they were not native to.

Similarly, the cremated skeletal elements from BB.1 may indicate an intrusive burial practice, whereby foreigners or individuals of a different ethnic background, for example, became acquainted with members of Umm el-Jimal's population and were eventually interred in an extended family mausoleum. The lack of comparative material makes it difficult to estimate the origin of these people and the cremation custom. In addition, Toynbee (1971) argues that cremation declined and went out of use in the western empire by the beginning of the 2nd c. C.E. and that it was never common in the east.

Another possible explanation may involve the presence of infectious disease (evidence for this is discussed in greater detail below). The burnt bones interred in BB.1 could reflect a case where extended family members dying, perhaps, of contagious infection were cremated prior to burial as a form of disease- mitigating sanitation. The use of the mausoleum for this type of burial may also be indicative of diverse use of the tomb over an extended time period. It is interesting to note that no other example of cremation has surfaced in the tomb excavations carried out in the 80's or 90's at Umm el-Jimal..

Disturbances in Antiquity

An additional noteworthy aspect of the AA and Z cemetery involves the extensive robbing and/or disturbance evidenced in the region of Z.1 and in parts of area AA. Tomb Z.4a and Z.6, for example, were uncovered with completely intact cover slabs and chinking stones, but contained only fragments of human remains, coffin stains and small objects. Grave Z.5's cover slabs were intact except for one, and the burial was extensively disturbed. The contents of Z.4a, Z.5 and Z.6 were cleaned out very shortly after they were buried because the coffins were removed in their entirety, and apparently intact.

In area AA, tomb 9 contained the remains of a partially disarticulated subadult uncovered beneath intact cover slabs. The disturbance of this individual may have been related to robbery (no grave goods were found in association with the human remains), or to the intended, though apparently never carried out, addition of a second individual. As in Z.4a, Z.5 and Z.6, skeletal remains were upset very shortly after interment as connective tissues had not yet completely decayed. AA.9 differs from tombs Z.4a - Z.6 in that the majority of skeletal elements remained in the grave after tampering. Conversely, in AA.15b, no evidence of human remains were uncovered beneath the intact tomb cover slabs. The bones of the infant buried here (indicated by the small size of the grave) apparently either disintegrated beyond detection or were removed some time in antiquity.

The question with regard to these disturbances is whether the human remains and associated objects were removed or altered as an aspect of culturally defined mortuary practice, or whether these were upset during extensive robberies in antiquity. The possibility of looting seems likely given the modern prevalence of tomb destruction and object hunting. It must be noted, however, that the evidence for disturbance seen in Z.4a, Z.5, and Z.6 differs markedly from the robbing behavior noted in Z.1 in 1993 (Cheyney, 1995) and, perhaps, in AA.9. In Z.1 the majority of bones were left behind and piled in one corner of the tomb as though they had been systematically sorted through in an effort to recover grave goods. Presumably, only the objects were removed. The cover slabs were also left disturbed with no effort to replace them. Similarly, the bones of the subadult buried in AA.9 were not removed, although the positioning of the cover slabs did not indicate disturbance as they did in Z.1. In contrast, the robbers of Z.4a, Z.5, Z.6 and possibly AA.15b made a real effort to cover their tracks. Even the small chinking stones were meticulously replaced between the slabs.

Another possible interpretation involves the systematic reuse of burial cists over a period of time. Several reports from tomb excavations in Jordan describe the removal of primary burials to make room for new interments (McNicoll, et al., 1992; Waterhouse, 1973; Stirling, 1978; Ibrahim & Gordon, 1986). This behavior has also been suggested for other funerary units including tomb BB.1 at Umm el-Jimal (Brashler, 1995, in press). At the Byzantine cemetery in Carthage, Ellis and Humphrey (1988) report deliberate disturbances related to reburial practices. In some cases skulls from other burials were reinterred in newly dug grave pits along with additional individuals. The authors presume that the act of placing a portion of a skeleton into a grave shaft was viewed as a satisfactory means of reinternment. It is unlikely that the skulls were overlooked or accidentally reburied when the new shafts were filled with soil.

In area Z, the only evidence for the reuse of graves comes from Z.7. A detailed inventory of human remains from this burial revealed two complete individuals, a subadult female and an adult male. In addition, three diagnostic fragments were found during screening that could not have belonged to the first two individuals. A fragment of an iliac crest that was in an earlier stage of union than those found for the subadult and two distal epiphyses of ulna completely unfused were uncovered. Based on duplication and developmental stage, these fragments must belong to a third individual. They were uncovered beneath the deepest burial, and therefore, must predate the two present complete individuals. The remains left behind in the disturbed tombs Z.4a, Z.5 and Z.6 were similar to these in that they were small fragments likely be left behind when skeletons are removed, whether by robbing or in an attempt to clear a tomb for reuse.

In area AA, analysis of skeletal remains from the AA.1 multiple interment revealed patterns of disturbance similar to those observed in Z.7. In the AA.1 grave

three adult individuals were clearly indicated by the prevalence of diagnostic bone material and duplicated sideable elements. A fourth individual, a subadult, was distinguished by the presence of one immature bone fragment - a billowed vertebral centrum. Because only one skeletal element definitively belonging to this individual could be identified, it remains likely that the bone fragment was left behind when the subadult was removed to accommodate additional adult interments. The robbery of grave AA.1 in recent times (1993), however, makes this interpretation tenuous.

The stratigraphy of tomb AA.11 indicates that individuals were interred during separate burial episodes. A layer of soil fill uncovered between two fully articulated skeletons suggests that an indeterminable period of time elapsed between the deposition of remains. This may also have been the case in Z.3 as 16 individuals were placed in a coffin just over 0.5 m deep. However, because 12 of the 16 individuals were either infants or older subadults, and because there was no evidence for fill layers between burials, it is possible that these individuals were deposited simultaneously or within a very short time of one another. These patterns indicate reuse and reopening of burials, although they differ from those described above in that none of the earlier burials appear to have been disturbed in the process.

Reports from Heshbon document nearly empty burial shafts with intact covering structures (Stirling, 1978; Waterhouse, 1973). The authors attribute this arrangement to looting but also note the prevalence of reuse in other contemporaneous tombs. Excavation of shaft tombs on the Nablus Road in Jerusalem also revealed the presence of intact slabs sealing completely empty burial cists (Hamilton & Husseini, 1934). Further investigation is necessary to clarify these questions of burial practice and postdepositional disturbance; however, at present, it seems likely that both robbery and reuse combined to play a role in the complexity and diversity of burial types evidenced in areas AA and Z.

