MOCHLOS IIC

Period IV. The Mycenaean Settlement and Cemetery

The Human Remains and Other Finds

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Necklaces from the Limenaria cemetery (from top to bottom): numbers 6, 4, 1, and 7. Plakalona Necklace at bottom. Watercolor by D. Faulmann.

PREHISTORY MONOGRAPHS 32

Mochlos IIC

Period IV. The Mycenaean Settlement and Cemetery
The Human Remains and Other Finds

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by

Jeffrey S. Soles, Joanna Bending, Thomas M. Brogan, Kelly Caldwell, Tristan Carter, Alessandra Giumlia-Mair, Katerina Kopaka, Dimitra Mylona, Ann Nicgorski, Maria Ntinou, David S. Reese, George Rethemiotakis, R. Angus K. Smith, Sarah L. Smith, Mary Ellen Soles, Sevi Triantaphyllou, and Polly Westlake

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Table of Contents

List of Tables in the Text

List of Illustrations in the Text

List of Figures

55. Obsidian from House H: blade from the *plein débitage* (**IIC.663**) and tertiary flake (**IIC.511**); obsidian from House Θ: core (**IIC.440**), blade from the *plein débitage* (**IIC.642**), and secondary flake (**IIC.475**); obsidian from House I: blades from the *plein débitage* (**IIC.677**, **IIC.678**) and secondary flake (**IIC.474**). Scale 1:1.

56. Obsidian from House K: primary series blade (**IIC.622**), blade of initiation (**IIC.611**), blades from the *plein débitage* (**IIC.657–IIC.660**, **IIC.662**, **IIC.665**, **IIC.666**), rejuvenation piece (**IIC.732**), and tertiary flake (**IIC.512**). Scale 1:1.

57. Obsidian from House M: blade of initiation (**IIC.612**), primary series blade (**IIC.627**), blades from the *plein débitage* (**IIC.669–IIC.671**, **IIC.673–IIC.676**), rejuvenation flake (**IIC.737**), tertiary flake (**IIC.513**), and secondary flakes (**IIC.472**, **IIC.473**). Scale 1:1.

58. Fragmentary stone vases from the LM III settlement (**IIC.746**, **IIC.748–IIC.751**, **IIC.753**, **IC.755**, **IIC.757**, **IIC.762**, **IIC.764**). Scale 1:3 unless otherwise indicated.

59. Stone lamps from the LM III settlement: (**IIC.767**, **IIC.769**). Scale 1:2.

60. Stone lids from the LM III settlement: (**IIC.770–IIC.778**). Scale 1:2.

List of Plates

16. Necklaces 1, 7, 8, and 9 (**IIC.30**/**IIC.49**, **IIC.33**/**IIC.42**, **IIC.45**, **IIC.36**) from Limenaria Tombs 10, 16, and 31.

17. Necklaces 4–6 (**IIC.33.1**, **IIC.32**, **IIC.33.4**/**IIC.33.5**) from Limenaria Tomb 16.

18. Rings (**IIC.63**, **IIC.65–IIC.67**, **IIC.69**, **IIC.72**, **IIC.73**); pins (**IIC.83**, **IIC.85**, **IIC.86**, **IIC.88–IIC.90**); bracelets/armlets (**IIC.91–IIC.93**).

19. Knives (**IIC.94–IIC.102**).

20. Chisels (**IIC.103–IIC.106**); cleavers or razors (**IIC.107**, **IIC.108**); fish hook (**IIC.109**); spinning needle (**IIC.110**).

21. Bowl (**IIC.111**); mirror/lid (**IIC.112**).

22. Lead objects (**IIC.117**, **IIC.119**, **IIC.120**).

23. Loomweights (**IIC.124**, **IIC.130**, **IIC.136**, **IIC.139**, **IIC.161**, **IIC.172**, **IIC.177**, **IIC.179**, **IIC.183**, **IIC.184**, **IIC.187**); spindle whorl (**IIC.189**).

24. Miscellaneous clay and bone objects: drains (**IIC.192–IIC.195**); lamps (**IIC.196**, **IIC.198**); crucible (**IIC.201**); potter's wheel (**IIC.203**); spit rest (**IIC.200**); nozzle (**IIC.202**); waster (**IIC.204**); bath tub (**IIC.205**); bone etui (**IIC.210**).

25. Seal stones (**IIC.213–IIC.216**).

26. Shells (**IIC.218**, **IIC.221–IIC.224**, **IIC.226**).

27. Double axe stand/mortar (**IIC.227**).

28. Type 1 stone implements with pecked or battered ends (**IIC.230**, **IIC.232**, **IIC.257**, **IIC.258**, **IIC.260**, **IIC.261**).

29. Type 2 stone implements with pecked circumferences and one or two abraded faces (**IIC.263**, **IIC.267**, **IIC.272**, **IIC.275**, **IIC.278**, **IIC.283**, **IIC.288**).

30. Type 4 handstones (**IIC.315**, **IIC.317**, **IIC.324**); Type 5 implement with heavy abrasive use-wear (**IIC.347**); Type 6 sub-cuboid cobbles with abrasive wear (**IIC.349**, **IIC.350**); Type 8 irregularly shaped implement with light abrasive use-wear (**IIC.355**); Type 9 elongated cobbles and pebbles with areas of light abrasion (**IIC.357–IIC.359**).

31. Type 10 differentially weathered cobbles (**IIC.368**, **IIC.370**); Type 11 drill-guides (**IIC.373**, **IIC.375**); Type 14 saddle querns (**IIC.377**, **IIC.382**); Type 19a mortar (**IIC.401**); Type 27 pivot-stone (**IIC.437**).

32. Type 16 whetstone (**IIC.399**); Type 21 balance weights (**IIC.406–IIC.408**); Type 22 biconically perforated weights (**IIC.409**, **IIC.414**, **IIC.416–IIC.418**); Type 24 loomweights (**IIC.423**, **IIC.424**); Type 25 naturally perforated weights (**IIC.427–IIC.429**); Type 29 axe (**IIC.438**).

33. Faience Bead (**IIC.30**) shows an altered surface, covered by calcareous incrustations. Gold bead (**IIC.49**): front side with rosy pink patina. Detail A: the bead was cast with a core showing the opening from which part of the core was removed (not to scale). Detail B: microscopic detail of the unpatinated side; the dark area around the hole is due to the annealing process (not to scale). Stone vases (**IIC.755**, **IIC.767**, **IIC.769–IIC.771**, **IIC.773–IIC.777**, **IIC.779**).

34A. Cluster of painted plaster fragments in soil (**IIC.780**, PL 4a), as lifted during excavation of House A.

