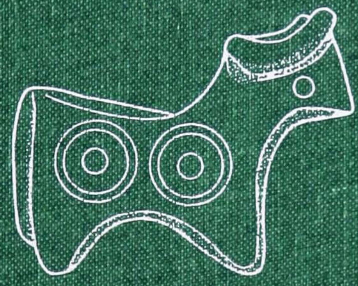
SUBSISTENCE AND SETTLEMENT IN A MARGINAL ENVIRONMENT

Tell es-Sweyhat, 1989–1995 Preliminary Report



Subsistence and Settlement in a Marginal Environment: Tell es-Sweyhat, 1989–1995 Preliminary Report

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Subsistence and Settlement in a Marginal Environment: Tell es-Sweyhat, 1989–1995 Preliminary Report

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and

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Gypsum anthropomorphic bead from
a necklace found in Tomb 5 (see pp. 54–55).
Drawn by Jana Fisher after Denise Hoffman

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

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PREFACE

This report is a preliminary account of the University of Pennsylvania Museum's surveys and excavations at Tell es-Sweyhat, Syria, in 1989, 1991, 1993, and 1995. The site was originally excavated for three seasons from 1973 to 1975 as part of the international salvage project undertaken in connection with the construction of the hydroelectric dam at Tabqa (Holland 1976, 1977; van Zeist and Bakker-Heeres 1985; Buitenhuis 1983). The University of Pennsylvania Museum renewed the excavations, with a short first field season from August 2 to September 7, 1989 (Holland and Zettler 1991: 717–719). Subsequently, the University of Pennsylvania Museum and the University of Chicago's Oriental Institute formed a joint expedition to carry out a three-month field season from September 15 to November 29, 1991 (Holland, Wilkinson, and Zettler 1994:139–142). Following the 1991 season, Pennsylvania and Chicago opted to continue work every year, alternating field seasons, while co-ordinating overall goals. The University of Chicago worked in Fall 1992 (Holland, Wilkinson, and Zettler 1994:139–142); the University of Pennsylvania Museum from April 19 to June 28, 1993, and from April 25 to July 7, 1995. (For a discussion of our research interests and goals, see Chapter 1, pp. 5–9.)

This volume includes Naomi F. Miller's report on the archaeobotanical remains recovered in 1991 and 1993 (Chapter 6). Miller also discusses the significance of archaeobotanical remains from several Euphrates valley sites in Turkey and Syria for understanding environmental constraints on food production in that part of the Middle East (Chapter 7). Jill Weber's preliminary report on the faunal remains recovered through 1993 is included as well (Chapter 8). A report on Chicago's work will be published separately.

As for the field crews, in 1989 Thomas A. Holland (University of Chicago) and Richard L. Zettler (University of Pennsylvania) served as joint Directors. Lee Horne (Museum Applied Science Center for Archaeology, hereafter MASCA) undertook the survey of the lower town and also served as a site supervisor. Christine Hide and Stephen P. Harvey (University of Pennsylvania) were site supervisors. In addition to her other work, Christine Hide undertook flotation of soil samples. Andrew Weiss (MASCA) was surveyor/computer specialist. Gil J. Stein (Analytical and Conservation Laboratory, Smithsonian Institution) joined the expedition early in the season for a preliminary investigation of the Tell es-Sweyhat region. Rudolf Mayer (Yale University) came at the end of the season and provided much needed assistance in section drawing. Mohammad Muktash (Raqqa) served as representative of the Directorate-General of Antiquities and Museums.

In 1991 Holland and Zettler were again joint Directors. Tony J. Wilkinson (British School of Archaeology in Iraq) undertook regional survey. Jennifer Arzt (University of Chicago), Timothy Adams, Adam Ford, Emma Murray, Sally Randell (Institute of Archaeology, London University), Michael D. Danti, and Matthew Waters (University of Pennsylvania) were site supervisors. Danti and Waters performed double duty: Danti served as surveyor/computer specialist; Waters carried out flotation of soil samples. John Ellsworth (Oriental Institute) was draftsman, and Donna Strahan (Walters Art Gallery) and Mark Fenn (Analytical and Conservation Laboratory, Smithsonian Institution), conservators. Anwar Ghafour, photographer at the Aleppo Museum, joined us for several weeks to photograph the site and artifacts. Bassam Falhout (Damascus), Mohammed Ali (Aleppo), and Ma'an Hassoun (Raqqa) were successive representatives of the Directorate-General of Antiquities and Museums.

In 1993 Zettler acted as Field Director. Michael Danti was Assistant Director and also served as surveyor/computer specialist and site supervisor. James A. Armstrong (University of Chicago) took overall charge of work on the high mound, directed work in Operation 1, and served as pottery specialist. Peter N. Peregrine (Juniata College) was in charge of remote sensing and was assisted by Andrew J. Bell (University of Bradford, England). Steven Tinney (Babylonian Section, University of Pennsylvania Museum), the project's epigrapher, visited the site for two weeks. Kevin Danti (Purdue University), Erica Ehrenberg (Institute of Fine Arts, New York University), Augustine Fahey, Julia Lewandowski, James Matthieu, Amy Westerman (University of Pennsylvania), and Allen McCune (University of Chicago) were site supervisors. Lewandowski also

undertook flotation of soil samples, while K. Danti and Westerman assisted Armstrong in work on the pottery. Ehrenberg was field registrar. Jacqueline Shaffer (Time-Life Books) served as draftsman and photographer. Mustafa Hussein (Raqqa) was the representative of the Directorate-General of Antiquities.

In 1995 Zettler was Field Director, with M. Danti continuing as Assistant Director, surveyor/computer specialist, and site supervisor. Armstrong (Semitic Museum, Harvard University) oversaw excavations in Operations 1, 12, and 20 on the main mound and served as pottery specialist. Peregrine (Lawrence University) was in charge of remote sensing and also acted as a site supervisor. Matthew Braithwaite (University of Bradford, England) assisted Peregrine and carried out the magnetic mapping. Naomi F. Miller (MASCA) joined the excavations in the field for the first time to carry out archaeobotanical studies. She also gave generously of her time as a site supervisor when need arose. Brad Bentz, William R. Fitts, and Jill Weber (University of Pennsylvania), Kevin Danti, Paul Delnero, and Peter Roberson (Purdue University), and 'iyad Yunus (University of Damascus) were site supervisors. In addition to their roles as site supervisors, Weber took charge of faunal remains; Bentz, K. Danti, Roberson, and Yunus assisted Armstrong with pottery; and Delnero acted as field registrar. Denise Hoffman (Near Eastern Section, University of Pennsylvania Museum) served as staff artist. Nowris Mohammed (Raqqa) was the representative of the Directorate-General of Antiquities.

We would like to thank Dr. Ali Abu Assaf and Prof. Dr. Sultan Muhesen, successive Directors-General of Antiquities, and Dr. Adnan Bounni, Director of Excavations, for making our work possible. We would also like to thank Dr. Michel Maqdisi for his help. We owe a sincere and large debt of gratitude to Murhaf al-Khalaf, who heads the Directorate-General of Antiquities and Museums in Raqqa, and to the staff of the Raqqa Museum for facilitating our work, as well as for their hospitality and friendship. We also need to thank friends and colleagues in Aleppo, in particular Mohammed Muslim, Hamido Hamadi, and Anwar Ghafour in the Aleppo Museum.

In the U.S. and England, we owe thanks to Robert H. Dyson, Jr., and Jeremy Sabloff, former and current Directors of the University of Pennsylvania Museum, and a particular debt of gratitude to Stuart Fleming, Scientific Director of MASCA. Stuart Fleming has been a valued collaborator. He was also very generous in loaning us MASCA's expertise and, in the early stages of the project, even its personnel. We also want to thank A.M. Pollard, Head of the Department of Archaeological Sciences, University of Bradford, who provided the loan of a gradiometer, computer, and software; Rick Jones, Senior Lecturer in Archaeology, University of Bradford; and William M. Sumner, Director of the Oriental Institute, University of Chicago.

Michael D. Danti produced the plans included in this volume and has been involved with every facet of the Tell es-Sweyhat Project. He deserves a real measure of the credit for this volume. Jana Fisher, Denise Hoffman, and Carole Linderman contributed the line drawings for the report. Jennifer Quick and Kathleen Ryan provided valuable editorial help and we are grateful for their patience.

The University of Pennsylvania Museum's 1993 research and excavations were supported by the American Philosophical Society and the National Endowment for the Humanities (RK-20053-93). Our 1995 excavations were supported by grants from the National Endowment of the Humanities (RK-20235-95) and the National Geographic Society (5498-95).

We would also like to thank a number of very special friends whose financial contributions made the 1989 season possible and who continued to provide backing in 1991, as well as in 1993 and 1995. We want to single out Robert S. Bass and Gerald Vincent; we would especially like to thank Carolyn Z. Livingood and Carlotta ("Jill") Maher by dedicating this report to them. Though Carolyn Livingood died January 4, 1994, memories of her passion for archaeology will continue to energize those of us who knew her. Carlotta Maher has been a constant source of encouragement, as well as distraction and amusement. Her tireless efforts on behalf of Near Eastern archaeology and, in particular, Egyptology, as well as her personal support, are inspiring.

Richard L. Zettler
February 24, 1997

1

INTRODUCTION

Richard L. Zettler

Southern Mesopotamia, with its irrigation agriculture base, has long been dubbed "cradle of civilization" and, more recently, "heartland of cities" (Adams 1981). These terms underscore its primacy as the locus of one of the world's "pristine" civilizations. In contrast, the dry farming regions of northern Mesopotamia were long considered a sort of social evolutionary "backwater," even though inscriptions of the Akkadian kings Sargon (2334–2279 B.C.) and Naram-Suen (2254–2218 B.C.) mentioned northern polities such as Ebla.[1] Now, excavations carried out in northern Iraq, Syria, and southeastern Turkey over the last twenty-five to thirty years have substantially altered our understanding of northern Mesopotamia, demonstrating that complex urban, literate states had gradually emerged there, apparently through indigenous processes, by the mid-third millennium B.C. (Schwartz 1994a).

Archival texts found in the burned Royal Palace G at Tell Mardikh (ancient Ebla) provide a glimpse of the north in the mid-third millennium, suggesting a political situation not radically different from that in the better documented 18th–17th centuries (Archi 1993:470; Klengel 1992:44–79). The Ebla texts, which document the reigns of three sovereigns (Archi 1995a:113) in the early 24th century B.C., suggest that by that time a large part of northern Mesopotamia was organized into city-states. These states, 20–30 km apart and encompassing on average 800 km^2 each, were gradually brought through military action and treaties into larger regional entities dominated by Mari, located on the Euphrates near the Syria-Iraq border, and Ebla, located just south of Aleppo (Archi 1993:466–468; 1995a:115). For example, a letter from Enna-Dagan, king of Mari, to an unnamed contemporary at Ebla[2] details Mari's gradual expansion into part of the western Khabur triangle, the lower Balikh valley, and up the Euphrates, perhaps as far north as Gaziantep (Edzard 1981; Meyer 1996:155–170). This expansion led to Ebla's paying a substantial tribute to Mari. Under Irkab-Damu, the second of the three kings who appear in the archives, Ebla apparently redressed the balance of power. It came to control a territory that stretched 200 km north-south and 100 km east-west, from the Plain of Antioch and Carchemish in the north to Hama in the south and from the Jabbul Plain in the east to the Jebel Ansariyah in the west (Archi 1995a:115). The Royal Palace G archives contain a wealth of data bearing on the subsistence economy (e.g., Archi 1984, 1991a; Milano 1987) and internal administrative organization (Archi 1991b, 1995a) of Ebla at the time of its floruit. They are equally informative on other domains, such as religion and ritual, writing and literature (for summaries and references, see Archi 1995b:120–125 and 1995c:134–139).

The Ebla texts contain references to other northern Mesopotamian states in addition to Mari: Harran on the upper reaches of the Balikh (Archi 1988); Emar near modern Meskene on the "big bend" of the Euphrates, a kingdom with which Ebla concluded a dynastic marriage alliance (Archi 1990b); Tuttul (Tell Bi'a) at the confluence of the Euphrates and the Balikh (Archi 1990c); and Nagar (Tell Brak) near modern Hassake on the Khabur (Bonechi 1993:253–254; Matthews and Eidem 1993). There are also references to an array of smaller polities linked to the more powerful states through socio-political and economic ties. The texts likewise mention Kish, the major center in the northern part of the southern Mesopotamian floodplain with which Ebla appears to have had close ties (Bonechi 1993:158–159). Surprisingly few references exist to nomadic pastoralists such as the Martu, who appear to have existed in the area of Ibal, not far from modern Homs, and in the Jebel Bishri, along the west bank of the Euphrates between the confluences of that river and the Balikh and Khabur (Archi 1985, 1993:470; Bonechi 1991:71–73).

Despite accumulating archaeological evidence and available written documentation, northern early complex societies remain as yet poorly understood phenomena. Tell es-Sweyhat, a large site located on the left (east) bank of the Euphrates, ca. 65 km down-river from Carchemish (Fig. 1.1), provides a compelling research

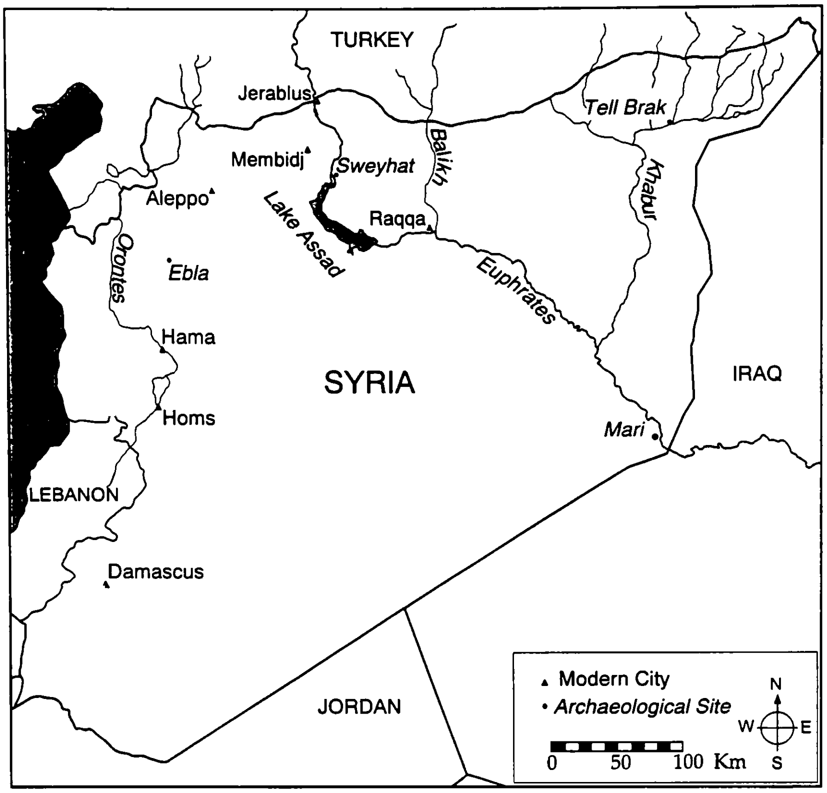


Fig. 1.1. Map of Syria showing location of Tell es-Sweyhat.

"laboratory" for investigating urbanism and the dynamics of urbanization in at least one northern region. A reanalysis of ceramics from stratigraphic soundings made in the 1970s (see below) suggested that its occupation spanned the whole of the third millennium (or Early Bronze Age) without break, and demonstrated that remains from the time of the settlement's floruit in the late third millennium were apparently well-preserved and readily accessible.

The Regional Landscape and Subsistence Strategies

Tell es-Sweyhat stands in the center of a plain formed by a broad crescent-shaped embayment in the Euphrates-Balikh uplands (Figs. 1.2, 1.3). The plain today borders the northern end of the impound lake (Lake Assad) behind the hydroelectric dam at Tabqa. Prior to the construction of the dam, the site would have been ca. 3 km from the river. Bedrock in the area is a soft, white chalk-like limestone of Tertiary age (Wilkinson 1976:67; n.d. a: 1–6). It is capped by a light brown, sandy thin-bedded limestone that forms the surrounding uplands (el. 400–450 m above sea level). The uplands are fringed by steep scarp slopes, and the Tell es-Sweyhat plain slopes gently from the plateau scarps (el. 375 m) to the west where it is cut by the floodplain of the Euphrates (el. 320 m). The plain represents a mid-to-late Pleistocene course of the Euphrates, which at the time flowed 15–20 m above the present level of the floodplain. The river's deposits of silt, sand, and gravel are visible on the surface in the western part of the plain, extending to a line 1 km west of Tell es-Sweyhat, while to the east they are covered by alluvial fan and colluvial sediments eroded from the adjacent uplands. The plateau sediments are up to 14 m thick and are predominantly reddish yellow or strong brown sandy loams, loams, and clay loams, which contain occasional bands of gravel. The surface of the plain is crossed by a series of roughly parallel *wadis* (seasonal watercourses) which flow from the uplands to the Euphrates. Their courses are, for the most part, indistinct. Only one wadi, which runs through Nefileh, is today active for most of its length.

The Tell es-Sweyhat plain has a mean annual precipitation of 200–300 mm and relatively high interannual variability of 25 to 35% (de Brichambaut and Wallén 1963:9–10). These factors place it at the southern limit of the semi-arid "transitional zone" between the desert steppe (Arabic *badiyah*) and the better-watered lands of northern and western Syria (Lewis 1987:1–2). The plain comprises some 4800 ha of arable land (Wilkinson, pers. comm. 1993) and, in terms of the Syrian government's classification of agricultural land, it falls in Zone 3, where one or two barley harvests are expected every three years (cited in al-Ashram 1990:167–168). As such yield expectations suggest, dry farming, although possible, is nevertheless precarious, and pastoralism would probably have been a critical part of the subsistence economy in the past, as today (see Chapter 7). Indeed, some combination of small-scale, non-intensive agriculture and pastoralism could be argued to be the most viable long-term subsistence strategy in such a marginal environment (Lewis 1987).

Tell es-Sweyhat

Tell es-Sweyhat is composed of three distinct morphological zones (Fig. 1.4).

1. A central high mound 5–6 ha in area and 15 m high.
2. A lower tell surrounding the high mound. It is enclosed by a low rise or embankment that approximates a rectangle 700 by 600 m (Holland 1976:36).

Fig. 1.2. SPOT-image of Tell es-Sweyhat embayment, with Tell es-Sweyhat (1) in the center and Tell Hajji Ibrahim (2) just to the southeast. The Euphrates (3) and the northern end of the impound lake behind the hydroelectric dam at Tabqa are on the left side of the image, high uplands between the Euphrates and the Balikh (4) on the right.

The lower town is ca. 30 ha in area.

3. An area to the south of the lower town (hereafter referred to as lower town south) ca. 10 ha in area. Though not visible on the ground, low-level aerial photographs of the site (Fig. 1.5) show a dark line—perhaps a rampart or wall—that encloses the area and abuts the south side of the outer embankment.

Settlement History

Tell es-Sweyhat was occupied from the beginning of the third millennium B.C. It was initially a relatively small village localized in the area of the central mound (Wilkinson n.d. b). The settlement may have encompassed an area of 15 ha by the mid-third millennium (see Chapter 3, pp. 48–51) and had tripled in size to become an urban state center (or an urban node in a larger polity) by the end of the third millennium. The original settlement became a fortified center or citadel, and a substantial outer (lower) town emerged around it. The entire site was enclosed by a wall at that time (Chapter 3, pp. 49–51).

Wilkinson's survey data (n.d. b) suggest that the late third millennium represents a peak period of settlement not just at Tell es-Sweyhat but on the plain around it, with at least one major site (Tell Jweif or Jouweif, 8) located on the floodplain and a number of sites (e.g., Nefileh, 5, and Tell Othman, 20) on the terrace (Fig. 1.3). Wilkinson has identified traces of roadways linking the sites in the embayment and leading into and out of the embayment (1993:549–551), as well as a zone of intensively cultivated lands around Tell es-Sweyhat and possibly around Nefileh (1976:68–70; 1982:328–330).

The extensive occupation of the Tell es-Sweyhat plain in the late third millennium peak period of settlement represents an "exception" rather than the norm for the area (Wilkinson n.d. b), but the factor(s) responsible for Tell es-Sweyhat's expansion from village to urban center and the extensive occupation of the embayment remain(s) uncertain. However, the settlement system's growth might have been linked to area-wide socio-political alterations such as the gradual growth and expansion of Mari and/or Ebla into the area,[3] or the collapse of the state centered on Ebla under military pressure from the southern Mesopotamian Akkadian kings. (For an attribution of Royal Palace G's destruction to the time of Sargon or even a few decades earlier, see Archi 1993: 468.)

Or Tell es-Sweyhat's expansion might have been due to the rapid population displacement that Harvey Weiss and his colleagues in the Tell Leilan excavations have linked to abrupt climatic change in northern Syria and upper Mesopotamia. Weiss and his colleagues have estimated that a period of desertification, which began around 2200 and lasted until roughly 1900, would have resulted in a net loss of ca. 182 ha of built-up site area (Weiss et al. 1993:1002). They calculate that between 14,000 and 28,000 persons within 15 km of Tell Leilan would have been displaced and probably three to four times that number of persons across the Khabur drainage basin.[4] The Tell es-Sweyhat settlement system's growth was not an isolated phenomenon. It was paralleled by a significant increase in site numbers and in total occupied area upriver in the Bireçik-Carchemish areas; the historic records suggest that by the late third or early second millennium Carchemish had emerged as a significant independent city-state (Algaze, Breuninger, and Knudstad 1994:14–17).

Tell es-Sweyhat collapsed probably early in the second millennium, but the site continued to be occupied in an Early Bronze–Middle Bronze transitional period. With its population markedly decreased, the settlement retracted to the area of the central mound. Tell es-Sweyhat was abandoned certainly no later than 1800, since no Middle Bronze IIB ceramics (cf. Dornemann 1992) have been recovered in excavations or on the surface. Tell es-Sweyhat's collapse coincides with the reoccupation of sites such as Tell Mardikh and Tell Leilan, and parallels the contraction or collapse of settlement in the Bireçik-Carchemish areas (Algaze, Breuninger, and Knudstad 1994:14–17).

Tell es-Sweyhat was reoccupied a thousand years after its collapse, in the Hellenistic and late Roman periods.

The 1970s Excavations and Renewed Research

The 1970s excavations at Tell es-Sweyhat concentrated on the inner town and uncovered extensive remains of the late third millennium urban settlement (see Fig. 1.4). The excavations revealed (1) portions of the inner fortification wall, a 2.5 m thick mudbrick construction set on stone footings with buttresses or a series of defensive towers (Holland 1976:49 and 1977:7)[5]; (2) evidence for centralized grain storage (Holland 1976:55, 59; van Zeist and Bakker-Heeres 1985:309) and metal working (Holland 1976:51, 66–67), as well as administrative artifacts, including an inscribed weight (Holland 1975), in a number of interconnected rooms built against the wall on the western side of the citadel or Area IV (Holland 1976:49–62 and 1977:37–43); and (3) domestic buildings on the northeast edge of the citadel in Area III (Holland 1976:48–49). In addition to evidence of the late third millennium settlement, late remains were uncovered in a series of squares on the southern side of the mound, Area I (Holland 1976:38), and stratigraphic sequences were defined in an as yet unpublished step trench on the northern slope of the mound, Area V (Holland 1976:62), and in two 5 by 5 m squares just west of the mound's summit, Area II (Holland 1976:38–48).

As originally laid out in 1989, Penn's research had two interrelated major goals, one site specific and one regional. The former involved the study of form and structure in a late third millennium urban center. The regional program aimed at examining (1) the relatively rapid growth of the site from a small village to a major urban center in the late third millennium, and its equally rapid contraction in the early second millennium, and (2) the degree of integration between the late third millennium urban center and its hinterland. We have to date focused our efforts largely on Tell es-Sweyhat itself, and in the last couple of years have expanded our efforts to look not just at the late third millennium settlement, but at earlier phases of occupation as well. This report will deal primarily with our surveys and excavations at the site. However, Wilkinson completed his initial surveys of the region around Tell es-Sweyhat in 1992, and the University of Pennsylvania initiated a new phase of regional research in the following year, which we will describe here briefly (see Chapter 5, pp. 85–88).

Whatever our specific research goals, the Tell es-Sweyhat Project was explicitly designed in collaboration with MASCA to take advantage of the applied sciences in a well-thought-out and cost-effective manner. Specifically, from its inception the project has employed and highlighted the utility of an integrated Macintosh

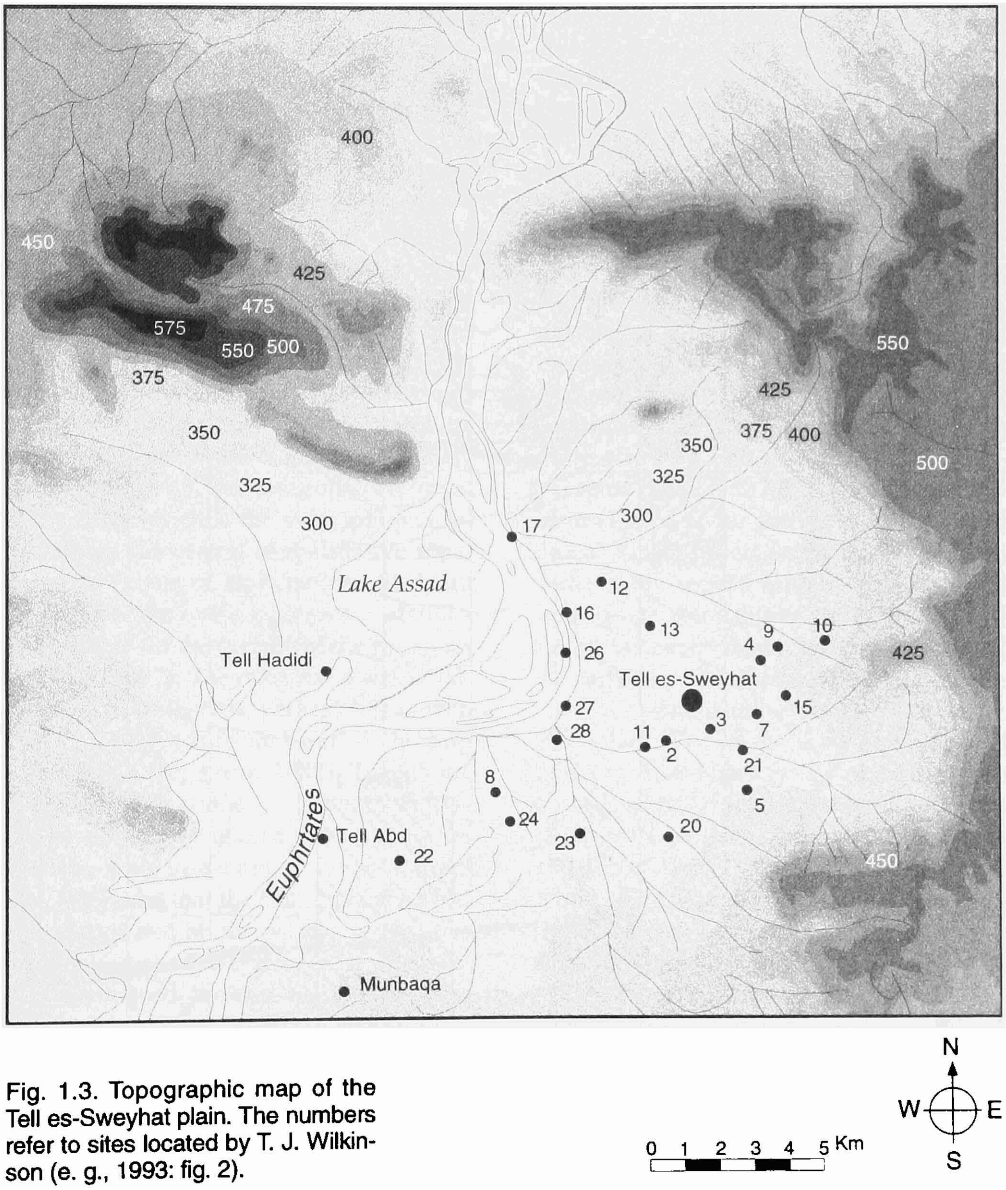


Fig. 1.3. Topographic map of the Tell es-Sweyhat plain. The numbers refer to sites located by T. J. Wilkinson (e. g., 1993: fig. 2).

computer-based survey and mapping system (FORESIGHT) which MASCA developed and continues to support. We have now added to it a data-base record-keeping and cataloguing system employing Claris' FileMaker Pro. In addition, in keeping with our understanding of the Tell es-Sweyhat plain as a marginal environment, we have emphasized the importance of paleobotanical and faunal remains and the integration of

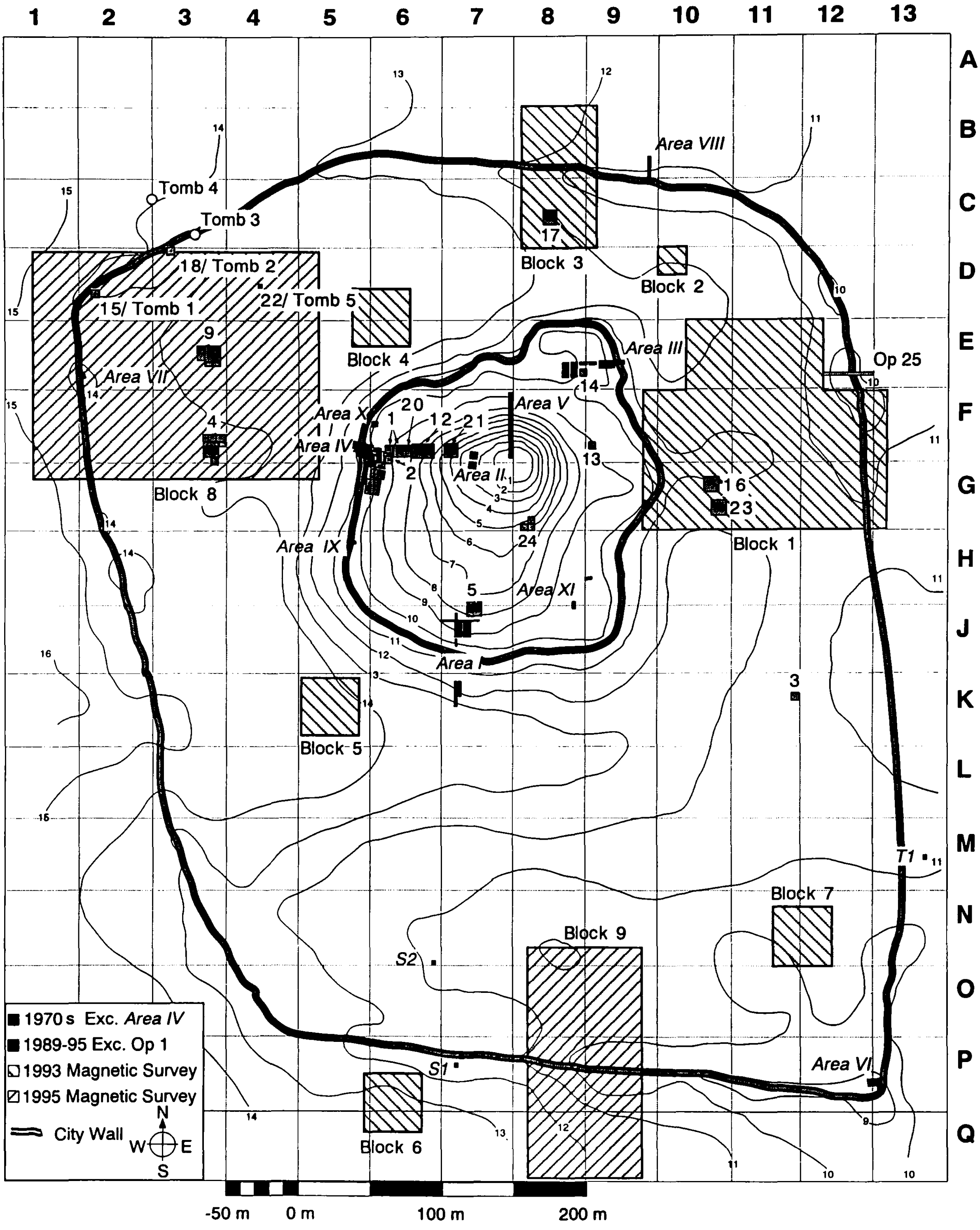


Fig. 1.4. Topographic map of Tell es-Sweyhat showing excavations and geomagnetic survey areas.

ecofactual data with other categories of material remains (see Chapters 6–8). Encouraged by the nature of the archaeological deposits in the lower town, we initiated a program of non-invasive data collection (see below and Chapter 4). Analytical studies on ceramics and metals, among others, are planned for the future. The effectiveness of our particular collaboration with MASCA is evident in the interpretation of the results of our work detailed in Chapters 2–8 and summarized in the Conclusions (Chapter 9).

Northern Mesopotamian Urban Form and Structure

In his now classic discussion of ancient Mesopotamian urbanism, Leo Oppenheim described northern cities as composed of a fortified center, where the palace, temple, and their dependencies were located, and an outer residential area commonly surrounded by a second fortification wall. Oppenheim dubbed them "citadel cities" (1964:130–133).

Ancient written documentation—in particular, the Tell Mardikh/Ebla Royal Palace G archival tablets—presents a picture of northern cities that is seemingly consistent with Oppenheim's description. Both the excavator and epigraphers have interpreted the Ebla tablets as indicating that the mid-third millennium city was divided into two parts: (1) the center, identified with the site's acropolis, and (2) the outer town. At least four important households or institutions, whose composition is known at least in part but whose functions are poorly understood, were located on the acropolis: the royal palace, where the king resided; the principal palace, which probably housed the central administrative apparatus of the state; the [place of the] chariots, likely an armory; and the house of the cattle, perhaps the administrative center responsible for the feeding of the royal cattle (Grégoire 1981:392–397). The outer town was divided into four administrative districts, perhaps linked with (or named after) gateways into and out of the city (Matthiae and Pettinato 1976; Arcari 1988). Though the written record, consisting as it does of a royal administrative archive, is obviously biased (and cannot be assumed to describe a socio-economic whole), Archi has, nevertheless, suggested that the Ebla tablets make it clear the city was dominated by the palace and that virtually the entire population was dependent on or indirectly bound to it. He argued, in other words, that urban center in effect corresponded to palace structure in northern cities (Archi 1990a:15–16).

Archaeologists have long recognized the distinctive shape of northern Mesopotamian urban sites, suggesting that such ruin mounds reflect the existence of a highly centralized or authoritarian political power (Poidebard 1934:149–150; van Liere and Lauffrey 1954:133–140; Moortgat-Correns 1972:26–52). Excavations have fleshed out our picture of northern cities, but only to a limited extent. Several sites, for example, have yielded information on the extent of occupation in the outer towns of northern cities. Mapped surface remains at Tell Taya, in the Tell Afar plain of northern Iraq, and excavations at Tell Leilan, ancient Šehnā/Šubat-Enlil (Weiss 1990:201–209), located in the upper Khabur drainage basin, indicate that in the mid-to-late third millennium the lower towns of northern cities were densely occupied. The plan of Tell Taya's lower town shows major roadways, open spaces, blind alleys, houses of various sizes, buildings that were probably small temples at some street junctions, and industrial areas, notably potteries and a flint knapping quarter (Reade 1982:77). Recent geomagnetic mapping and excavations at Titriş Höyük in southeastern Turkey suggest that though the periphery of the late Early Bronze Age (2300–2200/2100 B.C.) outer town may have contained open areas, its core was densely packed. The geomagnetic maps have also revealed the courses of major roadways (Algaze et al. 1995:22–23, 25–26).

Whether the form that characterized northern Mesopotamian cities in the third millennium continued unchanged in succeeding periods is questionable. For example, the topography of Tell al-Rimah (ancient Karana), located in the Tell Afar plain, as well as excavations at Tell Leilan, suggests that in the second millennium northern cities' lower towns were *not* densely occupied (Oates 1982:87). Weiss explained the seeming contradiction in the picture presented by Tell Taya and Tell al-Rimah by suggesting a change in northern urban form in the second millennium. He noted that in the mid-to-late third millennium, the lower town at Tell Leilan contained dense residential occupation, while in the early second millennium the site became, in effect, a "hollow" administrative center for an area of dense rural settlement. The lower town contained a large public building, but otherwise its defensive wall enclosed a considerably larger area than would ever have been required for buildings (Weiss 1990:201–209; Akkermans and Weiss 1987/1988:97–98). David Oates suggested that such open urban areas would have served as places of refuge for the people of the countryside and their flocks in troubled times (1982:87). Whatever the explanation, northern Mesopotamian urban form, considered over the *longue durée*, would seem to have been dynamic, responding to broader natural and/or social forces.

Excavations at larger sites in southeastern Turkey, Syria, and northern Iraq continue to yield fragments of urban form, but our picture of northern cities remains sketchy. Even within the admittedly limited framework

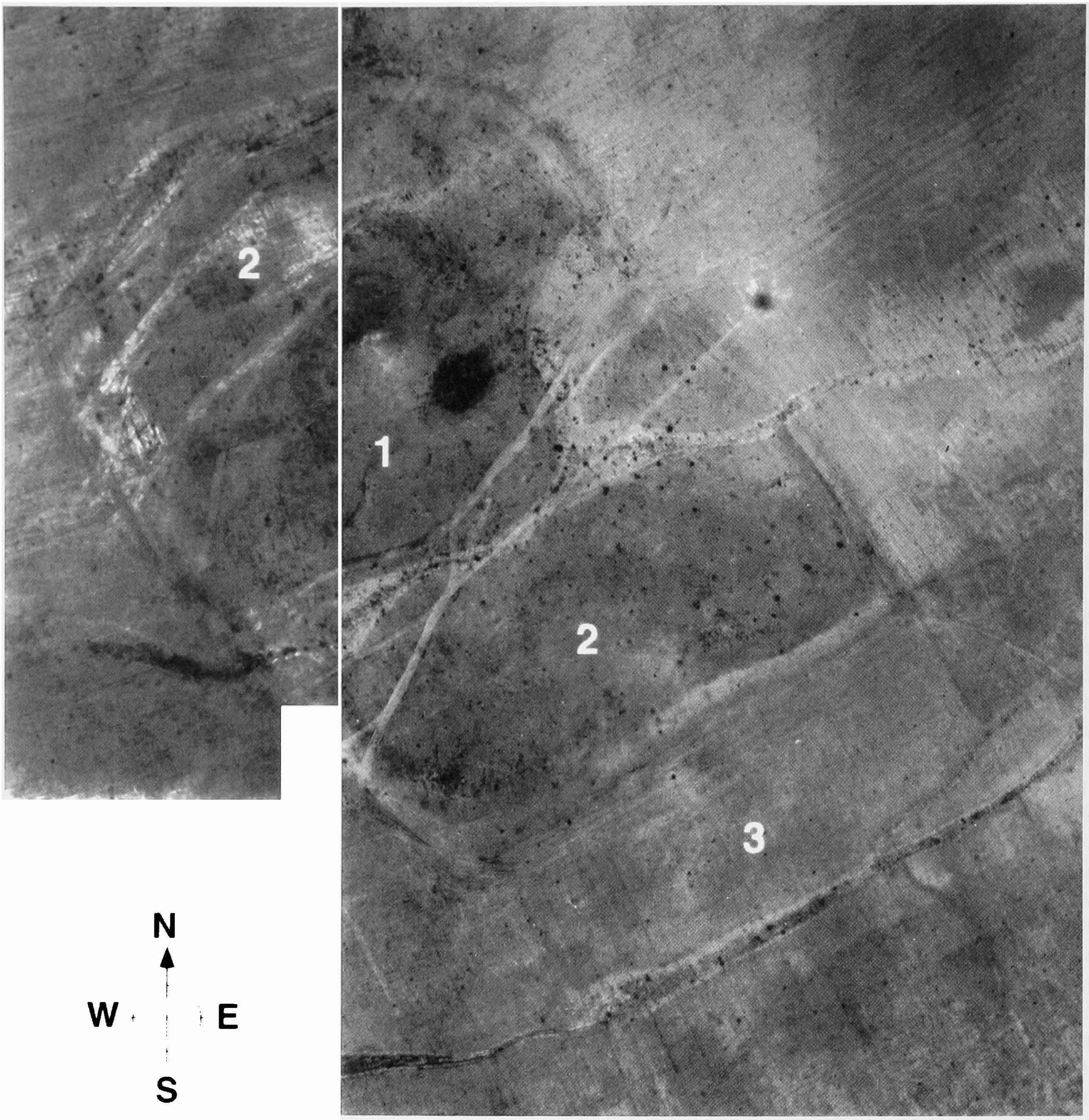


Fig. 1.5. Low-level aerial photograph of Tell es-Sweyhat, showing the central high mound (1), lower tell (2) and lower town south (3).

of Oppenheim's general description, archaeologists can pose and answer many questions. Did outer towns contain dense residential architecture or were there open spaces such as gardens or orchards, or undeveloped land that could have served to accommodate herds of sheep and goat or trash dumps? What was the extent, if any, of extramural settlement? Were city citadels occupied exclusively by palaces and temples and their dependencies? If houses existed in the citadels, did their size, architectural elaboration, and/or artifacts set them apart as a group from houses in outer towns? Did the occupants of the citadels and outer towns have differential access to natural resources, for example, meats and cereals? Were public administrative buildings and temples located in outer towns? Did houses in outer towns occur in distinct clusters that might be suggestive of ethnic, kin, or occupation-based quarters? Did the size and architectural elaboration of houses within outer towns vary? What industries (as opposed to household productions) were localized in northern cities? Were workshops located in both citadels and outer towns or only in the latter? If both, were certain industries concentrated in one area or the other? Were outer town workshops physically segregated or were they dispersed and/or perhaps embedded in largely residential areas, or do they manifest a dual pattern?