Finally, it is necessary to interpret the numerous funerary stelae found at the site. These were inscribed with texts in both Nabataean and Greek and have been located predominantly in the standing remains of the Byzantine and Islamic settlement (Littmann, 1913); a few were found in surrounding cemeteries. Although no funerary stelae have been uncovered *in situ* in areas Z and AA, it may be hypothesized that pit and cist burials would normally have been marked by one of these grave stones. The disturbance of the stelae and their reuse in later structures may eventually help to clarify the nature of the transition between occupational phases at the site, i.e. continuity or discontinuity in the population.

Subsistence and Burial Practice

Ibrahim and Gordon (1986) have argued that the Queen Alia cemetery, Umm el-Jimal's closest corollary in burial practice, contains the remains of nomadic pastoralists. This argument is based partially on the location of the burial ground at the border of the present desert where water and grass are plentiful only in winter and early spring. The authors contend that settled life would not have been possible in the region, and that the burials must be associated with a seasonal camp for pastoralists residing in the caves and courtyards on the low hills adjacent to the cemetery. Ibrahim and Gordon presume that these people would have interacted with the Roman troops in the area, but that unique burial practices set them apart as indigenous and nomadic. As stated previously, pottery, which is common among settled communities, is conspicuously absent in graves at Queen Alia. The authors contend that the lack of this material culture indicates a nomadic-pastoralist background because ceramics would have been difficult to transport and, therefore, unfavored.

If this argument is accepted and applied to Umm el-Jimal, the individuals buried in areas AA and Z could be identified as semi-nomadic pastoralists interacting with the

more settled community at Umm el-Jimal who may have been buried in monumental tomb structures like BB.1. This interpretation, however, is somewhat problematic. At the Queen Alia cemetery, pottery was collected from the hills nearby and from silted layers in the graves. This indicates that ceramics were in regular use on the site at the time of the cemetery. The authors acknowledge that it is unlikely that the pottery-users were from a different population than those buried in the cemetery.

Alternative explanations for the presence of pottery at sites, and not in graves, can be argued with reference to potential status and/or cultural variations. For example, lower status individuals may not have possessed the resources to warrant use of objects as grave goods. The lack of pottery could also reflect a cultural practice whereby ceramics were simply not considered to be appropriate inclusions in tombs. A multiplicity of social factors may have interacted to affect burial customs and traditions. Analysis of paleobotanical remains from dated occupation levels in the Queen Alia cave shelters and in Umm el-Jimal's Early Roman/Late Roman village may eventually provide more substantial evidence for seasonal inhabitation and nomadism. At present, there does not seem to be enough evidence to positively correlate subsistence strategy with burial practice. However, it may be possible to posit some preliminary hypotheses that can be tested through future research.

At Umm el-Jimal, dental evidence, discussed in greater detail below, suggests that individuals interred in the combined areas of AA and Z and in BB.1 consumed high quantities of agricultural goods. In addition, architectural remains of permanent domestic structures and surrounding fields and farms suggest Umm el-Jimal's economy was based on settled agrarian production. Relatively imprecise dating, however, makes it difficult to ascertain when settled agriculture became the predominant subsistence strategy of the site's inhabitants. Haiman's (1995) analysis of relations between settlers and nomads in the Negev desert during the Byzantine and

Early Islamic periods provides important data which may help to guide future research at Umm el-Jimal.

Haiman's (1995) survey of the northern Negev provides evidence for two distinct regions of settlement located adjacent to each other, one populated by permanent farmers and another by seminomads. The author argues that even though the ethnic origin of sedentists and nomads was probably similar (i.e. all descendent of Nabataean Arab desert nomads), their housing structures, burial practices and other forms of material culture were distinct. Seminomads were reportedly interred in cairns, while more settled populations who had been assimilated into dominant Mediterranean Christian culture were buried in cemeteries and churches. According to Haiman, more settled populations also adopted urban style town layouts, government institutions and the use of Greek as the official language. Continuous interaction between nomads and agriculturalists was necessary because the desert did not provide enough resources for non-settled peoples to live independently. Haiman hypothesizes that a spontaneous settlement of seminomadic peoples occurred in the Byzantine period. This argument is based on the close proximity of nomadic and permanent sites and on continuing economic connections between populations.

A similar pattern of interaction between nomads and agriculturalists may have occurred at Umm el-Jimal, although the timing and nature of the transition to a sedentary life style was probably unique. Changes in subsistence strategy and material culture may have been slow, perhaps paralleling the gradual abandonment of area R (Lenzen, 1996). Burial practices seem to have been retained throughout this period, with slight modifications. The inclusion of plaster chalices and other ceramics in higher status cist burials, the use of cemeteries, and the architecture of monumental tombs could reflect the dual influences of a nomadic heritage and the Roman cultural and military presence.

Biological Profiles and Mortality Patterns

Life Expectancy

Life expectancy at birth for Umm el-Jimal's residents was very low, approximately 20 years compared to 35 years today for non-industrialized societies (Molleson, 1981). Kilgore and Jurmain (1988) report a similar value of 19.5 years for life expectancy in the Byzantine cemetery at Carthage. Following periods of infant and childhood mortality, life expectancy at Umm el-Jimal increased; however, only a very small portion of the population would have survived past the ages of 35 - 40 years. Similar maximum life span estimates have been reported for the Romano-British population at Lankhills (Clarke, 1979, as cited by Molleson, 1981), the semi-nomadic pastoralists buried in the Queen Alia Airport cemetery (Ibrahim & Gordon, 1986), the Byzantine inhabitants of Khirbat As-Samra (Nabulsi, 1996), Roman period tomb material from Pella (Bourke, 1992) and the 7th c. cemetery at Carthage (Kilgore & Jurmain, 1988).

In addition, slight differences in longevity and life expectancy have been suggested for males and females buried in BB.1 and in the AA and Z cemetery at Umm el-Jimal. Females excavated from BB.1 and the combined areas of AA and Z have life expectancy at birth figures of 14.37 and 14.44, respectively, compared to males from both locations whose estimated values are approximately 19 years. A similar pattern exists between males and females from the Lankhills cemetery and from the Roman period burials at Pella. Bourke (1992) reports slightly enhanced longevity for males interred at Pella, and Molleson (1981) notes that very few women in the Lankhills skeletal collection lived more than thirty years.

Similarly, both the Lankhills and the Pella study report mortality peaks for

females between the ages of 17 and 25 years. These heights are attributed to the hazards of parturition. At Umm el-Jimal, in areas AA and Z, females demonstrate a higher percentage of deaths in the 15-24 years age category when compared to males (37.5% and 18.2% respectively). In BB.1, the difference between males (22.0%) and females (23.1%) in the same age category is comparatively slight. This suggests that in the lower status segments of Umm el-Jimal's population, females had higher mortality rates than both males and other higher status females during late adolescence and early adulthood. This may be attributed to decreased overall health status related to disease or occupational stress. It may also reflect differential gender- and/or status-biased access to medicinal and nutritional resources. Sex-specific differences in crude death rates indicate similar gender biases with females from both areas of the site demonstrating significantly higher mortality than males in the population. This suggests that overall, and regardless of status, women at Umm el-Jimal were faced with biological, and perhaps cultural, stresses which resulted in increased rates of mortality.