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Jeffrey S. Soles
Costis Davaras

Abbreviations

The following abbreviations are used in this volume:

AMS	accelerator mass spectrometer
AQ	Artisans' Quarter
approx.	approximate
Cal	calibrated
CC	calcium carbonate
cf.	compare with
CF	Coarse Ware fabric
CS	chipped stone
d.	diameter
dims.	dimensions
EDS	energy dispersive spectroscopy
EM	Early Minoan
Eo	life expectancy
est.	estimated
ext.	exterior
F	female or fused
FF	Fine Buff fabric
FM	Furumark motif
FTIR	Fourier Transform Infrared Spectroscopy
g	gram
GS	ground stone
h.	height
HM	Herakleion Museum
IMS-FORTH	Institute for Mediterranean Studies–Foundation for Research and Technology-Hellas
int.	interior
L.	length
LB	Late Bronze (Age)
LC	Late Cycladic
Le	left

LH	Late Helladic
LIBS	Laser-Induced Breakdown Spectroscopy
LM	Late Minoan
LRS	longitudinal radial section
LTS	longitudinal tangential section
M	male or mature
MM	Middle Minoan
m	meter
max.	maximum
min.	minimum
mm	millimeter
µm	micrometer
MNI	minimum number of individuals
NAA	neutron activation analysis
NISP	number of identifiable specimens
nm	nanometer
O	old
pers. comm.	personal communication
pers. obs.	personal observation
P	prime
Ph.	Phase
PL	plaster
PLM	polarized-light microscopy
pres.	preserved
R	right
RH	relative humidity
RL	render layers
sp.	species level identification
T	temperature
th.	thickness
TNR	total number of remains
TS	transverse section
UF	unfused
UV	ultraviolet
vert.	vertebra(e)
w.	width
XRD	X-ray diffraction
XRF	X-ray fluorescence
Y	young
yrs.	years

Introduction

Jeffrey S. Soles

Mochlos IIC is the third and final part of the second volume in the Mochlos Publication Series. Volume II overall is concerned with Mochlos in the Mycenaean era, or the LM II and LM III remains uncovered by the Greek-American excavations in the summers of 1989–1994 and 2004–2005. In *Mochlos* IIA (Soles 2008) the contributors present descriptions of the two main sites of the Mycenaean community, including the stratigraphy and architecture of the settlement, the tombs in the Limenaria cemetery, and a list of all finds placed in their respective contexts. Soles also offers general conclusions about the nature of life and death at Mochlos in this period. The organization of the Mochlos volumes is premised on the belief that finds have meaning only in context. For this reason, all finds are listed in *Mochlos* IIA in their contexts, and the main conclusions about Mycenaean Mochlos are located there. There is only limited space in volume IIA for the description of these finds, however, and subsequent parts of the volume are designed to present more detailed information about these finds. Therefore, the LM II and LM III pottery finds from the settlement and cemetery, along with the earlier and later pottery found in these contexts and a petrographic analysis of LM III ceramics, are published in *Mochlos* IIB (Smith 2010). In *Mochlos* IIC, the authors present additional information on the skeletal material, small finds, and ecofactual material from LM III settlement and cemetery contexts.

In Chapter 1 Triantaphyllou completes the study of the human skeletal remains from the Limenaria cemetery that are itemized after the description of each tomb in *Mochlos* IIA (Soles and Triantaphyllou 2008, 135–184). The chapter provides an overall picture of the physical attributes of the LM III population, particularly the sex, age at death, and stature of individuals, as well as aspects of their health, including the evidence for disease, deformity, cause of death, and nutrition or malnutrition. This examination of the skeletal material reveals a great deal about the lives of the LM III inhabitants and complements the information that the artifactual and ecofactual evidence provides.

In Chapters 2, 3, and 4, the authors discuss the various types of artifacts recovered from the excavation. Chapter 2 is concerned with the burial containers from the Limenaria cemetery. The different types of containers reflect social ranking in the population, and the painted scenes on the sarcophagi, like those on the large pyxides, depict popular beliefs about the afterlife that show a remarkable resemblance to later Homeric beliefs, as previously noted in *Mochlos* IIA (Soles 2008, 196–197). Chapter 3 contains the catalog of jewelry and other small finds that were inventoried from the excavation. Most of these finds are organized by material categories, including copper, bronze, lead, clay, bone, shell, and stone. Each of these material categories includes several different kinds of objects. The jewelry is cataloged and discussed separately since it forms a discrete group, even though it is made from many different materials. All of these objects reveal something about life in LM III Mochlos, although some reveal more than others. Chapter 4 presents the catalog of ground and chipped stone implements collected from the LM III levels, along with the identification of the sources of the raw materials that were used to make these implements and a description of the uses to which they were put.

In Chapter 5 the authors discuss the faunal assemblage, including mammal, shell, and fish remains, and the floral finds, including wood charcoal and seeds. Like the human skeletal remains and small finds, these organic materials are also detailed in context in the lists that follow each room description in *Mochlos* IIA. Of all the finds from the LM III levels, the organic remains are probably the most likely to be compromised by earlier and sometimes later occupation on the site. It is possible to distinguish a LM I sherd from a LM III sherd lying in a LM III level, but it is not possible to distinguish LM I mammal remains from LM III remains lying in a LM III level. LM I deposits lay below virtually every LM III level, and the potential for material to have been kicked up from below is considerable. Some of the organic remains must derive from the LM III period, however, and they provide some indication of the types of food that the LM III population consumed.

In Chapter 6, which concludes the main text of the volume, Brogan and Smith examine Mochlos's position in its wider region. This position is likely to have changed during the course of the Mycenaean occupation as a result of the destruction of the palace at Knossos. Originally dependent on Knossos, Mochlos was freed of this dependency when the palace and the polity it controlled came to an end (Soles 2008, 201–205).

The volume ends with five appendices. In Appendix A, Soles publishes three radiocarbon dates from LM III deposits in the settlement that supplement one already published from the Artisans' Quarter Cemetery in *Mochlos* IC (Soles 2004a, 145–146). Each comes from a well-stratified level associated with cataloged LM III pottery, including two from the floor deposit of a house and one from the floor deposit of an exterior space, but only one is from a short-lived sample. In Appendix B, Alessandra Giumlia-Mair discusses the findings from her XRF analysis of necklace no. 1 from Tomb 10 in the Limenaria cemetery. In Appendix C, Carter presents the stone vase remains found in LM III contexts. In Appendix D, Westlake discusses the painted plaster found in House A, and in Appendix E, Caldwell and Smith consider the pumice collected from LM III levels. The stone vases are LM I in origin, although some of them may have been reused, and the plaster may also be a LM I survival, although it lay on a LM III floor next to a wall.