The answers to such questions will provide information on the demographics of northern Mesopotamian cities and, more importantly, insights into the political structure and the degree of socio-economic differentiation and economic specialization within and between citadels and outer towns.

In approaching our research questions, we opted to focus our efforts largely on Tell es-Sweyhat's unexcavated lower town. Yet in order to recover a range of comparably excavated inner town contexts, we originally planned in effect to cross-section the central mound by excavating a series of 10 by 10 m units that ran east-west and north-south across it, the two series of squares intersecting near the mound's highest point. On the main mound (see Chapter 2), we have to date begun the east-west series of trenches with Operations 1, 12, 20, and 21 on the west side of the mound and a small square (Operation 13) on the east side of mound, and we have undertaken smaller excavations elsewhere. We also began the series of north-south trenches with Operation 5 on the south end of the mound; Chicago has continued that excavation (Holland 1993/94). In the lower town (see Chapters 3, 4), we have made controlled surface collections; begun a remote sensing mapping project; and undertaken excavations in seven areas (Operations 3, 4, 9, 16–18, and 23), as well as salvage work on shaft-and-chamber tombs accidentally discovered in 1993.

Regional Research

Wilkinson began an intensive geomorphological and archaeological survey aimed at reconstructing long-term land-use patterns in the Sweyhat embayment in the 1970s and completed his work in 1991 and 1992. He is currently preparing a final report. In 1993 we initiated a follow-up regional research program which involves expanding Wilkinson's areal coverage and making topographic maps, systematic surface collections, and soundings (or horizontal exposures) at relevant third and early second millennium sites (see Chapter 5).

Notes

1. See, for example, references cited in Frayne 1993:29–30, 132–135.

2. This contemporary may have been Igriš-Halam, the first of the three kings who appear in the Ebla texts.

3. Note the suggested identification of Tell es-Sweyhat with Burman of Ebla's Royal Palace G archives (Astour 1992:35, n. 213; Meyer 1996:167, n. 120; but see Bonechi 1993:82–83). The letter from Enna-Dagan, king of Mari, reports that his predecessor Iblul-il, king of Mari, brought Burman within Mari's orbit. Tiša-lim, a member of Ebla's royal family and Queen of Emar, held lands in one of the localities included in Enna-Dagan's letter as part of Burman (Archi 1990b:27; Meyer 1996).

4. Interpretation of the proxy data for Weiss and Courty's late third millennium abrupt climatic change continues to be debated (see, most recently, Dalfes, Kukla and Weiss 1997). In contributing to the discussion, we would only re-emphasize the evidence for continued occupation of the Khabur and Assyrian plains (and northern Mesopotamia more generally) in the late third millennium. Textual documentation and archaeological remains indicate that at least Tell Mozan (Urkish) and Tell Brak (Nagar) in the Khabur triangle of northeastern Syria and Nineveh (Ninua) on the Tigris in northern Iraq continued to be occupied in the late third millennium, though the evidence for Tell al-Hawa and Tell Taya, in northwestern Iraq, is more equivocal.

• The names of Hurrian kings of Urkish, Nagar, and Urkish and Nawar, all of whom were presumably contemporary with the late or post-Akkadian and Ur III periods, are known from their foundation and seal inscriptions (Wilhelm 1989:7–12; Matthews and Eidem 1993).

• Weiss noted in one of his varying formulations that extant documentation from southern Mesopotamia suggested that Urkish and Nineveh had only small remnant populations in the late third millennium (Weiss et al. 1993:999). However, there is little basis for such a conclusion. At the time of the Third Dynasty of Ur, Urkish and Nineveh were independent states on the northern and western peripheries of the southern kingdom, though Nineveh may have been a vassel state (Steinkeller 1991:28). While it is true that references to Urkish and Nineveh are not common in the extant epigraphic documentation from southern Mesopotamia, that is not surprising since our documentation consists largely of the internal administrative records of temples and state redistributive institutions. References to such neighboring polities might be expected to occur more commonly in state archives or the diplomatic correspondance of the Ur III kings. Nevertheless, the references to Urkish and Nineveh that have survived indicate that the two states were politically significant entities. Ti'āmat-Bāštī, perhaps a sister of Tiš-ātal, the king (Sumerian *lú*) of Nineveh, was perhaps one of Šu-Suen's wives (Wilcke 1988). Tiš-ātal himself made a state visit to the south in Šu-Suen year 3 (Whiting 1982:173–178; cf. also 6 NT 559, which provides unequivocal evidence that Tiš-ātal and eighty retainers were in Nippur at the end of the ninth month). References to Urkish record distributions made apparently in connection with a state visit of its ruler to the south (Edzard and Farber 1974:224).

• At Tell Brak building levels that postdate the Akkadian occupation of the site were recorded in Areas CH, SS, FS and ER. The excavators have assigned the levels to the late third millennium and insisted that occupation of that date exists "over the whole of the tell." Although the pottery is not yet published, the excavators have described some of the more distinctive ceramic index fossils (Oates and Oates 1994:167–176).

• Wilkinson documented a process of centralization at Tell el-Hawa in the "later third millennium," with the number of settlements decreasing, but Tell al-Hawa increasing in size from 24 to 66 ha (Wilkinson and Tucker 1995:50–53). However, the lack of a fine-tuned ceramic chronology that would permit the subdivision of the period between the Ninevite 5 and the Old Assyrian period characterized by Khabur wares and related types, into discrete blocks of time make a more detailed discussion of settlement developments in the later third millennium fruitless.
• The Taya stratigraphic and ceramic sequence remains largely unpublished and no definitive statements can be made in the absence of a final report on the excavations. Nevertheless, while Weiss may be correct in noting that Taya V is "synchronous with the abandonment at Tell Leilan," Taya VII-VI appear to have lasted at least until the end of the third millennium, if not somewhat longer. Taya, then, was not abandoned until well into the so-called Khabur hiatus (Reade 1968:252–256, 260–261, and 1971:99–100; Oates and Oates 1994:171; Matthews 1997:36–37, 43–45).

Whatever changes in the settlement system may have followed on the posited abrupt climatic change in the Khabur and Assyrian plain in the period 2200–1900, occupation elsewhere in Syria appears to have continued. For example, Carchemish (Algaze, Breuninger, and Knudstad 1994:14–17), Tell Banat (Porter 1995), Tell es-Sweyhat, Tell Bi'a (Einwag 1993a) and Mari (Durand 1985 and Margueron 1996) in the Euphrates river valley continued to be occupied, as did Tell Mardikh (Ebla) in western Syria (Frances Pinnock, pers. comm. May 1997; see preliminarily Matthiae 1993:634–637).

Both the historical scenario that Weiss has constructed around the late third millennium abrupt climatic change and certain of the paleoenvironmental and archaeological data that he has adduced as supporting climatic deterioration are open to question and debate and merit further discussion. As for the former, Weiss's reconstruction implies large-scale shipment of grain from the Khabur to the southern floodplain. Except for a reference to an inscribed bulla from Chagar Bazar that lists quantities of grain and a boat (Weiss and Courty 1993:148, n. 73) he has not supported his assertion and he has not yet convincingly demonstrated that the Dynasty of Akkad was in any way "dependent" on the Khabur as its "breadbasket." Further, as Glassner has noted (1994:50), the Third Dynasty of Ur was not a lesser copy of the Dynasty of Akkad, and the fact that the Ur III kings did not retake the Khabur really does not prove that the region was insufficiently productive for southern imperialization. As year dates suggest, the kings of the Third Dynasty had their own particular geo-political orientation, campaigning extensively in the area east of the Tigris and setting up a sort of militarized "buffer zone" (Steinkeller 1991:24–33). The Ur dynasts maintained effective relations with the north by means of royal marriage alliances with Nineveh (see above) and Mari (Durand 1985:156–157; Boese and Sallaberger 1996).

Among data Weiss has adduced to support posited abrupt climatic change, he has cited Adams' survey data and references in nearly contemporary literary texts to "natural disasters" such as drought, wind turbulence, harvest collapse, Euphrates flow reductions and flaming potsherds. Both sources need to be used with caution. Adams' survey data lacks the sort of fine-tuned chronology that makes its application to historical reconstructions problematic. Adams himself recognized that fact and accepted it as part of his "study's emphasis on wide geographic coverage and hence rapidity of application" (Adams 1981:143). For the later third millennium Adams specifically noted the problem of distinguishing Early Dynastic from Akkadian, Akkadian from Ur III and Ur III from Isin-Larsa in surface collections (Adams 1981:142–143). In fact, Adams apparently did not include the "band-rim bowl" as an index fossil for the late third and early second millennium. As Gibson and McMahon have recently noted, the "band-rim bowl" is the only pottery type that is specific to the Ur III period (1995:8, 16).

With regard to the assumption of an "historical core" of information in nearly contemporary literary texts, Tinney's recent discussion of Naram-Suen's royal inscriptions concerning the "Great Rebellion" and Old Babylonian literary texts purporting to detail the same events has cautioned us not just against taking references to "natural disasters" as metaphor, but more broadly against reconstructing "history" from literary manipulations of royal inscriptions. As Tinney noted, perhaps the most effective approach to both historical inscriptions and literary reworkings is "to examine texts with a view to learning not what they tell us about the events they purport to describe, but what they tell us about themselves and the reasons for describing these events in a given way" (1995:2).

5. Holland has described the construction of the late third millennium inner fortification wall, but he apparently did not excavate much below the wall's footings, and the existence of an earlier wall below it (or further to the east) surrounding the early to mid-third millennium settlement cannot be excluded.

2

EXCAVATIONS ON THE HIGH MOUND (INNER TOWN)

James A. Armstrong and Richard L. Zettler

We began excavations on the high mound in 1989 with two 5 by 5 m soundings (Operations 1 and 2) just east of the 1970s Area IV (Fig. 2.1). Our intention was to expand one of them into what would be the first in the planned series of 10 by 10 m squares across the northern end of the mound. Because of time constraints we were forced to restrict the actual area excavated in each operation in order to reach a floor level contemporary with the Area IV building (ca. 2 m below the surface of the mound). In 1991 we enlarged Operation 1 to a 10 by 10 m square (with the original sounding forming the northwestern corner of the unit), but excavated only its northern half to a floor level contemporary with the Area IV building.

In 1993 we spent the first part of the field season working on architectural and stratigraphic problems left unresolved in 1991. We then removed the walls in the western part of the unit and began a sounding that eventually reached virgin soil. Though a stratigraphic sounding was not originally part of our field strategy, our work in Operation 1 had provided a large area cleared to more than 2 m below the surface; so, we made an opportunistic decision to continue down. We saw the sounding as contributing to the long-term goals of the Tell es-Sweyhat Project: we had initiated a new phase of regional work in 1993 (Chapter 5, pp. 85–88), and the sounding provided a reliable stratigraphic and local ceramic sequence into which we could tie other sites in the area. Our sounding measured 5 by 6 m, and we cleared to virgin soil over the whole of the unit.

We began a second 10 by 10 m square (Operation 12) 6 m east of Operation 1 in 1993.[6] Eventually, we extended this unit 6 m farther to the east in order to investigate its architectural remains (see below, pp. 18–19). We also laid out a 10 by 10 m square (Operation 13) in line with Operations 1 and 12 on the east side of the mound in the southwest corner of Square F9. However, having cleared a substantial (1.5 m thick) wash layer that sealed the architectural remains, we decided to close the operation in order to focus our efforts elsewhere.

We returned to Operations 1 and 12 in 1995 with limited goals. In Operation 1 we wanted, first, to clear the as yet largely unexcavated parts of the upper occupation levels and, second, to expand our 1993 deep sounding to clarify the stratigraphy and dating of the lowest occupation levels. We also wanted to link Operations 1 and 12 by excavating the 6 by 10 m baulk between them. We dubbed the excavation of the baulk Operation 20. After clearing surface fill over the whole of the area, we restricted deeper digging to the central part of the operation, with the deepest excavations in a 1.5 m wide trench in the south central part, where we were 4.4 m below the surface of the mound, ca. el. 87.70 (Fig. 2.2). In addition to work in Operations 1, 20, and 12, we also laid out a new 10 by 10 m excavation unit (Operation 21) in line with those operations, approximately 10 m to the east (or up the slope of the mound), with the aim of clearing what we had assumed would be Hellenistic or Roman occupation levels in preparation for later work on third millennium levels. We began digging, but stopped when we encountered remains of third millennium occupations immediately below the surface. The results of excavations in Operation 20 had already convinced us of the impossibility of correlating such up-slope third millennium occupation levels with down-slope levels without physically linking the units. We will continue Operation 21, but only as we proceed more systematically up the mound.

Operations 1, 20, and 12

We have tentatively divided the almost 6 m of accumulated debris from virgin soil to the surface of the mound in Operations 1, 20, and 12 into six occupation phases (Fig. 2.3).[7] The phases group together building levels or depositional events and mark what we perceive to be continuities or discontinuities in the occupational sequence. As we will discuss more fully below, the six phases span the third and early second millennia, with Phase 1 attributed to the first half of the third millennium and Phase 4, our main occupation phase, to the end of the third millennium.

Fig. 2.1. Operations 1 and 2 at the start of excavations in 1989.

Phase 1

We reached virgin soil at 14.56 m (el. 85.44) below the cement bench mark on the top of the mound. Phase 1 consisted of a series of ashy soil layers that accumulated 90 cm to 1.20 m deep on virgin soil. From bottom to top, as visible in the south section, the successive layers consisted of three striated gray ash deposits separated by thin bands of heavy black ash; three mixed brown soil and ash deposits; two greenish-gray deposits; a thin band of brown soil; a greenish-gray ash deposit; and a thin line of black ash. We found no trace of any buildings associated with the Phase 1 soil layers, but in the northeast corner of the sounding we noted a circular pit cut into virgin soil from one of the intermediate soil layers. The pit was filled with ash.

Our study of the Operation 1 ceramics is not yet complete, but we can make a few preliminary remarks about the Phase 1 pottery. With the exception of a relatively few jars and wide-mouth pots made of coarse, low-fired, grit-tempered cooking-pot ware (Appendix 2.1: Fig. k), the vessels were generally made of a high-fired, medium-textured fabric that varied in color from buff to pink. The clay was tempered by sand, possibly a natural inclusion, supplemented by the occasional addition of chaff or grit. While some sherds were covered in a cream-colored slip, reserve-slip decoration was absent, as were other forms of decorative surface treatment. Several sherds bore incised marks made of several strokes of a stick in the wet clay. These were generally found on jars, but a few examples occurred on bowls as well (App. 2.1: Figs. b, f).

Although examples of straight-sided bowls were attested in Phase 1, the most common bowl/cup form had an incurving side and a rounded rim (App. 2.1: Figs. a, b). A bowl with S-shaped profile was also present (App. 2.1: Fig. c). Small jars had an everted neck and rounded rim (App. 2.1: Fig. d). A unique base for a small jar consisted of a tripod of three small knobs (App. 2.1: Fig. e). The standard, medium-to-large jar had a wide mouth, a short, everted neck and a rim that was usually rounded and frequently thickened (App. 2.1: Figs. g–k). Some examples had a depression on the interior just below the rim, forming a shallow ledge, perhaps to hold a lid (App. 2.1: Fig. h); others had a distinct groove on the outside of the rim (App. 2.1: Fig. i). The depression and groove were the result of pressure exerted by the fingertip and fingernail in finishing the jars' mouths. Larger storage jars had low necks and

Fig. 2.2. Operations 1, 20, and 12 at the end of 1995 field season.

rolled or rounded rims (App. 2.1: Fig. l).

The assemblage represented by our Phase 1 pottery is essentially the same as that already published from Sweyhat, Area IIA, Phases A–F (Holland 1976:39–48). Close parallels can also be drawn with the pottery from Tell Ahmar, Area A (Jamieson in Bunnens 1990), and Hadidi, Area RII, Stratum 1, Levels 1–4 and Stratum 2, Level 1 (Dornemann 1988). More generic parallels exist with Kurban Höyük, Period V (Algaze 1990:281–309; cf. Wilkinson 1990:214–217). All these parallels indicate that our Phase 1 is to be dated to the first half of the third millennium, that is, to the early part of the Early Bronze Age (EBA).

Our Phase 1 remains show that early third millennium village activities probably extended to the western edge of the main mound. However, occupation there is considerably lower in terms of absolute elevation than the apparently contemporary building levels in the Area II sounding.[8] The disparity in elevations may indicate that the core of the mound conceals an even earlier occupation. If not, it may be that the early third millennium levels in the center of the mound were raised, perhaps by setting buildings on artificial platforms or terraces.

Phase 2

Phase 2 included the earliest architecture on the western edge of the mound recorded to date (Fig. 2.4). The excavated remains can be divided into earlier and later occupations, but those distinct chronological periods have not been assigned sub-phase numbers here. Our earliest architecture consisted of three partially cleared buildings constructed on or associated with the latest Phase 1 soil layer: a stone construction oriented northwest to southeast in the northwest corner of the excavated area (hereafter referred to as the NW Building); a fragmentary structure running southeast to northwest across the northeast corner of the sounding (hereafter referred to as the NE Building); and a pit house to the south. As will be detailed below, the NW and NE Buildings stood for the duration of Phase 2, while occupation of the pit house was short-lived.

We uncovered only the southeastern corner of the NW Building. The corner, set in a pit or foundation trench cut from the latest Phase 1 soil layer, was made of stone and preserved more than 1.20 m high.

We cleared the outer (or southwestern) wall of the NE Building, as well as the northwestern wall and corner of an interior room. The 75 cm wide walls, constructed on the latest Phase 1 soil layer, were made of mud bricks measuring 39 by 39 by 11 cm, set on low stone footings. A bench stood against the exterior face of the building. Inside, the gray ashy floors of the room lay at the base of the stone footings and the mud bricks of the walls were covered with a 5 cm thick plaster. A doorway was set in the northwestern wall and would presumably have led into another interior room (Fig. 2.5); only one jamb of the doorway was preserved in the sounding.

To the south of the NE Building we discovered roughly half of an oval building set in a pit cut into virgin soil from the uppermost Phase 1 soil layer. Since the layer from which the pit was cut was the outside living surface associated with the NE building, the oval building would have been semi-subterranean. The building measured ca. 4.5 by 6.5 m (or ca. 23 m^2). Its wall was built of mud bricks measuring 52 by 30 by 10 cm that were set on a low stone footing. The wall lay against the edge of the pit in places, but was separated from the edge by as much as ca. 30 cm of loose fill and brick fragments elsewhere (as on the north). The uppermost portion of the wall on the north and east sides was offset from its lower courses, creating a sort of shelf inside the room at a height of a meter above the floor (Fig. 2.6). The wall of the pit house appears to have been built in segments (or, alternatively, to have been rebuilt in the course of its occupation). For example, where two segments join on the east, the stone footings of the southernmost segment, set on debris, step up and over the mud bricks of the northern portion of the wall. The inside surface of the stone footing and both the inner and outer faces of the mud-brick wall were heavily plastered (at least where the outer face did not abut the edge of the pit).

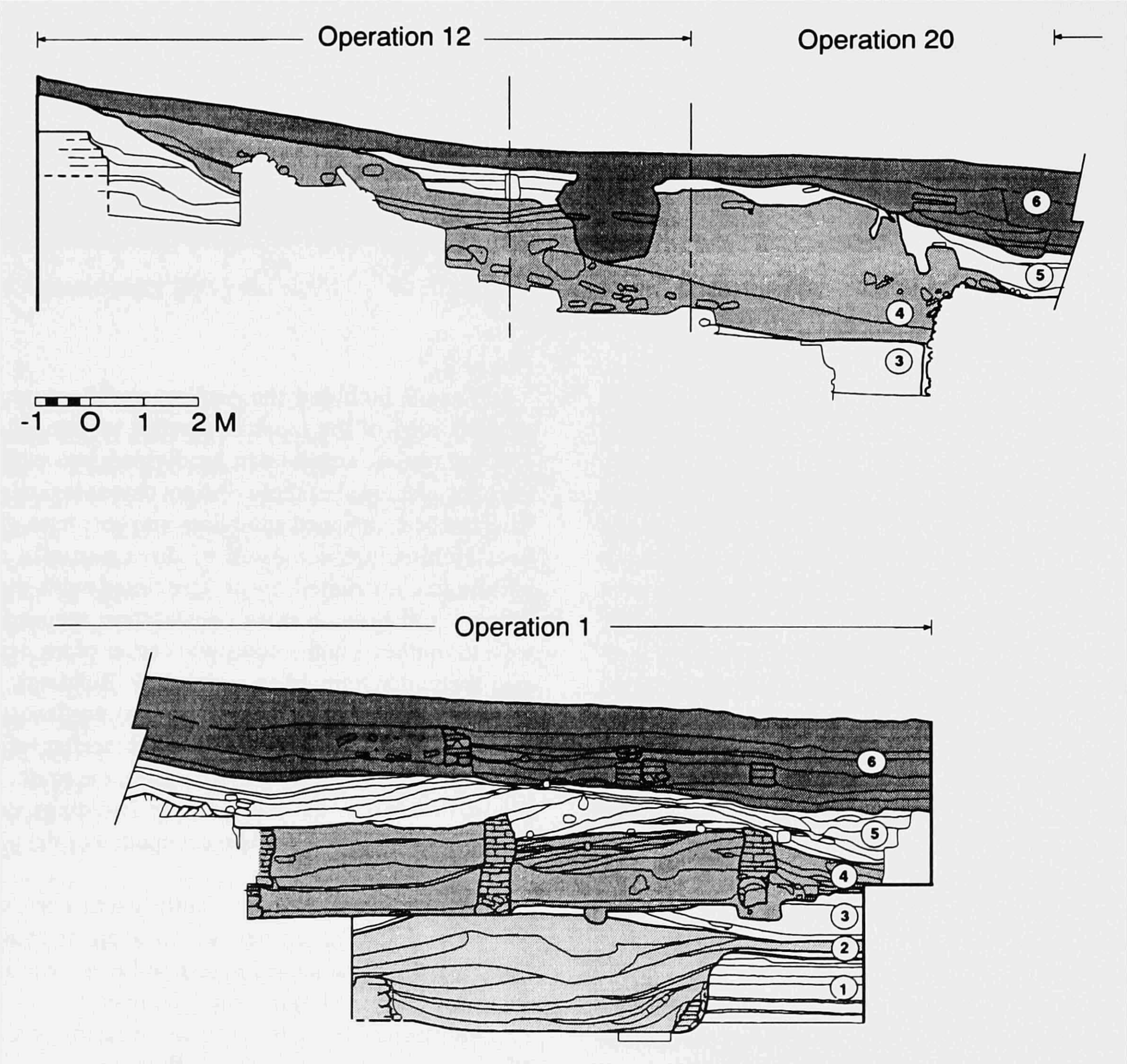


Fig. 2.3. South Section of Operations 1, 20, and 12 showing the main phases of occupation.

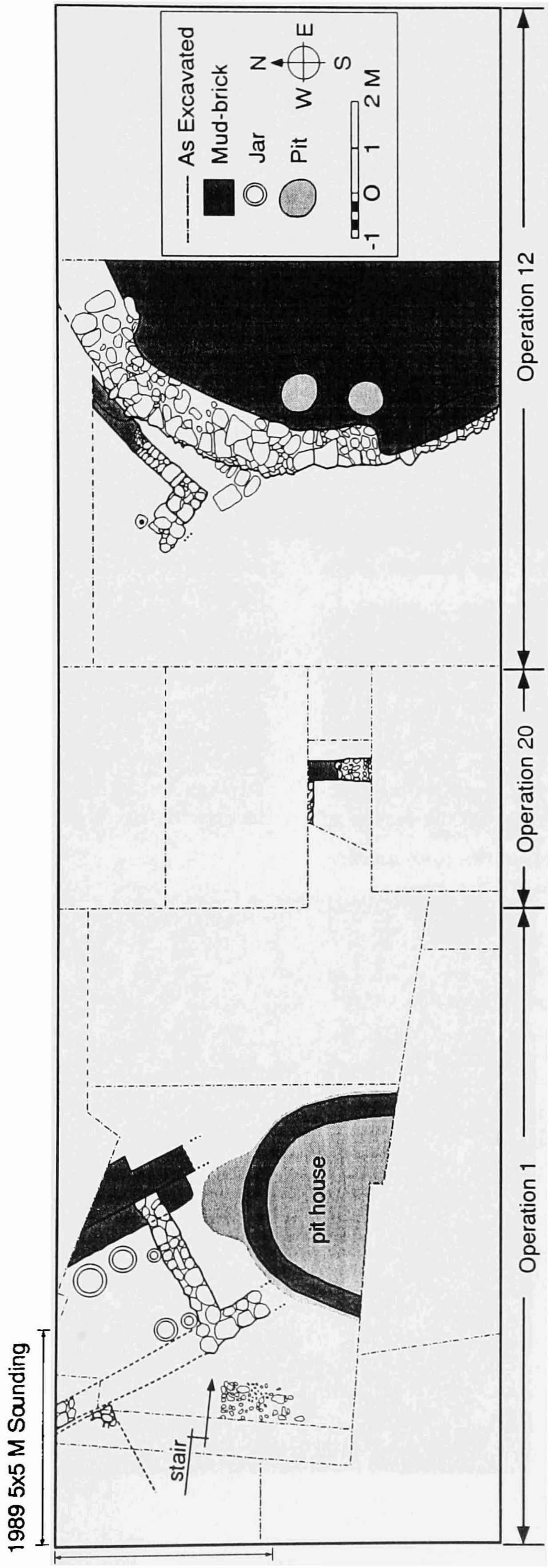


Fig. 2.4. Plan of Operations 1, 20 and 12, Phases 2-3.

The floor inside the building, covered with ashy occupational debris, was ca. 1 m below the level of the surface from which the pit was cut (or ca. 20 cm below the level of virgin soil). We recovered pottery, a model chariot wheel, chipped stone, bones, and a shell from the occupational debris and floor. The pottery included a large number of medium- to large-sized simple ware jars (diameters range from 13 to 21 cms, but one example is 37 cm), all with an indentation for a lid on or just below the rim (see App. 3.3: Figs. aa, bb). The diagnostics also included simple ware cups with a plain rounded rim, deeper bowls with a club rim, smaller jars with everted neck and plain rounded rim, as well as a brick-red metallic ware pedestal base.

We found no evidence bearing on the question of access into or out of the building in the area so far exposed, but by process of elimination the entry would have to have been from the southwest. A ramp might have led into the building, or perhaps a stairway similar to those that provided access to the nearly contemporary "pit houses" at Arslantepe (Conti and Persiani 1993: 365–369; Frangipane 1993:86–89).[9]

Fill accumulated in the pit house subsequent to its occupation; in time, the northernmost section of its mud-brick wall toppled inward (as can be seen clearly in the east section of the sounding; see Fig. 2.6). We found a second floor 40–50 cm above the original floor. The floor abutted the fallen bricks, providing evidence for post-collapse use of the space. Fills subsequently continued to accumulate against the section of toppled wall and eventually sealed the pit house early in the life of the NE Building.

Except for the large number of jars fitted for lids, our pit house showed no evidence of having a specialized function and every indication of having been a domestic structure. The jars, which might indicate a storage function, could equally be explained if the occupants lived off stored comestibles.

The existence of such pit houses on what would have been the western edge of the early village is intriguing, particularly in contrast to the nearby contemporary rectangular building with its floor at ground level. Patricia Gilman has noted that pit houses correlate with three conditions: non-tropical climate during the season of use; minimally a biseasonal settlement pattern; and reliance on stored food while the pit house is inhabited (1987:540–548). Similar semi-subterranean dwellings (Arabic *debbabe* in the region of Raqqa; *debdabe* around Deir ez-Zor; and, *damme* around Abu Kemal) were used by semi-sedentary or transhumant tribal populations in the Euphrates valley even in the relatively recent past (Daker 1984:58–60; D'Hont 1994:200–201).[10]

The resemblance between the structures Daker and D'Hont describe and our excavated pit house is remarkable. The pits were 1–1.5 m deep and the houses, though normally rectangular or subrectangular, were 4–6 m in length and 3–4 m wide, with the longitudinal axis oriented north-south. The earth from the digging was piled on the sides around the pit to form the base of the walls and increase the useful height of the building. Frequently, in

Fig. 2.5. Doorway in the northwestern wall of the NE Building in Operations 1, 20 and 12, Phase 2, with the floors and plasterings associated with the original and secondary rebuilding of the NE Building detailed.

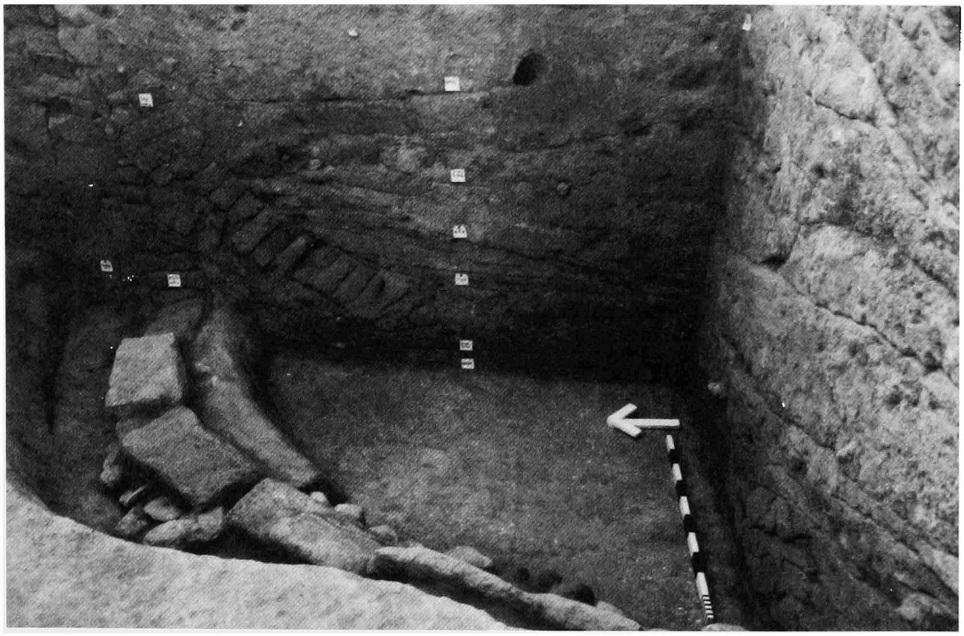


Fig. 2.6. Lower portions of the eastern and southern sections of the sounding in Operation 1 (1993). The approximate height of the wall of the Phase 2 pit house is preserved in the east section, showing the offset between the lower and upper portions of the wall, as well as a portion of the wall toppled inward onto fill that accumulated on the structure's original occupation floor.

cutting the pit, benches for sitting, sleeping, and storing materials were left on all sides. The superstructure was commonly constructed of branches and brush supported by interior posts and beams. It would have been plastered to keep the interior warm and make it watertight. An opening, commonly in the southwest corner (as in our pit house), measured ca. 1 m wide and 1.2–1.5 m high. The opening functioned as a doorway, as well as providing for light and air and for the evacuation of smoke. Its position in the southwestern corner would permit the sun to penetrate and warm the interior. A ramp or stairway provided access. A low curb constructed at the opening prevented rainwater from getting into the house (Daker 1984:58–60).

Olivier D'Hont has noted that at the beginning of this century, when the 'Agedat herded sheep and practiced cereal agriculture in the summer and early fall, if the pastoral potential of production units was reduced by cold, the poorest members of the tribe would be forced to give up transhumance temporarily and pasture their reduced herds in the river valley (1994:211). They would frequently live during that time in semi-subterranean dwellings. Between WWI and WWII, the 'Agedat began to grow wheat and barley in the fall and winter (in large part because of market forces). When the majority of the tents were relocated to the desert in February, a small number of tribesmen would remain behind in the river valley with a few animals to watch and work the fields. Those who remained commonly occupied semi-subterranean dwellings through the winter (1994:212).

The pit house may suggest the existence of a semi-sedentary or transhumant element in the early village's population. The original floor may represent initial human occupation, and the later floor a subsequent use of the structure as an animal pen. Our observations may provide the basis for the formulation of specific, testable hypotheses as we uncover more of the earlier settlement.

In the later Phase 2 occupation, the NW Building continued to exist, apparently unchanged, while the NE Building was rebuilt. The floor associated with the reconstructed NE Building lay 15–20 cm higher than the original gray ashy floors, approximately at the top of the second course of mud bricks from the bottom. The interior walls were covered with a heavy plaster, 20 cm thick at the base, thinning to 10 cm above (Fig. 2.5). During reconstruction, the open space between the NE and NW Buildings was divided into several rooms by the addition of walls set on a hard brown floor that ran over the top of the bench against the outer (southwestern) wall of the NE Building. All that remained of the dividing walls were fragmentary stone footings preserved only one course high. One of the walls ran northeast to southwest and abutted the outer face of the NE building; the other ran northwest to southeast perpendicular to it. The walls defined three spaces: Locus 23 on the southeast, Locus 26 on the southwest, and Locus 27 on the northeast.

Locus 27 contained a fire pit, ca. 60 cm in diameter and 18 cm deep, as well as five storage jars sunk into plastered holes in the floor. The floor was covered with a layer of black ash, presumably from the fire pit. We took soil samples for floatation from one of the storage jars, but our archaeobotanist has suggested that the plant remains recovered, including *Eremopyron* seeds and *Aegilops* chaff, both wild grasses, are unlikely to have been the original contents. The charred remains were perhaps deposited when the tops of the jars were sheared off (see below) and the Phase 2 remains leveled (see Chapter 6, p. 101).

Phase 3

Phase 3 (Fig. 2.4) is as yet poorly understood. This occupation phase includes floors, debris layers, and pits that follow on Phase 2 remains and precede the Phase 4 buildings. At the end of Phase 2, the walls defining Loci 23, 26, and 27 were leveled, and the portions of the jars in Locus 27 that had protruded above the floor were sheared off. A mud-brick packing was laid over the floor of Locus 27. In the southern end of the sounding we uncovered a series of red plaster floors each separated by thin layers of ashy occupation debris. A substantial layer of brown bricky fill covered the mud-brick packing and floors. A fragmentary stone paving was put down on top of the fill in the southwest corner of the sounding. A band of green-gray ashy soil covered the brown bricky fill. The latest Phase 3 remains include an ash-filled pit in the northeast corner of the sounding; the pit cut through Phase 2 remains and into Phase 1 soil layers.

Though we have not yet connected Operations 1, 20, and 12 at the level of our Phase 3 occupation, we have uncovered substantial architectural remains in Operations 12 and 20 that are earlier than Phase 4 (see below) and that should probably be attributed to Phase 3 (Fig. 2.4). The most important of these is a curved structure in Operation 12, which, if round, had a diameter of more than 12 m (Fig. 2.7). It is built of mud brick set on a stone foundation, of which only the western face has been exposed. In the northern end of the operation its foundation is made of substantial stones or boulders and is seven to eight courses high; in the southern end the foundation is made of smaller stones and is only three courses high. The absolute elevation of the bottom of the stone foundation appears to rise from north to south, suggesting that it was built on a slope. The mud bricks on top of the stone foundations extend more than 5 m to the east of the foundation's western face. The structure

Fig. 2.7. Curved structure in Operation 12 tentatively assigned to Phase 3. The southeastern corner of an even earlier building is visible in the lower left corner of the photograph. The stones in front of the curved structure on the right side of the photograph are associated with Phase 4.

may be similar to, for example, the round building from Tell al-Raqā'i in the Middle Khabur (see, most recently, Schwartz and Curvers 1992), but seems more likely to be a platform or terrace built on the northern slope of the mound, presumably to expand the area available for building.

Fragmentary remains in Operations 20 and 12 can be dated even earlier than the round structure. We would tentatively attribute them to Phase 3, but only future excavations will determine their precise position in the occupational sequence. The remains include walls made of mud brick set on stone footings that form the northeast corner of a room in Operation 20, and the southeastern corner of a building in the north central part of Operation 12. The Operation 20 remains were cut by a Phase 4 terrace wall (see below). The building in Operation 12 stood on a low platform, whose lime-plastered face curved to the southeast. The plastered jamb of a doorway and a pivot stone were preserved in what remained of the building's southwestern wall. We recovered a flat copper or bronze axhead from fill inside the building. The southeastern wall of the structure was cut by the curved structure to the east.

Phase 4

Phase 4 represents the main phase of Tell es-Sweyhat's occupation and the period of its floruit. In Operation 1 it includes parts of three buildings to the east of the Area IV building uncovered in the 1970s (Figs. 2.8, 2.9). We found evidence of extensive terracing operations undertaken in preparation for the construction of the buildings, and probably for the inner fortification wall and Area IV building as well. The western side of the existing mound was cut down ca. 95 cm and roughly leveled. A retaining wall running northeast-southwest was then built against the cut face of the mound, with the base of the wall at el. 87.84 (Fig. 2.10). The 70 cm wide wall consists of a single line of stones fifteen to twenty courses or 2.3 m high at its highest preserved point. The wall was carried up in mud brick and the exterior face of the stones and mud brick covered in a thick plaster. The area behind (or to the east of) the wall was filled in with earth presumably from the western side of the mound (see the south section, Fig. 2.3). We have identified two soil layers behind the retaining wall, which presumably represent a deliberate sorting of fills and two distinct filling episodes. The lower fill, 30–60 cm thick, is rubble with whole and fragmentary mud bricks; in Operation 20 this fill includes a large number of substantial stones. The upper fill, more than 2 m thick in places, is a relatively clean and homogeneous brown soil. The top of the brown fill presumably approximates the surface level of the north-central part of the late third millennium settlement.

As can be seen in the south section, the fill behind the retaining wall goes up to and over the top of the round building or platform uncovered in Operation 12 (see above), meaning that the structure must be earlier than our Phase 4 structures.