Infant and Preadult Mortality

It is difficult to determine infant mortality rates from archaeological communities for several reasons. Material remains and historical sources suggest that deceased children, especially neonates and stillborns, were not always buried with the rest of the population in community cemeteries or extended family mausolea (Collins, 1977; 1977a; Aries, 1962). Bodies of infants may also be overlooked when only partial excavation of a site has been conducted (Collins, 1977a). In addition, immature skeletal remains can be destroyed through erosion of the soil (Molleson, 1981). At Umm el-Jimal, it is apparent that at least some infants and children were buried in cemeteries and mausolea along with older individuals. The presence of empty infant

graves suggests that the disintegration of fragile subadult remains may have occurred at Umm el-Jimal. Therefore, infant mortality rates may be under- represented.

BB.1 and the combined areas of AA and Z demonstrate relatively low percentages of deaths in the 0 - 1.5 years age category - 9.2% and 12.5% comparatively. These values increase for children in older age intervals and contribute to a subadult mortality rate of between 40 and 50% prior to the ages of 14-25 years. Umm el-Jimal's infant and subadult mortality rates are similar to those reported for other pre-industrialized societies. Hassan (1973), for example, calculated average mortality rates of 40-50% and 15-20% for subadults and infants in prehistoric populations. Ortner (1981) reports a 9% infant death rate and a 39% value for all subadults combined at the early Bronze age site Bab edh-Dra in Jordan. In addition, a similar value of approximately 40% has been reported for skeletal remains excavated from the Byzantine cemetery at Khirbat as-Samra. Finally, a subadult mortality rate of 37.3% has been estimated for Early Bronze Age remains from Bahrain (Frolich, 1982).

Overall, initial studies at Umm el-Jimal indicate that the Late Roman/Early Byzantine inhabitants of the site experienced relatively high infant and subadult mortality rates regardless of status as reflected by burial style (pit and cist or monumental tomb). Hazards of weaning, including dysentery and gastroenteritis, along with infectious disease are the most likely contributors to the prevalence of childhood death for rich and poor. Finally, the possibility that infant mortality rates have been underestimated for this population must be taken into consideration. The presence of empty infant graves at Umm el-Jimal, for example, may indicate a more substantial subadult death rate than values reported for other pre-industrialized societies. Unique environmental, disease, dietary, or cultural stresses such as infanticide during economic hardships (Molleson 1981) or outbreaks of infectious disease (Gibson, 1928) are two examples of rationalizations that have been used to

explain elevated subadult mortality figures. An increase in both sample size and in comparative data from contemporaneous sites are required to further clarify these questions.

Sex and Age Distributions

At Umm el-Jimal, a total of 32 males and 21 females were identifiable from skeletal remains. This 20% imbalance in favor of males may be explained, at least partially, as a function of sampling error associated with a limited sample size. When this bias towards males is interpreted in terms of world wide skeletal collection averages, Umm el-Jimal demonstrates a pattern that has been recorded for at least 43 other preindustrial and industrial populations cross culturally. Weiss (1972) noted that these imbalances are usually in favor of males, and that they frequently occur at rates of approximately 12%. Because a sex ratio of approximately 1:1 occurs in living populations, physical anthropologists have begun to question the accuracy of skeletal sexing techniques and to explore socioeconomic and cultural factors potentially related to this phenomenon (Donion, 1993; Sieff, 1990).

There are several factors that may be contributing to the imbalance evident at Umm el-Jimal. The first and most apparent explanation is related to the small sample size, as stated above. In addition, failure to identify skeletal markers of sex correctly (due to disturbance or poor preservation as in BB.1, for example) or increased mortality among subadult females may contribute to sex ratio biases. For example, if a larger number of females die before sexual differentiation of the skeleton at puberty, then adult females will obviously be under-represented in the sample. Peak mortality figures calculated for females in area AA and Z during the 15-24 years age interval suggests that this factor may be playing at least a partial role in sex ratio discrepancies at Umm el-Jimal. It is interesting to note that initial sex ratios reported for the Queen

Alia airport cemetery, were similarly biased by 20% in favor of males. Frolich (1986) interpreted this variation as evidence for the presence of a military garrison cemetery where the prevalence of unmarried soldiers would help to explain an uneven sex distribution. Subsequent excavation and analysis of skeletal remains from the Queen Alia Airport cemetery, however, resulted in the identification of additional female skeletons (Ibrahim & Gordon, 1986). Thus, with an increased sample size, the cemetery ended up revealing a normal population distribution with a nearly 1:1 sex ratio.

With regards to age ratios, research on archaeological skeletal populations suggest a typical distribution of 10-15% infants, 40-50% total subadults (all individuals under 18 years combined) and approximately 50% adults (Angel, 1971; Ortner, 1981; Ortner & Frolich, 1982; Hassan, 1981). The Umm el-Jimal sample does not vary significantly from these percentages of age distributions. In areas AA and Z, the ratio of adults to subadults is approximately 1:1, whereas in BB.1 the sample is biased (although very slightly) in favor of adults. It should be noted that the highly disturbed nature of BB.1, combined with the likelihood of differential preservation in fragile immature remains, may have resulted in a reduced estimation for infants and young subadults. Interestingly, Ortner's (1981) analysis of Early Bronze Age shaft tombs at Bab edh-Drah yielded nearly identical age distributions as tomb BB.1 at Umm el-Jimal. Ortner calculated a minimum of 92 people, including 56 adults (61%) and 36 subadults (39%). A total of 90 individuals comprised of 54 adults (60%) and 36 subadults (40%) indicates comparable age distributions for the BB.1 mausoleum at Umm el-Jimal.

Stature

Due to the fragmentary nature of much of Umm el-Jimal's skeletal material, it

was possible to obtain stature estimates for only ten adults from the combined areas of AA and Z. Means calculated from the high and low values of stature ranges were averaged for a total of two females and eight males. The average living stature for females was estimated at 152 cm with 146 and 157 cm at the lowest and highest ends of calculated ranges. Estimates for males indicated an average of 170 cm with 161 and 179 cm at the lowest and highest extremes of height ranges. The Queen Alia airport sample reported averages of 153 and 166 cm for females and males, respectively (Frolich, 1986). Analysis of living stature at the 7th c, cemetery at Carthage revealed means of 158 cm for females and 163 cm for males (Kilgore & Jurmain, 1988) when estimates with the lowest standard error were averaged. Bab edh-Dhra reported 165 cm for males and 155 cm for females, while Bahrain indicated the following values - 171 cm for males and 166 cm for females.