The present work, like *Mochlos* IIB, contains important documentation for the general conclusions reached in *Mochlos* IIA. The authors describe the actual physical remains of the LM III inhabitants, the foods they consumed, and the activities in which they engaged through an examination of lines of evidence that are sometimes also important sources of cognitive information. The pottery vessels the inhabitants chose and the way they used those vessels, the different burial containers they selected and the scenes they painted on those containers, and the various personal possessions and tools they used provide insights into who the inhabitants were, how they thought, and sometimes even what they thought.

1

The Human Remains

Sevi Triantaphyllou

Relatively little work has been done on prehistoric skeletal assemblages from Crete, even though a large number of tombs have been excavated on the island. A few earlier publications have been concerned with material from the Early Minoan (EM) and Middle Minoan (MM) periods (Arnott 2003 on EM I–MM II Pseira; Becker 1975 on MM I Pezoules Kephala and Kato Zakro; Carr 1960 on MM III Knossos; Triantaphyllou 2005 on the EM III/MM I Tholos Γ at Archanes). Skeletal remains from Late Minoan (LM III) Chania have been examined systematicly by Hallager and McGeorge (1992) and those from the LM III Artisans' Quarter cemetery at Mochlos by Soles and Walker (2003). In addition, there are a number of studies discussing the Minoan skeletal assemblages with regard to special issues of physical anthropology such as the stature or the mean life expectancy of the Minoans (McGeorge 1988, 1990), Bronze Age demography in Crete and the Greek mainland (Halstead 1977), and bioarchaeological evidence for the role of the traditional Mediterranean diet in the development of Minoan Crete (Riley 1999). With these exceptions, however, there have been remarkably few studies at the population level based on systematic recording of the skeletal material using modern methodological standards (Buikstra and Ubelaker, eds., 1994) and recently developed theoretical approaches of biological anthropology (Larsen 1997).

The human remains of the LM III population at Mochlos come from two different cemeteries. A small group of burials, preserving the remains of eight individuals, was located above the ruined debris of the old LM IB Artisans' Quarter in a cemetery described by the excavators as a "veritable potter's field" (Soles 2003, xviii). Each of these burials, which are thought to have belonged to a single family unit, is published in *Mochlos* IA (see Soles and Walker 2003, 135–145). A larger group of burials, preserving remains of 32 individuals, was located on the Limenaria hill just to the south of the Artisans' Quarter cemetery overlooking the Limenaria bay to the west. This was the principal cemetery of the LM III settlement, and it contained LM IIIA and LM IIIB burials of both the elite and the general population. Each of these burials is described in its context in *Mochlos* IIA (see Soles and Triantaphyllou 2008) where the skeletal remains are inventoried individually, and their preservation is described. The methodology of the study, including the criteria for determining the sex of the skeletal remains, age at death, stature, pathologies, and indicators of muscle attachments and enthesopathies (skeleto-muscular markers), is also presented by Soles and Triantaphyllou (2008). A more general discussion of the skeletal remains from the Limenaria cemetery is provided here.

Treatment of the Deceased

Information concerning the minimum number of individuals in each tomb, their recovery location during excavation, sex, age, and pathologies is summarized in Table 1.1. As noted in the discussion in *Mochlos* IIA (Soles and Triantaphyllou 2008, 133), about one-third of the excavated tombs gave no evidence of human skeletal remains due to factors relating to environmental conditions, burial practices, or recovery biases. The remaining 20 tombs yielded a total of 32 individuals. Three of these (Tombs 1, 2, and 3) preserved only some part of the skeletons originally placed in the tombs. Of the remaining 17 tombs in which all of the original burials were represented at least in part, 11 (65%) contained single burials, five (29%) contained burials of two people (Tombs 10, 11, 17, 23, 29), and two contained more numerous burials, with four in Tomb 19 (where there were two pithoi, or, in effect, two tombs) and five in Tomb 13.

Tomb and Skeleton	Locus	Preservation	Sex	Age[1]	Pathologies
1.1	?	Cranial skeleton	F?	Old adult	Osteoarthritis
2.1	Sarcophagus **IIC.2**	Cranial and post-cranial skeleton	F?	Old adult	Osteoarthritis, Schmorl's nodes, non-specific infection, dental disease
3.1	Pithos	Cranial skeleton		Infant	
10.1	Locus 3 (Sarcophagus **IIC.5**)	Cranial and post-cranial skeleton	M	Mature adult	Osteoarthritis, Schmorl's nodes, non-specific infection, tumour, trauma, metabolic disease, dental disease
10.2	Locus 3 (Sarcophagus **IIC.5**)	Cranial and post-cranial skeleton	F	Prime adult	Schmorl's nodes, osteochondritis dissecans, dental disease
11.1	Loci 3 and 4	Cranial and post-cranial skeleton	?	Juvenile?	
11.2	Loci 2, 3 and 4	Cranial and post-cranial skeleton	F?	Prime adult	
13.1	Loci 2 and 3	Cranial and post-cranial skeleton	M	Prime adult	
13.2	Locus 4	Cranial and post-cranial skeleton	F	Mature adult	Metabolic disease, dental disease
13.3	Pyxis IIB.798	Cranial and post-cranial skeleton	F?	Young adult	Osteoarthritis, dental disease
13.4	Loci 2, 3 and 4	Cranial and post-cranial skeleton	F	Young adult	Osteoarthritis, metabolic disease, dental disease
13.5	Loci 3 and 4	Cranial skeleton	?	Juvenile?	Metabolic disease, dental disease
15.1	Locus 3 (Sarcophagus **IIC.8**)	Cranial and post-cranial skeleton	M?	Mature adult	Osteoarthritis, non-specific infection, trauma, metabolic disease

Table 1.1. Summary of the LM III skeletal material from Mochlos. [1]Neonate: birth to 1 year; infant: 1–6 years; child: 6–12 years; juvenile: 12–18 years; young adult: 18–30 years; prime adult: 30–40 years; mature adult: 40–50 years; old adult: 50+ years.