The buildings uncovered to the west in Operations 1 and 20 abutted the stone retaining wall described above (see Fig. 2.8). Those structures—and presumably the inner fortification wall and the Area IV complex—would have stood on a lower level than whatever structures existed to the east. Though parts of three buildings lay within the two operations, a single large complex, still not completely excavated, occupies all but the north-northeast part. This building provides evidence for both the original construction and a subsequent rebuilding. We uncovered part of an alleyway or street (Locus 1.14), which separated the large building from the Area IV building, in the western end of the operation. In the building itself we defined two rooms (Locus 20.8 and 20.10) east and two rooms (Locus 1.13 and Locus 1.15) west of an L-shaped courtyard (Locus 1.16). The building was constructed of mud bricks, measuring 33–35 by 33–35 by 7–8 cm, set on a stone footing two to three courses high. Both the stone footings and the mud bricks were heavily plastered.

The cut-down surface of the ground was uneven at the time of the building's construction. We uncovered foundation cuts intrusive into the Phase 3 gray-green ashy layer in the western part of the operation. As can be seen in the southern section, the foundation cut had been backfilled somewhat before the stone footings of the southernmost portion of the western wall of the building were laid. The walls in the eastern portion of the building were founded on ground level. The tops of the building's stone footings were at roughly the same absolute elevation as the bottom of the stone retaining wall.

The alleyway between the Area IV rooms and the Operation 1 building had a deliberately prepared surface: a shallow, 1.5 m wide linear trench, filled with pebbles, that ran south to north. The western wall of the building had a doorway that led from the alleyway or street into Locus 1.13. A plastered bench had been built against the wall to the north of the doorway. A large flat-topped stone set into the top of the bench perhaps served as a work installation. Flat limestone slabs that lay on the surface of the alleyway protruded from the western baulk. The slabs would presumably have been work surfaces perhaps along the eastern outer wall of the 1970s Area IV building. The pebble paving of the alleyway suggests that it was an outside space, and both the stone slab work surfaces to the west and the bench against the outer wall of the Operation 1 building imply a functional

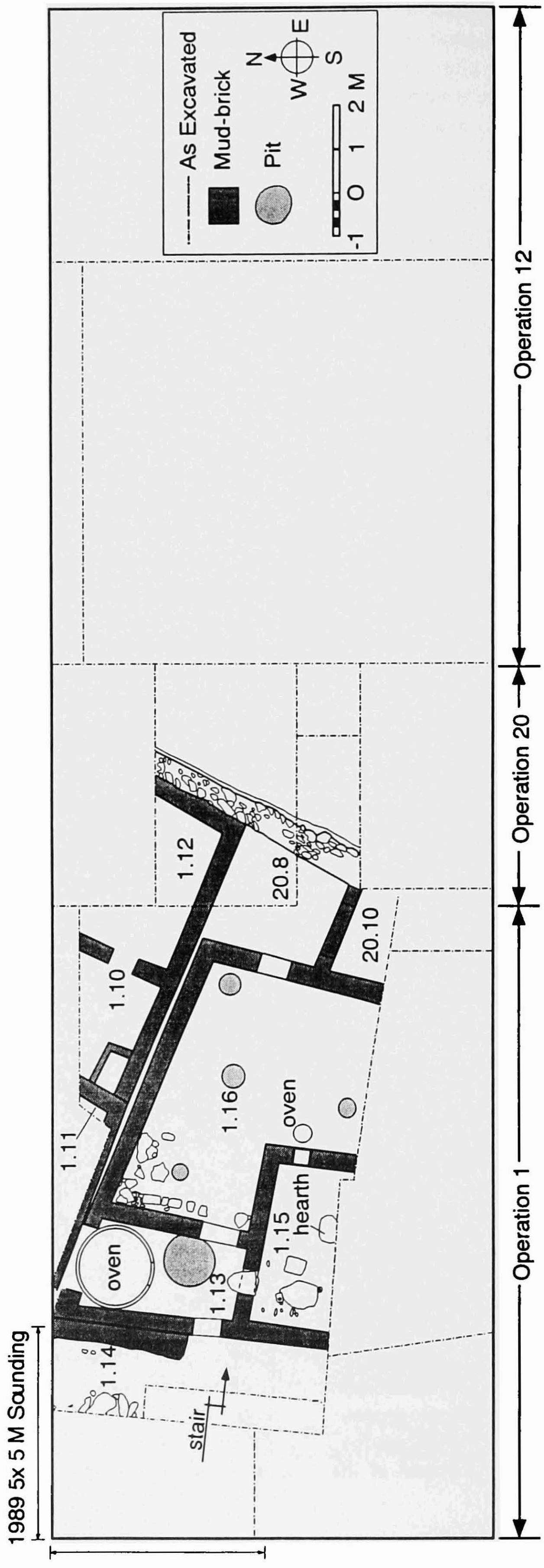


Fig. 2.8. Plan of Operations 1, 20 and 12, Phase 4.

Fig. 2.9. Phase 4 architecture in the westernmost portion of Operations 1, 20 and 12. Locus 1.14 is in the lower portion of the photograph; Locus 1.13 with a circular oven and Locus 1.15 are in the center; and the L-shaped courtyard, Locus 1.16, is in the upper portion of the photograph. The division between the original building and its reconstruction is visible on the eastern and northern walls of Locus 1.16.

relationship between those two structures.

Locus 1.13, a rectangular room, occupied ca. 9.5 m^2 In addition to the doorway to the street in its western wall, doorways in the room's southern and eastern walls led into Locus 1.15 and the courtyard, Locus 1.16, respectively (see Fig. 2.8). An arch, whose piers were bonded to the western and eastern walls, defined the northern end of the room, abutting a wall (apparently the southern wall of Locus 1.11) which ran parallel to and north of it (Fig. 2.11). The arch spanned 55 cm, and the springer and initial voussoirs were preserved (Fig. 2.12). We have estimated that the opening would have reached a height of 1.4 m above the original floor. The wall against which the arch was built was founded at roughly the same absolute elevation as the arch and the eastern and western walls of the room. The wall consisted of mud brick laid on stone footings three courses high. The mud brick was preserved six or seven courses high. The arch and the wall formed a niche at the northern end of the room. The size of the room and the existence of the door in its western (outer) wall (see below) suggest that it had been roofed.

The Locus 1.13 floor was a little below the top of the stone footings of the wall. Two pivot stones, one higher than the other, were located at the southern jamb of the doorway in the western wall. The lower and earlier of the two pivot stones was ca. 25 cm north of the existing southern jamb. It may provide evidence for a doorway that was planned and not built or an earlier, narrower doorway that was later widened. In any case, no trace of an earlier, narrower doorway remained.

A large circular oven, 2.2 m in diameter, occupied the northern end of the room (Fig. 2.11). It was built on a stone platform (Fig. 2.13) and consisted of mud bricks (22–24 by 16 by 6 cm) laid around the circumference, with an opening ca. 65 cm wide to the south. The oven was domed and probably had a flue in the top or back, but this cannot be determined given the state of preservation. The inside floor was paved with pebbles, and the outside wall was heavily plastered. We have estimated the interior height as ca. 1.1 m. Since its interior wall was reddened, but otherwise showed no signs of high heat, the oven was probably used for cooking (for a comparable oven, see Aurenche 1977: fig. 242) rather

Fig. 2.10. Operations, 1, 12 and 20, Phase 4 stone retaining wall from the east.

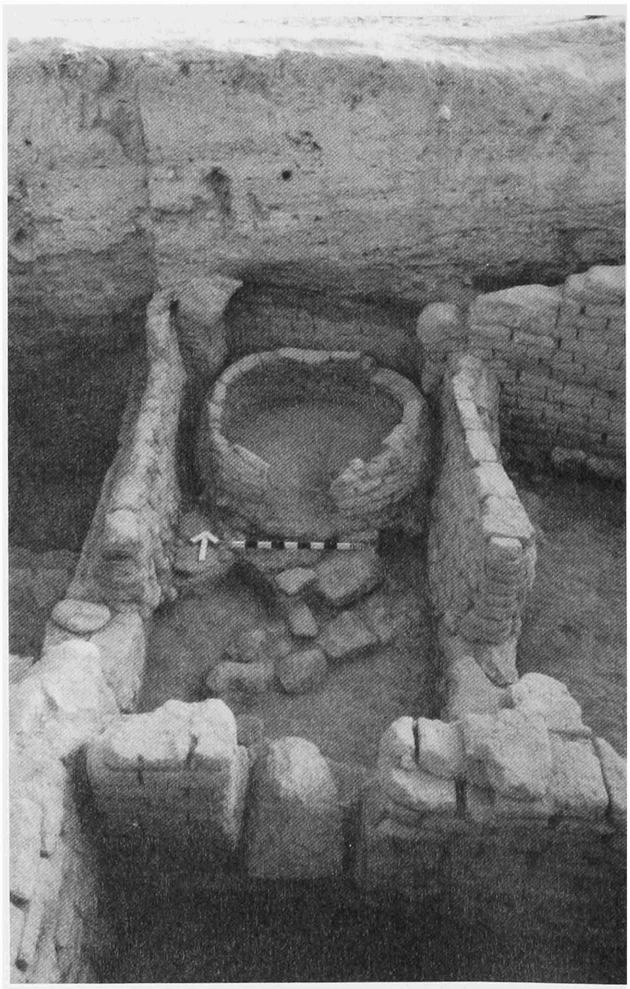


Fig. 2.11. Locus 1.13 from the south. The arch forming the northern wall of the Locus 1.13 is at the top of the photograph, with the circular oven associated with the original floor of the building. The oven's mud brick wall and plastering is visible on the right side of the stokehole. Doorways leading from the outside (Locus 1.14), from Locus 1.13 to Locus 1.16, and from Locus 1.13 to Locus 1.15 are in the left, right and bottom of the center portion of the photograph respectively. The boulder in the doorway between Locus 1.13 and Locus 1.15 was put in place at the time of the Phase 4 building's reconstruction. The stones running diagonally (southwest to northeast) across Locus 1.13 at a level below the floor on which the oven sits are the fragmentary stone footings that belong to the latest Phase 2 constructions.

than for industrial purposes. Though smaller, the oven is reminiscent of the circular one in the Mari palace, Court 70 (Parrot 1958:230–235). The existence of the oven may explain the unusual construction at the northern end of the room. With the oven set into the niche formed by the arch and wall, space would be maximized.

We uncovered only a portion of the room (Locus 1.15) which lay to the south of Locus 1.13. A pivot stone originally sat at the west jamb of the doorway connecting the room with Locus 1.13. We found the stone out of place, ca. 40 cm to the south of its original position. A doorway also existed in the room's eastern wall leading into the courtyard (Locus 1.16). As in Locus 1.13, we uncovered a floor at roughly the level of the top of the stone footings. Two large slabs of limestone and a small pierced stone disk lay on the floor in the western end of the room. The slabs were presumably work installations. A similar large stone was found on the floor in the west end of the room. A hearth was located in roughly the center of the room and extending south, and a fire pit, 51 cm in diameter and 16 cm deep, was uncovered in the southeasternmost excavated part of the room.

The L-shaped courtyard, Locus 1.16, lay to the east of Locus 1.13 and Locus 1.15 (Fig. 2.14). We uncovered all but the southeasternmost portion of the space, which occupied ca. 20 m^2. Unlike Loci 1.13 and 1.15, a sequence of four floors was preserved in Locus 1.16 (perhaps not surprisingly since courtyards frequently have a greater build-up of floors than adjacent rooms). The earliest, a mottled brown surface, lay at the base of the stone footings; so, at least initially, anyone moving from the courtyard into Locus 1.13 or Locus 1.15 would have had to step up into those rooms. The lower courtyard floor would have served to keep rainwater out of the building's interior rooms. The mottled brown floor was succeeded by gray and green surfaces, and by a lime-plastered floor, which still lay below the top of the stone footings.

The courtyard contained a large number of fixed features. Cylindrical pits cut into the original floor and kept open with each successive floor were uncovered in the northeast corner, and in the southwestern, central, and west-central portions of the area. The pit in the northeast corner, which was typical, was 57 cm in diameter and

Fig. 2.12. Detailed view of arch at the northern end of Locus 1.13, showing springers and voussoirs. The arch abutted a wall, apparently the southern wall of Locus 1.11, that ran parallel to and north of it.

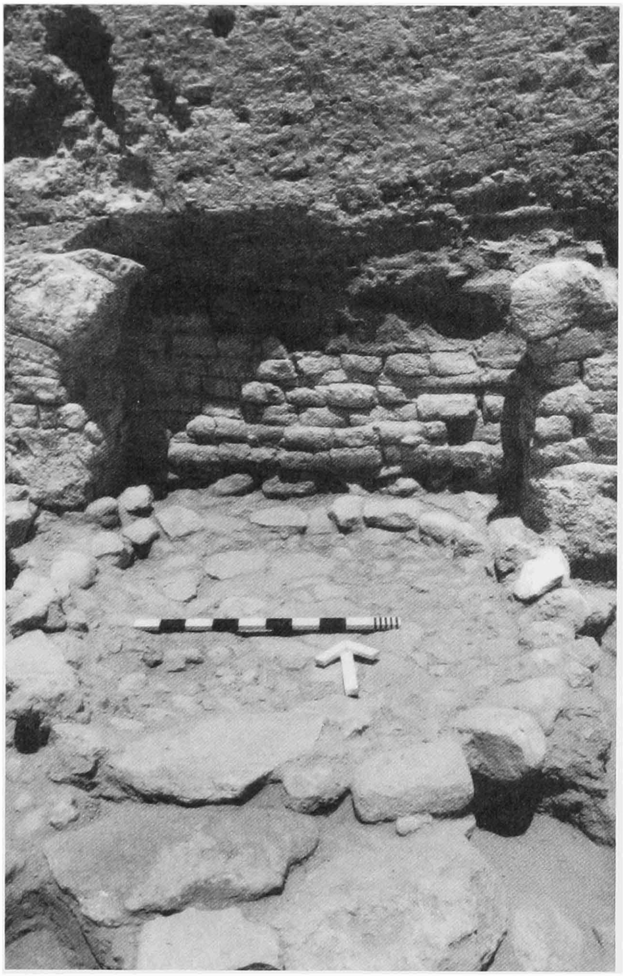


Fig. 2.13. Base of the oven in the northern end of Locus 1.13. The large flat stones at the bottom of the photograph are associated with Phase 2.

ca. 50 cm deep; it contained a number of grinding stones and mortars (Fig. 2.15). On the uppermost floor just to the southwest of the pit we found a large oblong limestone mortar. A platform of large stones lay on the original floor near the corner formed by the northern and eastern walls of Locus 1.15. A beehive-shaped oven (Arabic *tannour*) stood near the doorway from the courtyard into Locus 1.15, and fragments of chipped and ground stone lay on the floor nearby. An L-shaped stone work bench was situated in the northwestern corner of the courtyard at the level of the latest floor, and several stone slabs lay on the floor in the vicinity of the bench.

To the east of Locus 1.16, we cleared Locus 20.8 to the floor associated with the building's reconstruction (see below), and only defined the tops of the walls of Locus 20.10 (see Fig. 2.8). Though we have not excavated the original versions of the rooms, what we have uncovered so far provides at least a few indications as to the original layout of that part of the building. In the original Phase 4 building, access into the two loci must have been from a doorway in the southeastern corner of

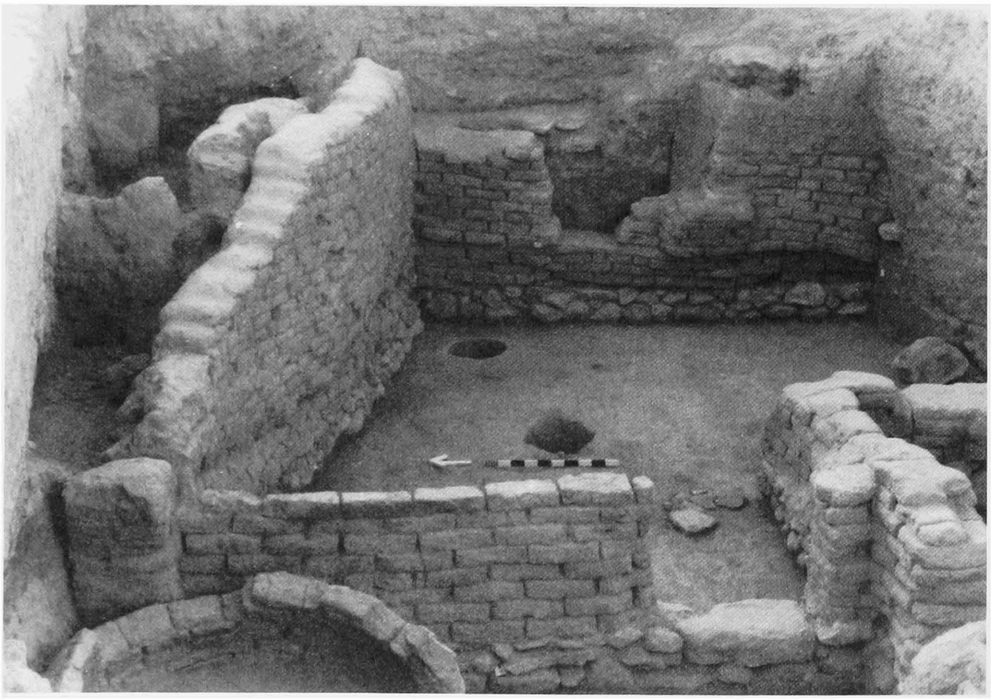


Fig. 2.14. Courtyard Locus 1.16 from the west. The division between the original building and its reconstruction is visible on the eastern and northern walls of the courtyard. The pit in the northeastern corner of the courtyard contained the grinding stones and mortars shown in Fig. 2.15.

Locus 1.16 into Locus 20.10. An archway connected Locus 20.10 to Locus 20.8 (Fig. 2.16).

Locus 20.8 was bounded on its north by the southern wall of the building located to its north. The eastern wall of the locus, as already noted, was the stone retaining wall, whose face was heavily plastered. Heavy black ash, which became visible as we cleaned the floor of the reconstructed building in Locus 20.8, suggests that the room originally contained an oven.

The number of work surfaces and cooking installations in the original Phase 4 building suggests that large-scale food preparation was carried out in it, and we have dubbed it the "kitchen building."

The kitchen building was rebuilt once in the course of its existence. In preparation for its reconstruction the walls of the original building were apparently leveled. The doorway between Locus 1.13 and Locus 1.15 was blocked with a large limestone boulder, the doorway between Locus 1.15 and Locus 1.16 was filled with mud bricks, and the rooms of the building were packed with a brown bricky fill 40–60 cm deep. New walls were set on the cut-down walls of the original building; the faces of the rebuilt walls overhung those of the original walls in places, as can be seen in the northern and eastern walls of the building (see Figs. 2.9, 2.14).

Though the layout of the rebuilding nearly duplicated that of the original structure, sufficient differences existed to suggest that the function of the building had changed. Most importantly, two of the ovens went out of use. In Locus 1.13, the oven in the northern end of the room was replaced by a fire pit, ca. 1.4 m in diameter, located to the south near the doorway to Locus 1.16. A single mud brick stood on its floor, but otherwise the pit contained only charcoal and black ash. In Locus 20.8, the oven was given up and a doorway opened from Locus 1.16 directly into Locus 20.8. The arch between Locus 20.8 and Locus 20.10 was blocked at the same time (Fig. 2.16). Only minor modifications were introduced in other rooms. In Locus 1.15, for example, a shallow fire pit was dug in the floor in the eastern end of the room. We found few artifacts on the floor of the rebuilt building.

In addition to the kitchen building, we excavated parts of three rooms (Locus 1.11 and Loci 1.10 and 1.12) apparently associated with two buildings to its north. We cleared the spaces only to the level of the Phase 4 rebuilding. Since the exterior face of the southern wall of Loci 1.10 and 1.12 was plastered, it must have been standing for some time before the walls of the kitchen building were rebuilt. Other than a bin in the southwestern corner of Locus 1.10, the partially excavated rooms contained no fixed features or other indications of function.

As noted above, our Phase 4 is contemporary with the Area IV burned building uncovered in the 1970s. The Area IV building is securely anchored in time by four radiocarbon dates run on charcoal and carbonized grain associated with its original floor (Table 2.1). The calibrated dates suggest that the Area IV building and our Phase 4 date to the end of the third millennium or, more specifically, are probably later than 2150 B.C. Though our study of the pottery is not complete, we can at least note that aside from the expected parallels with the Area IV pottery, strong parallels exist with Kurban Höyük, Period III, and Tell Bi'a's Akkad "silo" fill (Einwag 1993a:46–49).

Fig. 2.15. Grinding stones and mortars from the pit in the northeastern corner of the L-shaped courtyard, Locus 1.16.

Table 2.1. Calibrated radiocarbon dates for charcoal and carbonized grain associated with the Area IV building (Buitenhuis 1983:132–33; Holland 1977:62–63)

Lab No.	**P 2338**	**P 2324**	**GrN 10349**	**GrN 10350**
Locus	Area IV, Rm. 7	Area IV Bldg.	Area IV F 1.15	Area IV P 1.5
Material	Charcoal	Carbonized Grain	Charcoal	Charcoal
BP Date	3730±70	3640±70	3675±40	3810±35
Intercepts	2135, 2071, 2063 BC	2011, 2009, 1977 BC	2033 BC	2272, 2258, 2204 BC
1 Sigma Calibration	2271-1982 BC	2125-1898 BC	2129-1976 BC	2288-2146 BC
Probability Estimate Quoted as date: (Relative contribution to probabilities)	2271-2263 (.03) 2203-2020 (.90) 2001-1982 (.07)	2125-2081 (.20) 2044-1898 (.80)	2129-2079 (.42) 2046-2010 (.30) 2010-1976 (.29)	2288-2191 (.90) 2159-2146 (.10)
2 Sigma Calibration	2391-1917 BC	2194-1775 BC	2176-1927 BC	2396-2065 BC
Probability Estimate Quoted as date: (Relative contribution to probabilities)	2391-2389 (.00) 2334-1917 (1.00)	2194-2153 (.04) 2149-1866 (.89) 1844-1775 (.07)	2176-2167 (.01) 2142-1927 (.99)	2396-2380 (.02) 2347-2135 (.98) 2071-2065 (.01)

Fig. 2.16. Blocked arch between loci 20.8 and 20.10. The arch abuts the Phase 4 stone retaining wall (shown here with its original plaster removed). The brown fill behind the retaining wall is visible to the left. The ashy surface on which the meter stick and north arrow lie is the floor associated with the reconstruction of the Phase 4 buildings.

Phase 5

When the Phase 4 rebuilt complex was abandoned, it must have stood open for some period of time, and the walls gradually collapsed. The central part of the northern wall of Locus 1.16 was still preserved to a height of ca. 1.5 m above floor level, the eastern wall to ca. 90 cm, and the other walls to 40–60 cm. At least parts of the abandoned and crumbling building were apparently used as a dumping ground and were still being walked around in, as fragmentary tamped earth surfaces were uncovered in Loci 1.15 and 1.16.

Phase 5 consists of the debris that was dumped over the ruins of the rebuilt kitchen building. The debris consisted of alternating brown sandy loams and gray ashy layers. Wilkinson examined the deposits in the field and wrote in the field notes:

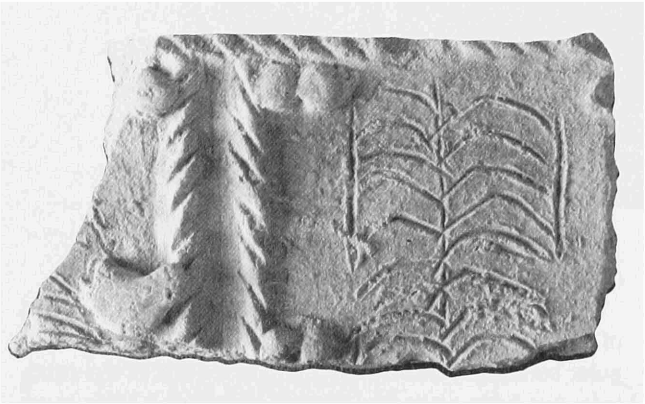


Fig. 2.17. Fragment of a model house (SW 741) from the Phase 5 debris layers. H. 8 cm, L. 14 cm.

> The distinct boundaries between sedimentary units and the distinct nature of each individual layer suggests that the ashy and brown layers accumulated as separate and distinct episodes. It is suggested that the brown "mineral" layers accumulated as floor and yard sweepings. The absence of laminated bedding and wash layers in the brown layers suggests that these layers did not accumulate as a result of action of water. The ash layers were probably dumped. It seems that ash accumulated as the result of dumping of refuse from fires or kilns.

Our Phase 5 debris layers yielded substantial quantities of pottery, which is still being studied, as well as bone. The soil samples which we took for flotation proved particularly rich in botanical remains (see Chapter 6). Small finds from the debris included: a fragment of a model house (Fig. 2.17) presumably similar to those from excavations at Tell Ali il-Haj, near Rumeileh (Masuda 1983:153–160) and Assur (Andrae 1922:36–38 and pls. 13–17) and to one in the Aleppo Museum (Khayata 1974/75) (Fig. 2.18); a nearly complete figurine of a male with slightly cocked head, applied eyes, and incised beard, eyebrows, and hair (Fig. 2.19a,b); and the head of a chalk figurine of a male with eyes, nose, mouth, and beard standing out in relief on a flat face (Fig. 2.20).

Phase 6

Phase 6 represents several successive, poorly preserved building levels in the accumulation—more than 1.2 m deep in places—from the top of the debris layers

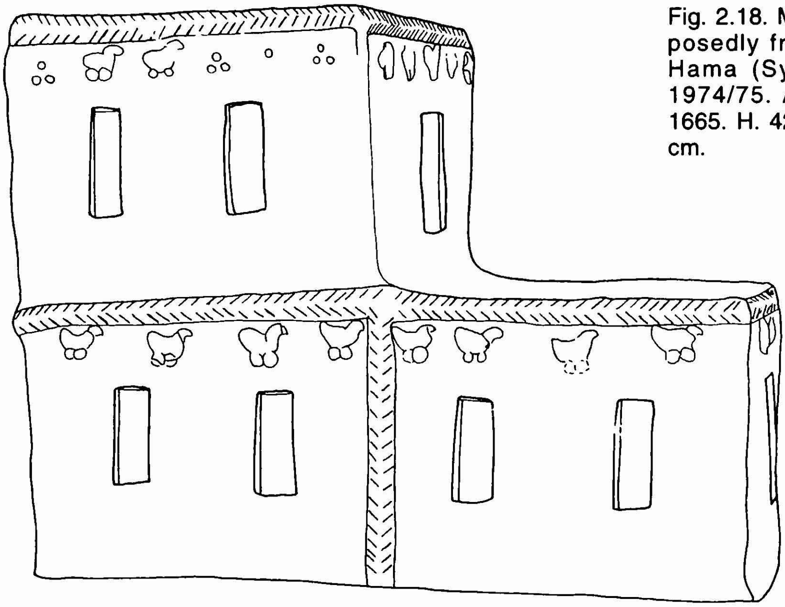


Fig. 2.18. Model of a house, supposedly from Salamiyya, near Hama (Syria). After Khayata 1974/75. Aleppo Museum No. 1665. H. 42 cm, L. 54 cm, W. 27 cm.

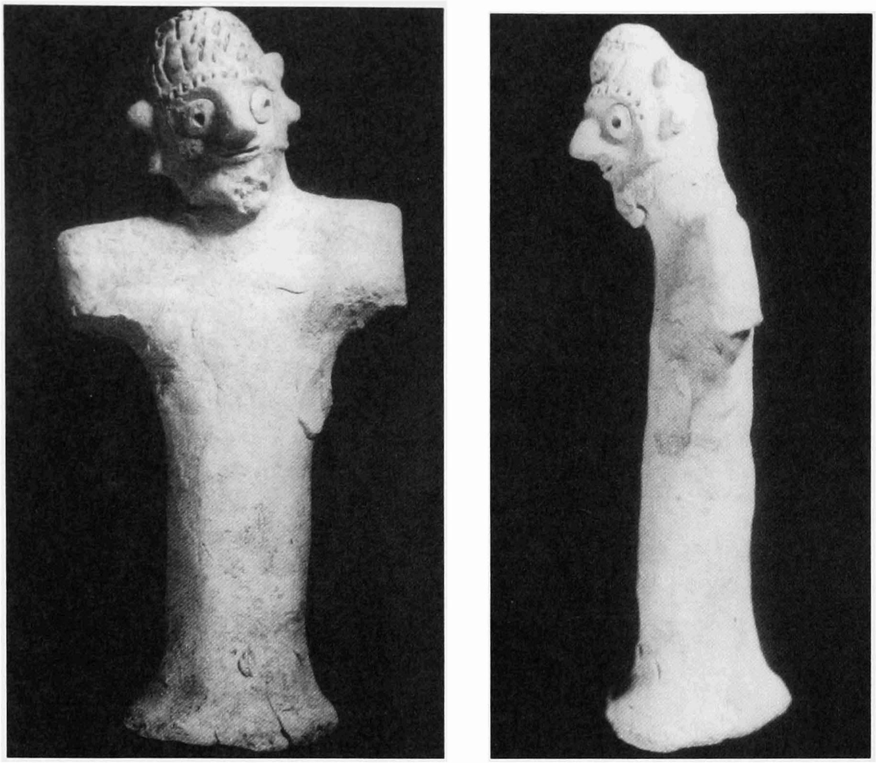


Fig. 2.19a,b. Frontal and left profile views of a nearly complete figurine (SW 812) from the Phase 5 debris layers. H. 12 cm, W. 6 cm.

that sealed the kitchen building up to the surface of the mound. The phase will be subdivided after additional work in our next field season clarifies the sequence of remains. The Phase 6 architecture was scattered and fragmentary. The earliest level, preserved only in the southwestern portion of Operation 1, consisted of the northwestern corner (1.8) of a room (Fig. 2.21). The walls were built of mud brick set on stone footings one course high. A bench of whole and fragmentary mud bricks set in a heavy plaster abutted the inner face of the stone footings.

The second building level included the northern portion of a room (1.3) in the same area of Operation 1. The western and northern walls were built of mud bricks. The bricks, which measured 40 by 40 by 10 cm, were laid without mortar. The northern wall ran over the top of the stone footings of the earlier wall, and abutted a line of stones on the west.

The third level consisted of parts of two small buildings, one roughly rectangular (1.4) and the other horseshoe-shaped (1.17). The rectangular building occupied a little more than 6 m^2. Except on the northeast, where mud brick was set directly on the line of stones that formed the eastern side of the preceding building (and which effectively served as a stone footing), only a single course of the stone footings was preserved. A doorway was set in the northern wall, with a threshold consisting of a slab of limestone ca. 60 cm long. A pivot stone sat in the interior of the room at the eastern jamb of the doorway.

The horseshoe-shaped structure, perhaps some sort of oven or kiln, abutted the southern wall of the rectangular building. We uncovered only a portion of the structure, but have estimated that it occupied a little more than 3 m^2. As with the rectangular building, only a single course of its stone footing was preserved. It had a doorway opening to the east, with jambs formed by larger limestone blocks. Small stones served as a facing for the interior wall. The fill consisted of heavy black ash over which lay a pebbly fill.

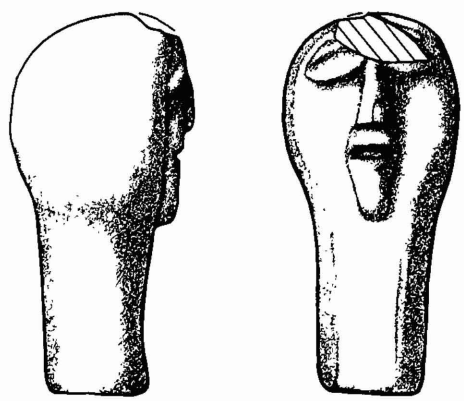


Fig. 2.20. Chalk head (SW 813) from the Phase 5 debris layers. H. 5 cm, Th. 2.4 cm

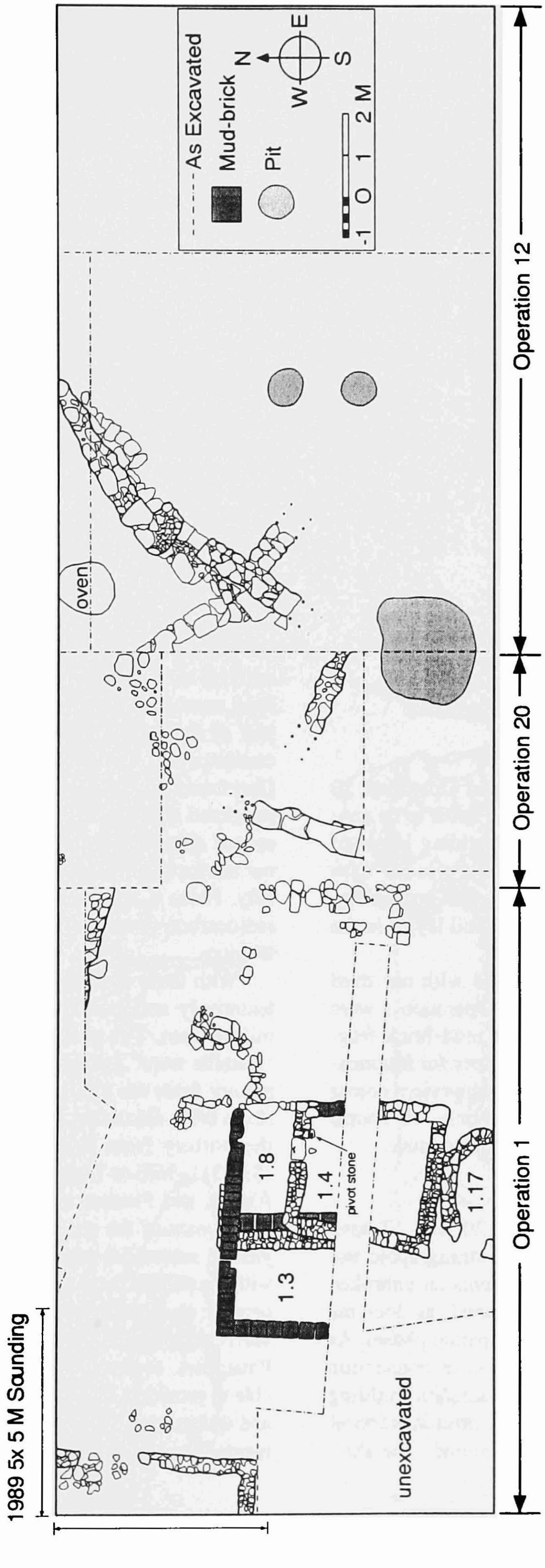


Fig. 2.21. Plan of Operations 1, 20 and 12, Phase 6.

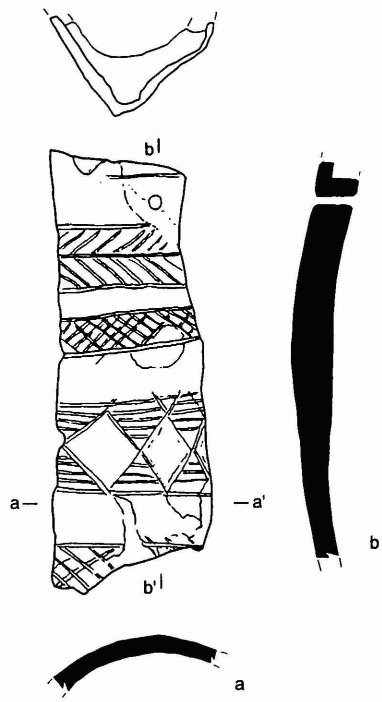


Fig. 2.22. Hollow bone cylinder with incised decoration (SW 792) from Phase 6 layers in Operation 12. L. 8.8 cm, W. 3.4 cm.

Fig. 2.23. Head of a figurine (SW 787) from Phase 6 layers in Operation 12. H. 3.5 cm, W. 3.2 cm.

Fragmentary architecture and pits in Operation 20 and the western portion of Operation 12 seem to be contemporary with the second and third building levels of Phase 6. A fragmentary hollow bone cylinder with incised decoration (Fig. 2.22)[11] and several broken figurines were recovered from the Phase 6 soil layers in the area (Figs. 2.23, 2.24a–c, 2.25).

The architectural remains associated with our third building level in the southwest part of Operation 1 were capped by a 10–20 cm thick layer of mud-brick fragments. This cap served as the building floor for fragmentary stone footings located in the far northwestern corner of Operation 1. The footings, preserved only one course high, formed the southeastern corner of a structure.

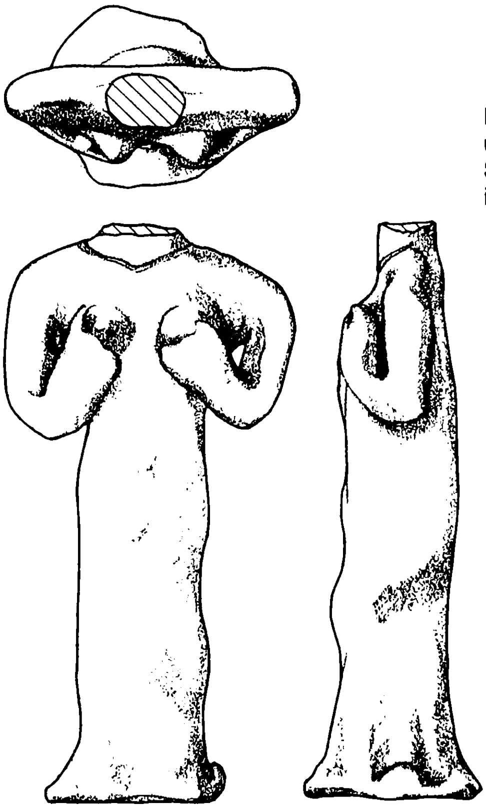
Summary

Our excavations in Operations 1, 20, and 12 have produced a long and potentially useful stratigraphic and ceramic sequence. Whether this represents an unbroken sequence remains as yet to be determined, as does the more detailed dating of individual occupation phases. As for the former, the terracing undertaken in connection with the construction of the Phase 4 kitchen building resulted in the removal of a substantial accumulation of debris from the western edge of the mound. The shallowness of our Phase 3 remains in Operation 1 on the west side of the terrace wall and the substantial remains we have tentatively assigned to Phase 3 in Operations 20 and 12 on the east side of the terrace wall suggest that excavations there are likely to yield additional stratigraphic data and a more complete ceramic sequence.

As for dating, our Operations 1, 20, and 12 occupation phases are anchored at two points in the sequence: Phase 1 and Phase 4. As detailed above, comparisons of the pottery recovered from the debris layers that accumulated on virgin soil in Operation 1 with the pottery from nearby sites suggest that Phase 1 dates to the first half of the third millennium. Yet the marked degree of continuity in ceramics of the early third millennium (Jamieson 1993:36) precludes our suggesting a more restricted span of time. Without radiocarbon dates we cannot determine whether the succession of soil layers we attributed to Phase 1 spans four hundred years or fifty. Phase 4, on the other hand, is securely pinned by radiocarbon dates to the last 150 years of the third millennium.