The remains from Umm el-Jimal demonstrate the greatest difference between averages for males and females with a deviation of 18 cm. Remains from the Queen Alia Airport cemetery demonstrate a similarly large difference between average heights for males and females with a discrepancy of 13 cm. Comparisons of values from other sites reveal greater similarities in sex-specific living stature estimates. Frolich (1986) has interpreted the extreme sexual dimorphism in stature reported at the Queen Alia cemetery as possible evidence that males and females originated from separate populations. The even greater difference in stature found at Umm el-Jimal is probably related, at least to some degree, to the small sample size available for females. However, it is also possible that some females came to Umm el-Jimal from outside communities following patrilocal marriage patterns. In addition, sex-specific differences in health status during periods of growth and development could have contributed to decreased adult stature for females in the population.

Paleopathology

While the pathological survey of the skeletal sample from Umm el-Jimal was by no means comprehensive, some preliminary observations may be suggested. The most frequently observed conditions for individuals buried in the combined areas of AA and Z and in the the BB.1 mausoleum included osteoarthritis, antemortem tooth loss and associated alveolar resorption, dental caries and enamel hypoplasia. Paleopathological analyses at Pella Browne (1992), Queen Alia (Frolich, 1986), Jerash (Hendrix, 1995), Khirbat As-Samra (Nabulsi, 1996), and Carthage (Kilgore & Jurmain, 1988) report similar patterns of skeletal conditions in Roman and Byzantine period remains. Maladies with the highest prevalence include degenerative spinal disease and osteoarthritis of peripheral joints. Frolich (1986), for example, notes the high frequency of degenerative arthritis in vertebrae and in extremities at the Queen Alia airport cemetery and argues that this pattern suggests exposure of individuals to difficult physical labor during adolescence and adulthood. As in the Queen Alia sample, hard physical labor apparently played an important role in daily life patterns at Umm el-Jimal. Frolich observed that degenerative disease was found almost exclusively in males, whereas at Umm el-Jimal, osteoarthritis appears equally likely to occur in males and in females in middle and late adulthood age categories. In addition, robusticity of muscle attachments in both males and females at Umm el-Jimal indicates that the daily life of men and women included a significant component of heavy physical labor.

Older adults at Umm el-Jimal also tended to develop dental caries, and antemortem tooth loss evidenced by alveolar resorption was not uncommon. By way of contrast, reports from Khirbat As-Samra, Carthage and Jerash state that dental caries were not prevalent among members of the population. Positive evidence for carious

lesions and alveolar resorption (which is frequently caused by tooth loss or extraction in response to dental caries development) suggests that a relatively rich diet was enjoyed by the residents of Umm el-Jimal buried in area Z, AA and BB.1 (see Nabulsi, 1996, for a similar argument). Ortner and Putschar (1981) note that dental caries are twice as likely to occur among agriculturists as hunter-gatherers. This difference is believed to be tied to higher intakes of carbohydrates and subadult malnutrition between the ages of 0 and 6 years which adversely affects tooth formation. Middle to late adult individuals in Umm el-Jimal's population also evidence extreme dental attrition and angled molar wear patterns. Smith (1972, 1984) notes that agriculturists tend to develop occlusal wear patterns that are increasingly angled as opposed to hunter-gatherers who tend to derive flatter wear. Angled patterns in agriculturalists result from the consumption of more highly processed and finely ground food products.

Finally, the prevalence of enamel hypoplasia (lines of uneven dental enamel deposition associated with disease and/or dietary stress) and a high subadult mortality rate suggest that malnutrition associated with weaning and infectious disease during childhood were major causes of death in this population. The mortality peak recorded for individuals between the ages of 2 and 5 years in area BB.1 corresponds with common weaning ages in non-industrial societies and in traditional Arab communities (Grinquist, 1947; Sillen & Smith, 1984) and may, therefore, further substantiate this interpretation.

In sum, the specific pattern of pathology evidenced at Umm el-Jimal reflects the influence of degenerative diseases, aging, a diet rich in carbohydrates and subadult infectious disease and weaning stress. Conversely, malnutrition in adults, trauma related to interpersonal violence (note that only two cases were suggested in remains from BB.1) and epidemic disease do not seem to have played important roles in mortality at Umm el-Jimal. If epidemic, rather than infectious, disease were prevalent

at Umm el-Jimal, the abandonment of traditional burial practices would be expected (see Hendrix, 1995, on the mass burial in the Hippodrome at Jerash, and Conrad, 1981, 1986, for an analysis of primary historical sources dealing with plague and burial).

CHAPTER VI

CONCLUSION

Summary of Interpretations and Observations

Mortuary Practice

The pit and cist burials at Umm el-Jimal have been dated to the early 4th c. C.E. through ceramic and artifactual evidence. Tomb BB.1 was in use during the same time period with extensive reuse and robbery continuing into the Umayyad period. Individuals interred in these structures were probably inhabitants of the Early Roman/Late Roman village and early residents of the Byzantine town.

In terms of grave contents, lead and stone sarcophagi and coffins uncovered at contemporary sites are conspicuously absent in both burial areas, the AA and Z cemetery and the BB.1 mausoleum. A few stone sarcophagi were found in other monumental tombs at Umm el-Jimal, though they were rare. Wooden coffins appear to have been more common, at least for members of the 4th. c. population interred in surrounding cemeteries. The pit and cist burials do not contain significant amounts of pottery; in fact, ceramics are found only in the wealthiest graves. This suggests that while some individuals in the cemetery were set apart through higher status grave goods, they were still intimately connected to the lower status individuals by virtue of their close proximity and similarity of burial structures. Slight social stratification is suggested within what may be interpreted as an extended family, kin- and/or clan-based cemetery. Individuals interred in BB.1 are further differentiated from those buried in the pits and cists through the monumental architecture that attests to their

higher status and increased ability to acquire resources.

Gender also seems to have played a role in the way individuals were interred. The lack of females in Z.3, the highest status grave in the cemetery, may indicate that gender-based stratification existed at Umm el-Jimal. Age may have been an additional social factor involved in determining the way individuals were interred. The high incidence of subadults in higher status graves (Z.3 and BB.1), the presence of gold earrings buried with a small infant, and the many beads associated with children in Z.3 may suggest that social hierarchies and age were connected. Ascribed, rather than achieved, status may have characterized segments of this population. In sum, available evidence indicates that gender, status, age, and possibly subsistence strategy, were integrated and played important roles in the way subgroups of the population were treated at death.