Tomb and Skeleton	Locus	Preservation	Sex	Age[1]	Pathologies
16.1	Locus 3 (Pithos **IIC.16**)	Cranial and post-cranial skeleton	F?	Young adult	Dental disease
17.1	Locus 1	Post-cranial skeleton	M?	Adult	Trauma
17.2	Locus 2 (Pithos **IIC.17**)	Cranial and post-cranial skeleton	F?	Prime adult	Trauma, dental disease
19.1	Locus 2 (Pithos **IIC.19**)	Cranial and post-cranial skeleton	M?	Prime adult	Osteoarthritis, deformity, dental disease
19.2	Locus 3	Cranial and post-cranial skeleton	M?	Prime adult	Metabolic disease, dental disease
19.3	Locus 3	Cranial and post-cranial skeleton	M?	Adult	
19.4	Locus 4 (Pithos **IIC.20**)	Cranial and post-cranial skeleton	?	Juvenile	Dental disease
20.1	Locus 3 (Pithos **IIC.21**)	Cranial and post-cranial skeleton	?	Young adult	
21.1	Loci 1 and 2	Cranial and post-cranial skeleton	?	Young adult	
23.1	Locus 2 (Pithos **IIC.23**)	Cranial and post-cranial skeleton	?	Juvenile	
23.2	Locus 2 (Pithos **IIC.23**)	Post-cranial skeleton	?	Infant	
24.1	Locus 2 (Pithos **IIC.24**)	Cranial and post-cranial skeleton	M	Young adult	Osteoarthritis, non-specific infection, metabolic disease
26.1	Locus 2 (Pithos **IIC.26**)	Cranial and post-cranial skeleton	M	Prime adult	
27.1	Locus 4 (Pithos **IIC.27**)	Cranial and post-cranial skeleton	?	Adult	
28.1	Locus 3 (Pithos **IIC.28**)	Cranial and post-cranial skeleton	F?	Prime adult	Dental disease
29.1	Locus 1 (chamber)	Cranial and post-cranial skeleton	F?	Adult	
29.2	Locus 1 (chamber)	Cranial and post-cranial skeleton	M?	Adult	
30.1	Locus 3 (Sarcophagus **IIC.9**)	Cranial and post-cranial skeleton	M	Mature adult	Osteoarthritis
31.1	Loci 2 and 3	Cranial and post-cranial skeleton	F?	Adult	

Table 1.1, cont. Summary of the LM III skeletal material from Mochlos. [1]Neonate: birth to 1 year; infant: 1–6 years; child: 6–12 years; juvenile: 12–18 years; young adult: 18–30 years; prime adult: 30–40 years; mature adult: 40–50 years; old adult: 50+ years.

The total numbers provided here follow the estimations of the osteological analysis only. Excavation reports raise the number of the tombs with single burials to 20 out of 31, the number with two burials to six out of 31, and the number with three or more burials to three out of 31, including the cases where skeletal remains were recorded during excavation but not saved (Soles 2008, table 1). Also, among the collective tombs, three cases (Tombs 10, 13, 19) produced commingled human remains in the deposit fill, i.e., skeletal segments that could not be associated with certain individuals.

There was a clear preference for individual burial, which, with the exception of juveniles, cut across age and sex differences. Juveniles were always associated with another burial; they were never found alone, although infants were buried singly in some instances (Soles and Walker 2003). While there was a tendency for tombs with two burials to have been used for male/female couples (Tombs 10, 17, 29), this was not always the case. The two burials found in Tomb 11 were a juvenile and a possible female, the two in Tomb 23 were a juvenile and an infant. The collective tombs (13 and 19, with five and four burials, respectively) may have been used over an extended period by family groups; they display a notable lack, however, of age groups below 12 years old.

The successive reuse of the collective tombs resulted in a significant disturbance of the skeletal remains. The matching of skeletal fragments from different areas of the tombs in the course of the osteological analysis substantiates the conclusion that all skeletons were initially placed in the burial containers, either sarcophagi or pithoi, as primary burials. At a secondary stage, the skeletal remains of the primary burial were often removed as a pile of disarticulated bone material and placed outside the burial container on the floor of the chamber. This seems to have been done without any particular care since fragments of the initial skeleton were often found within the burial vessel. Only in Tomb 10 did the two burials remain inside the sarcophagus (Soles and Triantaphyllou 2008, 144–148).

Occasionally it has been possible to deduce the order of burial through osteological analysis. In the case of Tomb 10, the female seems to have been the last burial, in view of the better state of her skeletal preservation. This order of burial is also confirmed by the location of finds in the tomb. The female was the younger of the two burials at the time of death. In other cases it has also been possible to deduce the order of burial by the disposition of the bones in the tomb. In Tomb 17, for example, the female must have been the last burial since her remains were still located inside the pithos, while the earlier male burial had been moved outside the pithos (Soles and Triantaphyllou 2008, 162–164). In this case the female was the older of the two at the time of death and also the last to be buried. In the earlier of the two pithos burials in Tomb 19, the youngest individual was the last burial placed in the pithos, while two earlier male burials lay outside (Soles and Triantaphyllou 2008, 166–169). In Tomb 13 the last burial in the tomb, still located in the sarcophagus, was male. At least three female individuals, two younger and one older than the male, appear to have predeceased him (Soles and Triantaphyllou 2008, 152–157). Clearly neither age nor sex determined the order of burial.

The disturbances that took place inside the tomb did not result solely from continuous reuse and reopening of the tombs by later users. The removal of bone material also occurred as a result of severe rodent interference, as indicated in two cases (Tombs 11, 13) where bone fragments from the last burials that remained in the sarcophagi were found in the outside fill deposit.

Bone representation from the skeletal material recovered outside the main burial containers in Tombs 11, 17, and 19 is consistent with the preferential collection of skulls and long bones (Ill. 1.1). The users of Tomb 13, however, showed a particular concern for a more intensive collection of the remains of earlier burials. The repetitive presence of small and flat bones from the hands, feet, and scapulae, which had escaped the attention of the later users of Tombs 11, 17 and 19, may indeed indicate a special, differential treatment of the dead by the owners of Tomb 13. This interpretation is supported by the use of a pyxis as a burial container for a secondary burial. Significantly, some of the bones of the pyxis burial show gnaw marks, possibly from rodents (Soles and Triantaphyllou 2008, pls. 26B, 52A–C). Rodents often chew on bones to keep their incisors sharp or even to obtain supplementary calcium in their diet (Byers 2002, 363). The condition of the bones would suggest that they were exposed on the floor of the chamber for a long time, i.e., until the flesh had completely decomposed, before they were carefully placed inside the pyxis.