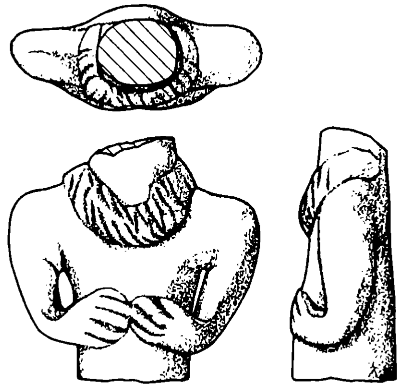
With those chronological "anchors" in mind, we have tentatively assigned Phases 2–3 to the mid-to-late third millennium. The pottery from those phases includes "metallic ware" and appears to be contemporary with the pottery from the tombs we uncovered in the outer town (for a fuller discussion, see Chapter 3, pp. 51–72) and with the pottery from Kurban Höyük Period IV (Algaze 1990:311–368) or Titriş Höyük mid- to late EBA (Matney, Algaze, and Pittman n.d.). Phases 5–6 likely date to the early years of the second millennium. Fortunately, they yielded substantial quantities of pottery. We anticipate that with the pottery from our Phase 4—and recently excavated ceramic sequences from sites such as Qara Quzak (Olávarri 1992), Tell Banat (Porter 1995), and Mari (Nina Pons, pers. comm. January 1997)—we will eventually be able to provide a secure ceramic sequence for the late third and early second millennium, a period as yet poorly documented for northern Syria.

As regards Tell es-Sweyhat's main Phase 4 occupation, our excavations in Operations 1, 20, and 12 uncovered evidence of substantial labor investment in terracing activities in the late third millennium settlement. They also revealed that a "kitchen building" was located to the east of a deliberately laid-out alleyway from the Area IV building that contained bulk stores of processed grain. The two complexes were almost certainly connected in terms of their function and might be thought of as ancillary to whatever existed upslope in the "core" area of the settlement.

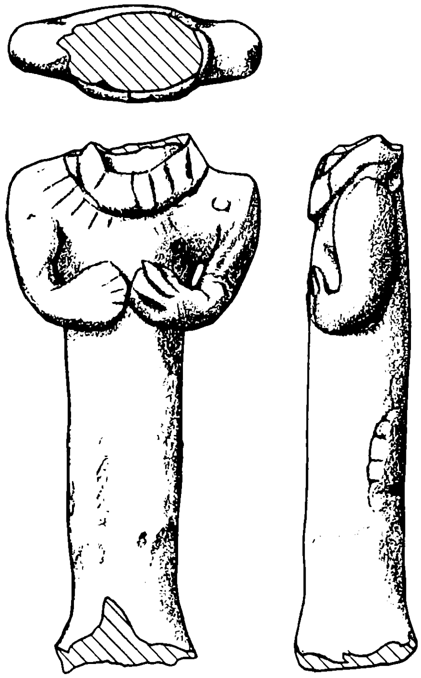


a

Fig. 2.24a–c. Torsos of figurines (SW 879, 8 TSw 26, SW 859) from Phase 6 layers in Operations 12.



b



c

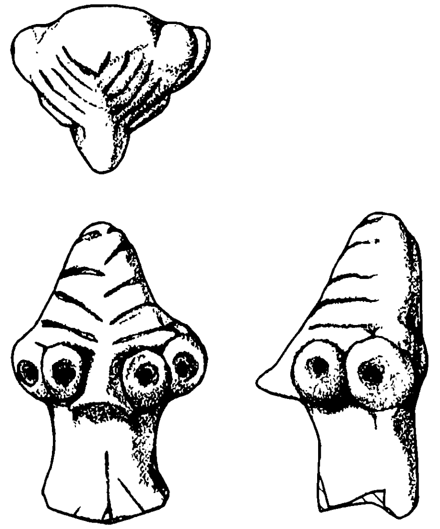


Fig. 2.25 (left). Head of figurine (SW 858) from Phase 6 layers in Operation 12.

Notes

6. The distance between Operations 1 and 12 was determined by the need for a path for wheelbarrows and because of safety concerns resulting from the severe erosion suffered by Operation 1's east section between 1991 and 1993.

7. We had originally divided the stratigraphic sequence in Operations 1, 20, and 12 into eight phases (Zettler et al. 1996:17–18), but subsequently decided not to assign phase numbers to topsoil layers.

8. The lowest level reached in the Area IIA sounding was ca. 8.9 m below the bench mark on top of the mound (see Holland 1976:39). Our Phase 1 varied from ca. 14.5 to ca. 12.5 m below the bench mark, so early third millennium levels were at least 3.6 m lower than contemporary levels in Area II.

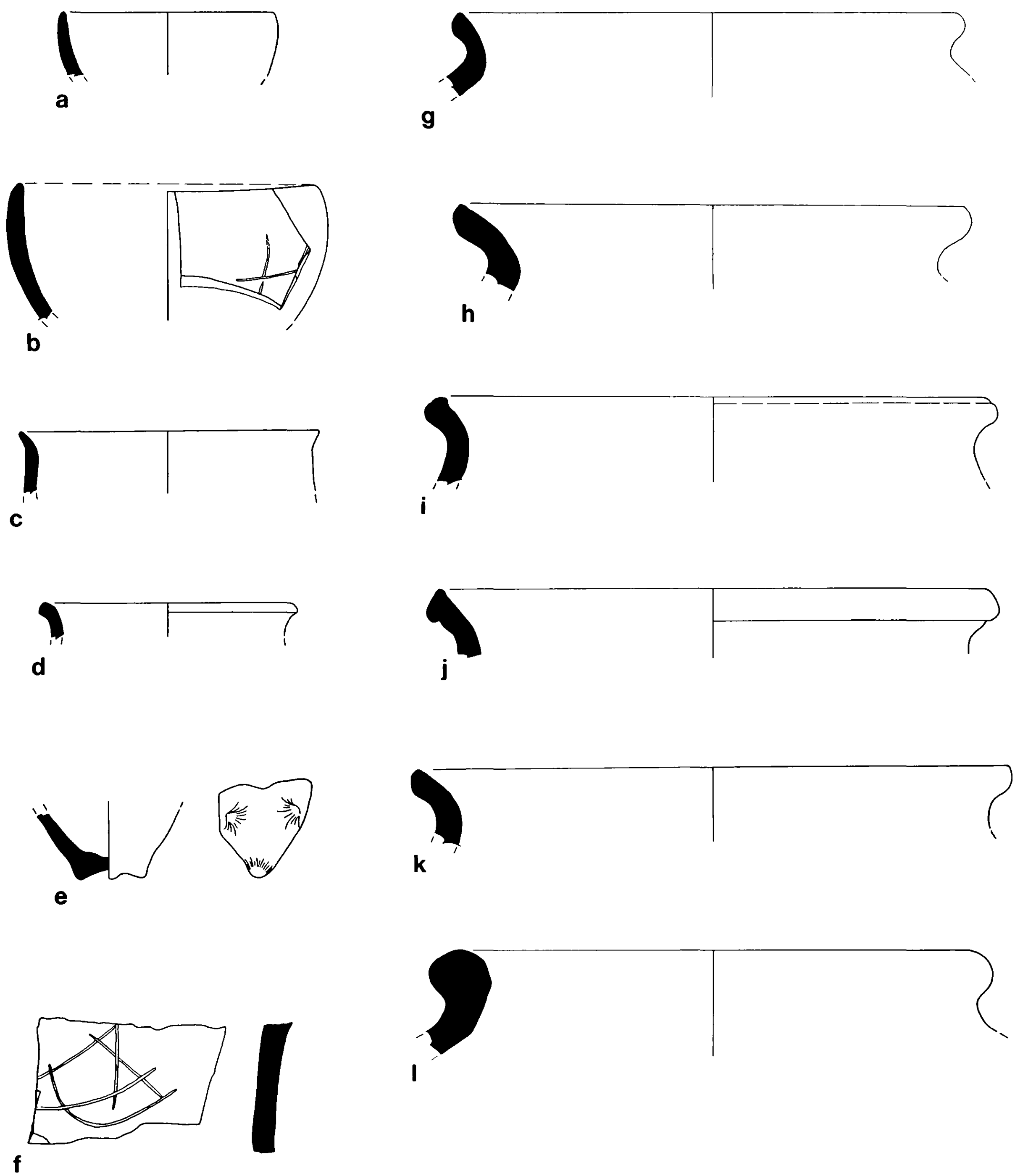
9. Note also the even smaller mid- to late Early Bronze Age "pit houses" at Titriş Höyük. Based on impressions of botanical remains in a silty clay that had accumulated in the bottom of the pits, Algaze suggested that the installations had "some sort of function in the leaching and processing of acorns for human and animal consumption" (1995:24–25).

10. Note also the existence of semi-subterranean structures in winter pastoral stations in the Khar o Tauran in northeastern Iran (Horne 1993).

11. For similar bone cylinders from Tell es-Sweyhat's shaft-and-chamber tombs, see Chapter 3, pp. 51–56. On incised bone cylinders more generally, see Zarzecki-Peleg 1993. In addition to the bone cylinders catalogued by Zarzecki-Peleg, see those from Tell Banat Tomb 1 (Porter 1995:8–9 and fig. 8), Tell el-'Abd (Finkbeiner 1995:81–82) and Tell Bi'a (Strommenger 1994: abb. 10). The University of Pennsylvania Museum's Near East Section holdings include one such cylinder from Tell Billa (Field No. 809 = UM 31-51-78), found in an apparently late burial.

APPENDIX 2.1

PHASE 1 POTTERY



Pottery from Operations 1, 20 and 12, Phase 1: a–j and l are simple wares, k is cooking pot ware. For a detailed discussion, see pp. 12–13. Scale 1:3.

3

SURFACE COLLECTIONS AND EXCAVATIONS IN THE LOWER TOWN AND LOWER TOWN SOUTH

Richard L. Zettler

Our work in the lower town and lower town south has involved both "non-invasive" data collection methods, such as surface surveys and remote sensing mapping, as well as excavation. We will discuss our surface collections and excavations in this chapter and the results of our remote sensing mapping in Chapter 4.

Surface Collections

We began work in the lower town in 1989 by making controlled surface collections in order to establish the chronology and areal extent of settlement and to document any specialized activity areas that might have existed. After a preliminary assessment of the density of surface debris, we laid out a series of transects from the inner fortification wall (approximated by the main mound's 10.5 m contour) to the outer wall, and cross-transects in areas where we judged artifact densities to be particularly high (Fig. 3.1). We spaced collection units—circles with a radius of 2.82 m (or a total area of 25 m^2)—at 30 m intervals along the transects and collected all of the artifacts in those units. In all we laid out and collected a total of 90 circles or 2250 m^2, which, assuming a lower town of 30 ha, would represent less than 1% of its total area.

As noted in the Introduction (p. 4), from examination of low-level aerial photographs we had postulated that a roughly rectangular area immediately south of the outer fortification wall might have been part of the urban settlement of the late third millennium B.C. In walking across the area in 1991, we observed several features, including a linear alignment of large stones (perhaps the remains of stone foundations) and a pit filled with field stones (perhaps a backfilled well or robbed-out tomb), which seemed to confirm our assumption. We decided, therefore, to extend our systematic surface collections to that area (lower town south). We laid out one east-west transect along the south side of the outer fortification wall, and two parallel transects 50 and 100 m farther south. We collected 14 units of 25 m^2 each at 50 m intervals along each of the three transects. In all, we collected 42 circles or a total of 1050 m^2, which would represent 1% of the total area, based on our estimate of the size of the lower town south as ca. 10 ha.

Surface artifacts from the lower town collection units in general were not numerous. They consisted largely of pottery and chipped and ground stone, but also included human and animal figurines, model chariot wheels, and spindle whorls or loom weights. We recovered artifacts from all of the collection units, suggesting that the whole of the lower town was occupied. The pottery diagnostics are consistent with the pottery from the Area IV building (Holland 1976:49–62; 1977:37–57), and date the occupation of both areas to the late third millennium. We found no obviously earlier rim forms and only a few unequivocally later forms, all of which were from collection units near the main mound and may, therefore, have been washed down off its slopes.

In analyzing the surface-collected artifacts, we compared the densities of pottery and chipped stone by count and weight. We found a positive linear correlation between counts and weights and so have chosen to illustrate pottery and chipped stone densities only by weight here (Figs. 3.2, 3.3). We found ground stone in only half of the collection units and no more than seven fragments in any one unit. We found no discernible correlation between ground stone counts and weights. Four areas of the lower town exhibited relatively high pottery densities: north (SC Units 72 and 74); east-southeast (SC Units 9–12, 14, and 22) and southeast (SC Units 17–19 and 58–59); and west (SC Units 34–37, 40, and 85–90). Surface concentrations of chipped stone were much less evident than sherd concentrations, but chipped stone densities were high east-southeast (SC Units 9–11), west (SC Units 38 and 88), and northwest (SC Unit 69). Whether the higher artifact densities reflect ancient spatial organization within the lower town—for example,

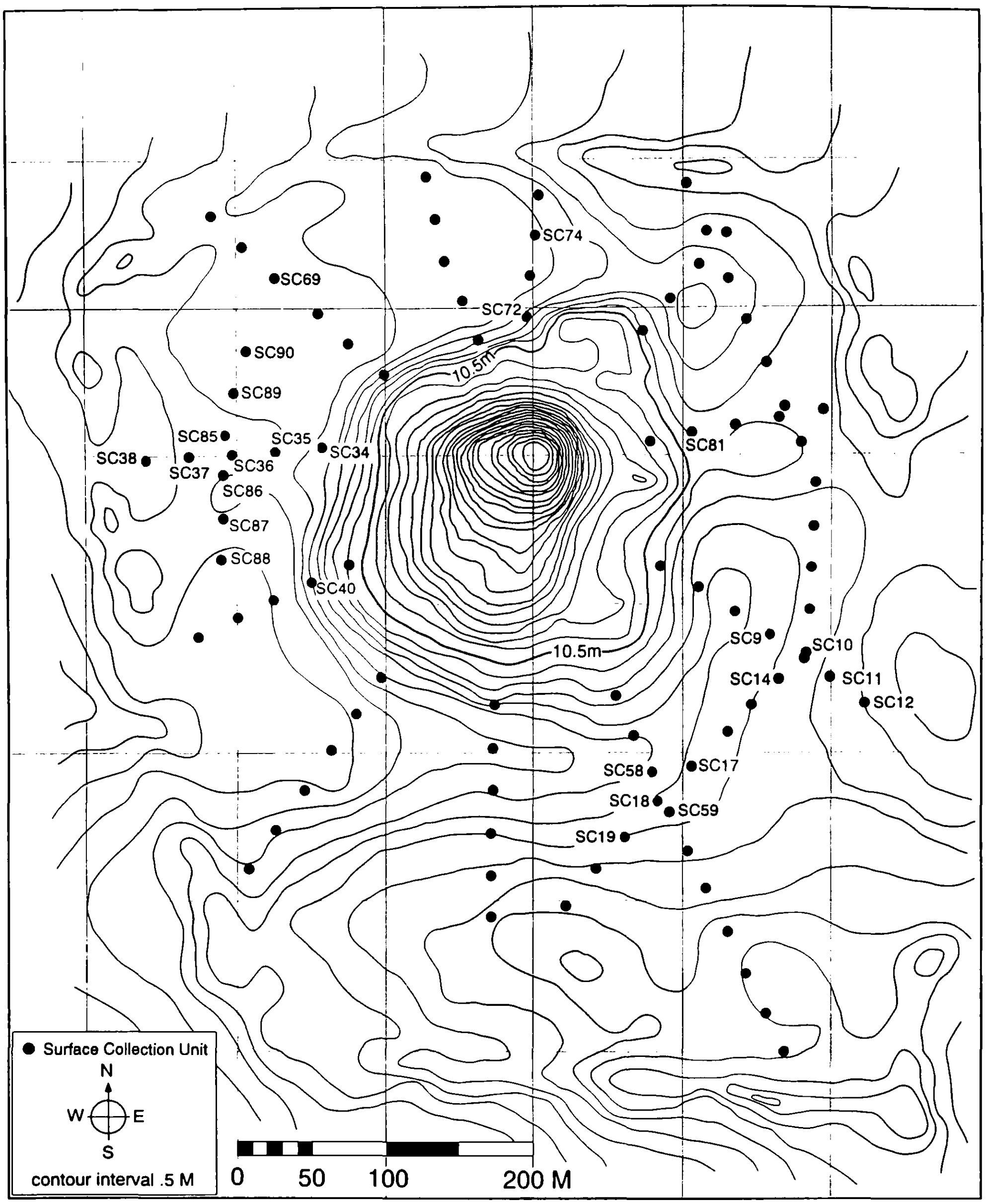


Fig. 3.1. Topographic map of Tell es-Sweyhat showing the approximate location of the late third millennium inner fortification wall (10. 5 m contour) and surface collection (hereafter SC) units. The SC units numbered on the map correspond to ones referred to in the text. The map does not show SC units in the lower town south.

Moreover, we do not know what effect cultivation has had (and is currently having) on the distribution of artifacts. Since the area is today integrated into the wider market-based economy, the landowner farms the lower town every year, plowing with a tractor and chisel plow.

Our surface collections have provided some evidence for specialized activity areas. Chipped stone density is high, particularly in relationship to pottery density, in SC Unit 69 to the northwest, suggesting a stone-working area, though our evidence is not as convincing as the specialized stone-working area found in Titriş Höyük's eastern suburb (Algaze et al. 1995:26). We recovered kiln wasters in SC Units 81 and 11 to the east and southeast, suggesting the existence of pottery kilns in those areas. We subsequently confirmed the existence of kilns in the vicinity of SC Unit 81 (see pp. 46–48 below).

As in the lower town, we recovered pottery and chipped stone from all of the collection units in the lower town south, and the few diagnostics were all consistent with a late third millennium date. Artifact densities in the lower town south were much lower than densities in the lower town. Figures indicate that not only were fewer sherds and pieces of chipped stone recovered from the lower town south's collections, but on average the sherds and pieces of chipped stone were smaller. Collection units in the lower town averaged 67 sherds (1088 g by weight) and 5 pieces of chipped stone (218 g by weight); collection units in the lower town south averaged 33 sherds (337 g by weight) and 4 pieces of chipped

densely occupied as opposed to sparsely occupied or open areas—or are the result of geomorphological processes such as erosion remains to be determined. Data from our excavations are inconclusive. For example, much as Redman and Watson's tests carried out over twenty years ago (1970:285) might have led us to expect, Operation 3, near the artifact concentrations in the east-southeast, yielded few intact features; Operations 4 and 9 near the artifact concentrations to the west had relatively well-preserved architectural remains.

stone (74 g by weight). Though the sherd densities may have been low by comparison with lower town's densities, they are, nevertheless, much higher than the sherd densities that Wilkinson took as evidence of manuring (1982). If converted to comparable figures, the lower town south densities would have varied from 4 to 324 per 100 m^2, with a mean density of 134; the sherd scatters that Wilkinson associated with manuring varied from 0 to 146 sherds per 100 m^2, with a mean density of 40 (Wilkinson n.d. a:14). We concluded that the lower town south was occupied in the late third millennium. Our 1993 excavations, as well as our 1995 magnetic mapping, confirmed the initial conclusion that was based solely on surface observations and collections. The low artifact densities may have been the result of a short-lived and sparse occupation.

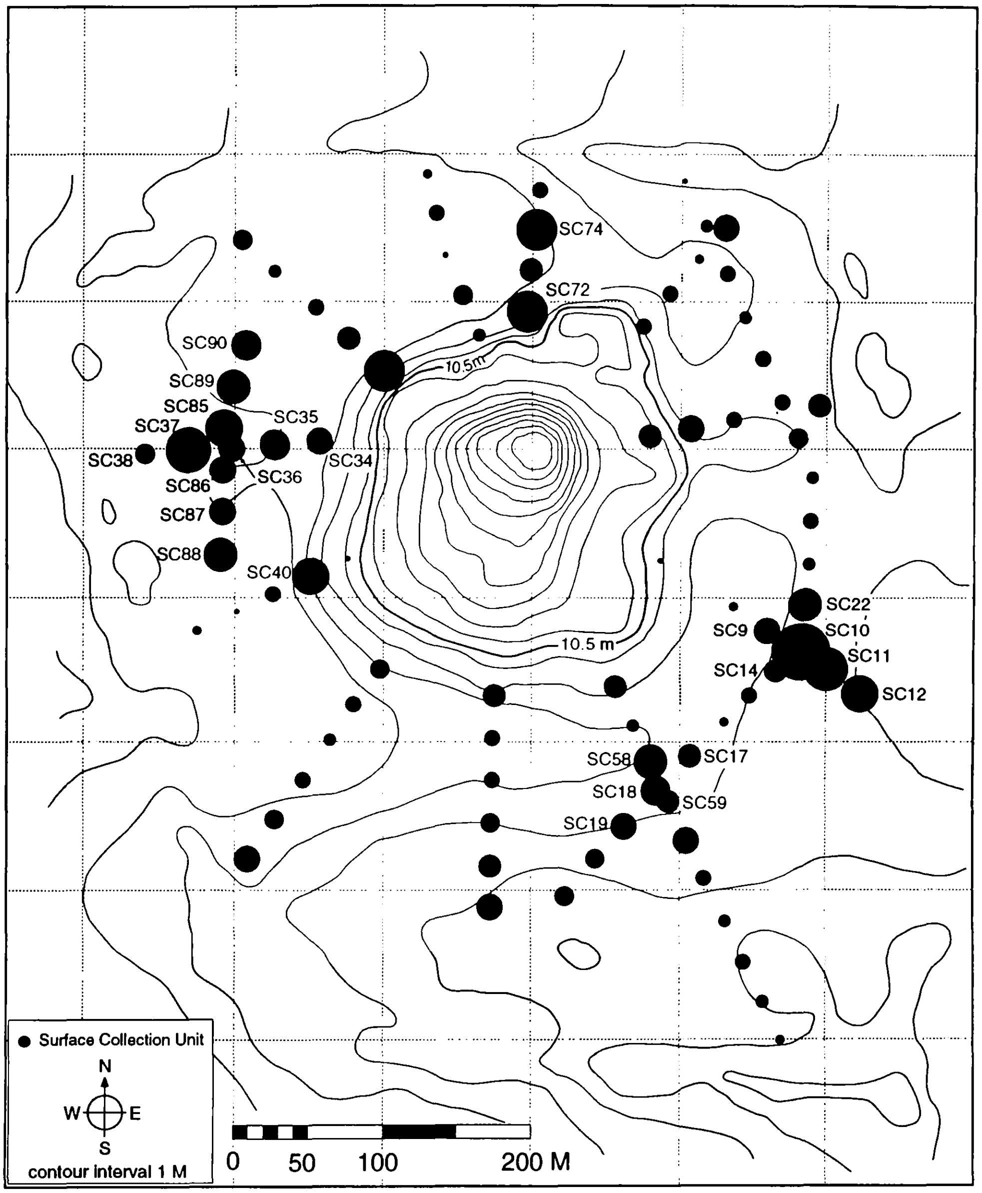


Fig. 3.2. Topographic map of Tell es-Sweyhat showing the relative density of pottery from the SC units.

Excavations in the Lower Town

We began excavations in the lower town in 1989 with two 5 by 5 m soundings in areas where our survey found heavy concentrations of surface debris: Operation 3 to the southeast (northeast corner of K11) and Operation 4 to the west (west central part of F3). In Operation 3, we uncovered a fragmentary pebble-paved surface, a scatter of stones, and the lower portion of a jar. After completing a sounding into virgin soil (reached at ca. 90 cm below the surface) in the southeast corner, we decided to discontinue the operation. In Operation 4, once we had gotten through the plow zone, we restricted excavations to a 2 by 2 m sounding and continued down to virgin soil (ca. 80 cm below the surface). We encountered a mud-brick wall set on stone footings and a gypsum-plastered floor with black ashy occupation debris on it. We expanded Operation 4 in 1991 to an area 215 m^2. In that same year we also laid out a 10 by 10 m square (Operation 9) roughly 50 m north of Operation 4, and expanded it to 170 m^2 by the end of the season.

We had planned to continue Operations 4 and 9 in 1993, but when we arrived at the site that spring, we found that the local landowners had plowed and sown the whole of the lower town and were irrigating its

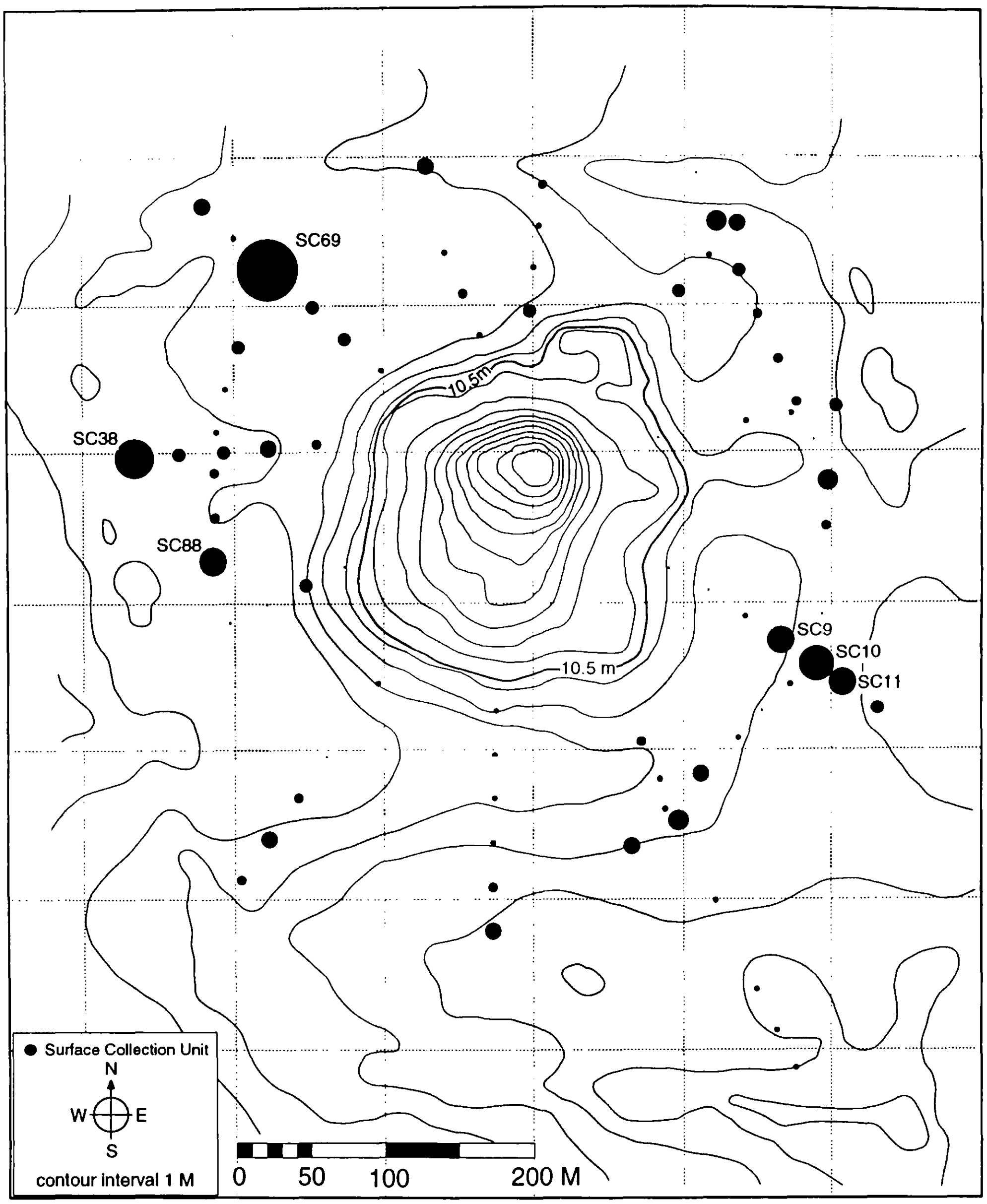


Fig. 3.3. Topographic map of Tell es-Sweyhat showing the relative density of chipped stone from the SC units.

sherds on the surface; the northern square (Operation 17) was in the center of Grid Square C8. Protracted negotiations over the conditions of our work and land compensation provided time to complete a magnetic survey (see Chapter 4) of both areas prior to excavation. We began work in Operation 16 because the mapping picked up markedly high magnetic anomalies in the southwest quadrant of that unit. We excavated Operation 17 for only a short period of time. Besides Operations 16 and 17, we excavated two additional 3 by 5 m units (Operations 19A, 19B) in the lower town south in 1993. We expanded Operation 19B to follow the architecture we uncovered there.

Our landowners' irrigation water, while damaging remains in the lower town, led to an unexpected discovery of major archaeological significance. The irrigation water opened up three deep holes along the line of the feeder canal (Fig. 3.4). Our guard pointed out the holes to us half way through our field season, in large part because looters from the nearby village of Hajji Hasan, northeast of Tell es-Sweyhat, had recently been down in them. We investigated one of the holes and quickly concluded that they were the shafts associated with large chamber tombs. We decided to undertake salvage operations on two tombs in the month or so remaining in our field season.

In 1995, we laid out new operations in the lower town designed to provide ground truth for geomagnetic data collected in our 1993 survey. Operation 23, in G10

northwesternmost part. A major feeder canal ran along the high ground represented by Tell es-Sweyhat's outer fortification wall, with smaller canals branching off it. The irrigated barley surrounded Operations 4 and 9 and made expansion of those excavation units impossible. Therefore, we laid out 20 by 20 m squares in the unirrigated eastern and northern parts of the lower town, where the ripening barley was only ankle-high due to poor rains. The eastern square (Operation 16) was in the north central part of Grid Square C10, in the general vicinity of our SC Unit 81, where we had found waster just southeast of our 1993 Operation 16, was a 10 by 10 m square laid out over a high magnetic anomaly, roughly circular in shape. We had assumed that the anomaly represented a kiln similar to the kilns we initially surveyed and later excavated in Operation 16. Operation 25 was a slit trench in E12, measuring 2 by 30 m, laid out to check parallel linear anomalies ca. 20 m apart. Based on our 1993 mapping and excavations we thought the anomalies might represent the remains of the settlement's outer fortification wall.

In walking across the northwestern part of the lower town early in our 1995 field season, we spotted a sink hole in the middle of D4. We recognized the depression as the shaft of a tomb similar to those discovered in 1993, and decided to excavate it.

We will describe these excavations by area in the following order: the lower town proper, that is, the settlement within the confines of the outer fortification wall; along the outer fortification wall itself; the lower town south; and, finally, the cemetery area.

Lower Town

We have clustered our operations in the lower town in the northern half of the settlement. We had assumed, based largely on the disappointing results of excavations in Operation 3, that much of the southern portion of the site had been eroded by the wadi that cuts across it (see Fig. 1.5). However, more detailed investigation of the southernmost part of the lower town, including magnetic mapping undertaken in 1995, suggests that it is a more promising area for future excavation than had been earlier thought.

Operation 4

Our excavations in Operation 4 not only found evidence for the topography of virgin soil in the lower town, but also uncovered three building episodes in a single occupation phase datable to the end of the third millennium (and, so, contemporary with Phase 4 of Operations 1, 20, and 12). Operation 4's southeastern section shows the level of virgin soil dipping markedly to the southwest. The dip is perhaps to be associated with Wilkinson's "linear hollow" or ancient road running from the floodplain northeast to Tell es-Sweyhat (Wilkinson 1993:549–551). The earliest Operation 4 remains consisted of an oven sealed by a later wall, and a series of pits cut from virgin soil. The oven and pits may have been associated with the construction of the building in the succeeding level. The second or intermediate level included the remains of a large, relatively well preserved building oriented north-northeast by south-southwest, as well as three rooms and an open space on the southeast (Figs. 3.5, 3.6). The latest level included the fragmentary remains of a reconstruction of that building.

We exposed the southeastern and northeastern outer walls of the large building that originated in the Operation 4 intermediate level, as well as eight interior

Fig. 3.4. Collapsed shaft of Tomb 3. The spread of soil to the right is the fill excavated from the tomb by local looters.

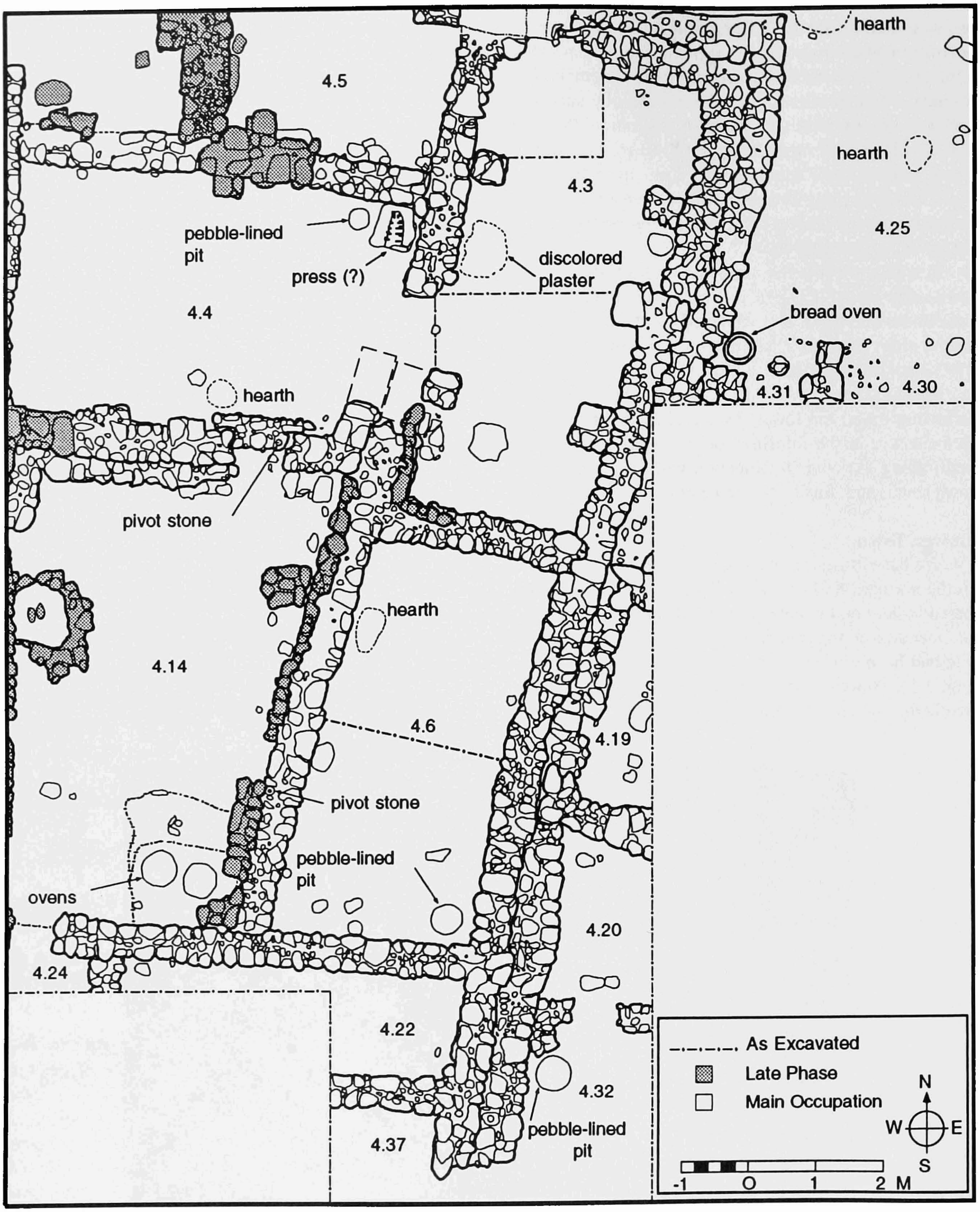


Fig. 3.5. Plan of the architectural remains in Operation 4.

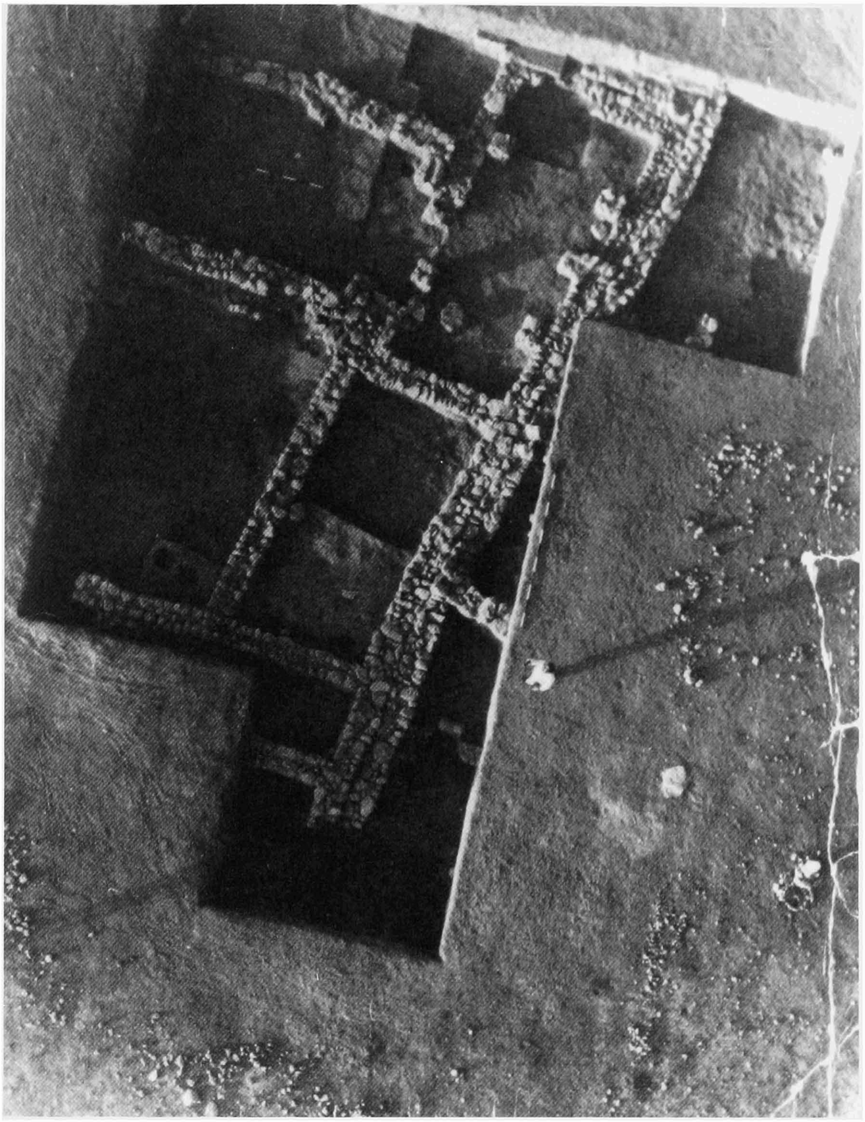


Fig. 3.6. Kite photo of Operation 4 taken at the end of excavations. The aerial view was taken by Anwar Abdul Ghafour, photographer of the Aleppo Museum.

rooms or parts of rooms.[12] The walls were made of mud bricks set on stone footings. The stone footings were preserved one to three courses high. A single course of mud brick was preserved on top of the footings of the northeastern outer wall. The outer walls were double: two walls ca. 70 cm wide were built against each other. Interior dividing walls were single. A series of distinct floors had accumulated in the rooms designated Loci 4.4–4.5 and 4.14; a single floor only was found in Loci 4.3 and 4.6.

Locus 4.5 in the northwestern corner of the building probably had doorways in its northeastern and northwestern walls, though only one jamb of each fell within the excavation area. The room contained no features. When the building was rebuilt, the room was divided. The dividing wall was built on the latest floor in the room, a pebble-paved surface.

Locus 4.4, which lay to the southwest, had an opening in its southeastern wall that led into Locus 4.3 and a doorway in its southwestern wall that led into what may have been a courtyard. The southwestern wall was rebuilt during the course of the building's life span. The rebuilt wall was offset to the northeast. A sill stood in the later doorway and a pivot stone at its southeast jamb. The pivot stone provides evidence that the room could be closed off from Locus 4.14. We found two fixed features in the northeast corner of the room. A large limestone block with truncated oblong depression and narrow channel stood in the corner. A circular pit, 42 cm in diameter and lined with clay and pebbles, was cut into the floor next to it.