Research on Umm el-Jimal's mortuary installations also indicates that extramural burial was the norm and that it may have continued into the Byzantine or early Umayyad periods. Funerary stelae, which have been reused extensively in the structures of the Byzantine and Islamic settlement, may have been employed originally as grave stones in the surrounding cemeteries. Furthermore, the coexistence of cremation and inhumation in tomb BB.1 may indicate the presence of either: (a) infectious disease which led to the use of cremation as a form of disease-mitigating sanitation, or (b) an intrusive burial practice.

A variety of post-depositional disturbances are also evident at Umm el-Jimal. Culturally defined mortuary practices involving the removal and reuse of graves or the interment of additional individuals during separate burial episodes are indicated by the positioning of skeletons, nearly empty shafts with intact cover slabs, and the presence of extraneous bone material in some of the pits and cists.

Finally, with the amount of evidence that is presently available, it is not

possible to correlate subsistence strategy and burial practice. Investigation of potential evidence for seasonal occupation of area R, including paleobotanical analysis and surveys for transhumant structures, may eventually help to characterize the nature of sedentist-nomadic interactions that have been hypothesized for the region. Comparative studies on interactions at other sites provide useful parallels and analogies. This evidence may eventually be correlated chronologically with burial types in evidence at Umm el-Jimal.

Mortality Patterns

Life expectancy at birth for the site's residents was approximately 20 years, with only a very small portion of the population surviving past the ages of 35-45 years. Slight differences in longevity were indicated between males and females buried in BB.1 and the combined areas of AA and Z. Lower status females demonstrated higher mortality rates than males and higher status females. AA and Z females also exhibited increased rates of death in late adolescence and early adulthood which may be attributed to the hazards of parturition. Sex-specific differences in crude death rates indicate gender biases as females from both areas have higher rates than males. This suggests that overall, and regardless of status, women at Umm el-Jimal experienced biological and cultural stresses which resulted in increased mortality rates.

Initial studies also indicate that the inhabitants of the site experienced relatively high infant and subadult mortality rates, regardless of status. Hazards of weaning and infectious disease are the two most likely contributors to childhood death in both subgroups of the population. Life expectancy and subadult mortality calculations are comparable to demographic data available for contemporaneous settlements.

At present, the skeletal sample is biased by approximately 20% in favor of males. This is most likely due to a small sample size, but may also be the result of

increased female mortality prior to the sexual differentiation of skeletal features at puberty. Age ratios at Umm el-Jimal do not differ significantly from typical distributions. Differential preservation of subadult remains, evidenced by empty graves, may have resulted in a slightly under-estimated subadult mortality rate.

The skeletal sample from Umm el-Jimal demonstrates the greatest difference in average living stature between males and females for any of the estimates available from comparable studies. Sex-specific variations in health status during periods of growth and development are the most likely contributors to a decreased average adult height for females in the Umm el-Jimal population. A survey of pathological evidence from both areas indicates health patterns which reflect the influence of degenerative disease, aging, a diet rich in carbohydrates, subadult infectious disease and weaning stress. Malnutrition in adults, interpersonal violence and epidemic diseases do not seem to have played important roles in mortality at Umm el-Jimal.

In summary, this study of mortality patterning and mortuary practice suggests that numerous biological and social factors combined to influence the material culture evident at Umm el-Jimal. Skeletal remains have provided data concerning disease, nutrition, childhood stress, reproductive patterns and mortality. Symbolic measures of status and gender hierarchy in the form of burial structure and tomb contents, have been analyzed with reference to indices of biological well-being and health. Results suggest that gender and status were significant factors affecting quality of life and treatment at death. Age and subsistence strategy may have interacted with these social factors to influence access to resources, burial location and grave contents. In addition, these factors must have been influenced by the political, economic and religious control of Rome and Byzantium, though the site's inhabitants do not appear to have been passive assimilators of these forces. The multiplicity of factors affecting demography and burial structure suggest that the indigenous peoples of Umm el-Jimal developed a

core of daily preoccupations - a local cadence to the routine of life - that actively enabled them to accept, withstand, cope with, and adapt to the vagaries of foreign controls, hardships of daily life, and a changing landscape.

BIBLIOGRAPHY

Aiello, L., & Dean, C. (1990). An introduction to human evolutionary anatomy. San Diego: Academic Press Limited.

Angel, J. (1971). The people of Lerna: Analysis of a prehistoric population. Princeton and Washington: American Schools of Classical Studies at Athens and Smithsonian Institution Press.

Aries, P. (1962). Centuries of childhood. NY: Random House, Inc.

Aries, P. (1987). A history of private life. Cambridge: Belknap Press of Harvard University.

Ascadi, G., & Nemeskeri, T. (1970). History of human life span and mortality. Budapest: Akademiai Kiado.

Banning, E. (1986). Peasants, Pastoralists and the Pax Romana: Mutualism in the Southern Highlands of Jordan. Bulletin of the American Schools of Oriental Research, 261, 25-50.

Barclay, G. (1958). Techniques of population analysis. New York: John Wiley.

Bass, W. (1995). Human osteology: A laboratory and field manual (4th ed.). Columbia: Missouri Archaeological Society.

Bennett, K. (1993). A field guide for human skeletal identification (2nd ed.). Springfield: Charles C. Thomas Publisher.

Betts, A. (1996). Tides of time: Settlement dynamics and the Jordanian badia. Paper presented at the annual meetings of the American Schools of Oriental Research. New Orleans, LA.

Binford, L. (1971). Mortuary practice: Their study and their potential. In J.A. Brown (Ed.), Approaches to the social dimensions of mortuary practice (pp. 6-29). Society for American Archaeology, Memoir 25.

Bisheh, G. (1972). A Cave Burial Tomb from Jabal Jofeh El-Sharqi in Amman. Annual of the Department of Antiquities of Jordan, XVII, 81-84.

Bisheh, G. (1973). Rock-cut Tombs at Rajib. Annual of the Department of Antiquities of Jordan, XVIII, 63-68.

Boraas, R., & Horn, S. (1973). Heshbon 1971: The second campaign at Tell Hesban. Berrien Springs: Andrews University Press.

Bourke, S. (1992). First preliminary report on the excavation and study of human remains. In Pella in Jordan 2 (pp. 215-226). Sydney: Mediterranean Archaeology Supplement 2.

Brashler, J. (1995). The 1994 Umm el-Jimal cemetery eExcavations: Areas AA and Z. The Annual of the Department of Antiquities of Jordan, 39, 457-468.

Brashler, J. (in press). Umm el-Jimal 1996: A report on monumental tomb excavation and tomb survey. Annual of the Department of Antiquities of Jordan.

Brooks, S., & Suchey, J.M. (1990). Skeletal age determination based on the os pubis: a comparison of the Acsadi-Nemeskeri and Suchey-Brooks methods. Human Evolution, 5(3), 227-238.