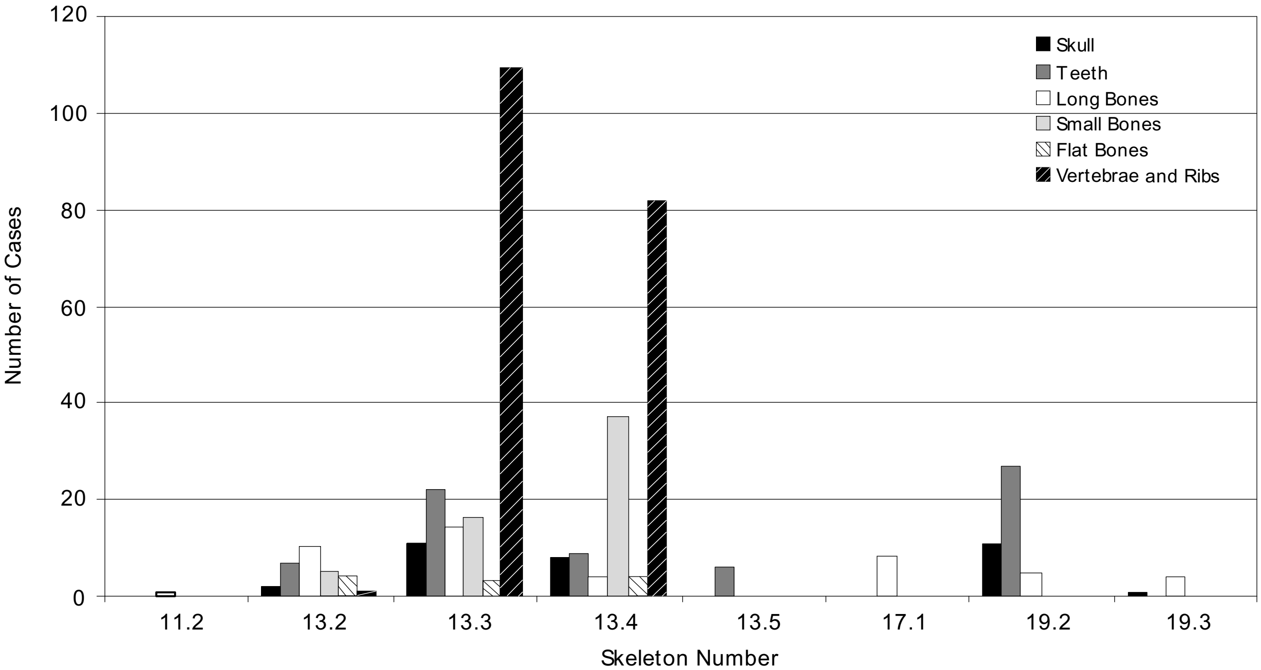

Illustration 1.1. Approximate bone representation of secondary burials in Tombs 11, 13, 17, and 19.

Paleodemography

Of the 32 burials 12 were female or likely to have been female, while 11 were male or likely to have been male. Two burials were identified as infants, four as juveniles or possible juveniles, six as young adults, eight as prime adults, four as mature adults, and two as old adults. Due to severe preservation problems that affected the relevant anatomical indicators, sex could not be identified in seven adult or juvenile individuals on the basis of the osteological analysis alone (Skeletons 11.1, 13.5, 19.4, 20.1, 21.1, 23.1, 27.1). Similarly, the age groups of six adults (Skeletons 17.1, 19.3, 27.1, 29.1, 29.2, 31.1) could not be defined specifically. It was possible, however, on the basis of the finds in the tombs to identify the likely sex of one additional female (Skeleton 19.4), a juvenile, and one additional male (Skeleton 21.1), a young adult (Soles 2008, 191–192, table 1).

With regard to the demographic picture of the Mochlos Limenaria cemetery (Ill. 1.2; Table 1.2), four issues are worth discussing:

1. Neonates and children are notably absent, and there is a significant underrepresentation of infants (numbering only two out of 32 burials). According to the U-shaped model mortality curve of the West series table, which is based on a life expectancy at birth of thirty (Eo=30), neonates would have a high mortality rate that would decrease sharply during childhood and juvenility (Coale and Demeny 1983, 44). The mortality profile represented as a superimposed line on the bar graph (Ill. 1.2) was calculated from a model life table, the West series, and is used in the population case study for comparative reasons only. The most

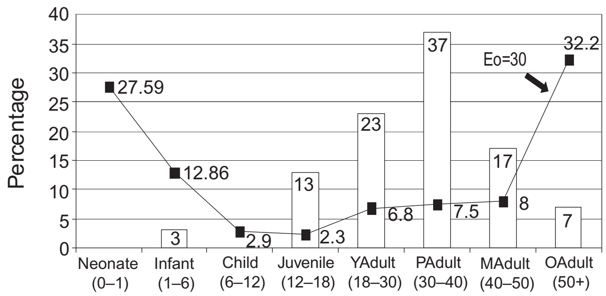

Illustration 1.2. Mortality profiles in LM III Mochlos. YAdult = young adult, PAdult = prime adult, MAdult = mature adult, OAdult = old adult.

Sex/Age Group	Male	Female
Young Adult	1/11,10%	3/12, 25%
Prime Adult	6/11, 55%	6/12, 50%
Mature Adult	4/11, 36%	1/12, 8%
Old Adult	0/0	2/12, 17%

Table 1.2. Distribution of the sexes by age group. Indeterminate adults have been assigned proportionately according to the distribution of the age categories.

widely and frequently used model life tables in human paleodemography are provided by the Office of Population Research at Princeton University (Coale and Demeny 1983; for more information, see Chamberlain 2006, 32). Preservation factors, as already noted, have affected the representation of the human skeletal remains, and friable neonatal and infant bones are particularly vulnerable to both post-depositional and post-excavation conditions (Walker, Johnson, and Lambert 1988; Saunders 1992; Walker 1995). It is, however, plausible that the absence of certain age categories, i.e., subadults under 12 years old, may represent the intentional exclusion of certain individuals from this burial location. Children may have been treated in a different way, not visible in the archaeological picture, or they may have been deposited in a different burial location. The fact that six of the eight burials in the Artisans' Quarter cemetery were subadults (Soles and Walker 2003, table 1) poses an interesting contrast with the situation in the Limenaria cemetery.

2. The mortality curve presents its highest peak in prime adulthood, i.e., between 30 and 40 years (Ill. 1.2). Contrary to expectation in the model of a life expectancy of 30 at birth, there appears to have been a decrease in deaths in the age groups over 40 years old, a phenomenon which may be due to the weakness of macroscopic methods for accurately defining age in old adult individuals (Chamberlain 2000, 2001).
3. There is an equal distribution of the two sex groups, suggesting the equal access of men and women to burial in the Limenaria cemetery (Table 1.2).
4. Death rates for both sexes have their highest peak in prime adulthood. Women in particular, contrary to the common pattern of death in young adulthood (Larsen 1997), appear to have overcome the risks of pregnancy and lactation and survived until late in life. The absence of men from the age group of old adults may be due to preservation factors.