Locus 4.3 to the southeast of Locus 4.4 was rectangular in shape. A series of three piers abutted its southeastern wall; opposing piers abutted the northwestern wall. The central pier against the northwestern wall had apparently been removed, but a single stone projecting beyond the wall's face and an area of discoloration on the floor marked its position. The piers would presumably have been used to buttress the walls and provide additional support for a roof. Their presence suggests that a second story may have been built over the room (and the house models from Tell Ali il-Haj and Assur, noted in Chapter 2, provide some support for the existence of second stories). Alternatively, the roof may have provided additional living space. Locus 4.3's floor was lime plastered; a layer of mottled black and orange soil, presumably living debris, lay on top of the floor. In addition to pottery, we found two baked clay disks with central perforations on the floor. One of the disks is plano-convex and the other lenticular in section. Both are less than 6 cm in diameter and we have estimated their weight as 35–45 g, though we did not actually weigh them in the field. The central holes are 0.7–0.9 cm in diameter and taper slightly. The disks are unlikely to be model wheels, since wheels usually have hubs. They are more likely spindle whorls (Liu 1978; Barber 1991: 39–65).

Locus 4.14 to the southwest of Locus 4.4 measured ca. 7 by 4.5 m. Its size alone suggests that it may have functioned as a courtyard. Doorways in the northeastern and southwestern walls led into Locus 4.4 and 4.24 respectively. A doorway with a pivot stone preserved in the rebuilt southeastern wall indicates that a doorway leading into Locus 4.6 existed in the original version of the wall as well. We excavated two floors in the room. The earlier floor was pebble paved, the later floor lime plastered. Two circular pits, each ca. 60 cm in diameter, were found in the southeast corner. The pit in the corner itself was cut from the earlier floor, but continued in use with the later floor. The second pit, to the northwest, was cut from the later floor. The inside walls of both pits were plastered and both contained dark gray ash. In addition, the later pit contained fire-cracked flint and stone, as well as medium-sized pebbles. The two were almost certainly cooking pits or ovens.

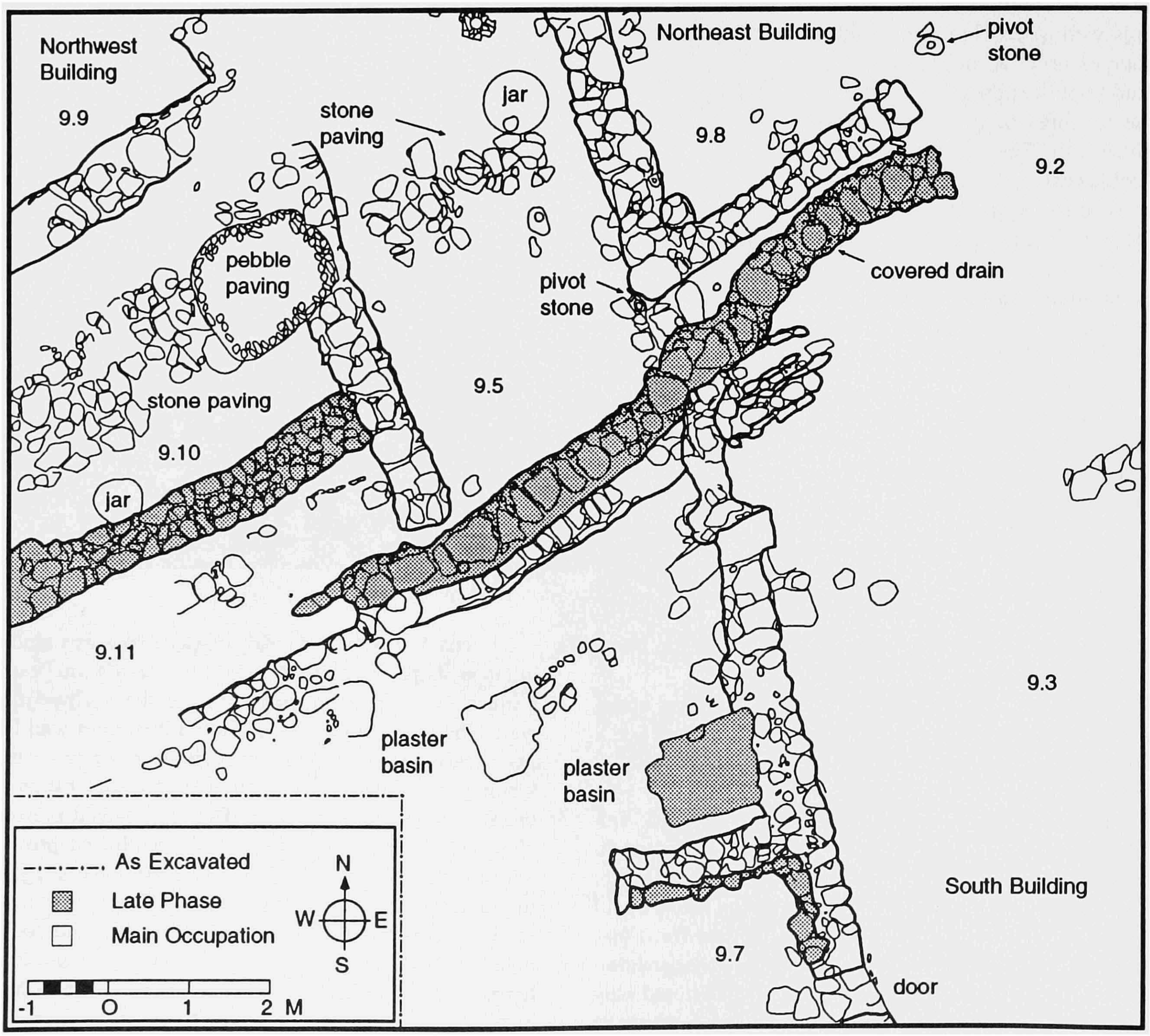


Fig. 3.7. Plan of the architectural remains in Operation 9.

Fig. 3.8. Water conduits in Operation 9 (photograph taken from the northeast). The original conduit is visible on the left, while the flat stones cover a reconstructed conduit. See p. 45 for a detailed description.

Locus 4.6 probably opened to the southeast off the courtyard. As in Locus 4.3, the floor was lime plastered and a layer of black occupation debris lay on top of it. We uncovered a hearth along the northwestern wall, and a circular pit lined with clay and pebbles in the southeast corner of the room.

We excavated only parts of Loci 4.22, 4.24, and 4.37 and did not reach the floors in any of the rooms. A whole jar sat in Locus 4.22's southeast corner, presumably on a floor.

The outside space to the north had a hard-packed clay surface that contained numerous pebbles. Hearths were located in the area, as well as a circular beehive-shaped oven. The southwesternmost of the three rooms that abutted the building's outer wall to the south had a doorway connecting it with the room to the northeast; it contained a circular pit lined with clay and pebbles in the northwestern corner.

In sum, the Operation 4 building would have had a floor space that exceeded 110 m^2, and so would have been more than twice the size of contemporary houses at the nearby sites of Halawa B (Orthman 1989:26, 43) and Tell Ali il-Haj, near Rumeileh (Masuda 1983: pls. I, II), and also larger than houses at Selenkahiye (van Loon 1973: fig. 5). Whether it was typical of or larger than other houses in Tell es-Sweyhat's lower town will have to await more extensive excavations. The building had a courtyard that occupied in excess of 30 m^2 and had either a second story or a roof that was utilized as a living space over its northeast corner. Fixed features in both the interior rooms and the outside space defined activity areas.

Clay-lined ovens in Locus 4.14 suggest that cooking was done in the courtyard; the beehive-shaped oven in the outside space suggests that bread was baked there. The large limestone block with an oblong depression and narrow channel in Locus 4.4 was probably some sort of press. The pebble-lined pits in Loci 4.4, 4.6, and 4.32 probably served as emplacements for jars that held liquids. The pebbles would have prevented ponding by facilitating dispersal of liquids that seeped out of the jars. The juxtaposition of a press and jars that held water or other liquids would make sense. Finds also provide a guide to activities carried on in the building. For instance, thread spinning might have taken place in Locus 4.3 where pierced baked clay disks were found. On balance, the evidence suggests that the building does not represent a specialized occupation, but a house, albeit a relatively large house. Whether the rooms that abut the building to the southeast were outbuildings or rooms belonging to another house remains uncertain.

Operation 9

The architectural remains in Operation 9 had been heavily damaged by pits and plowing and so are less readily intelligible than the remains in Operation 4. Moreover, the soil was exceptionally hard and compact, making it difficult to recognize and follow surfaces. In many instances the sequence of building activities has been reconstructed from the position of walls, features, and absolute elevations. As in Operation 4, we found evidence for several building episodes in a single, short occupation phase which seems to correlate with our main occupation phase on the high mound (Operations 1, 20, and 12, Phase 4). The earliest remains consisted of pits and jars cut into virgin soil. The second and principal

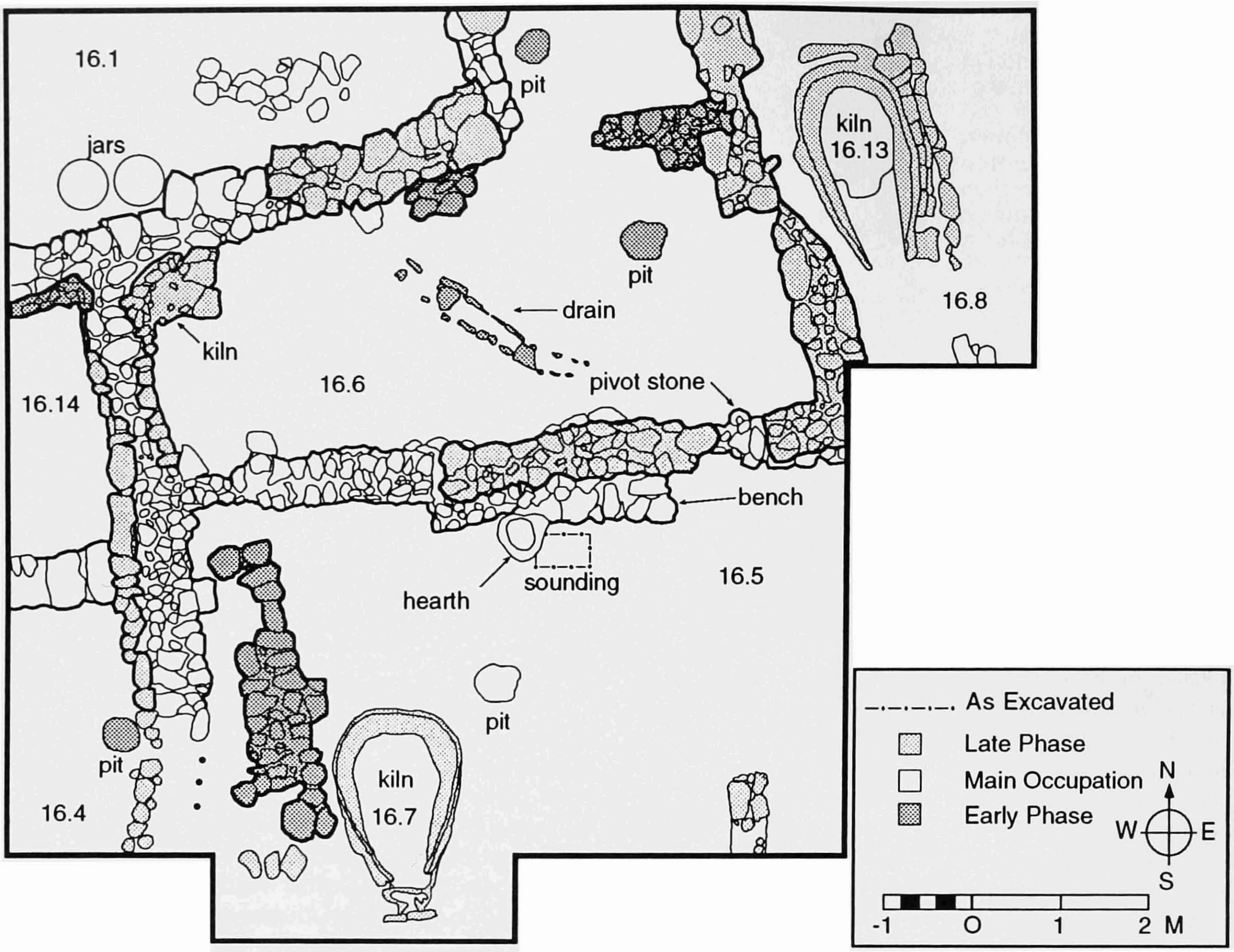


Fig. 3.9. Plan of the architectural remains in Operation 16.

Fig. 3.10. Operation 16 from the southwest.

level included parts of three buildings (hereafter referred to by their locations in the operation as the NW, NE, and S Buildings) and outside spaces associated with them (Fig. 3.7). A prominent feature of the second level was a stone-lined water conduit that snaked from the southwest to the northeast through the operation. The buildings and water conduit underwent modification and reconstruction during the course of their existence. The third level included miscellaneous features and walls, some seemingly associated with the earlier architecture of the second level, e.g., a basin and an isolated wall corner in the southern end of the operation, and others, such as the pebble-paved surface in the northwest quadrant of the operation, apparently unrelated to any of the buildings.

We uncovered two rooms of the NW Building. Only the 70 cm wide stone footings of the walls were preserved. The northeastern and southeastern outer walls provided evidence of two construction phases. The northeastern wall's lower courses, for example, were distinguishable from the upper courses by construction technique. The original southeastern wall was relocated to the northwest in the course of the building's history. A few stones of the original wall and a number of sherds that had been set on edge against its base remained. In contrast to the other walls that were constructed of limestone blocks, the rebuilt wall was constructed with medium-sized field stones.

Locus 9.9 contained no features, but the base of its southeastern wall was faced with sherds set on edge. Locus 9.10 contained a storage jar that was associated with the original version of the room (the rebuilt southeastern wall ran partially over the top of it). The jar contained a heavily cracked green lump of completely corroded copper or bronze, apparently the remains of an unrecognizable object of completely mineralized copper alloy.[13] The later phase of the southern room had a partial stone pavement.

We exposed only a single room (Locus 9.8) of the NE Building in the operation. The walls were built of small stones, while the corners and door jambs were formed by larger blocks. A doorway, whose southwestern jamb was preserved, was located in the southeastern wall. The continuation of the wall had been largely destroyed, but a pivot stone apparently marked the approximate location of the northeastern jamb. A circular feature (ca. 40 cm in diameter) was located in the southeast corner of room. The feature might have functioned as a post shoe, but was more likely a bin.

The S Building included two partially cleared rooms (Loci 9.3 and 9.7). Their northwestern walls were fragmentary, but could be reconstructed. A doorway connected the two rooms. The sill in the doorway, a large flat limestone block, was roughly 30 cm higher than the floors in the rooms, and there were steps on both sides of the doorway to facilitate movement from one room to the other.

A stone-lined water conduit sloped from southwest to northeast across the space (labeled Loci 9.2, 9.5, and 9.11) between the NW and NE Buildings and the S Building (see also a similar conduit associated with Steinbau V at Tell Chuera; Moortgat and Moortgat-Correns 1975:43). As we found some evidence for the existence of wells in the lower town in the form of Euphrates river cobbles on the surface (the cobbles would have been churned up in digging a well), the conduit may have served to channel water from such a nearby well. We actually mapped one area of cobbles ca. 6 m to the south of Operation 9. The availability of water has been one of the more perplexing aspects of Tell es-Sweyhat's location, some 3 km from the Euphrates. Perhaps a number of wells supplied the settlement. Such wells are known archaeologically (for example, Algaze 1990:47–48) and are an important source of water for villages near Tell es-Sweyhat today. The inhabitants would have obtained drinking water directly from the wells, storing it in jars in their houses, while the conduits would have provided water for other purposes or permitted waste water to be flushed away.

We uncovered segments of the original water conduit and of a reconstructed version (Fig. 3.8). The original channel had an interior width of 25 cm. The stone floor and side walls were preserved. The paving stones were flat pieces of limestone; the side walls consisted of similar stones laid on edge. When the conduit was rebuilt, it was relocated to the north of the original version. Perhaps its new location was related to the repositioning of the southeastern wall of the NW Building. The later conduit reused the northwestern side wall of the original version. Its channel was not paved, but it was covered with large, flat cap stones. The fill inside the channel consisted of laminated clay layers that appear to have been water-laid. The later conduit initially ran along a straight line, but its course was subsequently altered, curving to the north. The abandoned side walls of its straight course lay immediately north of the original conduit. Like the southeastern wall of the NE Building, the conduit was cut away in the northeastern corner of Operation 9.

At least at the time of the later conduit, Locus 9.2 was divided from Loci 9.3, 9.5, and 9.11 by the northwest continuation of the central wall of the S Building, apparently over the tops of the original conduit. The northeastern area (Locus 9.2) was poorly preserved. Two steps led from Locus 9.2 down into Locus 9.5. A pivot stone against the NE Building's exterior southern corner indicated that a door existed there. The door opened

Fig. 3.11. Firebox of the circular kiln in Operation 23. The stokehole is in the lower right corner of the photograph, the chimney to the left.

inward and would have restricted access from that area to the southwest. The counterpivot would presumably have been anchored into the southwestern wall of the NE Building. No trace of the southeastern jamb of the door remained. Locus 9.5 measured a little more than 3 m northeast to southwest and could have been roofed. We found evidence for two floors in the area. A large storage jar stood in the northern end of the area, and a mortar and pestle lay on the original floor. The later floor had a partial stone pavement, whose top was ca. 9–14 cm above the level of the earlier floor. When the floor was raised, the steps were relaid and a new pivot stone put in place; the storage jar continued in use with the later floor.

The area labeled Locus 9.11 was probably open. It contained a shallow basin made of ash plaster[14] a meter square. A pebble-and-sherd-lined channel that led out of the basin drained into a jar sunk into the floor. A second, larger basin was found to the southeast. Since it partially overlay the central wall of the S Building, it belonged to a later phase of occupation. It was presumably contemporary with the rebuilding of the northeast corner of the southernmost room. We found a basalt grinding stone in the later basin. The exact use of the two basins remains uncertain. Somewhat larger oval plaster basins were uncovered in houses in the Outer Town at Titriş Höyük. The Titriş basins produced residual traces of tartaric acid, indicating that they had been used for the processing of grapes (Algaze et al. 1995: 18–19). A similar interpretation for the Operation 9 basins is at least plausible, as remains of grapes (*Vitis vinifera*), though not common, were recovered from excavations on the main mound and from Operation 4 in the lower town at Tell es-Sweyhat (see Chapter 6, pp. 97, 111, and 114).

Operation 16 and Operation 23

Though Operations 16 and 23 were separated by some distance, the kilns recovered in the two excavations make it sensible to describe the results of work in the two areas individually, but back to back.

We found evidence for several occupation phases in the little more than 1 m of accumulated living debris in Operation 16 (Figs. 3.9, 3.10), but correlating them with the sequence of occupation on the high mound remains problematic (see below). The first and earliest phase consisted of fragments of abandoned walls such as that below Locus 16.5; an isolated segment of a stone-lined water conduit (under Locus 16.6); and miscellaneous trash pits and fireplaces. The second occupation phase included relatively well preserved architecture. The walls, oriented northwest to southeast, defined six spaces and showed evidence of at least one rebuilding. The third occupation phase represented a marked change in the use of the area and consisted of pottery kilns set in shallow pits or depressions. The latest evidence of human activity in the area included pits cut from the surface subsequent to the area's abandonment.

In the second occupation phase, Locus 16.1 was the southeast corner of a room that extended outside our operation to the northwest. Its walls showed evidence of two building episodes that could be distinguished by construction techniques. Stones of the later episode were only preserved at the northeastern end of the room. The southeastern wall included a wide, shallow niche or set-back near the western section line (at a point ca. 4 m from the southeast corner of the room). Two large storage jars stood in the niche.

Locus 16.6 was an irregular L-shaped open space to the southeast and northeast of Locus 16.1. The locus originally extended farther to the east; the northeastern wall shown on our plan represents a later construction (see below). The southeastern and southwestern walls show evidence of two construction phases. A straight joint in the center of the southeastern wall's stonework suggests that the eastern half of the original stonework had been cut away and replaced with a new section. The rebuilding formed a corner with a wall running north-northwest, bounding the locus on the east; the original wall seems to have continued to the east beyond the corner. Doorways at both ends of the southeastern wall led into what was probably an adjacent unroofed space (Locus 16.5). Two large stone blocks formed projecting piers at the western doorway, which also had a sill. A pivot stone lay at the northeast jamb of the original eastern doorway, providing evidence for the existence of a door that could have blocked access from the space to the south. A doorway was set in the rebuilt wall as well, its jambs offset to the east; no pivot stone was preserved at the level of the later doorway. Only the faces of the rebuilt southwestern wall were preserved; its center had been robbed out. A collapsed oven in the northwestern corner of the locus was associated with the rebuilt wall; an L-shaped fragment of pavement, presumably the remains of the late phase floor, lay near the northwestern wall.

Loci 16.4 and 16.14, which were associated only with the original building, extended to the west outside of our operation. The magnetic map of the 20 by 20 m square laid out at the beginning of the season shows the apparent continuation of Locus 16.14's walls (see Chapter 4, App. 4.1: Fig. a). The room appears to have been 3 m^2 A marked magnetic high, perhaps the remains of a kiln, was evident in its northwestern corner. Loci 16.4 and 16.14 seem to have formed a single room at the time of the building's reconstruction.

A large open space, Locus 16.5, extended outside the operation to the southeast. As noted, its northern wall shows evidence for two construction phases. The original wall seems to have had a bench built against it, though we have not yet removed the later construction to verify this.

The remains of the third occupation phase in Operation 16 included two kilns: 16.7 in the south-central part of the unit and 16.13 in the northeastern corner of the operation. Both the truncated remains of nearby walls associated with earlier occupation phases, as well as the operation's southern section indicate that Locus 16.7 was built in a shallow depression cut down into Locus 16.5. Only the firebox of what would presumably have been a two-chamber updraught kiln was preserved. It measured ca. 2.40 m long and had a maximum width of 1.40 m. The stoke hole was partly preserved to the south.[15]

For the construction of Locus 16.13, the northern portion of the wall that separated Locus 16.6 and Locus 16.8 was cut away and the fill of the space to the northeast cut down to a depth of ca. 50 cm. The kiln was set in a sort of bowl-shaped hollow or depression. The original fill of the room, a hard-packed light brown soil, was preserved only against the western wall. Black ash, presumably from the kiln, accumulated on the floor of the area against the original fill of the locus. The northern portion of the dividing wall between Loci 16.6 and 16.8 was then rebuilt farther west, and the space between it and the kiln packed with chunks of mud brick. Locus 16.13 was roughly the same size as Locus 16.7; its southern end, where the stoke hole would have been, was not preserved.

Though we did not find stacks of fused bowls or jars, we did recover substantial numbers of wasters and fused sherds from our excavations, suggesting that the kilns we uncovered were used for firing pottery. The wasters were associated with upper loci in the operation, consistent with the stratigraphic position of the kilns.

Our study of the Operation 16 pottery is only in its preliminary stages. However, metallic ware sherds from the excavations may indicate that the first and/or second occupation phases were contemporary with the tombs we uncovered in 1993 and 1995 (see below, pp. 51–56) and probably date to the third quarter of the third millennium. The kilns then were likely contemporary with or postdated the settlement's main or urban phase of occupation (and therefore date to the late third or early second millennium).

We recovered few traces of standing architecture in Operation 23, but did locate a circular kiln in the southeast quadrant of the square (Fig. 3.11). The kiln, measuring ca. 2.5 m in diameter, was set in a shallow bowl-shaped depression cut through earlier occupational debris and into virgin soil. Only the lower chamber (firebox) of what would likely have been a two-chamber updraught kiln was preserved (for similar kilns, see Heinrich et al. 1973:56–58; Orthmann 1981:61–62). It was sunk at least partially below ground level. A stoke hole was found on its east-southeast side. Large limestone blocks and smaller stones to the north and south of the stoke hole may represent the remains of walls to control wind. A semi-circular protrusion in the wall of the firebox may mark the emplacement of a chimney. Though the stacking floor was not preserved, mud bricks found in the kiln may have been part of arches or, alternatively, a pillar that would have served to support the floor. Traces of vents that had pierced the floor to allow heat into the upper, stacking chamber were found around the circumference of the firebox.

The excavation of the kiln proceeded slowly, and critical work in other operations demanded diversion of personnel and resources. We were not able to complete the excavation of the kiln before the end of the field season, so we covered it with plastic and backfilled the area around it. We will continue the excavations in our next field season.

In sum, our Operation 16 may suggest that at least a part of the eastern lower town was occupied in the third quarter of the third millennium. Operations 16 and 23 provide unequivocal evidence for the existence of industrial, pyrotechnic activities set in open areas in the lower town, though correlation with the chronological sequence established in Operations 1, 20, and 12 remains undetermined. The kilns confirm the validity of our geomagnetic data, which suggest that the physical extent of the industrial activities was substantial.[16] But the different types of kilns discovered in Operations 16 and 23 also raise interesting questions regarding Early Bronze Age ceramic firing technology. What, for example, is the functional difference between the large circular kiln in Operation 23 and the horseshoe-shaped kilns uncovered to the north in Operation 16?

Operation 17

We recovered few remains in our excavations in the northern part of the lower town. We found only a few stones and series of pits cut from a surface eroded or plowed away before we reached virgin soil ca. 50 cm below the surface. We recovered a number of whole (or nearly complete) pots from the pits. The pots included simple and metallic wares. The simple wares included a small bowl with a plain rounded rim; medium-sized globular jars with rounded or flattened bases, low to medium necks, and plain rims, one of which had an incised vegetal motif on the shoulder; a large globular jar with a short neck, thickened rim (subrectangular in section), and crude incising on the upper body and shoulder; a teapot or globular spouted vessel with plain everted rim; a crude bag-shaped jar with a beveled rim and applied crescent-shaped ledge on the upper body; and two miniature jars. The single metallic ware vessel was a squat globular jar with rounded base, relatively high neck, and plain everted rim.

The teapot resembles the Tell Chuera simple ware teapots for which Kühne has collected and cited relevant parallels (1976:76, 81–93). The type probably dates to the third quarter of the third millennium (for a thorough review of the dating of Tell Chuera pottery, see Algaze 1990:347–349, 386–387). The bag-shaped jar has parallels in a mid-Early Bronze Age tomb at Halawa (Orthmann 1981: pl. 58:13), as well as in a late third millennium level at Tell Brak (Mallowan 1947: pl. 71:12). The metallic ware jar is similar to jars from Tell Chuera and Tell Banat Tomb 1 (for example, Kühne 1976: figs. 56–57; Porter 1995: fig. 16, P240). Like the teapot, the jar probably dates to the mid-to-late third millennium. Though in secondary contexts, the vessels recovered from Operation 17 suggest the northern part of the lower town was already occupied by the third quarter of the third millennium and in any case earlier than our Operation 1, Phase 4.

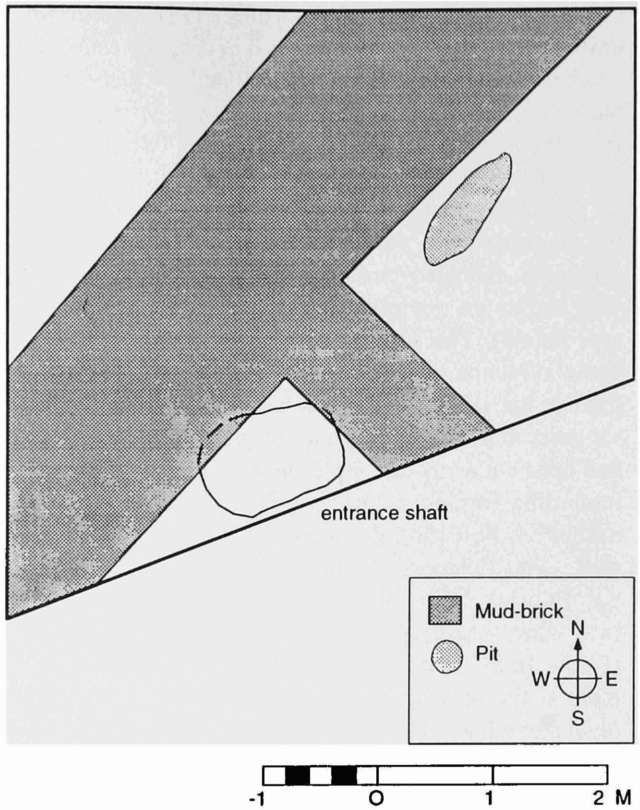


Fig. 3.12. Plan of the architectural remains in Operation 15, showing the location of the entrance shaft for Tomb 1. For the plan and cross-section of Tomb 1, see Fig. 3.15.

Outer Fortification Wall

We uncovered segments of the settlement's outer fortification wall in two 1993 excavations on the northwestern side of the lower town (Operations 15 and 18), as well as in a slit trench (Operation 25) across its eastern course. Operations 15 and 18, located on a low rise that we assumed represented the settlement's outer fortification wall, were laid out to minimize damage to ripening barley and were somewhat irregular in shape. Operation 15, a small unit over Tomb 1, took up less than 25 m^2; Operation 18 over Tomb 2, 70 m northeast of Operation 15, measured 5 by 5.25 m.

Operation 15

Since we began work in Operation 15 to excavate Tomb 1, we were somewhat surprised and puzzled when we found architectural remains just below the plough zone. We uncovered what we assume to be the exterior wall of a building, oriented northeast by southwest; parts of two interior spaces, formed by a wall running perpendicular (and bonded) to the exterior wall (Fig. 3.12) on the southeast side; and an outside space in the northwest corner of the operation. The exterior wall was ca. 1.80 m wide and the interior dividing wall ca. 90 cm wide. Both walls consisted of four to five courses of mud bricks, without straw temper, set on stone footings. The footings were two courses high; they were constructed with broad, flat stones perpendicular to the run of the wall and smaller stones in the interior. The walls were built on a thick clay layer that sealed Tomb 1's shaft.

We initially identified the architectural remains uncovered in Operation 15 as part of a casemate outer fortification wall, in large part because of the location of the excavation unit. Our magnetic map of the northern outer fortification wall in Block 3 (see Chapter 4, pp. 77–78) seemed to be consistent with such an identification (see, for example, Zettler et al. 1996:33). However, our Operation 25 excavations across the eastern outer fortification wall (see below) and magnetic mapping in the northwestern quadrant of the outer town, as well as a re-examination of low-level aerial photographs which the magnetic mapping occasioned (see Chapter 4, p. 79), have now made us less certain about the identification. The Operation 25 excavations revealed not a casemate wall but an earthen rampart. The results of the magnetic mapping—and the low-level aerial photographs—appear to show not one but two parallel runs of the northwestern outer wall (see Chapter 4, Fig. 4.3). Operation 15 (and Operation 18) are apparently located over the innermost of the two segments of wall. We still assume that the architectural remains in Operation 15 (and Operation 18) are connected with the settlement's outer walls and may, in fact, represent a casemate construction. However, we need to undertake additional excavations to clarify the nature of the northwestern fortifications.

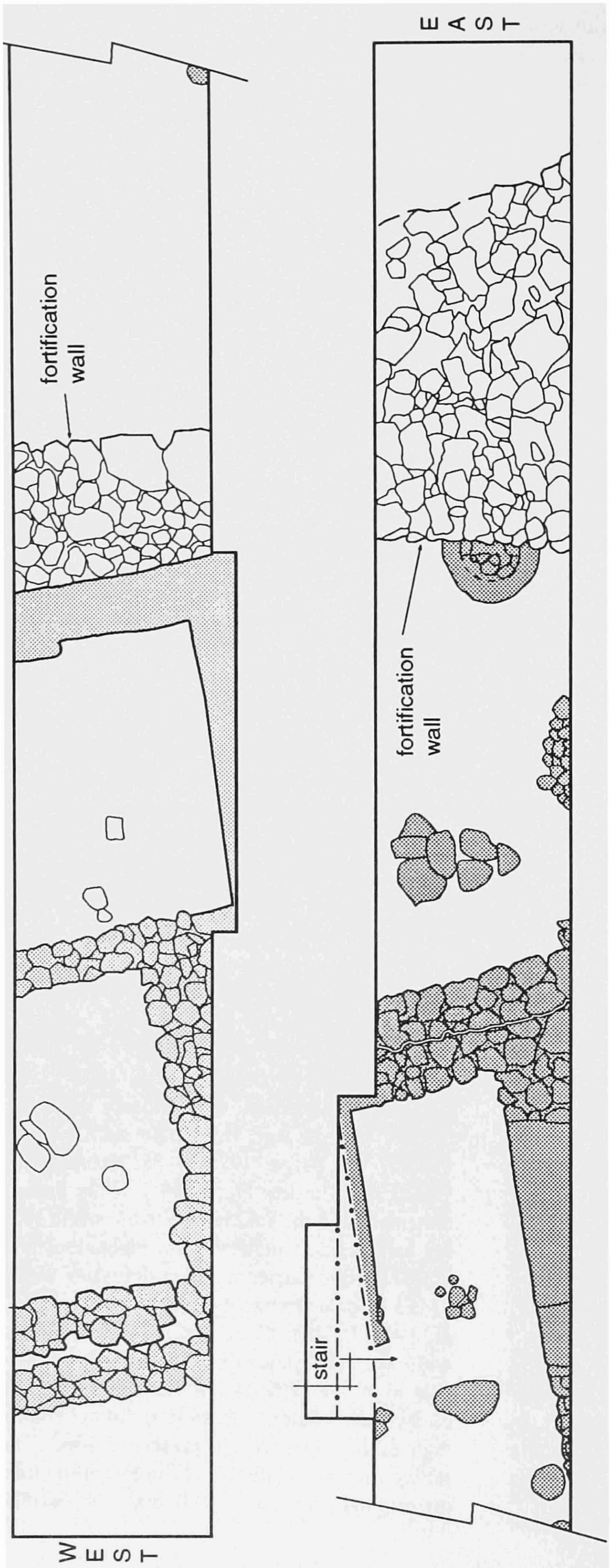
Operation 18

We uncovered the north face of a substantial wall on the south side of Operation 18, roughly in line with the wall uncovered in Operation 15. The wall was made of mud bricks formed without straw temper and set on stone footings whose construction was nearly identical to the stone footings of the Operation 15 wall. The base of the footing was above the level of Tomb 2's shaft. One meter north of the face of the outer town wall, we uncovered the stone footings of a second, narrower wall running parallel to it. The wall was built on a thick ash layer that abutted the face of the outer town wall and was thus somewhat later in date. Its function remains uncertain. The easternmost portion of the wall had tumbled into Tomb 2's shaft when it and the surrounding soil collapsed. We assume the architectural remains in Operation 18, like those in Operation 15, are associated with the outer fortification wall.

Operation 25

We exposed a sequence of three major occupation phases in Operation 25 (Fig. 3.13). The earliest phase consisted of portions of two buildings abutting each other. The buildings consisted of mud-brick walls set on stone footings. The walls were faced with several coatings of plaster.

The second phase included the outer fortification wall, which was built on the leveled-off remains of the earlier buildings. The eastern wall was apparently an earthen rampart 18.50 m wide. It was faced on the outside with a sloping stone revetment (Fig. 3.14) and supported on the inside with a 1.15 m wide retaining wall that consisted of mud bricks set on substantial stone footings three to four courses high. Tell es-Sweyhat's outer fortifications parallel defensive systems exposed at such nearby Early Bronze Age sites as Mozan (Buccellati and Kelly-Buccellati 1988:58–59, 61–64) and Titriş Höyük (Algaze et al. 1995:21–22), but in terms of construction, most closely resemble those of Middle Bronze Age Tell el-Balata/Shechem (Wright 1965:57–79; Seeger 1975:34–38; Kempinski and Reich 1992:132). The low slope (38°) of the preserved stone revetment and the relatively narrow width of the retaining wall perhaps suggest a low embankment that would probably have carried a higher defensive wall much like Ebla's Middle Bronze Age outer fortification (Davico et al. 1965:36–40). If we assume a leveled top 8–10 m wide, the embankment would probably have been about 6 m high. Nevertheless, we cannot be certain that Tell es-Sweyhat's outer fortifications did not consist of just a high earthen rampart. The preserved slope of the exterior facing may not duplicate (or even approximate) that of the original stone facing wall, and it is possible that such



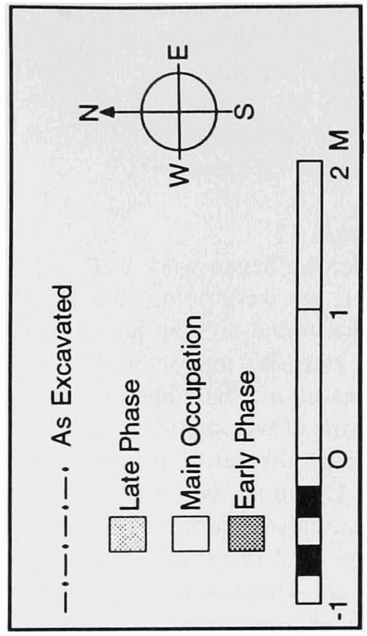


Fig. 3.13. Plan of the architectural remains in Operation 25.

a high rampart could have been terraced on the inside much like Ebla's wall (Davico et al. 1965:36–40; Parr 1968:33).

The third occupation phase consisted of a building or buildings, several phases of which were preserved, constructed against the inner face of the fortification wall.

Though we have not yet studied the ceramics, our preliminary field observations have led us to conclude that the earliest phase of occupation is contemporary with the tombs (see below) and so dates to the third quarter of the third millennium. The construction of the outer fortification wall was contemporary with the major occupation of the settlement and dates to the end of the third millennium. The third occupation phase postdates the construction of the outer fortification wall, but by how long a period of time remains uncertain.

Our Operation 25 excavations not only provide us with "ground truth" for interpreting magnetic anomalies noted in the eastern outer town (see Chapter 4, p. 78), but also with information on the growth of Tell es-Sweyhat as a settlement. In particular, the evidence indicates that the eastern part of the lower town to the line of the outer fortification wall was occupied by the third quarter of the third millennium.

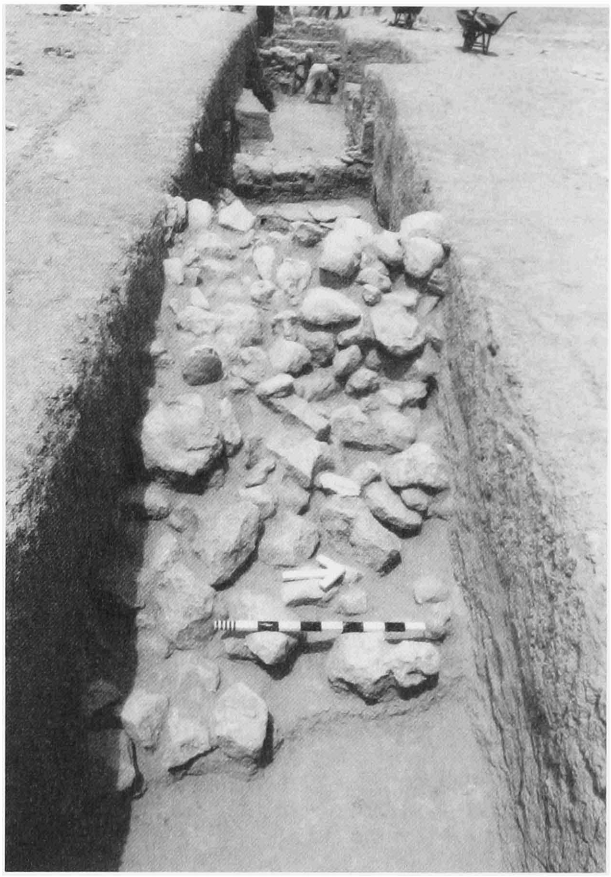


Fig. 3.14. Operation 25; sloping stone revetment that faced the outside of the outer fortification wall.