Brothwell, D.R. (1965). Digging up bones. Ithaca, New York: Cornell University Press.

Brown, J. (1995). On mortuary analysis - With special reference to the Saxe-Binford Research Program. In L. Beck (Ed.), Regional Approaches to Mortuary Analysis. (pp. 3-26). New York: Plenium Press.

Browne, C. (1992). Paleopathological survey of the human remains from Pella. In Pella in Jordan 2 (pp. 227-229). Sydney: Mediterranean Archaeology Supplement 2.

Cheyney, M. (1995). Umm el-Jimal 1993: A cist burial. The Annual of the Department of Antiquities of Jordan, 39, 447-455.

Cheyney, M. (in press) Umm el-Jimal 1996: Area Z. Annual of the Department of Antiquities of Jordan.

Clarke, G. (1979). The Roman Cemetery at Lankhills. Winchester Studies No. 3, Pre-Roman and Roman Winchester Part 2. Oxford: Claredon Press.

Cohen, M., & Bennet, S. (1993). Skeletal evidence for sex roles and gender hierarchies in prehistory. In B. Miller (Ed.), Sex and Gender Hierarchies (pp. 273-296). Cambridge: Cambridge University Press.

Collins, J. (1977a). Owslebury (Hants) and the problem of burials on rural settlements. In R. Reece (Ed.), Burial in the Roman World (pp. 26-34). CBA Research Report No.22. London: Council for British Archaeology.

Collins, J. (1977b). Pre-Roman burial rites in North-Western Europe. In R. Reece (Ed.), Burial in the Roman World (pp. 1-13). CBA Research Report No.22. London: Council for British Archaeology.

Conrad, L. (1981). The plague in the early medieval near east (Doctoral dissertation, Princeton University, Ann Arbor: MI). University Microfilms International.

Conrad, L. (1986). The plague in Bilad al-Sham in Pre-Islamic Times. In M.A. Bakhit & M. Asfour (Eds.), Proceedings of the Symposium on Bilad al-Sham. Amman: University of Jordan.

Damm, C. (1991). From burials to gender roles: Problems and potentials in post-processual archaeology. In D. Walde & N. Willows (Eds.), The Archaeology of Gender (pp. 130-134). Alberta: The University of Calgary Archaeological Association.

de Vries, B. (1981). The Umm el-Jimal Project, 1972-1977. Bulletin of the American Schools of Oriental Research, 244, 53-72.

de Vries, B. (1985). Urbanisation in the Basalt Region of North Jordan in Late Antiquity: The Case of Umm el-Jimal. In A. Hadidi (Ed.), Studies in the History and Archaeology of Jordan II (pp. 249-56). Amman: Department of Antiquities of Jordan.

de Vries, B. (1986). Umm el-Jimal in the First Three Centuries A.D. In P. Freeman & D. Kennedy (Eds.), The Defense of the Roman and Byzantine East (pp. 227-41). British Archaeological Reports, International Series 297. Oxford: B.A.R.

de Vries, B. (in press). Umm el-Jimal: A Nabataean, Roman, Byzantine and Early Islamic rural community in Northern Jordan. Vol. I.

Donion, D. (1993). Imbalance in the Sex Ratios in Collections of Australian Aboriginal Skeletal Remains. In H. du Cross & L. Smith (Eds.), Women in Archaeology: A Feminist Critique (pp. 98-104). Canberra: Department of Prehistory Publications.

Eisner, W. R. (1991). The Consequences of Gender Bias in Mortuary Analysis: A Case Study. In D. Walde & N. Willows (Eds.), The Archaeology of Gender (pp. 352-357). Alberta: The University of Calgary Archaeological Association.

Ellis, S., & Humphreys, J. (1988). Interpretation and analysis of the cemetery. In I. J. Humphreys (Ed.), The Circus and a Byzantine Cemetery at Carthage (pp. 325-336). Ann Arbor: The University of Michigan Press.

Engelstad, E. (1991). Feminist theory and post-processual archaeology.In In D. Walde & N. Willows (Eds.), The Archaeology of Gender (pp. 116-120). Alberta: The University of Calgary Archaeological Association.

Ery, K. (1969). Investigations on the demographic source value of tombstones originating from the Roman period. Alba Regia, 10, 51-67.

Frier, B. (1982). Roman life expectancy: Ulpian's evidence. Harvard Studies in Classical Philology, 86, 213-251.

Frolich, B. (1982). A Preliminary report on the human remains from Bahrain Island, excavated by the Arab expedition at Sar al-Jisr, Bahrain. Bahrain: Ministry of Information.

Frolich, B. (1986). The human skeletal series. In M. Ibrahim, (Ed.), A Cemetery at Queen Alia International Airport (pp. 50-56). Irbid: Yarmouk University Publications.

Frolich, B., & Ortner, D. (1982). Excavations of the Early Bronze Age Cemetery at Bab edh-Dhra, Jordan, 1981. Annual of the Department of Antiquities of Jordan, XXVI, 249-268.

Gath, J., & Rahmani, L. (1977). A Roman tomb at Manahat, Jerusalem. Israel Exploration Journal. 27, 209-214.

Gibson, G. (1928). The tragedy of St. Kilda. Caledonian Medical Journal, 50-62.

Glueck, N. (1942). Nabataean Syria. Bulletin of the American Schools of Oriental Research, 85, 3-8.

Graf, D. (1986). The Nabataeans and the Decapolis. In P. Freeman & D. Kennedy, (Eds.), The Defence of the Roman and Byzantine East (pp. 785-796). British Archaeological Reports (B.A.R.) International Series 297.

Graf, D. (1989). Rome and Sarecens: reassessing the nomadic menace. In T. Fahd (Ed.), L'arabie preislamique et son environment historique et culturel. Actes du Colloque de Strausbourg 24-27 juin 1987. Travaux du Centre de Recherche sur le Proche-Orient et la Grece antiques 10. (pp. 341-400). Leiden: Brill.

Greene, J. (1996). Desert warfare: The continuum of violence on the Nomadic fringe. Paper presented at the annual meetings of the American Schools of Oriental Research. New Orleans, LA.

Grinquist, H. (1947). Birth and childhood among the Arabs. Helsingfors: Soderstrom and Company.

Hachlili, R., & Smith, P. (1979). The genealogy of the Goliath family. Bulletin of the American Schools of Oriental Research, 235, 667-70.

Hadidi, A. (1979). A Roman family tomb at es-Salt. Annual of the Department of Antiquities of Jordan, XXIII, 129-138.

Hadidi, A. (1982). A Roman family tomb at Amman Citadel Hill. Annual of the Department of Antiquities of Jordan, XXVI, 283-288.