Health Status

The poor preservation of skeletal material has limited the assessment of health status in the LM III Mochlos population. Two broad subgroups of pathological conditions may be evaluated, however. The first of these includes the skeletal manifestations of stresses relating to the mechanical load experienced throughout life, including osteoarthritis, Schmorl's nodes, enthesopathies, cortical defects on long bones at the sites of muscular attachments (classified as skeleto-muscular markers), and trauma. The second includes pathological lesions closely related to the overall pathogen load affecting the population, e.g., metabolic diseases such as anemia and enamel hypoplasia, non-specific infections, and neoplastic disease. Due to the differential preservation of the skeletal material, the recording and, in turn, the evaluation of pathological conditions have been based on the skeletal element count; i.e., the occurrence of the recorded pathological lesions has been measured out of the total number of skeletal elements represented in the LM III Mochlos assemblage. The prevalence of pathological conditions represents the relative frequency of the lesions for each population subgroup and/or anatomical body part and therefore does not add up to 100%.

Osteoarthritis describes the pathology of the articular joints of the human skeleton including the vertebral column (Ortner and Putschar 1981, 419–433; Rogers et al. 1987, 179–183; Aufdeheide and Rodriguez-Martin 1998, 93–96). Factors that affect the development and severity of the disorder include both systematic predispositions, such as age, sex, metabolism, nutrition, hormones, and heredity, and mechanical-functional stress, which involves occupational activities, chronic or acute trauma, and obesity (Jurmain 1977; Merbs 1983).

Osteoarthritis in the LM III Mochlos population has been counted only in adult skeletal elements (538) and shows a low frequency of 8% (43/538). The distribution of lesions in the skeleton is more prevalent in the upper than the lower appendicular skeleton (12% versus 9%), while arthritis was most commonly manifested in the vertebrae (Ill. 1.3). The thoracic region, and, in particular, the ribs seem to have been affected most by arthritic lesions (53%), followed by the cervical region (45%).

Osteoarthritis is equally distributed between the two sexes (Ill. 1.4). The prevalence of degenerative changes within the age categories shows that they increased progressively from young to old adulthood (Ill. 1.5). Interestingly however, as regards the distribution of the lesions by sex within age groups (Table 1.3), the prevalence of arthritic changes is significantly higher in young adult women (10%) than in young adult men (2%). This may suggest an earlier involvement of women in activities associated with a physical workload, since it takes a long time before the resulting lesions manifest themselves on the skeleton.

Also, the distribution of osteoarthritis in the appendicular skeleton by sex group attests to the differential use of the articular joints (Ill. 1.6); arthritic changes were most prevalent in the upper skeletons of women and the lower skeletons of men. This

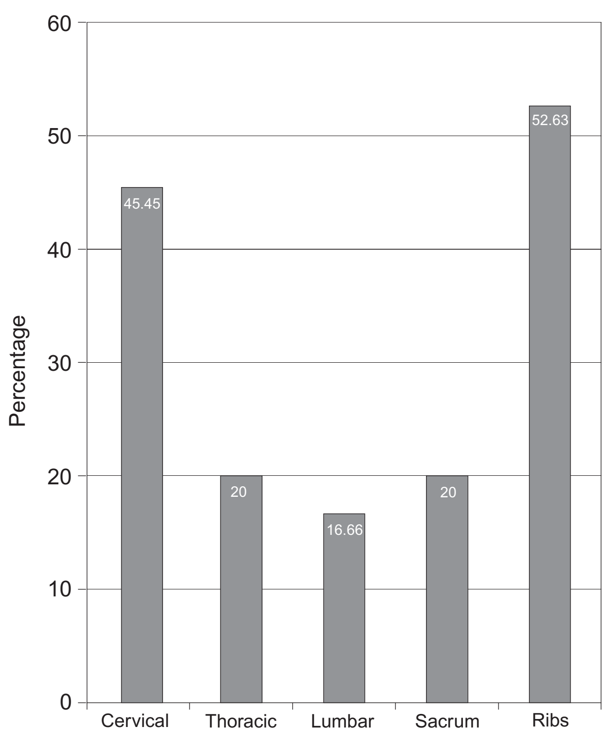

Illustration 1.3. Prevalence of vertebral arthritis.

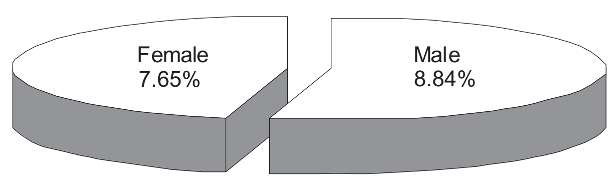

Illustration 1.4. Prevalence of osteoarthritis by sex group.

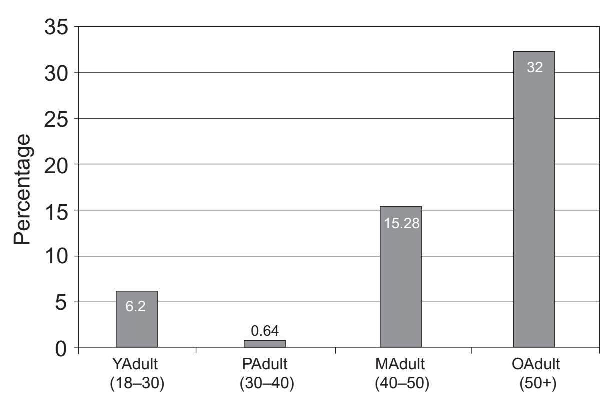

Illustration 1.5. Prevalence of osteoarthritis by age group. YAdult = young adult, PAdult = prime adult, MAdult = mature adult, OAdult = old adult.

pattern is also evident in the distribution of lesions on the vertebral column within the sex groups (Ill. 1.7); men had a higher frequency of arthritic changes on the lumbar and sacral region, while women experienced more changes on the cervical vertebrae.

The occurrence of joint disease of the vertebral column is represented by a moderate frequency (5/44: 11.36%) of depressions in both the superior and inferior vertebral endplates, which are known as Schmorl's nodes. These depressions may be formed by the protrusion of material from the intervertebral disk (nucleus pulposus) through the endplate of the vertebral body as a result of mechanical load that creates axial compressive forces at the center of the disk (Resnick and Niwayama 1988, 1528). In the Mochlos community, these defects occurred with considerably greater frequency in women than in men (Ill. 1.8).