Lower Town South

We undertook excavations in the lower town south to determine if in fact the area had been inhabited in the late third millennium. We laid out our Operation 19A, a 3 by 5 m trench, approximately 30 m south of the outer wall, in an area where the geomagnetic mapping picked up negative and positive magnetic anomalies adjacent to each other. Finds included pottery and a seemingly random scatter of stones, but no unequivocal evidence for occupation. We halted the excavations 50 cm below the surface. We located Operation 19B approximately 40 m south of Operation 19A. It was initially laid out as a 3 by 5 m trench, but was later expanded. We put the trench across the remains of stone footings discovered in our 1991 survey. We recovered the fragmentary footings of a substantial (1.5 m wide) wall, running in a north-south direction, and traced them for more than 6 m before we halted work. The sherds from Operations 19A and 19B were in general small and heavily eroded. The few diagnostics that we recovered were consistent with the shapes from the 1970s Area IV excavations.

We are now convinced that the area south of the outer wall was occupied at the time of the site's floruit (a conclusion which our 1995 magnetic mapping supports; see Chapter 4, pp. 79–81), making Tell es-Sweyhat in the late third millennium almost 40 ha in size. Whether the area was densely settled or contained discontinuous occupation remains an open question. Sweyhat's lower town south might have been the location of a trading enclave (Akkadian *karum*). Alternatively (and perhaps more realistically), the area might have been similar to Titriş Höyük's suburbs and the locus of specialized production (Algaze et al. 1995:26), a conclusion that the results of our magnetic mapping seem to support. Whatever its nature, the settlement outside the walls, like the settlement in Titriş Höyük's suburbs, was apparently short-lived, and erosion and plowing have now largely destroyed the remains of the occupation.

The Cemetery

In 1993 we salvaged what was left of two looted tombs (Tombs 1, 2) and noted the location of two others, one opened and presumably robbed (Tomb 3) and one to the northwest of the outer fortification wall visible as a sink hole (Tomb 4). In 1995 we excavated an undisturbed tomb (Tomb 5). Based on the size and distribution of tombs, we estimate that the cemetery of which they were a part would have covered an area of 1 ha and might have included as many as 100–150 tombs.

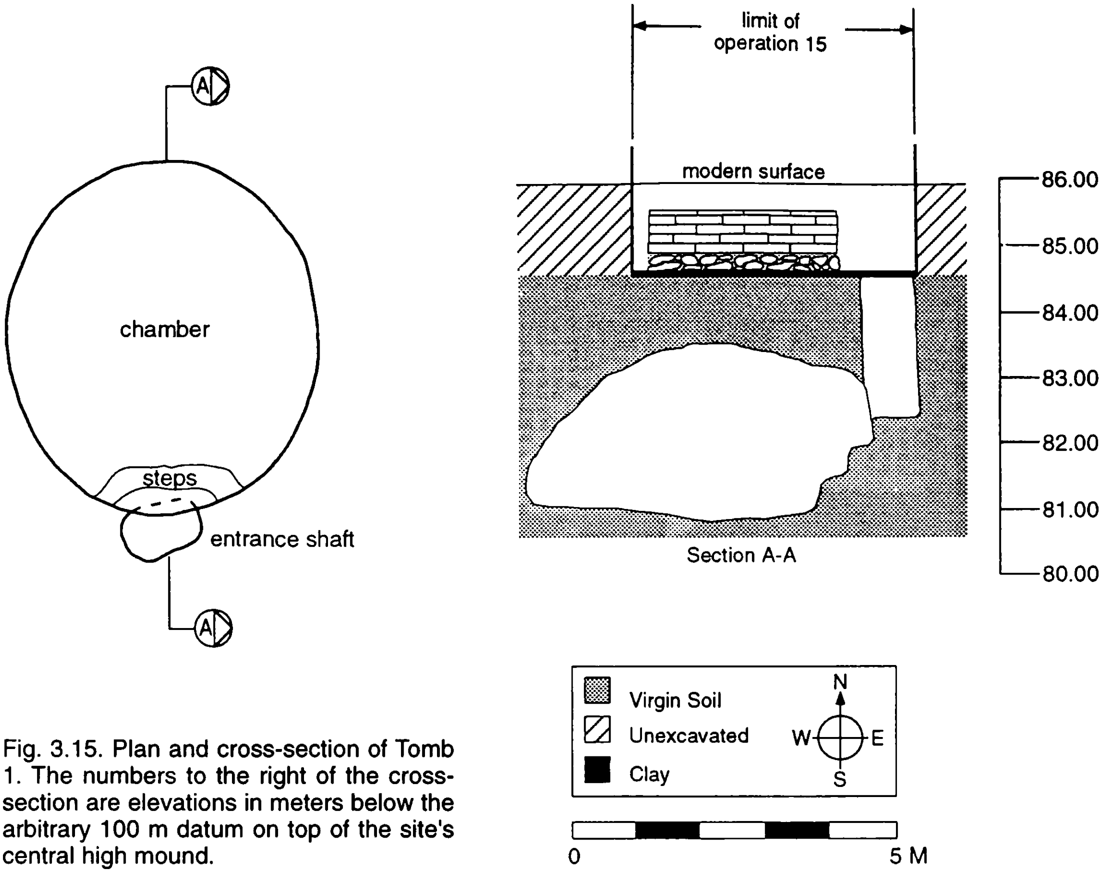


Fig. 3.15. Plan and cross-section of Tomb 1. The numbers to the right of the cross-section are elevations in meters below the arbitrary 100 m datum on top of the site's central high mound.

Tomb 1

The tomb consisted of a rectangular shaft, ca. 2 m deep, which ended on a narrow ledge (Figs. 3.12, 3.15). Two steps led down 1.5 m from the ledge to the floor of a roughly circular chamber, ca. 5 m in diameter. The shaft was cut entirely from the level of virgin soil. The chamber was dome-shaped, its high point ca. 2.5 m above the floor or ca. 1 m below virgin soil and 2.5 m below the surface of the mound in the area (on shaft-and-chamber tombs and burial customs more generally, see Orthmann 1980; Carter and Parker 1995).

Though the chamber was not filled, a substantial amount of soil had washed down into it, and the soil was very wet from the irrigation water which had run unchecked into the hole since the shaft first opened up. When we entered the chamber, we noted a depression, oriented roughly southwest-northeast, on the northeastern side of the chamber, with soil heaped up ca. 40 cm high on both sides; we assumed that the depression marked the spot where the looters had been digging. We found a large flat limestone slab in the backdirt to the east of the depression, and a similar slab in the southwestern quarter of the chamber near its entrance. The function of the first slab remains uncertain. Since we found no pits cut into the chamber floor, it probably did not serve to seal a burial, though it might have served as a bier. The second slab, which measured ca. 1.3 by 1.0 m, had probably sealed the entrance between the shaft and the chamber.

The consistency of the soil in the chamber made excavation and removal of the fill arduous and time-consuming. We could, perhaps, have increased our recovery of bones, small finds, and pottery if we had wet-sieved the soil we removed, but we had neither the time nor funds to do so. The tomb contained both human and animal bones as, for example, did contemporary tombs at Halawa (Orthmann 1981:89–101), but the state of their preservation was extremely poor. We will have to await analysis of the animal bones, but preliminary observations indicate that they were from sheep and/or goat. Despite the fact that the tomb had been recently looted and the pottery vessels carelessly thrown aside or deliberately broken, we managed to recover a substantial number of whole or nearly complete pots (Fig. 3.16), as well as stone beads, a shell ring, fragments of a hollow bone cylinder with incised decoration, a copper (or bronze) ring, a copper (or bronze) pin with a bent shaft, eye and globular head, and a copper (or bronze) "fork"

Fig. 3.16. Artifacts salvaged from Tomb 1.

that had a straight shaft with a V-shaped notch on one end. Pins with a bent shaft, eye, and globular head were, as Woolley noted, the most characteristic type of pin in the Royal Cemetery at Ur (1934:310). Such pins are also common at Tell Chuera (Moortgat 1965:42–44, with further references) and in Halawa's mid-Early Bronze Age tombs (Orthmann 1981: pls. 63, 71). The "fork" was probably a string notch from the butt end of a projectile. Woolley found string notches similar in shape and size in situ in the butt ends of what he described as light javelins or throwing spears (1934:304).[17] Its presence in Tomb 1 may suggest that, like the Til Barsip Hypogeum, the tomb originally contained weapons.

The pottery from Tomb 1 included simple, metallic, and cooking pot wares (App. 3.1). We have used the term metallic ware, like Kühne, as a general designation (1976:33–72).[18] The sherds from a spouted globular cooking pot with a low, flaring neck and plain, rounded rim were extremely friable. The vessel was not restored, but a complete example was found in Tomb 2 (see below).

In addition to ancient artifacts, we recovered empty packages of al-Hamra cigarettes and a cigarette lighter.

Tomb 1's shaft, as noted above, was sealed by a thick clay band which served as the building floor for what may have been part of the outer fortification wall of the late third millennium settlement (see above). The wall provides a terminus ante quem for the tombs.

Tomb 2

Tomb 2 was visible as a roughly circular hole ca. 3 m in diameter. The size of the hole was apparently the result of a collapse that occurred while the looters were working there. When we were clearing fill from the hole, we found stones from the outer fortification wall's footings and a crushed bucket the looters had used for removing dirt, as well as a digging tool. Because of the collapse we could not get any information on the exact location, shape, and size of the shaft. We cleared only a part of the tomb chamber before the end of the field season. While the tomb had been entered, it was still largely intact, and the bones we recovered were in a better state of preservation than those from Tomb 1, in large part because Tomb 2 had not been flooded by irrigation water. At least two large stones, one of which was probably the capstone, and clusters of smaller stones were found on the floor of the chamber or in the fill immediately above the floor. At least two humans had been buried in Tomb 2, as well as animals (or parts of animals), including sheep and cattle. Finds included a copper (or bronze) bent pin with eye and globular head, copper (or bronze) lunate-shaped earrings, and many whole and nearly complete pottery vessels.

As in Tomb 1, the pottery included simple, metallic, and cooking pot wares (App. 3.2). It also included a single example of smeared wash ware, a small globular jar with a flat base, short straight neck, and beveled ledge rim similar to, if somewhat smaller than, examples from the Amuq (Braidwood and Braidwood 1960: figs. 345:3 and 367:4). The surface decoration, dark purplish in color (see Braidwood and Braidwood 1960: pl. 89:3), covered the whole vessel.[19]

Tomb 5

Operation 22 was a 2 by 2 m square located over a sink hole, which we took to mark the location of a tomb shaft, in the middle of D4. We encountered no architecture or floor levels and quickly and easily defined the shaft. However, the tomb chamber was filled almost to the top. A certain amount of soil must have been brought into the chamber (or accumulated through natural processes) while the tomb was in use, since what was probably the capstone—a large fragment measuring 78 by 72 by 15 cm—was found in the fill ca. 15–20 cm above the floor. The bulk of the fill had accumulated after the stone, which had sealed the crawl space between shaft and chamber, had fallen in. The uppermost 80 cm of fill consisted of waterlaid deposits—hard yellow clay-like soil striated with less compacted brown soil—and presumably represents relatively recent depositional episodes.

Tomb 5's shaft, cut from the level of virgin soil, was funnel-shaped. It ended on a ledge from which access could be had into the tomb chamber. The top of the ledge was ca. 1.70 m above the floor of the chamber. The tomb chamber was a sort of flattened dome, ca. 1.90 m high. The floor of the chamber, ca. 4.50 m below the modern surface, was roughly oval in shape, measuring ca. 3.9 by 4.9 m.

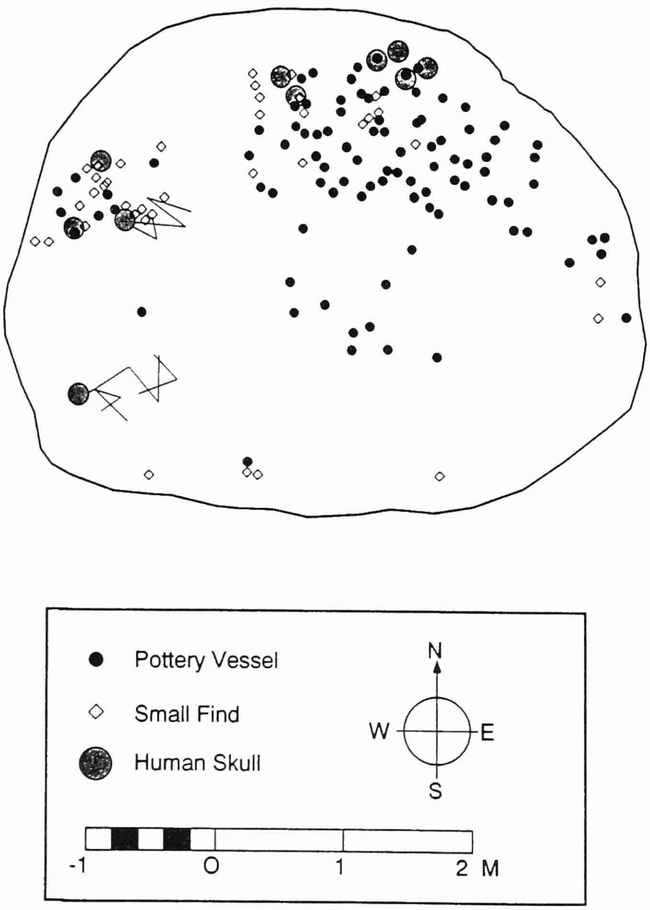


Fig. 3.17. Schematic floor plan of Tomb 5.

We found two articulated skeletons, both on the western side of the chamber (Fig. 3.17). One, that of a female near the chamber's entrance, was relatively well preserved and may represent the most recent interment; it had no artifacts specifically associated with it. A second, somewhat smaller and poorly preserved skeleton, also probably a female, was located more than a meter northeast of the first body; it had crossed straight pins of copper or bronze at the breast and a necklace (Fig. 3.18). The pins may have served to secure a shawl similar to that worn by women on the roughly contemporary shell inlays from Mari (Parrot 1962: pls. 11–12). One of the pins projected through a flat ring made of gypsum and decorated with incised concentric circles. The ring would have been secured to the shawl and served to anchor the pin. The necklace included rhomboid-shaped beads made of gypsum; date-shaped beads made of a crumbly black stone or composite material; carnelian biconoids and beveled ring-shaped beads; two gypsum beads in the shape of a cow or bull, both decorated with incised concentric circles[20]; and many small cylindrical beads made of gypsum. Near the skull were a gypsum ring nearly identical to the one at the breast and two ceramic wheels from a model. The ring may have originally been attached to the deceased's shawl to anchor the other pin or might equally have been a hair ornament.

The remainder of the human bones from the tomb were scattered around the floor of the chamber, with a large pile of bones against the north wall in part overlain by pottery vessels (Fig. 3.19). The bones of earlier burials were apparently rather carelessly tossed aside when the bodies of the more recently dead were interred. We found, for example, an articulated forearm and hand just northwest of the chamber's entrance. A small gray-black burnished ware jar was in the hand and a beaded bracelet encircled the wrist. We have not yet been able to determine the number of individuals in the tomb, though the number of skulls provides an index. In addition to the two articulated skeletons, we recovered three complete skulls and fragments of at least five others, so the tomb contained at least ten individuals.[21] The teeth of one complete skull, probably belonging to an older male, showed heavy wear—the premolars and the incisors, which were reduced to pegs, had no enamel; the right canine was impacted.

In addition to the human remains, the tomb also contained animal bones, both on the floor of the chamber and in the fill immediately above the floor. The animals included sheep/goat, pig, and various kinds of birds.[22]

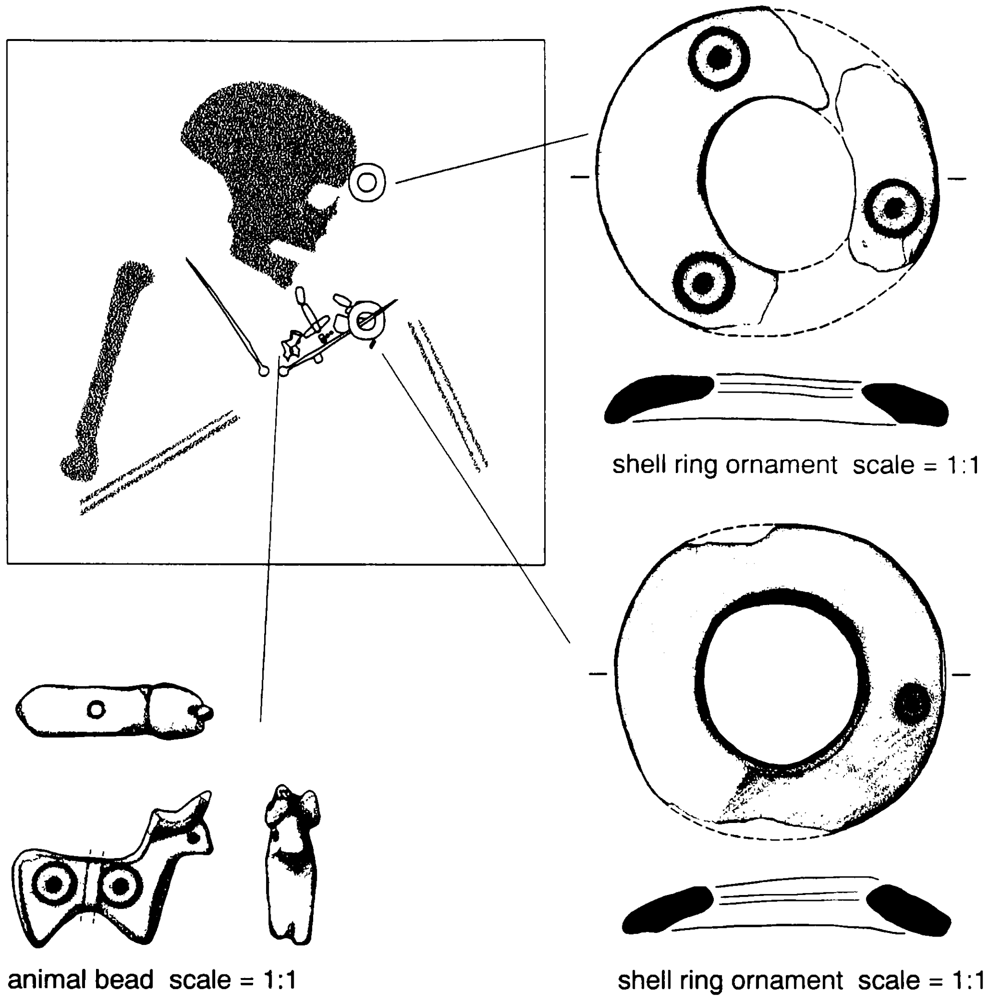


Fig. 3.18. Schematic drawing of partially preserved skeleton from Tomb 5 showing jewelry in situ, including pins, flat rings and anthropomorphic beads decorated with incised concentric circles.

The bones found in the fill appear to represent the remains of deliberate "offerings." The skull of one sheep/goat had bird eggs set in its eye sockets, and the skull of a different sheep/goat in the center of the chamber was surrounded by four stones. Both seem unlikely to have been the result of accidents. Our excavations uncovered no stratigraphic evidence that would shed light on the circumstances of such deposits. It is possible that they represent the remains of offerings placed on top of a mound of dirt that covered an individual. A piglet and a sheep skull, for example, were above but in close proximity to the articulated skeleton on the southwest side of the chamber. It is possible, though it would seem less likely, that the remains in the chamber were covered just prior to the tomb's being "abandoned" and that offerings were made at that time.

Most of the artifacts recovered were mixed with the bones and pottery vessels against the chamber's north wall. Copper or bronze artifacts included pins, most with a bent shaft, eye, and globular head (Fig. 3.20); a bent clasp that could have secured a shroud or a leather or cloth bag[23]; two bent hammered axe blades; a javelin point; a string notch for a light projectile; and six daggers (Fig. 3.21). The daggers, which have a central thickening or midrib and short tang, vary in length from 23 to 17 cm. On each, three rivets—two on the shoulder and one on the tang—would have served to secure the handles, which were probably made of wood and had disintegrated. Other finds included a hollow bone cylinder with incised decoration that was filled with a solidified black substance, perhaps a cosmetic pigment[24]; a flint core; a model of a wagon with tilt, as well as two

Fig. 3.19. Pottery against the northern wall of the chamber of Tomb 5. The tags on the right mark the locations of vessels already removed.

wheels (Fig. 3.22), perhaps originally associated with the two wheels found near one of the articulated skeletons[25]; a whetstone or pendant; beads; and more than one hundred pottery vessels (Fig. 3.23). Though we sieved the contents of nearly all the vessels and our archaeobotanist floated the soil removed from them, only the largest jar produced any evidence for what may have been the original contents, the bones of a large number of birds roughly the size of modern-day pigeons.

The pottery (App. 3.3) included the same wares found in Tombs 1 and 2. The simple ware forms included cups and goblets, bowls with thickened rims (including one with a high pedestal base), globular jars of varying sizes, including spouted examples commonly dubbed "teapots," a vat, and miniature jars. The examples of gray-black burnished metallic ware were two small globular jars with medium-high necks and flaring rims. Examples of corrugated, band-burnished, and band-painted metallic ware included a conical cup and bowls, several of which were deep and had three tubular feet; but most examples of this ware were small- to medium-sized jars with globular bodies, low ring bases, high necks, and flaring rims.

Dating and Significance

Though detailed comparisons will have to await a final report, on the whole, the pottery from the Tell es-Sweyhat tombs has its strongest parallels with Amuq I–J (Braidwood and Braidwood 1960:396–457), Kurban Höyük Period IV (Algaze 1990:311–367), Hadidi Early Bronze III–IV (Dornemann 1988:26–38), Halawa's mid-Early Bronze Age tombs (Orthmann 1981:49–60), Tell Banat Tomb 1 (Porter 1995), and Tell Chuera (Kühne 1976). The tombs ought to be dated to the mid-to-late third millennium. Since Tomb 1's shaft was partially sealed by the fortification wall of the late third millennium settlement, it cannot be as late as the last quarter of the third millennium. The tombs, therefore, are best dated to the third quarter of the third millennium.

The Tell es-Sweyhat tombs would have constituted the cemetery of the mid-third millennium village, situated to the northwest of the main population concentration. The late third millennium inhabitants who built the fortification wall either did not know of the tombs' existence or had neither structural concerns nor scruples about putting the wall over the tombs. If the builders did not know of the tombs' existence, we might logically infer that some time had elapsed between their use and the wall's construction.

Notes

12. We excavated the lower town operations in contiguous 5 by 5 m squares (or parts of such 5 by 5 m squares), assigning new locus numbers with each square, even in cases where an exca-

Fig. 3.20. Bent and straight pins with globular heads from Tomb 5.

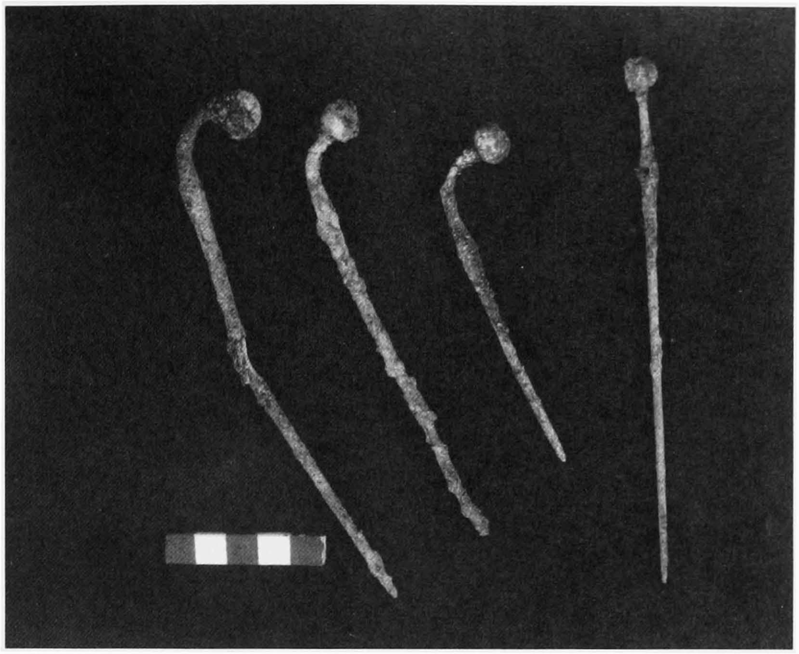
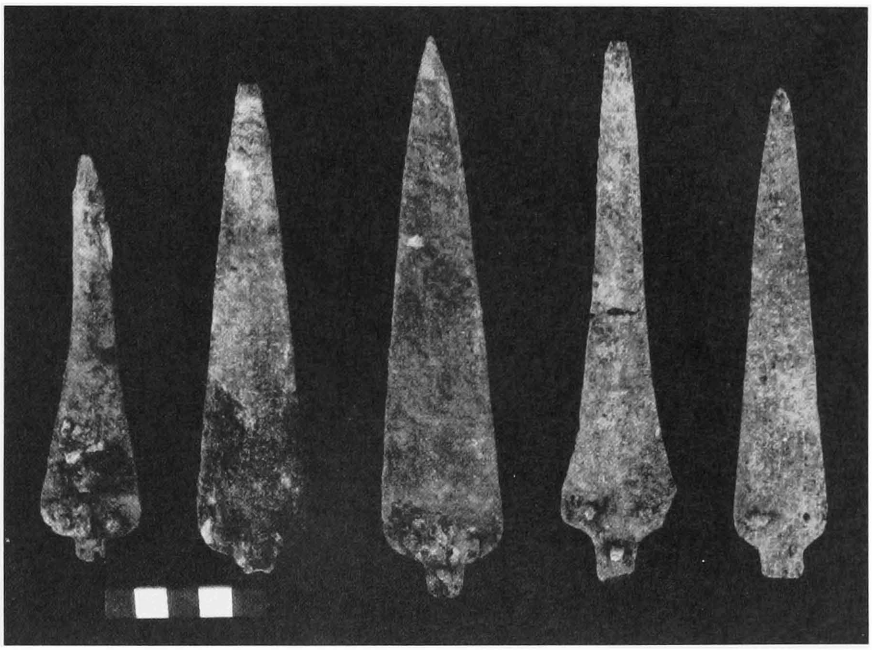


Fig. 3.21. Daggers from Tomb 5.



vated area was part of a bounded space uncovered in other squares. In order to simplify reference to spaces with multiple locus numbers and the plan of Operation 4, we have designated spaces with the first (and lowest) locus number assigned in the field.

13. Mark Fenn and Donna Strahan, Conservation Laboratory Report, 1991 Excavation Season. CAL no. 5330. February 20, 1992, p. 6.

14. Dr. Patrick McGovern (MASCA) analyzed a sample of the plaster from the basin using Infrared Spectrometry. He indicated that it was "at least a combination of calcium carbonate, sulfate and phosphate," the phosphate possibly from burnt bone.

15. For a similar horseshoe-shaped kiln at Halawa A, see Orthmann 1989:55–56; for a similar, if somewhat earlier kiln from Iran, see Alizadeh 1985:39–50; on ancient Near Eastern pottery kilns in general, see Delcroix and Huot 1972; also, Nicholson 1993.

16. For a similar pottery-producing area at Tell Chuera, see

Moortgat and Moortgat-Correns 1978:55–75.

17. A fragmentary string notch in the University of Pennsylvania Museum (B16403) is nearly identical in size to the example from Tomb 1. For a fuller discussion of the function of such "string notches," see Moon 1985:13–14.

18. For a recent discussion of metallic ware, see Dornemann 1988:27; also Orthmann and Rova 1991:72–77.

19. For smeared-wash ware, see Rova 1989.

20. A nearly identical bead was found in a burial at Tell al-Raqā'i, which Curvers and Schwartz attributed to Level 3 or early Level 2. In terms of absolute chronology, Level 3 probably dates to the 26th century and Level 2 slightly later in time. The burial also contained metallic wares and a pin with bent shaft, eye, and globular head (Curvers and Schwartz 1990:13–14, 18).

21. Tomb 5 appears to contain all of the bones of those who had been interred. Thus, burial practices at Tell es-Sweyhat stand in contrast to those at, for example, Titriş Höyük, where with each successive burial in "communal" tombs the postcranial bones of earlier interments were removed and disposed of, only the skulls being retained (Algaze et al. 1995:20).

22. Identification of the faunal remains in Tomb 5 were made in the field by Jill Weber.

23. The clasp is nearly identical in shape and size to an object from Tell Banat Tomb 1 which the excavators have identified as a pair of tongs (Porter 1995:8 and fig. 7:A386).

24. A block of kohl was found with fragments of similar hollow bone cylinders with incised decoration in Tell Banat Tomb 1 (Porter 1995:8–9).

25. On such covered wagons, see in particular Littauer and Crouwel 1974 and Strommenger 1990. In addition to the examples cited in these reports, see also a model from Terqa (Rouault and Masetti-Rouault 1993:333, 458), unpublished examples from Tell Chuera (Musée de la Civilisation, Prospectus for exhibit entitled Syrie: Terre de Civilisation, November 1996, nos. 2, 107, and 109), and two said to be from Hama on display in the archaeological museum in Hama.

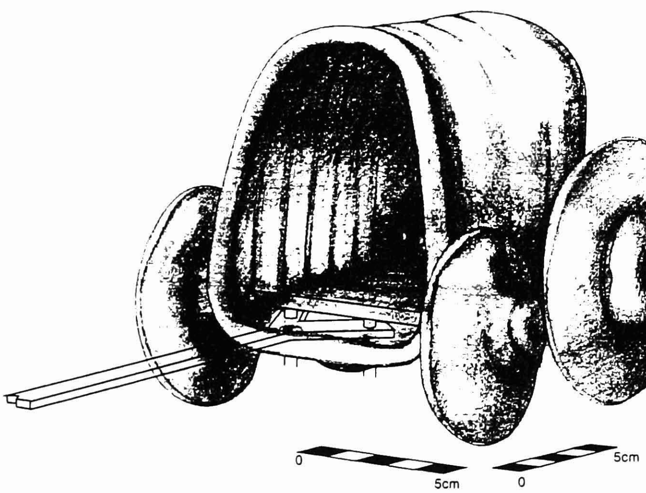
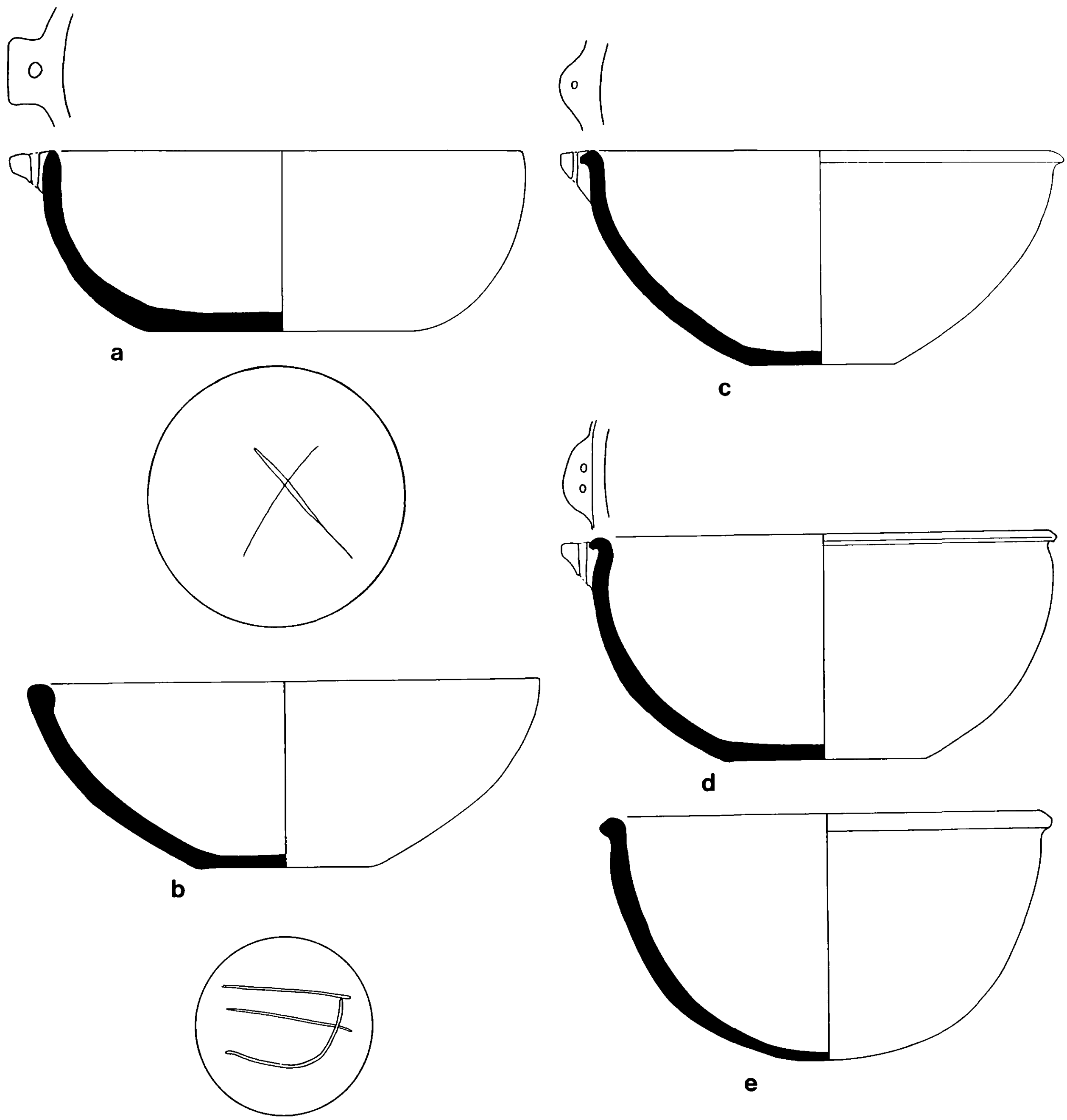


Fig. 3.22. Reconstruction of wagon with tilt from Tomb 5. The two sets of wheels found in Tomb 5 were not the same size. The larger wheels have been shown in the back as was the case with one of the carts found in the approximately contemporary burial PG 789 in the Royal Cemetery of Ur (Woolley 1934:64).

Fig. 3.23. Whole pottery vessels from Tomb 5.

APPENDIX 3.1

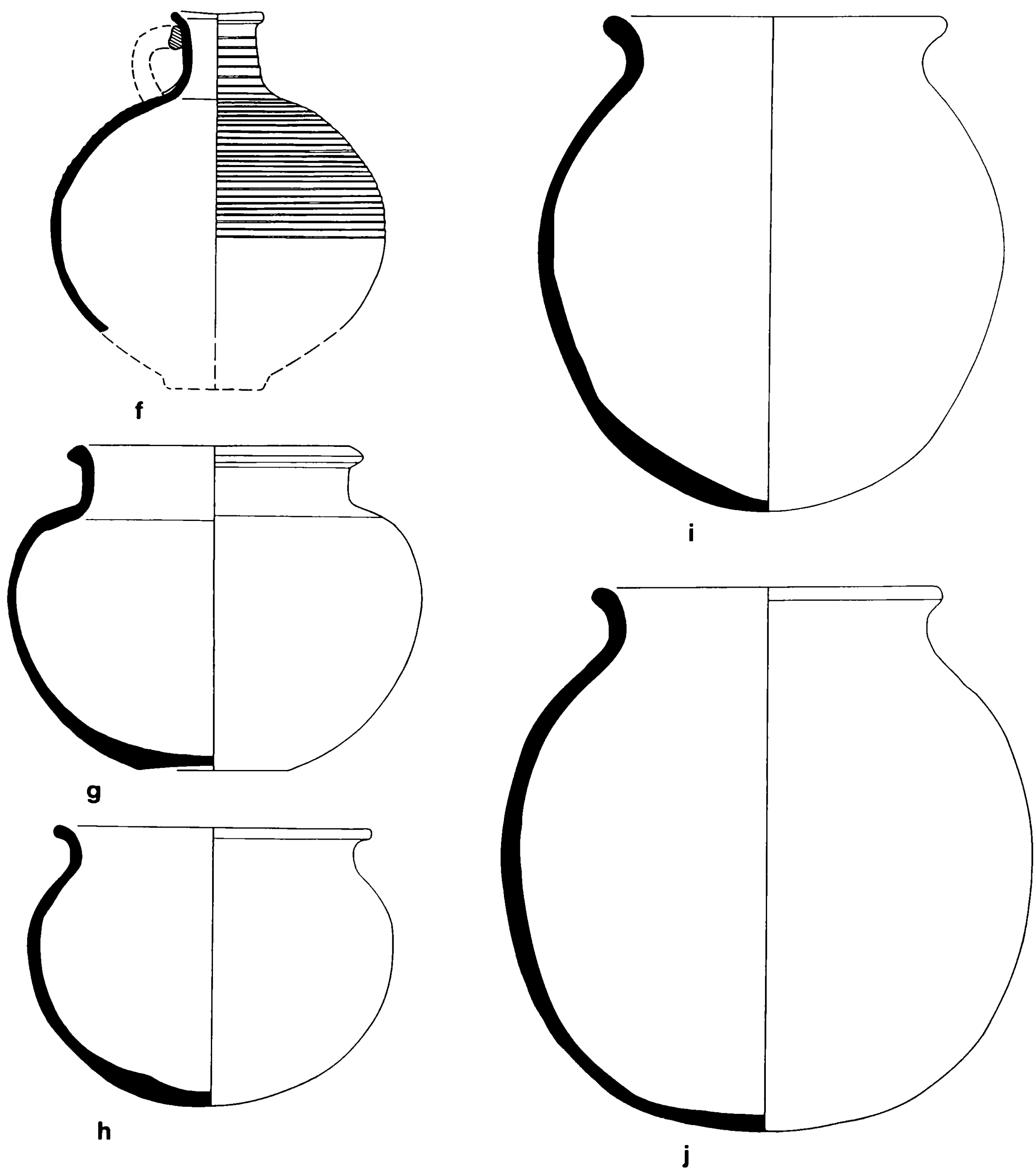
RECONSTRUCTED POTTERY FROM TOMB 1



Reconstructed pottery from Tomb 1. a–j are simple wares. k–n (p. 27) are metallic wares: k is gray-black; l is band-burnished; m, is band-painted on a multi-colored surface, with the upper portion a pale brown (Munsell 10YR 7/3) and the base a dark gray (10YR 6/1) and red (2.5YR 5/6); n is band-burnished and painted. Scale 1:3.