Haiman, M. (1995). Agriculture and Nomad State Relations in the Negev Desert in the Byzantine and Early Islamic Periods. Bulletin of the American Schools of Oriental Research, 297, 29-54.

Hamilton, R., & Husseini, S. (1934). Shaft tombs on the Nablus Road, Jerusalem. Quarterly of the Department of Antiquities of Palestine, IV, 170-174.

Harding, G. (1950). A Roman family vault on Jebel Jofeh, Amman.Quarterly of the Department of Antiquities of Palestine, XIV, 81-94.

Harding, G. (1951). A Roman tomb in Amman. Annual of the Department of Antiquities of Jordan, I, 30-33.

Hassan, F. (1973). On mechanisms of population growth during the Neolithic. Current Anthropology, 14 (15), 535-540.

Hassan, F. (1981). Demographic Archaeology. New York: Academic Press.

Hendrix, K. (1995). Preliminary investigations of the human skeletal remains from the Hippodrome at Jarash. Annual of the Department of Antiquities of Jordan, 39, 560-562.

Hershkovitz, I. (1981). The Neolithic population of the South Sinai and its relationship to other Mediterranean groups: An anthropological study. Unpublished master's thesis, Tel-Aviv University, Tel-Aviv.

Hershkovitz, I. (1984). The effect of mating type on growth and development of children in South Sinai Bedouin Isolates. Unpublished doctoral dissertation, Tel-Aviv University, Tel-Aviv.

Hershkovitz, I., Bar-Yosef, O., & Arensburg, B. (1994). Pre-pottery Neolithic populations of South Sinai and their relations to other circum-Mediterranean groups. Paleorient, 20(2), 59-84.

Hershkovitz, I., Kobylansky, E., & Arensburg, B. (1987). Neolithic populations of Southern Sinai, the Levant, Southern Europe and North Africa: Caniometric Mutivariate Analysis. In G. Gvirtzman, A. Shmueli, Y. Beit-Arieh, & M Har-el (Eds.), Sinai (Human Geography-Part II) (pp. 589-594). Tel-Aviv: Eretz, Ministry of Defence.

Hodder, I. (1982). Symbols in action: Ethnoarchaeological studies of material culture. Cambridge: Cambridge University Press.

Hodder, I. (1991). Gender representation and social reality. In D. Walde & N. Willows (Eds.), The Archaeology of Gender (pp. 11-16). Alberta: The University of Calgary Archaeological Association.

Humphreys, S.C. (1981). Introduction: Comparative perspectives on death. In S.C. Humphreys & H. King (Eds.), Mortality and Immortality: the anthropology and archaeology of death (pp. 1-13). London: Academic Press.

Ibrahim, M., & Gordon, R., (1986). A cemetery at Queen Alia International Airport. Irbid: Yarmouk University Publications.

Invison, E. (1996). Burial and urbanisation at Late Antique and Early Byzantine Corinth (c. AD 400-700). In N. Christie & S. Loseby (Eds.), Towns in Transition (pp. 99-158). Scolar Press.

Iscan, M.Y., Loth, S.R., & Wright, R.K. (1984). Age estimation from the ribs by phase analysis: White males. Journal of Forensic Sciences, 29, 1094-104.

Iscan, M.Y., Loth, S.R., & Wright, R.K. (1985). Age estimation from the rib by phase analysis: White females. Journal of Forensic Sciences, 30, 853-63.

James, E. (1989). Burial and status in the Early Medieval West. Transactions of the Royal Historical Society, 5th series (pp. 23-40).

Johnston, F. (1962). Growth of the long bones of infants and young children at Indian Knoll. American Journal of Physical Anthropology, 20(3), 249-254.

Keller, E. (1987). Feminism and science. In S. Harding & J.O'Barr (Eds.), Sex and Scientific Inquiry (pp. 233-246). Chicago: University of Chicago Press.

Kennedy, D. (1992). The Roman frontier in Arabia (Jordanian Sector). Journal of Roman Archaeology, 5, 473-89.

Kennedy, D. (in press) The Umm el-Jimal Area: Maps, Air Photographs, Surface Survey. In B. de Vries (Ed.) Umm el-Jimal: A Nabataean, Roman, Byzantine and Early Islamic Rural Community in Northern Jordan. Vol. I.

Kenyon, K. (1965). Excavations at Jericho. Volume II. London: British School of Archaeology in Jerusalem.

Kilgore, L., & Jurmain, R. (1988). Analysis of the Human Skeletal Remains. In I. J. Humphreys (Ed.), The Circus and a Byzantine Cemetery at Carthage (pp. 257-283). Ann Arbor: University of Michigan Press.

Kirk, T. (1993). Space, Subjectivity, Power and Hegemony: Megaliths and Long Mounds in Earlier Neolithic Brittany. In C. Tilley (Ed.) Interpretative Archaeology (pp. 181-123). Providence: Berg.

Lenzen, C. (1993). The desert and the sown: An introduction to the archaeological and historiographic challenge. Paper presented at the Annual Meetings of the American Schools of Oriental Research. Bulletin of the American Schools of Oriental Research, forthcoming.

Lenzen, C. (1996). Ethnicity: Beit ras/capitolias and Umm el-Jimal. Paper presented at the annual meetings of the American Schools of Oriental Research. New Orleans, LA.

Lenzen, C. (Manuscript in preparation) The Umm el-Jimal Pottery 1981-1984; 1993-1998. Volume 2.

Littmann, E. (1913). Greek and Latin Inscriptions. In Syria. Publications of The Princeton University Archaeological Expedition to Syria, Div. IV, Sect. A, Part 3, Umm Idj-Djimal. Leyden: Brill.

Macdonald, M. (1993). Nomads and the Hawran in the late Hellenistic and Roman periods: A reassessment of the epigraphic evidence. Syria, 70, 303-413.

McNicoll, A.W., Edwards, P.C., Hanbury-Edwards, J., Hennessy, J.B., Potts, T.F., Smith, R.H., Wamsley, A., & Watson, P. (1992). Pella in Jordan 2. Sydney: Mediterranean Archaeology Supplement 2.

Molleson, T. (1981). The archaeology and anthropology of death: What the bones tell us. In S. Humphreys & H. King (Eds.) Mortality and Immortality: the anthropology and archaeology of death (pp. 15-32). London: Academic Press.

Nabulsi, A. (1996). The Byzantine Cemetery at Khirbat as-Samra: Preliminary human osteological analysis. Annual of the Department of Antiquities of Jordan, XL, 315-321.

Ortner, D. (1981). A preliminary report on the human remains from Bab edh-Dhra Cemetery, 1977. Annual of the American Schools of Oriental Research, XLVI, 119-132.

Ortner, D., & Putschar, W. (1981). Identification of pathological conditions in human skeletal remains. Washington DC: Smithsonian Institute Press.