Enthesopathies are bony outgrowths that may result from an injury to the site of attachment (enthesis) of tendons and ligaments to bone. Enthesopathies and cortical defects at the site of major muscular attachments on the long bones may represent strenuous activity patterns exercised by individuals during life (Knüsel 2000a, 2000b). Enthesopathies and cortical defects on muscular attachments occur on 5.64% (33/585) of the cases in the Mochlos population, or a relatively low proportion of individuals. The distribution of the defects shows an age-progressive increase (Ill. 1.9), as was also observed with osteoarthritis. The distribution of the defects in the appendicular skeleton attests to the involvement of the upper skeleton (Ill. 1.10), suggesting a repetitive use of the arm and forearm in physical tasks.

Skeletal asymmetry in the forelimb, which is evident in the humeri of Skeletons 19.1 and 26.1, may be related to handedness (Steele 2000). Right-handedness can be confirmed by the distribution of the cortical indicators and enthesopathies by side (Ill. 1.11).

Skeleto-muscular markers occurred more frequently in men than in women (Ill. 1.12), although both sex groups appear to have been involved in strenuous activities early in life (Table 1.4). The distribution of the defects in the appendicular skeleton by sex group indicates a differential involvement of major muscular systems, perhaps suggesting a sexual division of labor. In men the markers represent a significant involvement of the upper skeleton in

Sex/Age Group	Male	Female
Young Adult	1/52, 2%	9/87, 10%
Prime Adult	1/102, 1%	0/78, 0%
Mature Adult	28/164, 17%	0/31, 0%
Old Adult	Undefined	11/30, 37%

Table 1.3. Distribution of osteoarthritis by sex versus age groups.

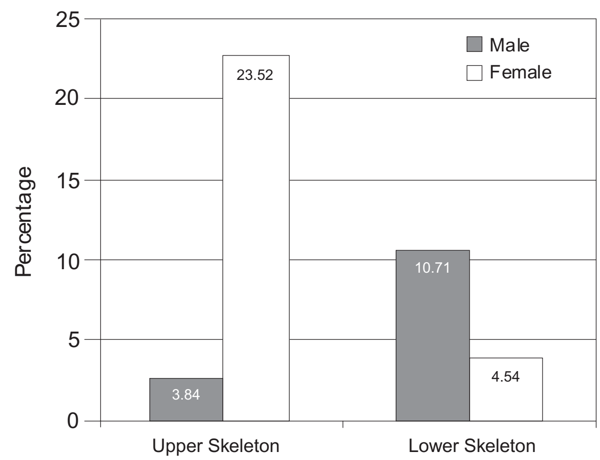

Illustration 1.6. Prevalence of osteoarthritis in the skeleton by sex group.

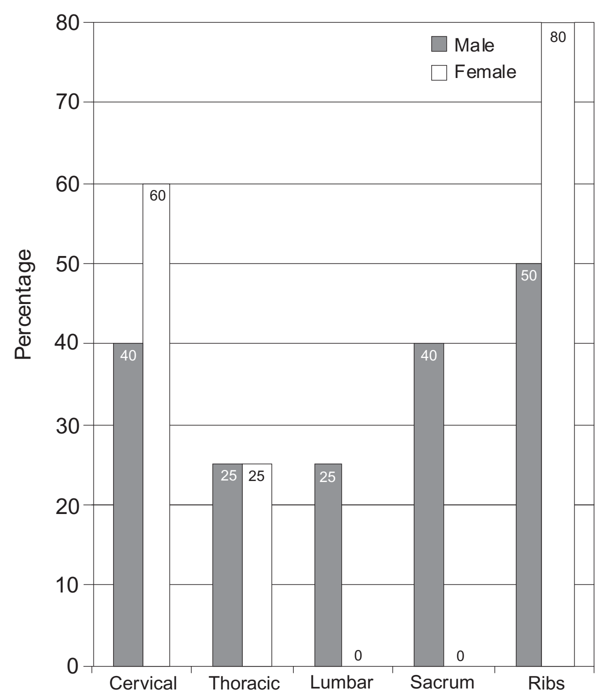

Illustration 1.7. Prevalence of vertebral arthritis by sex group.

physical activities, whereas in women there was an equal distribution of defects between the upper and lower skeleton (Ill. 1.13).

Trauma refers to any injury or wound related to personal or interpersonal violence or accidents. Patterns of traumatic lesions, the bones affected, the severity of the wound, and the evidence for healing, treatment, and medical agency can clarify the etiology of trauma and its biological and socio-cultural context (Grauer and Roberts 1996; Roberts 2000). The frequency of trauma in LM III Mochlos was low, occurring in 1.36% (8/585) of the cases. Fractures were most prevalent in the upper skeleton (Ill. 1.14), affecting the thorax (ribs) and the fore-arm (exemplified by a Colles fracture of the distal radius of the wrist, usually caused by falling with an outstretched hand). The ribs may be fractured as a result of a fall or a direct blow to the rib cage. In one case, the foot phalanges of a mature man (Skeleton 15.1) showed evidence of possible stress fractures caused by repeated micro-trauma or strain (Merbs 1989). It is difficult to discern whether

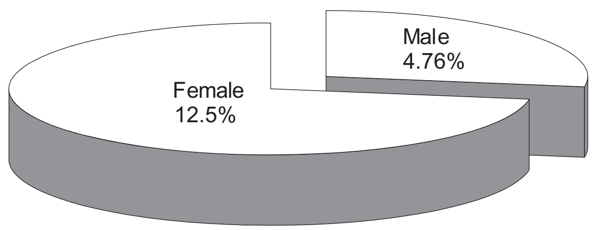

Illustration 1.8. Prevalence of Schmorl's nodes by sex group.

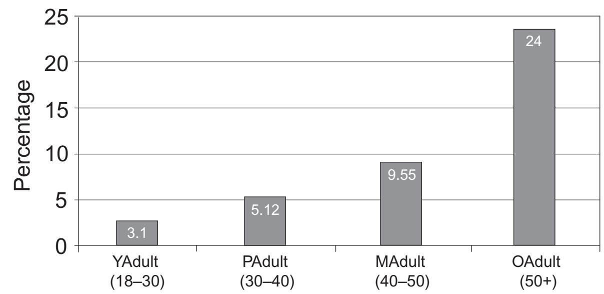

Illustration 1.9. Prevalence of skeleto-muscular markers by age group. YAdult = young adult, PAdult = prime adult, MAdult = mature adult, OAdult = old adult.