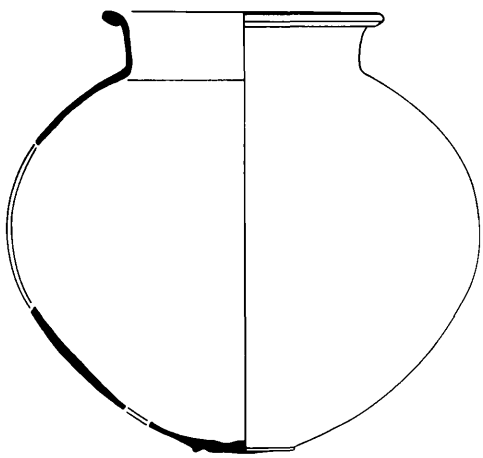
APPENDIX 3.1 (CONT'D)

RECONSTRUCTED POTTERY FROM TOMB 1



APPENDIX 3.1 (CONT'D)

RECONSTRUCTED POTTERY FROM TOMB 1



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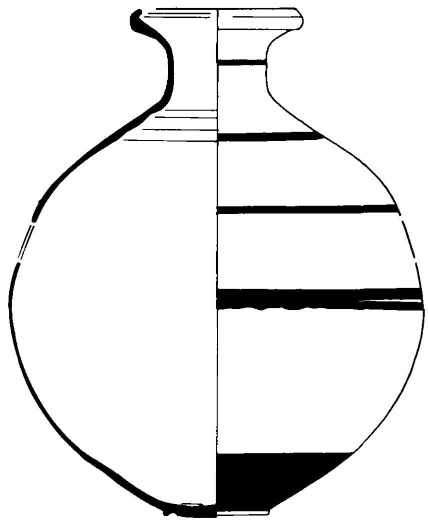

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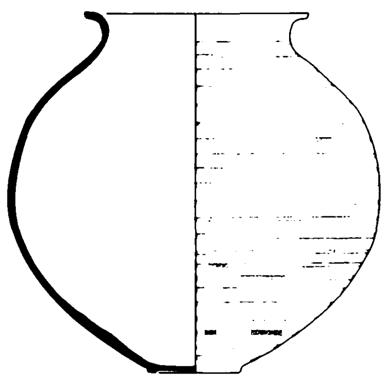

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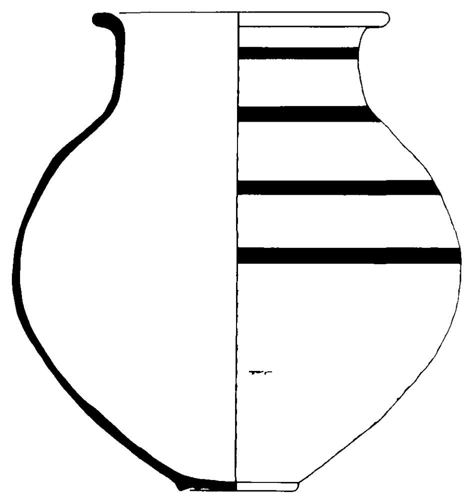

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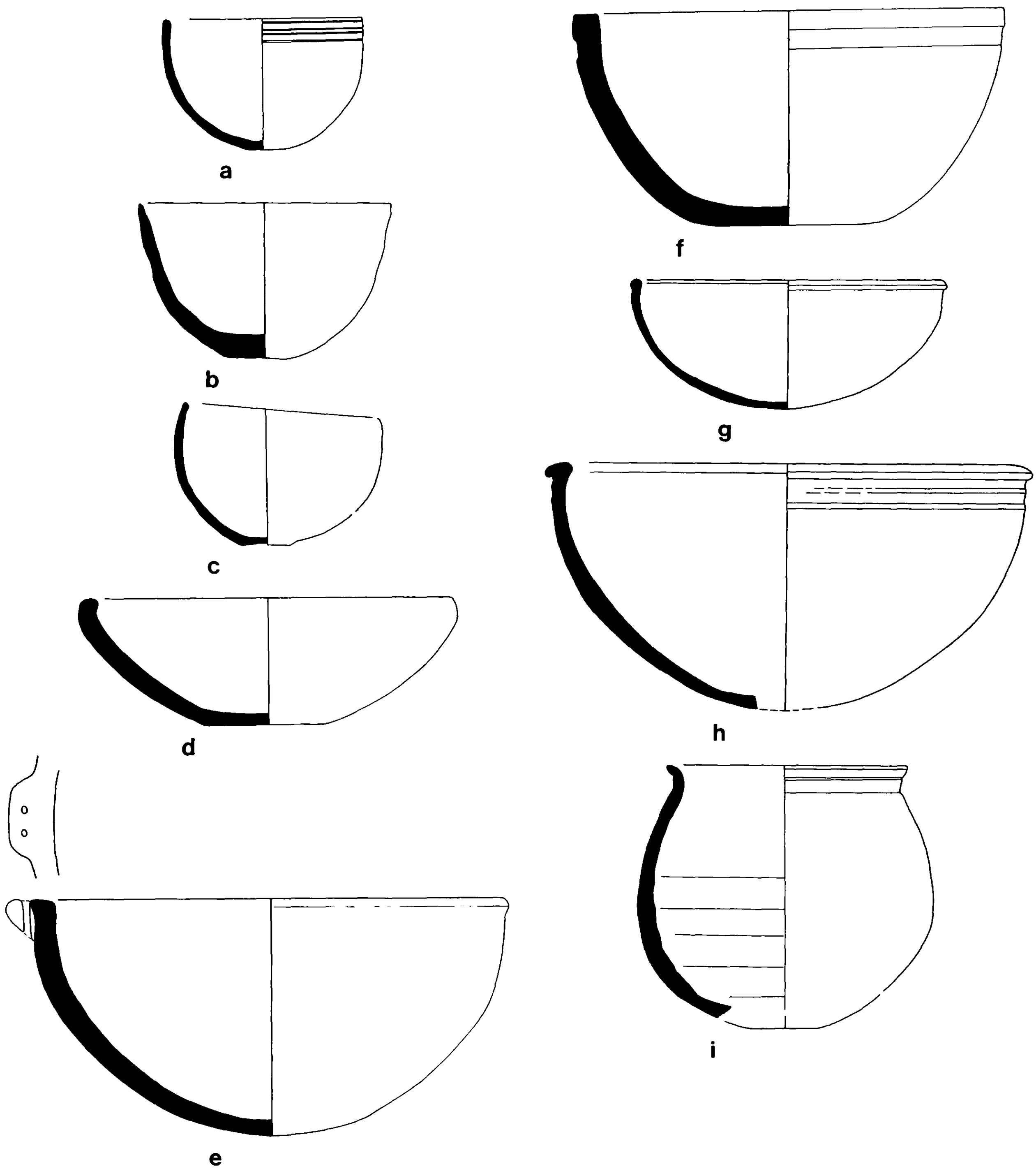
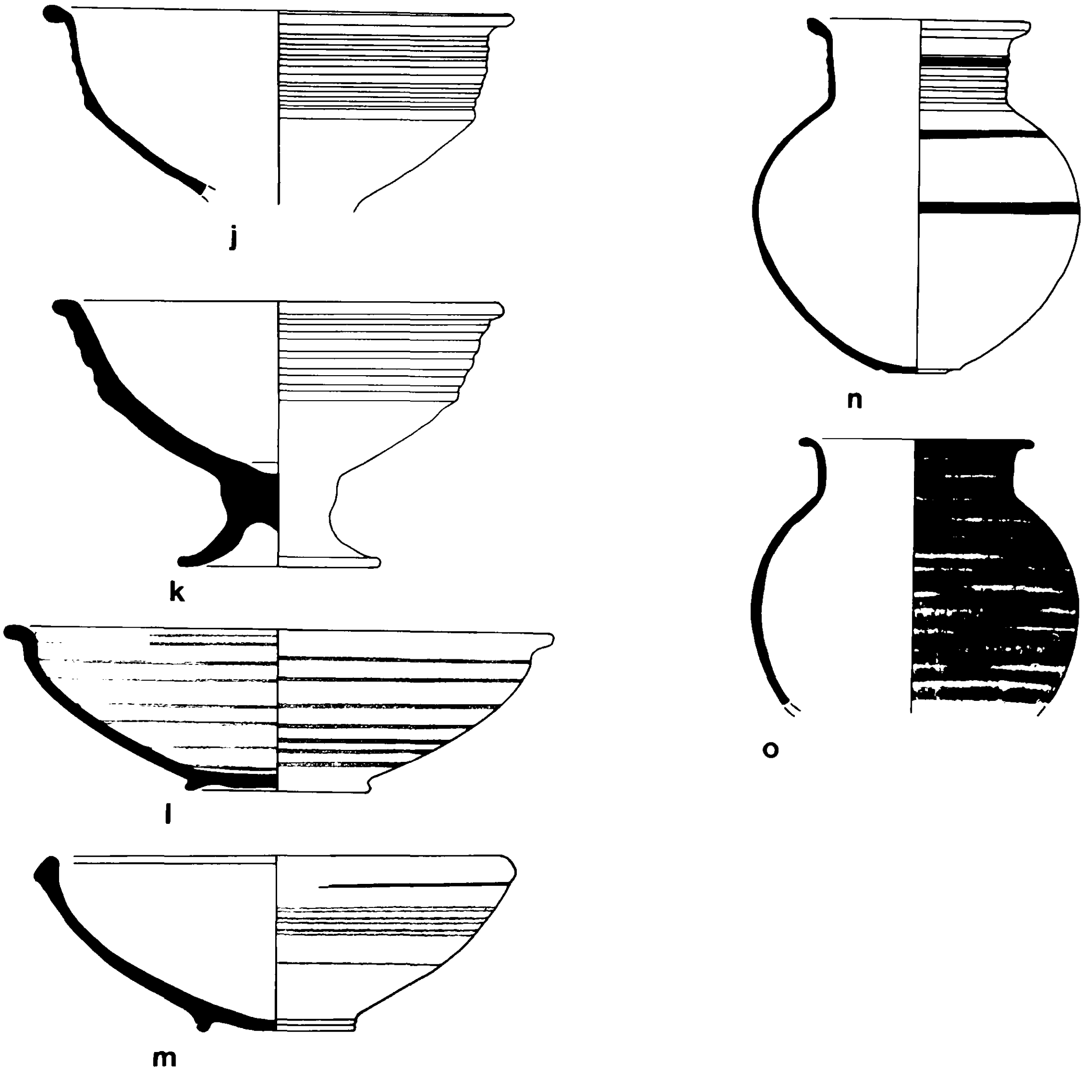
APPENDIX 3.2

RECONSTRUCTED POTTERY FROM TOMB 2



APPENDIX 3.2 (CONT'D)

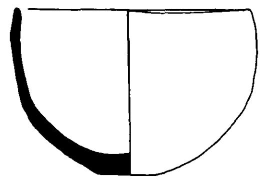
RECONSTRUCTED POTTERY FROM TOMB 2



Reconstructed pottery from Tomb 2. a–i (opposite page) are simple wares. j–n are metallic wares: j and k are corrugated; l and m, band-burnished; n, corrugated and band-painted; and the surface of o is covered with a dark purple (Munsell 5YR 3/1) smeared wash. Scale 1:3.

APPENDIX 3.3

POTTERY FROM TOMB 5



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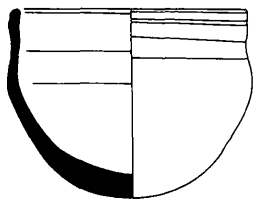

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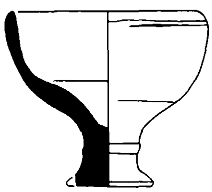

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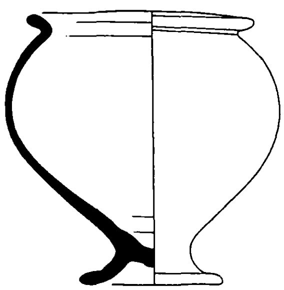

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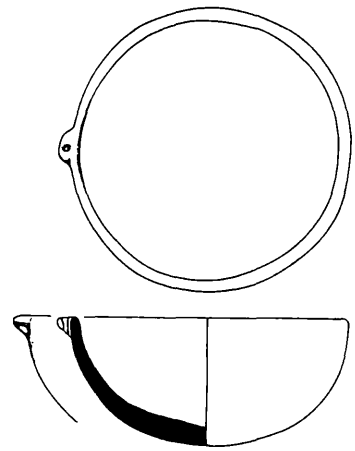

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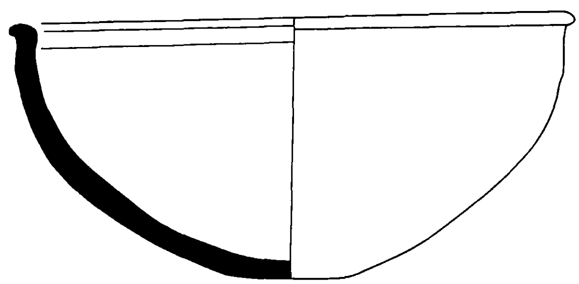

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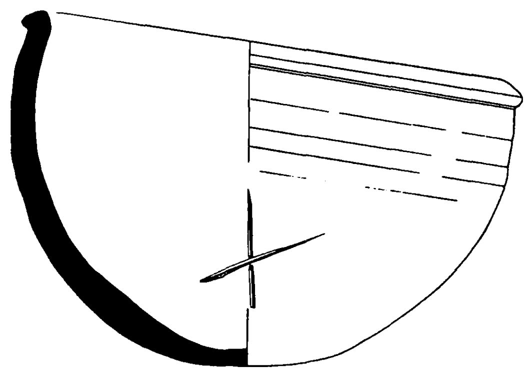

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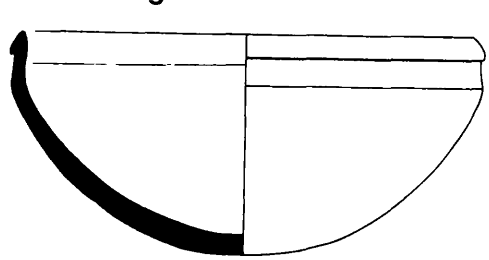
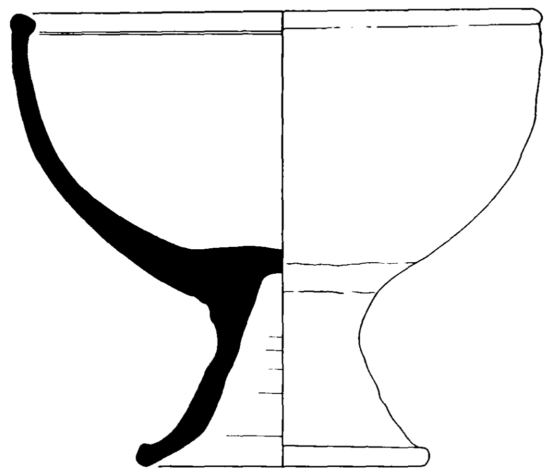


h

Pottery from Tomb 5. a–bb are simple wares, k is decorated with black painted bands. cc–uu are metallic wares: nos. cc–ee are corrugated; ff and gg, gray-black band-burnished wares; hh–mm, corrugated and band-burnished or band-burnished; nn–qq, corrugated and/or band-painted; and, rr–uu, corrugated and/or band-burnished and band-painted. Scale 1:3 (y and z, 1:5).

APPENDIX 3.3 (CONT'D)

POTTERY FROM TOMB 5



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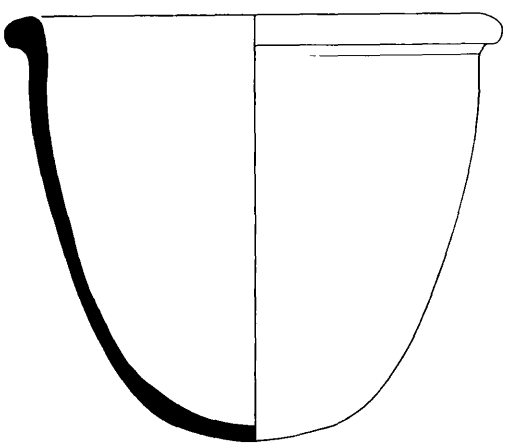

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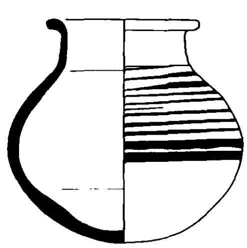

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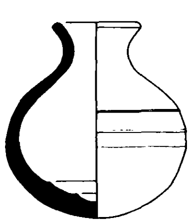

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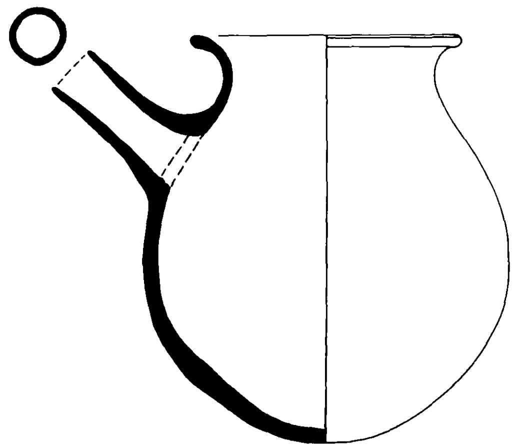

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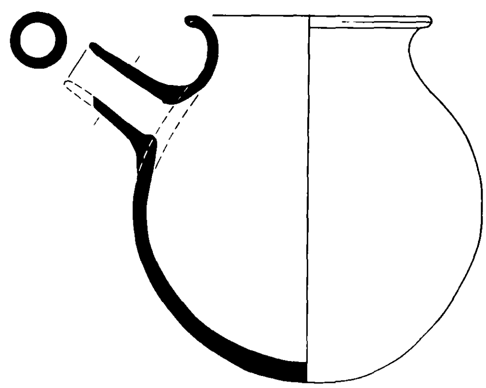

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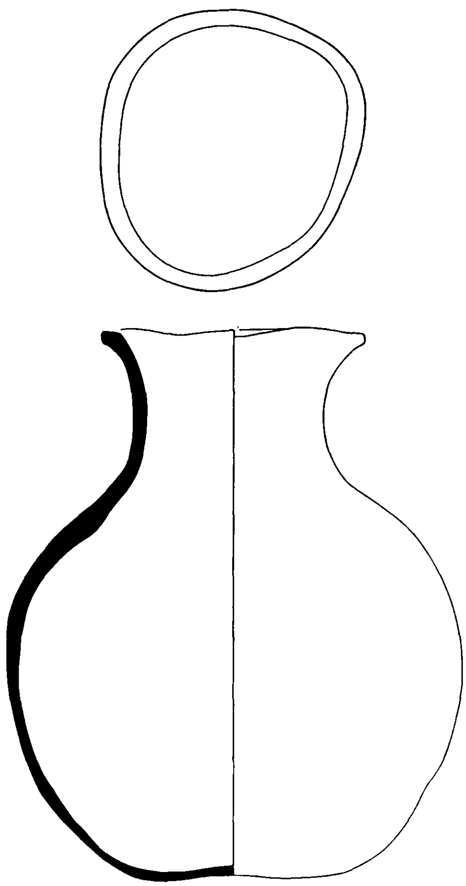

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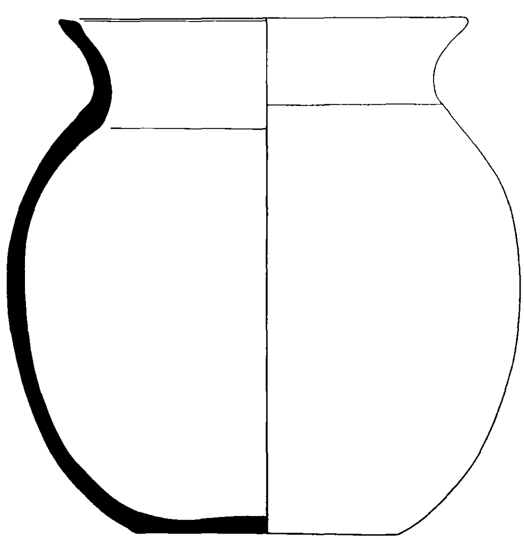

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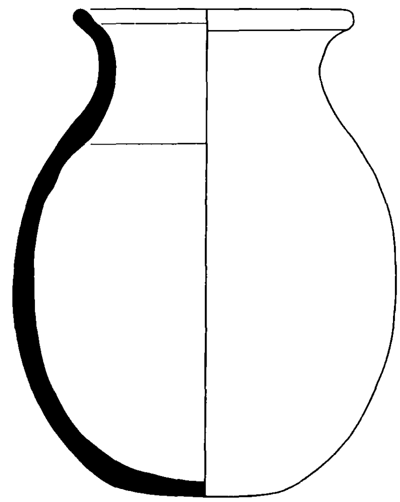

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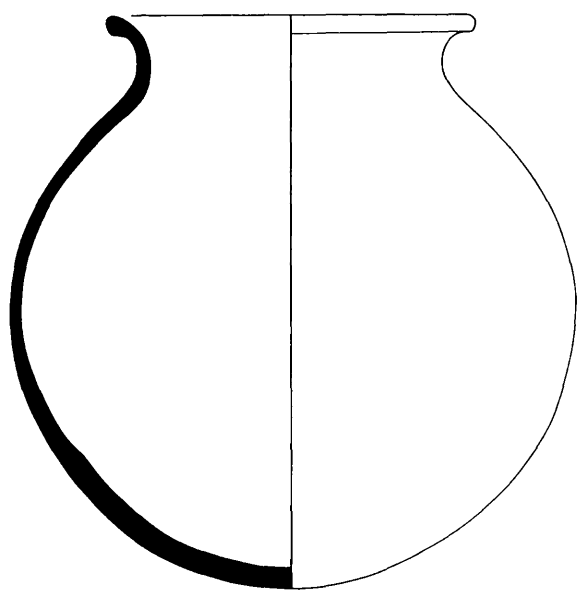

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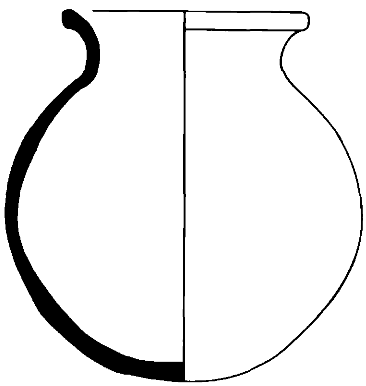

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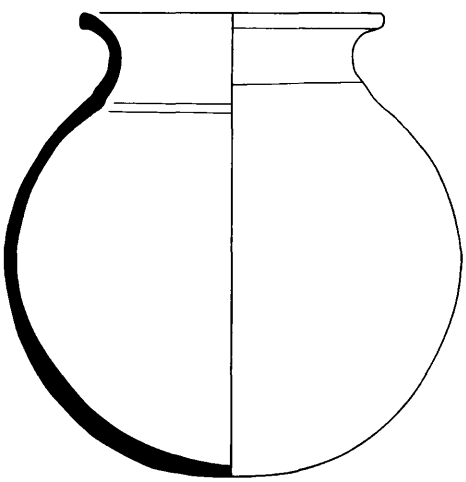

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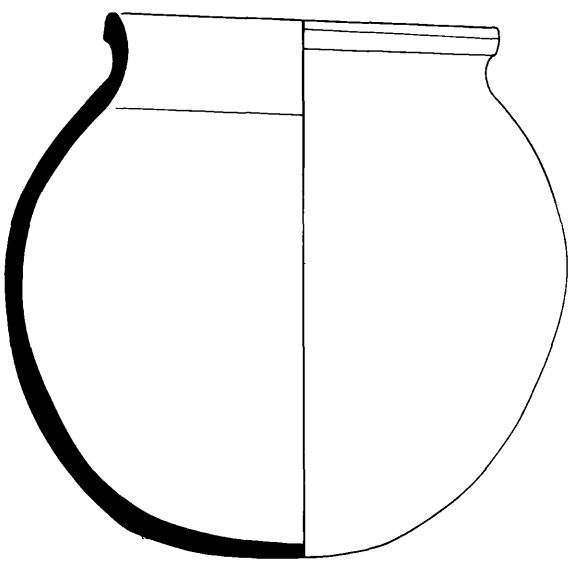

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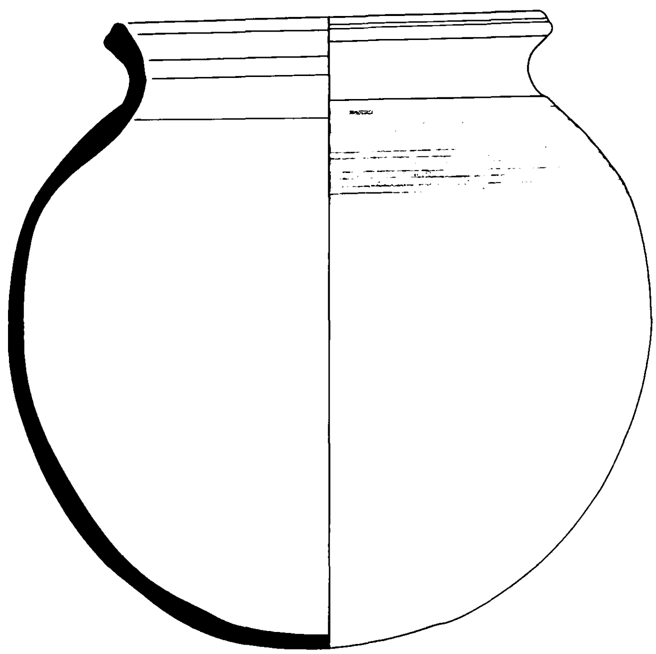

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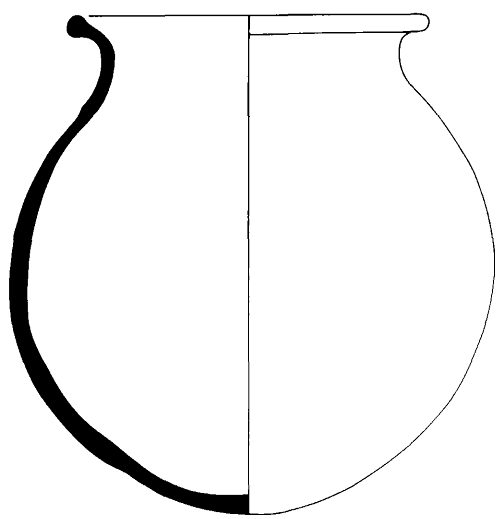

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APPENDIX 3.3 (CONT'D)

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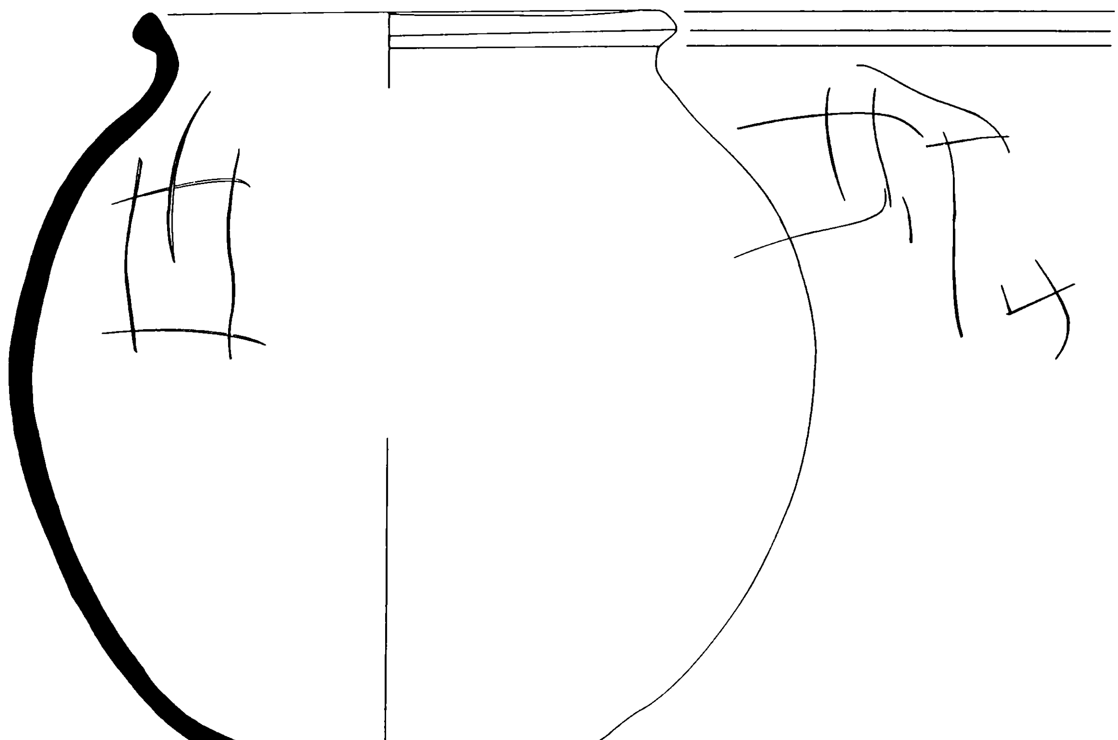

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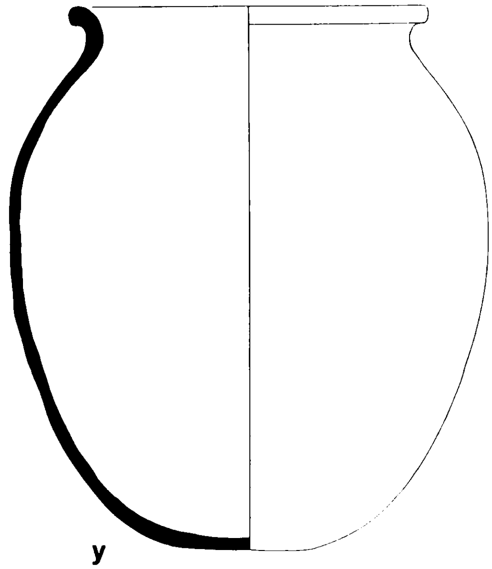

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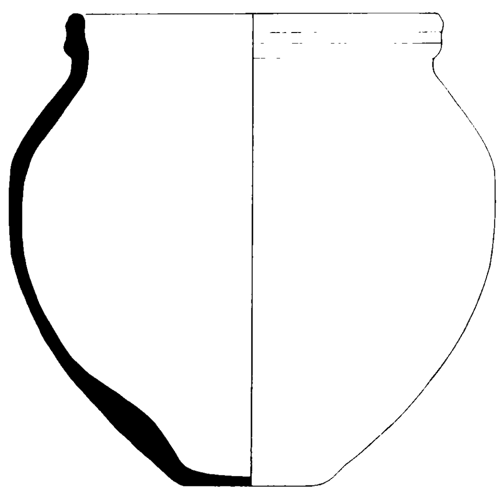

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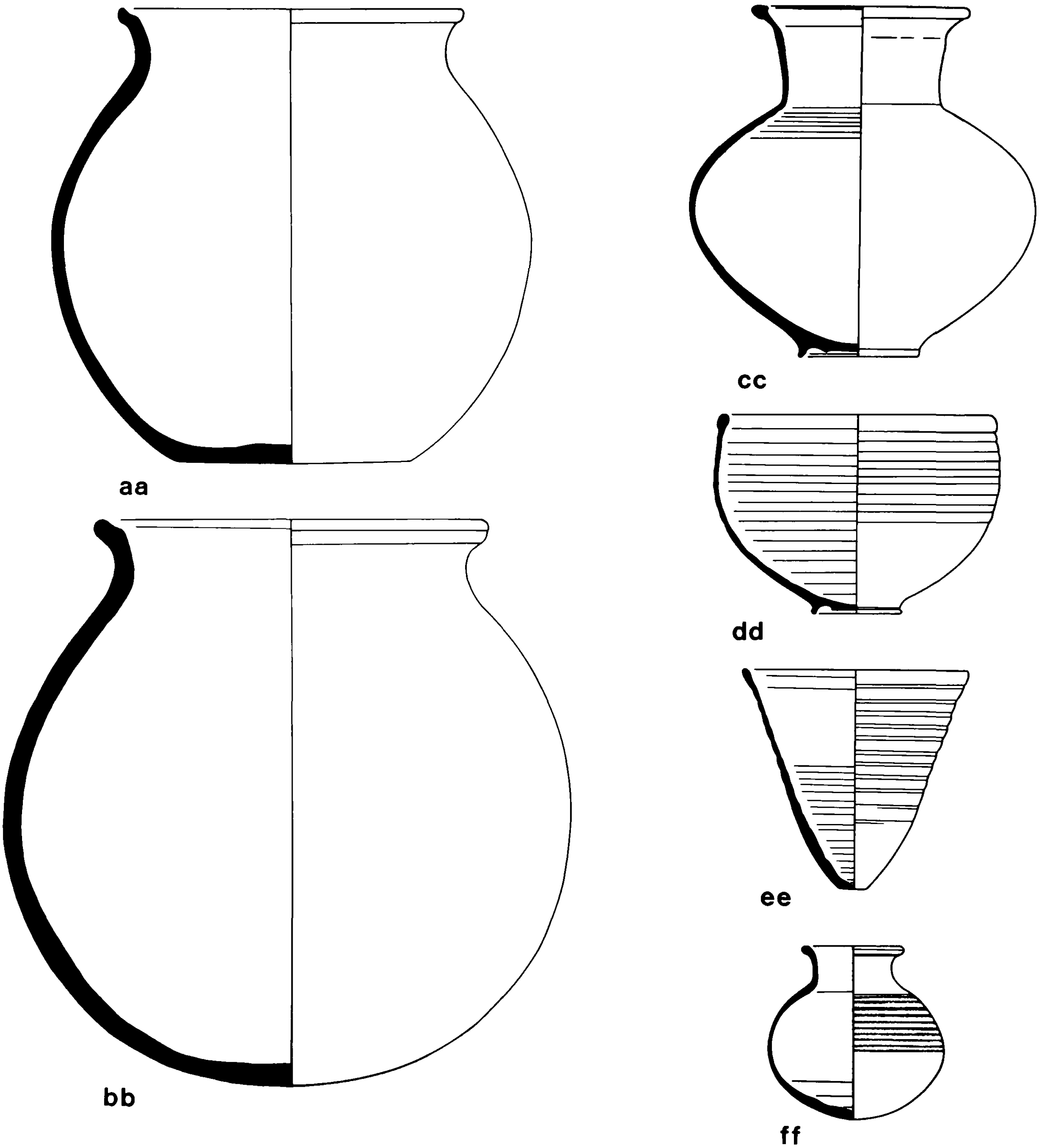

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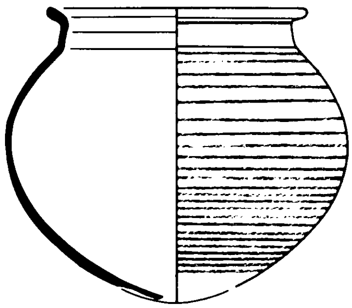

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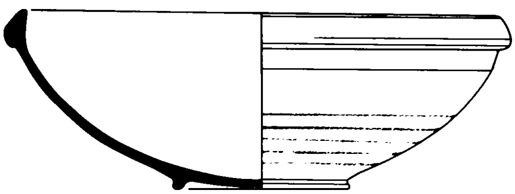

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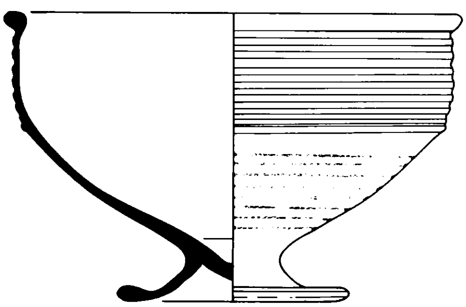

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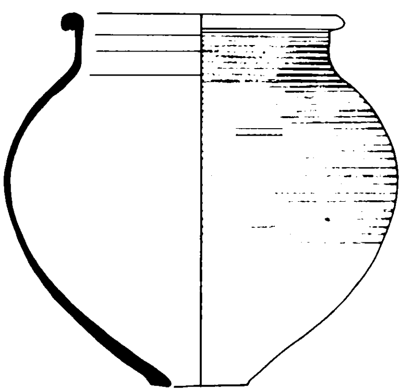

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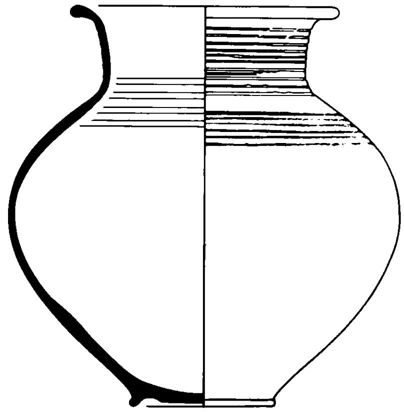

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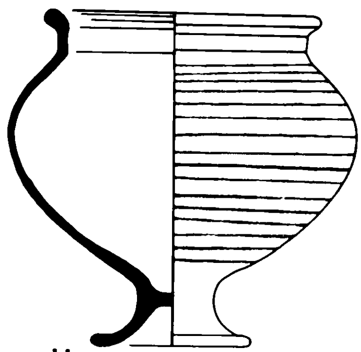

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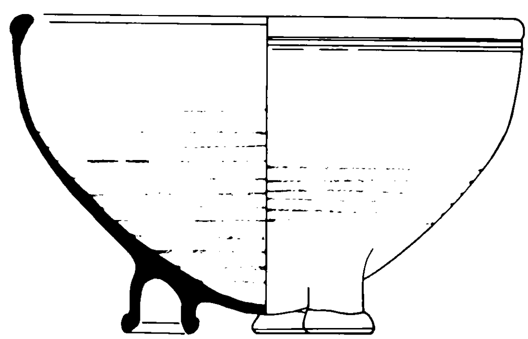

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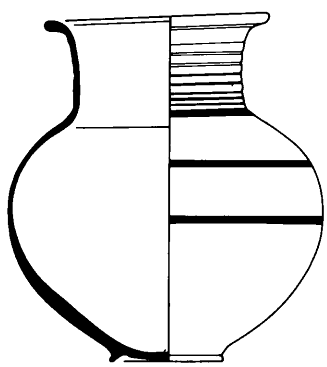

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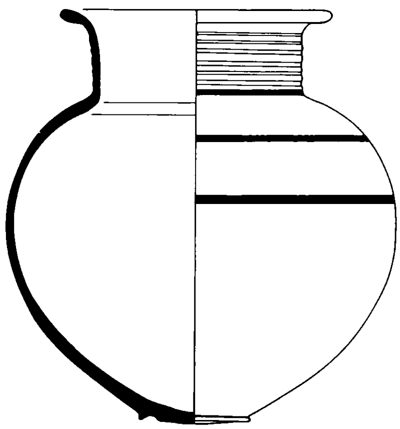
APPENDIX 3.3 (CONT'D)

POTTERY FROM TOMB 5



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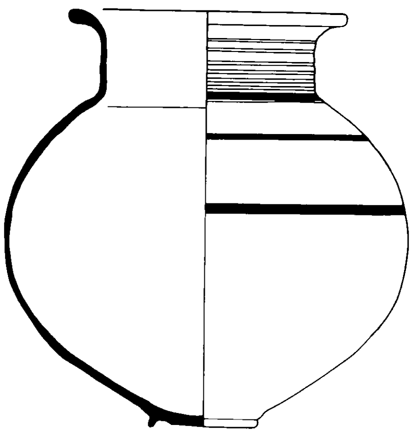

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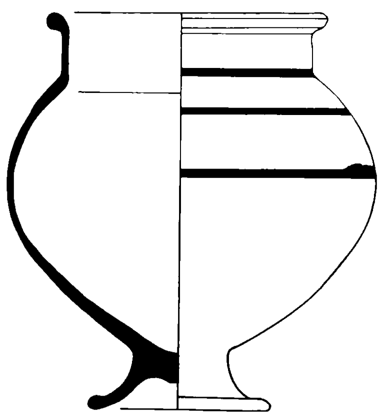

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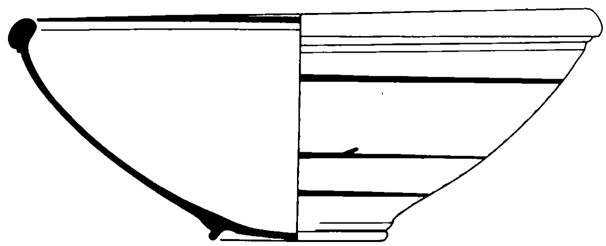

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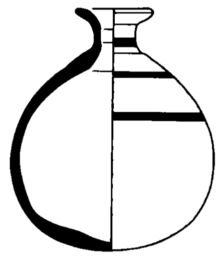

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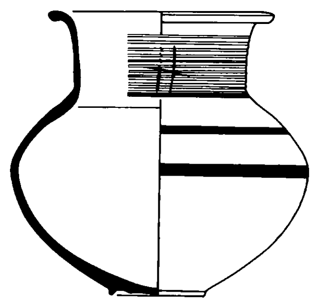

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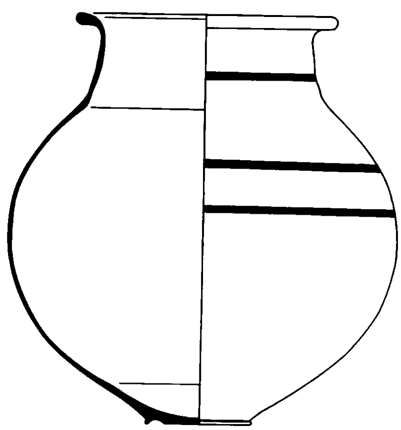

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4

GEOMAGNETIC MAPPING OF THE OUTER TOWN

Peter N. Peregrine, Andrew Bell, Matthew Braithwaite, and Michael D. Danti

Our 1989 and 1991 excavations indicated that Tell es-Sweyhat's lower town presented a nearly ideal field situation for geomagnetic mapping. The late third millennium building level represents the main occupation throughout the lower town. The buildings were built on virgin soil, and even though the occupation debris is not deep, the buildings are relatively well preserved, with limestone footings (as opposed to mud-brick walls) that include doorways, and floors with in situ features such as ovens and hearths, as well as artifacts. And the buildings are readily accessible below a shallow plow zone, so that test excavations to provide "ground truth" for interpretation of the geomagnetic maps are relatively easy.