Owsley, D., & Bass, W. (1979). A demographic analysis of skeletons from Larson Site (39WW2) Walworth County, South Dakota: Vital statistics. American Journal of Physical Anthropology, 51, 145-154.

Parker, S.T. (1987). Peasants, pastoralists and the Pax Romana: A different view. Bulletin of the American Schools of Oriental Research, 265, 35-51.

Parker, S.T. (in press). The town defences. In B. de Vries (Ed.), Umm el-Jimal: A Nabataean, Roman, Byzantine and Early Islamic Rural Community in Northern Jordan. Vol. I.

Patrik, L. (1985). Is there an archaeological record? In M. Schiffer (Ed.), Advances in Method and Theory, vol. 8. (pp. 27-62). Academic Press.

PES II Division II: Butler 1908, 1913a, 1913b, 1921. Publications of the Princeton University Archaeological Expeditions to Syria in 1904 and 1909.

Phenice, T. (1969). A newly developed visual method of sexing the Os pubis. American Journal of Physical Anthropology, 30, 297-302.

Pollock, S. (1994). Women in a men's world: Images of Sumerian Women. In J. M. Gero and M. W. Conkey (Eds.), Engendering archaeology: Women and prehistory (pp. 132-159). Oxford: Blackwell Publishers.

Rahmani, Y. (1960). Roman tombs in Shmuel ha-Navi Street, Jerusalem. Israel Exploration Journal, 10, 140-148.

Rahmani, Y. (1976). Roman tombs in Hahal Raqafot, Jerusalem. 'Antiqot (English Series) XI, 77-88.

Redfield, A. (1970). A new aid to aging immature skeletons: Development of the occipital bone. American Journal of Physical Anthropology, 33, 207-220.

Reisner, G., Fisher, C., & Lyon, D. (1924). Excavations at Samaria I. Cambridge: Harvard University Press.

Rowell, E. (1931). A rock-cut tomb at Nazareth. Quarterly of the Department of Antiquities of Palestine, I, 53.

Saunders, S. (1992). Subadult skeletons and growth related studies. In S. Saunders & A. Katzenberg (Eds.), Skeletal Biology of Past Peoples: Research Methods (pp. 1-20). New York: Wiley-Liss, Inc.

Saxe, A. (1970). Social Dimensions of Mortuary Analysis. Unpublished doctoral dissertation. University of Michigan, Ann Arbor, MI.

Schwartz, J. (1996). Skeleton keys: An introduction to human skeletal morphology, development, and analysis. New York: Oxford

Shah, M. (1997). Interpreting diet by age, status, and gender and establishing weaning patterns using trace element analysis on human remains from Umm el-Jimal, Jordan. Unpublished Master's Thesis. Western Michigan University, Kalamazoo, MI.

Shanks, M., & Tilley, C. (1982). Ideology, symbolic power and ritual communication: A reinterpretation of Neolithic mortuary practices. In I. Hodder (Ed.), Symbolic and Structural Archaeology (pp. 129-154). Cambridge: Cambridge University Press.

Sieff, D. (1990). Explaining biased sex ratios in human populations. Current Anthropology, 31 (1), 25-35.

Sillen, A., & Smith, P. (1984). Weaning patterns are reflected in strontium-calcium ratios of juvenile skeletons. Journal of Archaeological Science, 11, 237-245.

Smith, P. (1972). Diet and attrition in the Nutufians. American Journal of Physical Anthropology, 37, 233-238.

Smith, P. (1984). Patterns of molar wear in Hunter-Gatherers and agriculturalists. American Journal of Physical Anthropology, 63, 39-56.

Stewart, T. (1979). Essentials of forensic anthropology: Especially as developed in the United States. Springfield: Charles C. Thomas.

Stirling, J. (1976). Areas E, F, and G10. In Heshbon 1974. Berrien Springs: Andrews University Press.

Stirling, J. (1978). The human skeletal remains from Hesban's cemeteries. In Heshbon 1976. Berrien Springs: Andrews University Press.

Swedlund, A., & Wade, W. (1972). Laboratory methods in physical anthropology. Prescott: Prescott College Press.

Thomas, J. (1993). The Hermeneutics of Megalithic Space. In C. Tilley (Ed.), Interpretative Archaeology (pp. 73-181). Providence: Berg.

Toynbee, J. (1971). Death and burial in the Roman world. Ithaca: Cornell University Press.

Trotter, M., & Gleser, G.C. (1952). Estimation of stature from long bones of American whites and Negroes. American Journal of Physical Anthropology, 10, 463-514.

Trotter, M., & Gleser, G.C. (1958). A re-evaluation of estimation based on measurements of stature taken during life and long bones after death. American Journal of Physical Anthropology, 16, 79-123.

Tushingham, A.D. (1972). Excavations at Dhiban in Moab. In Philip J. King (Ed.) The Annual of the American Schools of Oriental Research. vol. XL. London: William Clowes and Sons, Limited.

Tzaferis, V. (1969). Tombs in Western Galilee. Ati kot. Sidrah Irvit. 5, 72-75.

Ubelaker, D.H. (1978). Human skeletal remains: Excavation, analysis, interpretation. Chicago: Aldine.

UJ84. Unpublished field notes. L. de Veaux, supervisor.

UJ94. Unpublished field notes. J. Brashler, supervisor.

Villeneuve, F. (1985). L'economie rurale et la vie des campagnes dans le Hauran Antique. In J.M. Dentzer (Ed.), Hauran I, Premiere Partie (pp. 64-136). Paris: Libraire orientaliste Paul Geuthner.

Waterhouse, S. (1973). Areas E and F. In Heshbon 1971. Berrien Springs: Andrews University Press.

Weaver, D. S. (1979). Application of the likelihood ratio test to age estimation using the infant and child temporal bone. American Journal of Physical Anthropology, 50, 263-270.

Weiss, K. (1972). On the systematic bias in skeletal sampling. American Journal of Physical Anthropology, 37, 239-249.

Whelan, M. (1991a). Gender and Archaeology: Mortuary Studies and the Search for the Origins of Gender Differentiation. In D. Walde & N. Wollows (Eds.), The Archaeology of Gender (pp. 358-365). Alberta: The University of Calgary Archaeological Association.

Whelan, M. (1991b). Gender and historical archaeology: Eastern Dakota patterns in the 19th Century. Historical Archaeology, 25(4), 17-32.

Winnett, F., & Reed, W. (1964). Dhiban Excavation Reports for 1957-1958. The Annual of the American Schools of Oriental Research Vols. XXXVI - XXXVII. Baltimore: The J.H. Furst . R. Co.

Zayadine, F. (1982). Recent excavations at Petra (1979-81). Annual of the Department of Antiquities of Jordan, XXVI, 365-393.