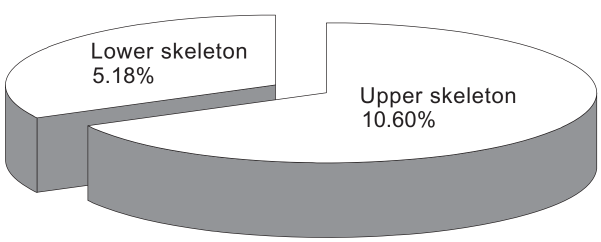

Illustration 1.10. Distribution of skeleto-muscular markers in the skeleton.

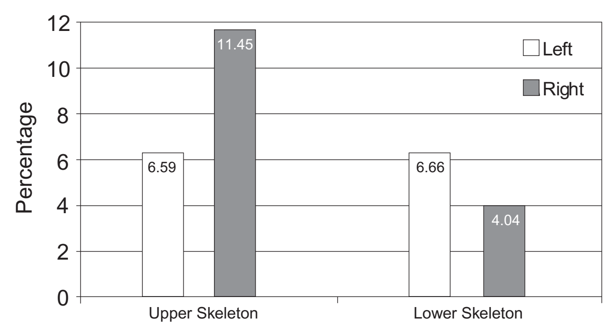

Illustration 1.11. Distribution of skeleto-muscular markers in the skeleton by side.

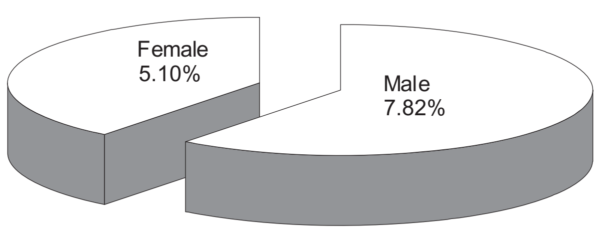

Illustration 1.12. Prevalence of skeleto-muscular markers by sex group.

Sex/Age Group	Male	Female
Young Adult	2/52, 4%	2/87, 2%
Prime Adult	6/102, 6%	2/78, 3%
Mature Adult	15/164, 9%	6/31, 19%
Old Adult	Undefined	0/30, 0%

Table 1.4. Distribution of skeleto-muscular markers by sex versus age groups.

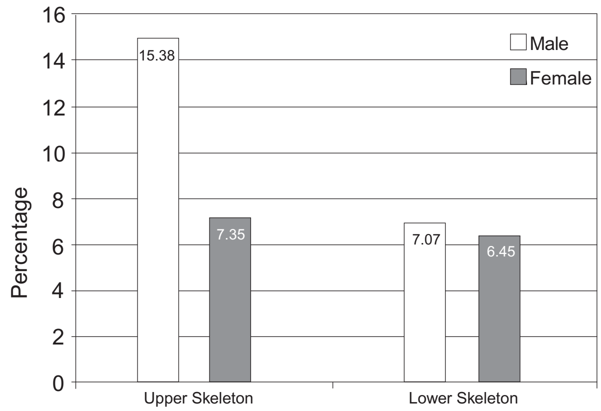

Illustration 1.13. Distribution of skeleto-muscular markers in the skeleton by sex group.

a fracture represented an accidental event or an episode of violence. There is one case of a Parry fracture (affecting the distal ulna) in another mature man (Skeleton 10.1); this type of injury may be associated with an attempt to defend a blow to the head (Roberts and Manchester 1995, 77).

The occurrence of trauma was more prevalent in men (5/294) than in women (1/196) in LM III Mochlos. Only one woman (Skeleton 17.2) showed evidence of a long-term healed fracture, which was found on the right femur. This unequal distribution may suggest the greater mobility of men relative to women in occupational activities and physical tasks.

Although there is clear evidence of long-term healing, most of the affected bones suffered post-traumatic complications ranging from misalignment of the two fractured segments to periosteal reactions of the shaft and severe arthritic changes of the neighboring articular joints (Table 1.5). Poor immobilization of the affected bones and the exposure of soft tissues to pathogenic organisms causing long-term non-specific infections would suggest that the treatment of fractures in the LM III population of Mochlos was rather inefficient.

Metabolic disease in the LM III Mochlos population is represented in the typical defects associated with anemia and enamel hypoplasia. Skeletal changes associated with anemia can be seen in porous lesions on the orbits (cribra orbitalia) and/or on the outer (ectocranial) surface of the cranial vault (porotic hyperostosis); these occur as the manufacture of red blood cells increases in order to compensate for a lack of iron (Roberts and Manchester 1995, 166). In general, there are two broad types of the defect: acquired anemias, particularly iron deficiency anemia, and genetic anemias, such as thalassemia and sickle-cell anemia. Many variable factors—environmental, geographical, dietary, cultural, and pathogenic—may contribute to the development of the disease (Hill and Armelagos 1990; Stuart-Macadam 1992a). Anemia is often a complex phenomenon involving the synergy of multiple causes, and its occurrence is considered a good indicator of stress or adaptation of a population to its environment (Stuart-Macadam 1992a, 1992b).

The recording of anemia in the study population is based only on the recovered bone fragments—that is, orbits and cranial vault fragments that have the potential to provide evidence of lesions associated with the disorder. Five of the 32 bone fragments examined (9.37%) showed evidence of porous lesions. The individuals affected were all men (Skeletons 10.1, 15.1, 24.1). The occurrence of cribra orbitalia in adult men could be considered a healed manifestation of the deficiency (Stuart-Macadam 1985), suggesting that anemia did not threaten their lives since they managed to cope efficiently.

Enamel hypoplasia refers to the surface defects on tooth enamel resulting from the disturbance of enamel formation. It represents episodic disruptions to matrix secretion throughout the growing dentition. Hypoplastic defects thus indicate periods of systemic disturbance during early childhood. Enamel disturbances commonly appear in archaeological specimens as linear furrowing or circumferential pitting (El Najjar, Desanti, and Ozebek 1978; Goodman, Armelagos, and Rose 1980; Goodman and Martin 1992; Hillson 1996, 166–167). Enamel hypoplasia can be the result of an hereditary anomaly, a localized trauma, or (commonly) of any nutritional or physiological stress.

Furthermore, dental defects have been highly associated with the effects of weaning, i.e., the cessation of breast feeding, which varies significantly even in contemporary populations (Blakey, Leslie, and Reidy 1994; Katzenberg, Herring, and Saunders 1996). Indeed, because of the loss of the mother's milk, which is enriched in certain nutrients, the post-weaning period coincides with a reduction in host resistance and a transitional period in the development of the individual's own immune system (Larsen 1997, 11). It seems