Geomagnetics

Geomagnetic techniques have been used in archaeology to find and map subsurface deposits since the 1960s (see, for example, Aitken 1961; Black 1967), but it was not until the recent development of robust, easy-to-use equipment and powerful personal computers for data processing that geomagnetics have become common in archaeological research (Weymouth 1986). The good results other researchers have had with geomagnetic mapping on Middle Eastern sites with deposits similar to those at Tell es-Sweyhat—such as Assur (Becker 1991), Demirchihüyük (Becker 1977/78 and 1979), Hassek Höyük (Becker 1981 and 1992), Kuşaklı (Stümpel 1995), and Troy (Jansen 1992)[26]—were of particular importance in encouraging us to test this technique. More recently, Becker and colleagues have had particular success using magnetics to map subsurface remains at nearby Mumbaqa (Becker, Fassbinder, and Chouker 1993), as Somers has had at Titriş Höyük (Algaze et al. 1995).

The premise of the archaeological use of geomagnetics is that archaeological deposits can be recognized as disruptions of the otherwise uniform magnetic character of most soils (Scollar 1990:422–450; Weymouth 1986:342). All soils have a particular magnetic susceptibility, and any intrusion with a different susceptibility, such as a stone foundation, wall, or a pit filled with organic debris, can be identified and mapped (von Frese 1984:11–12). Intrusions that have a magnetic potential, such as magnetic metals or hearths where heat has created thermoremnant magnetism in the soil, are even more readily identified and mapped (von Frese 1984:7–11). The technique used to identify these intrusions involves measuring the intensity of the earth's magnetic field at a particular location and comparing it to other, surrounding locations (von Frese and Noble 1984:39–40).

1993 and 1995 Geomagnetic Mapping

At Tell es-Sweyhat we anticipated three primary types of archaeological deposits that could be identified and mapped using geomagnetics. First, we knew that buildings in the lower town had stone footings and we expected these to be visible since the stone would likely not have the same magnetic susceptibility as the soil surrounding it. Our work to this point suggests that these stone foundations are slightly less susceptible than the soil, and they tend to show up on our maps as slight (2–3 nanotesla or nT) linear magnetic lows. Second, we expected hearths, ovens, and kilns to be clearly visible due to their thermoremnant magnetism. Finally, we also hoped that the decay of organic debris in refuse pits, wells, or other subsurface features would create a slightly higher susceptibility than surrounding soils (see von Frese 1984 for a discussion of the processes that may create increased susceptibility in organic debris). While we have not positively identified any such features, we have noted several potential locations and following test excavations may be able to define a magnetic signature for these features and locate more of them.

Data Collection

The University of Bradford's Department of Archaeological Sciences provided us with a Geoscan FM-18 fluxgate gradiometer to gather geomagnetic data. The FM-18 is a sturdy machine, designed specifically for the rigors of archaeological field work. It employs a pair of fluxgate sensors to measure the vertical gradient intensity of the earth's magnetic field, eliminating the need to correct the data for magnetic inclination. The instrument's automatic calculation of the vertical gradient intensity (done by taking the difference between the two sensors' readings) also eliminates the need to correct the data for diurnal variation (see Kearey and Brooks 1984:182–195). The FM-18 also allows data to be zeroed to a reference point so that separate data sets can be readily joined. To gather data, one simply walks, holding the instrument as vertical as possible, and presses a button to log a data point into the instrument's memory. The instrument contains enough memory to store 3200 data points.

A regular pattern of data collection must be employed in order to produce a useful map of the geomagnetic data. The FM-18's recording device allowed several types of collection strategies. We chose to collect data in square units or grids. Each grid consisted of 20 evenly spaced lines, each line containing 20 evenly spaced data points. In this manner, the magnetic character of each grid is represented by 400 evenly spaced readings of the earth's magnetic field. Data were collected for two kinds of grids: (1) 20 by 20 m grids with lines and data points at 1 m intervals; and (2) 10 by 10 m grids with lines and data points at .5 m intervals. Corner points for each grid were established with a theodolite and electronic distance measurer (EDM) to accurately locate them on the site. The grid lines themselves were physically laid out on the ground surface using nylon ropes with .5 m markings. All lines were oriented north-south, and all magnetic data were collected walking south to north along the lines, moving west to east as each line was completed.

In 1993, data collection took place over a one-month period from May 20 to June 19. A total of sixteen days were spent collecting geomagnetic data during this time period. Data were gathered for 93 grids, a total of 37,200 data points, in seven main blocks (see Fig. 1.4). Block 1 covered the largest area, a total of thirty-six 20 by 20 m grids directly east of the inner town and including sections of both the inner and lower town wall (see discussion below). Block 2 was the smallest, a single 20 by 20 m grid between Blocks 1 and 3. Block 3 consisted of eight 20 by 20 m grids north of the inner town and crossing the lower town wall. Blocks 4, 5, 6, and 7 each consisted of four 20 by 20 m grids, with Blocks 4, 5, and 7 each sampling a different area of the lower town, and Block 6 sampling an area of the lower town's southern extension. One grid in each of these blocks was surveyed at both 1 m and .5 m intervals to determine the degree to which closer data point spacing increased resolution, and four grids in Block 3 were surveyed twice to provide data for establishing reliability of the survey.

In 1995, data collection took place over a three-week period from June 5 to June 29. A total of eighteen days was spent collecting geomagnetic data during this time period. Data were collected for 114 grids, a total of 45,600 data points, in two major blocks (Fig. 1.4). Block 8 covered an area of 200 by 160 m on the northwestern edge of the lower town. Block 9 covered an area of 160 by 80 m crossing the southern edge of the lower town and extending into the town's hypothesized southern extension. We chose to gather data over several large, contiguous blocks, rather than covering smaller but more diverse areas of the site, because our 1993 work demonstrated that it was much easier to interpret larger areas than small ones. While this strategy limited the range of locations we could investigate, we felt it would allow us to better understand the data we did collect.

Data Analysis

To image subsurface features, the geomagnetic data were downloaded from the gradiometer and plotted as dot-density and contour maps. The maps' x- and y-coordinates were established by the magnetic survey grid and linked to the Sweyhat site grid by recording the corner points of the magnetic survey blocks. The z-coordinate was the vertical gradient intensity of the earth's magnetic field at a particular grid point. In essence, the final product of the geomagnetic surveys was a set of contour maps of the vertical gradient intensity of the earth's magnetic field over particular areas of the site (Scollar 1990:495). We used a DOS-based laptop computer running the Geoplot software package to download the data and do initial field mapping (in this case, dot-density mapping; see Scollar 1990:496–497). At the University of Pennsylvania Museum, we exported the Geoplot files to Microsoft Excel for Macintosh so they could be read into MacGRIDZO, a contouring application.

Each file output from Geoplot consisted of 400 readings of the intensity of the earth's magnetic field (one magnetic grid), which we transferred to Macintosh in ASCII format. We then assigned x- and y-coordinates to the z-values for plotting in MacGRIDZO. The readings for each grid had been calibrated to a zero point to correct for instrumental "drift" during data collection. These readings were output in the order collected, and took the form of a 400-line column of raw numbers. To prepare these for mapping we imported them into an Excel spreadsheet which had been set up with the correct x- and y-coordinates as the first two columns, and to which we simply added the 400-line column of raw data as a third column. This was made considerably easier by the fact that we had collected all the data in the same way (moving south to north and west to east). We also used Excel to concatenate magnetic grid files into files representing our larger magnetic blocks before plotting them in MacGRIDZO.

We chose MacGRIDZO as our primary mapping package because of its choice of interpolation algorithms (inverse distance and moving weighted least squares) and its flexibility in data manipulation, particularly in terms of selecting data ranges for mapping and in adjusting input and output parameters, e.g., combining grid files and filtering data. Much of MacGRIDZO's flexibility comes from the way it handles data. It first generates a "grid file" by taking the raw data and dividing it up into a grid of imaginary cells. This "grid file" might be conceptualized as a mesh draped over the raw data file with z-coordinate values assigned to each individual grid node on the mesh via the user-specified interpolation algorithm.

The number of cells in a grid file (user-specified) determines the total number of intersections in the mesh (nodes), and thus the total number of interpolated values used in generating the contour map. The number of cells plays a major part in the resolution of the final image. We found that an optimal number of cells for most applications was 900: 30 cells along the x-axis and 30 along the y-axis. In larger files, like our Block 1, cell spacing was higher (fewer number of cells and thus lower resolution) owing to file size and processing time required to generate such a large file.

For interpolation of the data we chose the moving weighted least squares method, which works the same as the inverse distance method. The inverse distance method estimates a grid node's value using the weighted average of a user-specified number of neighboring data points, which are weighted using the inverse of their distance to the grid node, taken to a user-specified power. These values are then used to determine a first-order polynomial (a floating plane) for each grid node. New grid node values are then computed based on the intersection of the node with its plane.

Although MacGRIDZO provides a variety of output options, we used it primarily to create two-dimensional color contour plots. MacGRIDZO generates color-filled contours depending on the user-specified contour interval entered before the image is produced. For example, a value of 10 will produce a contour map with contour lines drawn for every 10 z-units. We found a contour interval of .25 nT produced maps of sufficient resolution for our purposes. Clearly the smaller the number entered the finer the resolution; however, there is a limit to the number of contour intervals possible. MacGRIDZO's parameters allow only 256 contour intervals per image, and in some cases the contour interval of .25 nT was too small for a contour map to be drawn. Using GridMath, a module included with MacGRIDZO, we were able to filter "grid files" to select a range of z-values to be mapped. For example, by filtering a "grid file" to a maximum z-value of 15 nT we could, in effect, cut off all values above 15, thus allowing a lower contour interval value to be entered and providing better resolution within a particular z-value range of interest. This was particularly important for us in Block 1, where the kilns (discussed below) created a range of over 65 nT, but where, in looking for house walls, we were interested in carefully exploring a range of only about 5 nT. By eliminating the very high and very low readings, we were able to maintain resolution in regions of interest.

While many of the color images we used are included here as unfilled and gray-scale contour plots because of the cost involved in reproducing full-color images, it is important to note that the color-filled contour images were the primary ones we used in data analysis and interpretation. We made this choice specifically, basing it on our experiences analyzing color, gray-scale, and dot-density images and our impression that analysis and interpretation were greatly facilitated by the use of color. We were bolstered in this choice by the theoretical literature which suggested our impression was accurate (particularly Tufte 1990). The logic behind this is simple: humans have evolved color-dependent vision, and we use color as a primary means to distinguish patterns in visual data. Indeed, use of color appears to enhance pattern recognition and recall significantly (Bertin 1983: 91), a fact taken very seriously by scholars concerned with conveying graphic information (see, for example, Judd and Wyszecki 1983).

We used the contour maps produced by MacGRIDZO in a number of ways. We printed them directly as color contour maps, and we also exported them as TIFF and PICT files to the Adobe Photoshop and Canvas software packages. We used Photoshop and Canvas to produce gray-scale images of the MacGRIDZO color-filled contour plots, and to prepare both gray-scale and color images for publication. Canvas allowed us to add other layers of information to the images, for example the Operation 16 excavation plans shown in Figure 3.9. Most of the magnetic images presented in this report were generated using MacGRIDZO and Photoshop.

Results of the Surveys

Our 1993 field work was designed to address three specific issues: (1) the validity of the geomagnetic data for generating maps of archaeological features at Tell es-Sweyhat; (2) the reliability of the instrument and collection method used; and (3) the feasibility of actually mapping the lower town using geomagnetics.

Fig. 4.1. Preliminary contour map of Block 8. The outer fortification wall is on the west and northwest. Irrigation channels cut into the area in 1993–94, for example, have created a grid of magnetic lows over the central portion of the block. Blacked out data are excavation units. The map was produced by Matthew Braithwaite using the Contors software package running on an IBM-PC.

Validity of Geomagnetic Mapping

We defined validity as simply whether the geomagnetic data accurately reflected the actual archaeological deposits. To test the validity of our geomagnetic data we excavated two of our mapped grids. Appendix 4.1: Fig. a shows the archaeological features uncovered in Operation 16 overlaid on the corresponding geomagnetic map. It is clear that the geomagnetic data does accurately reflect the gross features of the archaeological deposits. Specifically, the large magnetic high near the center of the geomagnetic map relates directly to the kiln found in the southwest corner of Operation 16, even suggesting its horseshoe shape. The two smaller kilns in Operation 16 are also obvious on the geomagnetic map. More significantly, the walls forming an angle in the northwest section of Operation 16 can be seen as slight lows on the geomagnetic map, as can the walls branching off from them (except where magnetic highs associated with kilns have obscured them). The walls alongside and behind the large kiln are masked by the kiln's strong magnetic signature.

In addition to Operation 16, the area excavated in Operation 17 was also mapped geomagnetically, but no apparent archaeological anomalies were present. Except for a series of shallow pits, no features or walls were found in the magnetically flat Operation 17. In both cases, it is clear that the geomagnetic data accurately reflected the presence or absence of archaeological deposits, and was also useful in delineating the nature of archaeological deposits present.

Reliability of Data Collection

We defined reliability as whether geomagnetic data collected at different times or using different collection strategies repeatedly presented the same patterns of subsurface deposits. We tested reliability in two ways. First, we collected geomagnetic data at both 1 m and .5 m intervals in seven separate grids and at different times (we always collected the .5 m interval data first). Appendix 4.1: Fig. b presents .5 m interval data for the area around Operation 16. Appendix 4.1: Fig. c was created using the corresponding 1 m interval data. While there is an obvious decline in resolution, the major magnetic features shown in Appendix 4.1: Fig. b are clearly visible in Fig. 4.1: c.

Second, we tested reliability by repeatedly gathering data over the same area on subsequent days. We have elsewhere published a map of geomagnetic data collected over a two-day period alongside a second map showing the same area collected days later by a different crew (Zettler et al. 1996: figs. 4–5). They are quite similar. Both also show the major archaeological feature of interest, the outer fortification wall, which appears on the maps as a pair of parallel linear magnetic lows, 13–14 m apart. The linear features may represent rampart revetments similar to those uncovered in Operation 25 (see Chapter 3, pp. 49–51). It is also interesting to us that smaller linear lows branch off from the south of the town wall. We hypothesize that these are the remains of structures built against the town wall similar to those built against the inner town wall in Area IV (Holland 1976:49–62; 1977:37–42) and the lower town wall in Operation 25.

It is important to note that we did encounter some reliability problems. First, we found that data collected by different individuals did show some differences, but those differences were not enough to mask apparent archaeological features. They were most likely caused by differing heights of the gradiometer above the ground (as some individuals are taller or shorter than others) and differences in the way the gradiometer was held (it should be perfectly vertical, but in practice each individual holds it slightly off-vertical and in a unique way). Second, we found that some items of clothing could effect reliability. Individuals collecting data should not have any metallic objects on their person or clothing, but some metallic items could be easily overlooked. For example, we found that one collector was wearing socks with small metal product tags of which he was totally unaware. We only found them because strange magnetic "streaks" appeared in the data he collected.

What is more important, we found as the weather got warmer (particularly in June) that the instrument became more difficult to "balance" and that the "drift" that occurred while collecting data became greater. Before collecting data the instrument's two sensors must be aligned. This is called balancing, and requires some finesse to do properly, as the instrument is quite sensitive. We found balancing to be more difficult in the afternoons (when the heat was above 100° and the sun was having its greatest daily effect on the earth's magnetic field) than in the mornings (when we balanced the instrument in the cool of dawn). The data for each grid are also calibrated to a zero point. A single reading is taken at that point before collecting data for a given grid, and once the grid is completed a second reading is taken. These readings are used to correct for instrument drift. We found that it was common for the instrument to have zero drift in the morning, but to experience drift of up to 2 nT in the afternoon (a considerable amount when one considers that the walls we located differ from the surrounding soils by only 2 or 3 nT). We believe both are due to heat affecting the instrument's electronics and to the sun's increased disruption of the earth's magnetic field when at its height. However, none of these problems seems to have significantly affected reliability.

Feasibility of Mapping the Lower Town

The main purpose of our 1993 field work was to determine the feasibility of developing a useful archaeological map of the lower town using geomagnetic data. We concluded that the geomagnetic mapping of Tell es-Sweyhat is feasible based on our field experience and the validity and reliability studies we conducted. In only sixteen days of field work (much of it devoted to designing and evaluating different data collection strategies), we were able to map almost 4 ha of the lower town (which because of remapping grids to test reliability represents 2.4 ha or 7% of the lower town's surface). That is far in excess of anything that could be accomplished using standard excavation, even if aided by mechanized techniques. Of more importance, we were able to create useful and informative archaeological maps with the data we collected.

We returned to the site in 1995 to test the results of our 1993 surveys (see Chapter 3, pp. 47–51) and to continue mapping the lower town. As regards the latter, we decided to focus on collecting data from the northwestern portion of the lower town, an area we were unable to survey in 1993 because it was being irrigated, and from the southern part of the town (south of the wadi that cuts across the lower town) and the extramural extension, where we had uncovered tantalizing but severely eroded architectural remains in 1993 (see Chapter 3, p. 51). As already noted, we chose to collect data in two large blocks over these areas because the one large area we had surveyed in 1993 was much more informative than the smaller blocks. We are still analyzing the 1995 magnetic data.

Archaeological Resources in the Lower Town

We have collected magnetic data fairly broadly across the lower town. While we are only beginning to have enough ground truth from excavations to start the process of actually mapping the archaeological features in these areas, we do have enough information to make at least some preliminary judgments about the nature and extent of archaeological resources in the lower town. A note of caution is still appropriate. We have only five excavations upon which to base these judgments, and they must necessarily be taken as very tentative until further excavations can provide a firmer basis for interpreting the magnetic data.

Block 1, which encompasses nearly 1.5 ha, contains a diversity of archaeological features (App. 4.1: Fig. d). Excavations in Operations 16, 23, and 25 have demonstrated the presence of room blocks, pits, and both horseshoe-shaped and circular kilns. The magnetic data suggest room blocks are present across the entire area of Block 1 (see (App. 4.1: Fig. e for an example). Additional kilns are also apparent in the area around Operations 16 and 23, and we can tentatively conclude that this was a special pottery production site. We have identified what we think may be the inner fortification wall (just visible as a magnetic low on the west side of Block 1) and the outer wall (on the east side of Block 1). We have excavated a section of the lower town wall in Operation 25 (see Chapter 3, pp. 49–51), demonstrating the presence of room blocks built against it, as well as earlier structures underlying it. There appears to be a break and offset in the lower town wall due west of Operation 16, and we hypothesize that this might be the location of a gate. A linear feature seems present running from this location to the east. Other curving features branch off it to the north and south just inside (to the west of) the "gate." The linear feature then passes south of Operation 16. We think this feature could be a street running from the city gate through an intersection, where streets branch off it, to the "citadel." Further excavations are clearly needed to establish the identity of the feature.

Block 2 is too small for us to draw any conclusions about the archaeological deposits present. However, there appears to be a general continuation of the magnetic character of Block 1 into this part of the site, and we tentatively conclude that the region of architectural remains continues here.

The primary archaeological features apparent in Block 3 are those of the lower fortification wall (see above), and the probable walls abutting it within the lower town. These only exist near the wall, and the rest of the block seems devoid of identifiable archaeological features. As discussed above, the excavation in Operation 17 demonstrated that no obvious features are present. If features were present, they may have been destroyed by agricultural practices, or this area of the site may have been an open or undeveloped space or a refuse dump. Further excavation will be needed to establish this interpretation.

Block 4 has not been analyzed as carefully as the other blocks. There appears to be a number of magnetic highs that may relate to hearths or ovens, as well as related linear magnetic lows. Block 4 has not been the subject of test excavations either, but we tentatively conclude that architectural features, similar to those uncovered in Operations 4 and 9, may be present in this part of the site.

Block 5 is difficult to interpret. There are several small magnetic highs, similar to those we have been interpreting as hearths, along with some linear magnetic lows, but the two are not as clearly related as we would expect in architectural features (as, for example, are those in Block 4). In addition, these anomalies are generally restricted to the northern portion of this block.

Wilkinson (n.d. a) has suggested that this part of the site has been eroded by a wadi, and perhaps Block 5 crosses the area of erosion, with the northern portion retaining some archaeological debris, but the southern portion retaining none. Without test excavations to refine our ability to discern architectural features, however, we are unable to even tentatively conclude anything about this block.

Blocks 6 and 7 appear basically devoid of archaeological features. There was an isolated, pinpoint magnetic high in Block 6, similar to what we would expect to find associated with a small piece of magnetic metal, but a test excavation in the area of the high did not discover such an object. Block 7 appears to have no significant magnetic features of any kind. We conclude that any archaeological features in this area of the site have been obliterated by agricultural practices or, more likely, by the wadi identified by Wilkinson (n.d. a). Excavations in Operation 19 support this conclusion.

Block 8, covering 3.2 ha, is the largest contiguous block of magnetic data we collected (Fig. 4.1). It appears that surface features such as irrigation channels, ploughing, and backdirt piles from earlier excavations largely dictated the readings obtained. The irrigation channels cut into the area in 1993–1994, for example, have created a grid of magnetic lows over the central portion of the block. Despite this, the outer fortification wall is clearly visible in the central and northeastern portion of the block, as are anomalies possibly relating to archaeological features in other parts of the area mapped. As for the outer fortification wall, the Block 8 map appears to show a pair of two parallel linear magnetic lows running from south to north and then curving to the northeast. Low-level aerial photographs show a similar feature (Fig. 4.2), with the outermost (or northern and westernmost) of the pair joining the fortification wall on the north and south. What the innermost (or eastern and southernmost) of the pair represents—perhaps an earlier version of the wall—will have to remain an open question until we can undertake systematic work on the settlement's fortifications. As already noted, Operations 15 and 18 would appear to relate to the innermost of the pair of walls.

In processing collection grids in Block 8, we noted several circular anomalies in the vicinity of the outer fortification wall. Though not directly related to an understanding of the layout of the late third millennium settlement, we suspect these could be tomb chambers (see Chapter 3, pp. 51–56). Before undertaking excavations, however, we hope to try other remote sensing techniques to determine if our assumption is correct (see below).

Part of our purpose in collecting data in Block 9 (Fig. 4.3) was to see if the wall uncovered in Operation 19 was

Fig. 4.2. Low-level aerial photograph showing close-up of northwestern outer wall.

part of a larger, and perhaps more well-preserved, area of occupation. Although analysis and interpretation of the data from Block 9 has not formally begun, there is a clear network of linear features similar to those interpreted as room blocks in other areas of the lower town. These exist on both sides of the lower town wall, which runs east-west through the center of the block. There are also a number of interesting circular or oval lows, which we are unable to interpret at this time. Finally, there is a large, linear magnetic high at the extreme southern end of the block. The only archaeological feature we have found with similar high readings is the large kiln feature exca-

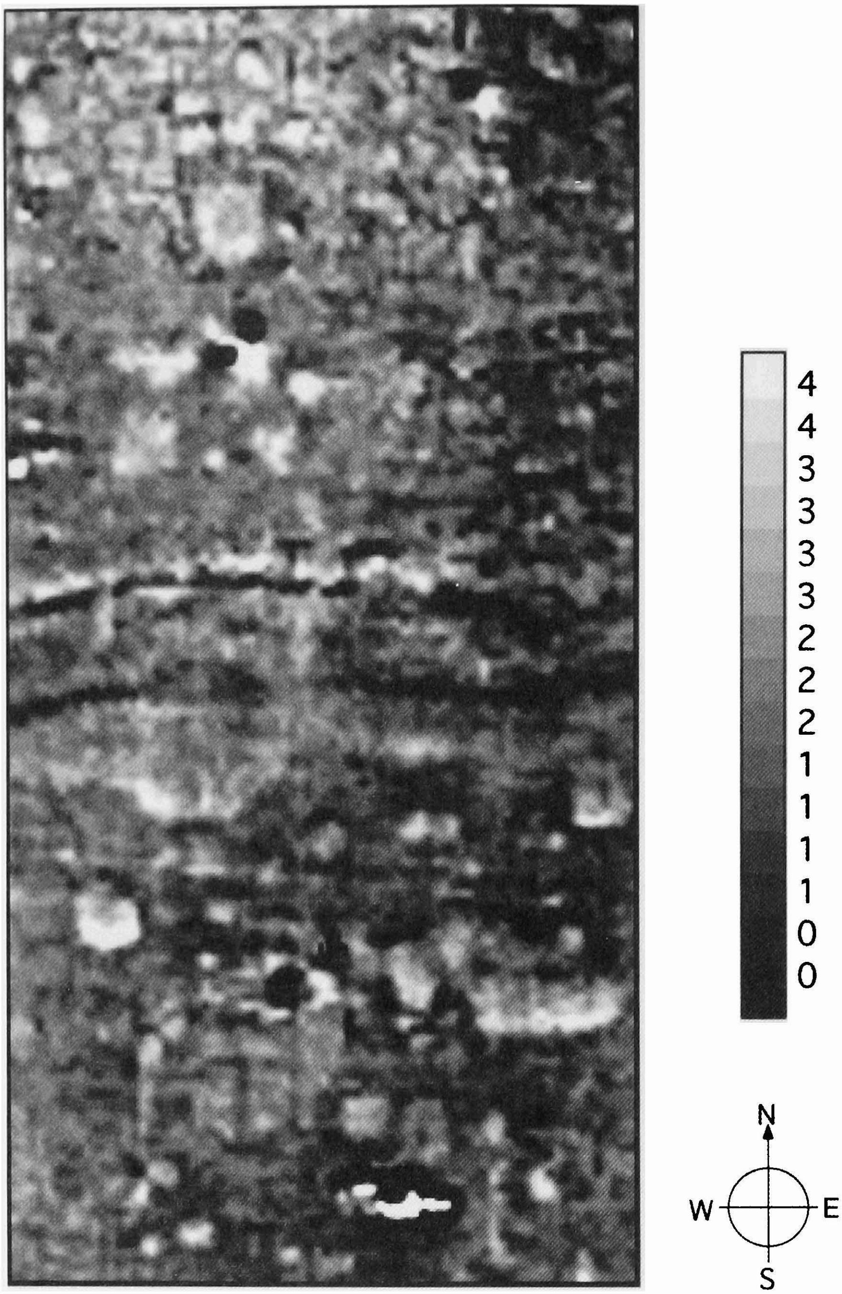


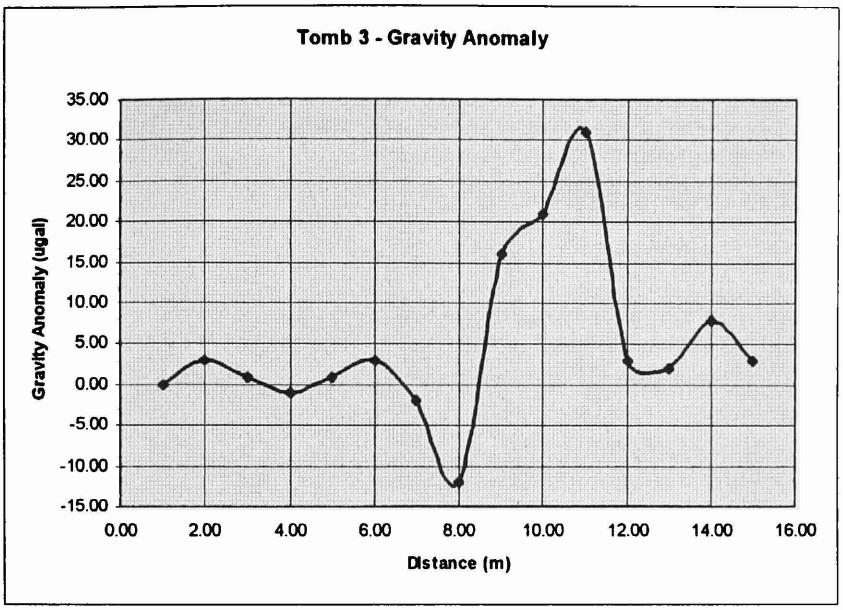
Fig. 4.3 Preliminary contour map of Block 9. The outer fortification wall runs east-west through the center of the block. There is a large, linear magnetic high at the extreme southern end of the block. The map was produced by Matthew Braithwaite using the Contors software package running on an IBM-PC.

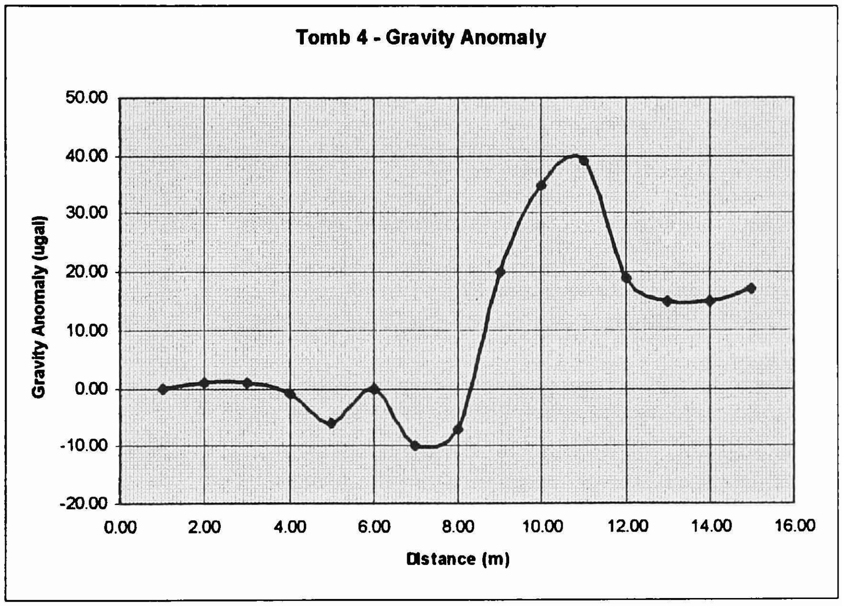
vated in Operation 23. This, then, may be another kiln. Additional excavations are needed to provide ground truth before interpretation of this block is possible, but it does seem clear that there was activity, and perhaps occupation, in the area south of the lower town wall, and there do appear to be some preserved structures in this extreme southern portion of the lower town.

Synthesis

The magnetic surveys and associated excavations suggest that there is a broad area of significant archaeological deposits in the eastern and northeastern portions of the lower town. These deposits include room blocks and several pottery production sites. The northern section of the lower town appears to have no architectural

Fig. 4.4a,b. Gravity readings from Tombs 3 and 4.





remains except perhaps abutting the town wall. Other architectural remains in this area may have been eroded or destroyed by agriculture, but this seems improbable given that neighboring sections of the lower town contain architectural remains. This area, therefore, may have been an empty space or perhaps a refuse dump. Excavations suggest that the western portion of the lower town is a second area of significant archaeological deposits, including large room blocks, but the magnetic data have yet to add any insights into this area. Further analysis of the problematic data from Block 8 may provide a better picture of this portion of the site. There appear to be no archaeological deposits of any significance in the south central portion of the lower town. Archaeological remains in this area may well have been eroded away by the wadi that cuts across the site, and we may be unable to reconstruct the nature of this portion of the site. The topographically high area near the southern outer fortification wall, as well as the lower town south, may contain significant remains.

This synthesis suggests that future research efforts should be focused on the northern portion of the site and on the extreme southern portion of the lower town (and perhaps the outer town south). Test excavations in surveyed areas should be carried out to provide further information to assist our interpretation of the magnetic data. Excavations should also be carried out to expose clearly delineated houses and the area we hypothesize may be one of the city gates. We hope this work can be initiated in our next field season.

Postscript

Research during a brief 1996 study season focused on using subsurface interface radar (SIR) and microgravity to map subsurface features in the lower town and, in particular, to locate undisturbed tombs in the suspected cemetery at the northwestern edge of the site. As already noted, our geomagnetic mapping of Block 8 showed a number of anomalies that we suspected might represent tombs, and we had hoped the additional techniques might confirm or contradict our assumptions. Unfortunately, neither SIR nor microgravity worked to our satisfaction.

The SIR equipment we used was an older Geophysical Survey Systems, Inc. (GSSI) System 8. It is a robust and accurate system, but somewhat cumbersome. The system identifies subsurface interfaces by shooting a broad-band electromagnetic pulse into the ground and graphically recording the returned signal on an electrostatic chart recorder. Soil interfaces and embedded objects are identified by anomalous signal returns, reflected back differentially from the surrounding soil matrix depending on the electrical characteristics of the interfacing soils or objects. For the system to work well, two conditions must be met. First, the soils or objects of interest must have differing electrical characteristics from the surrounding soil matrix. At least in looking for tomb chambers or voids, we knew this condition would be met (air is electrically quite distinct from soil). Second, the soil must have adequate conductivity to allow the electrostatic pulse to penetrate the ground. Most soils are very good insulators in the absence of water and salt, and we thought the soils in the area around Tell es-Sweyhat would be appropriate for this technique. We were wrong.

The soils around Tell es-Sweyhat appear to be highly conductive, especially at the surface. While one would think this would be good for radar surveying, the opposite is actually true. Conductivity is inversely related to the depth of penetration of an electromagnetic pulse. One can think of soils with high surface conductivity as something like a sponge, soaking up the entire electromagnetic pulse as soon as it hits the ground. Thus, over soils with high surface conductivity it is impossible to shoot enough energy into the soil to generate return signals large enough to measure. And this appears to be precisely the case at Tell es-Sweyhat—we simply couldn't get energy into the soil.

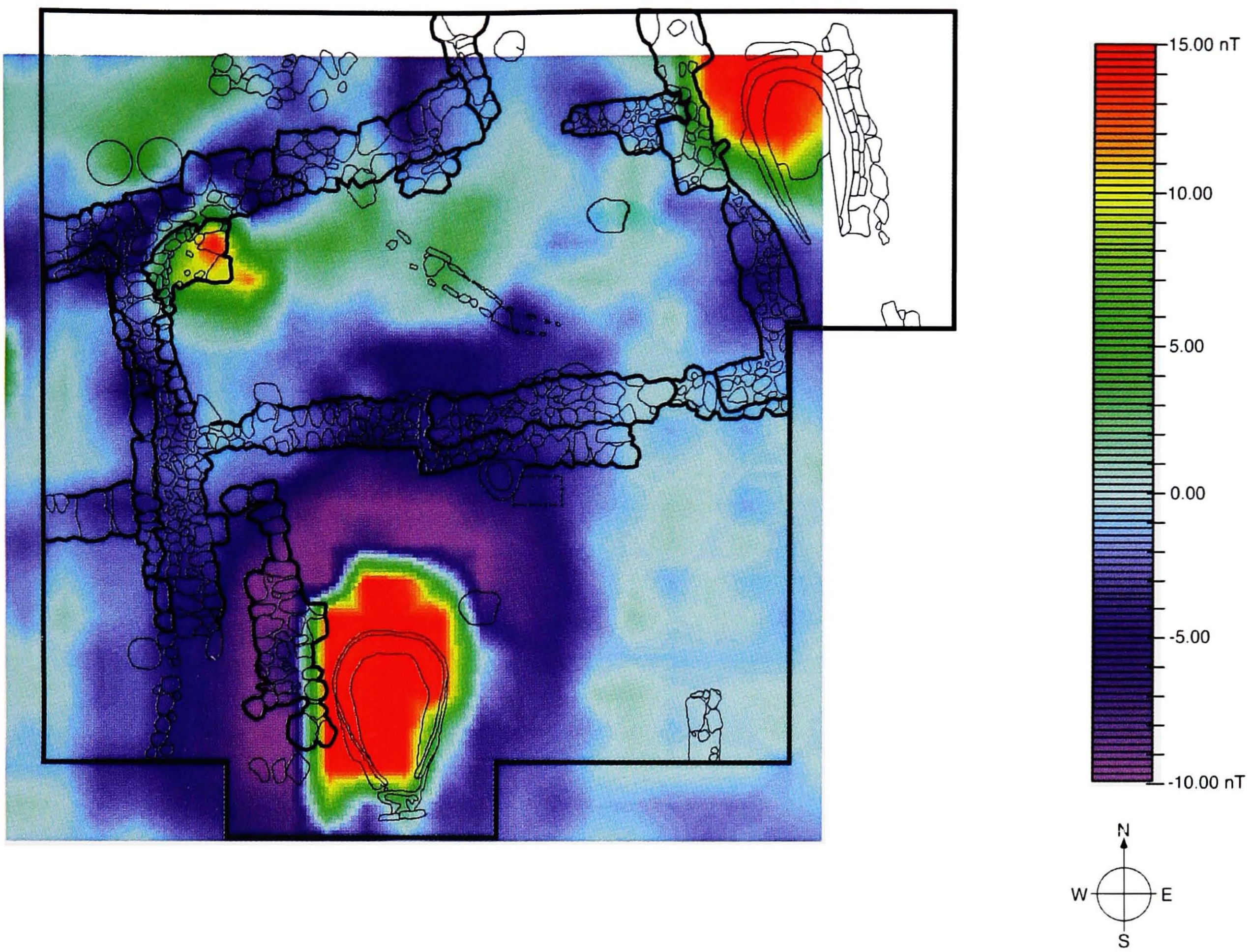
While the SIR proved unusable given the soil conditions around Tell es-Sweyhat, we had good results with the microgravity in locating tombs. We used an extremely sophisticated gravity meter for this job, a Scintrex CG-3 with a sensitivity of less than 5 microgals. The CG-3 measures the intensity of the earth's gravitational field by analyzing the force exerted on a small quartz spring suspending a proof mass within a constant-temperature vacuum chamber. When set up perfectly level and allowed to come to rest, the spring will be pulled downward by the proof mass with greater or lesser force in direct proportion to the intensity of the earth's gravitational field at that location. The intensity of the earth's gravitational field is, in turn, locally affected by subsurface conditions. Subsurface materials with high mass will locally intensify the earth's gravitational force, while we expected the tombs' voids to decrease the local intensity of the earth's gravitational field by between 10 and 30 microgals.

Gravity survey is a very slow process, typically taking ten minutes between readings. The gravity meter needs first to be leveled, taking two or three minutes. The quartz spring must then be allowed to stabilize for at least two minutes, and finally a reading can be taken, which requires at least two minutes as the instrument averages a series of instantaneous readings. Given the time-consuming nature of gravity survey, we were only able to collect three data transects: two over a known tomb in the cemetery (Tomb 3; see Fig. 4.4a), and one over an area we suspected held a tomb because of differential crop growth and a surface depression we noted two years ago (Tomb 4; see Fig. 4.4b). We had also hoped to collect data transects over suspected tombs identified through geomagnetics, but our very brief season did not allow that. Based on these transects, however, we believe we have identified an undisturbed tomb (Tomb 4).

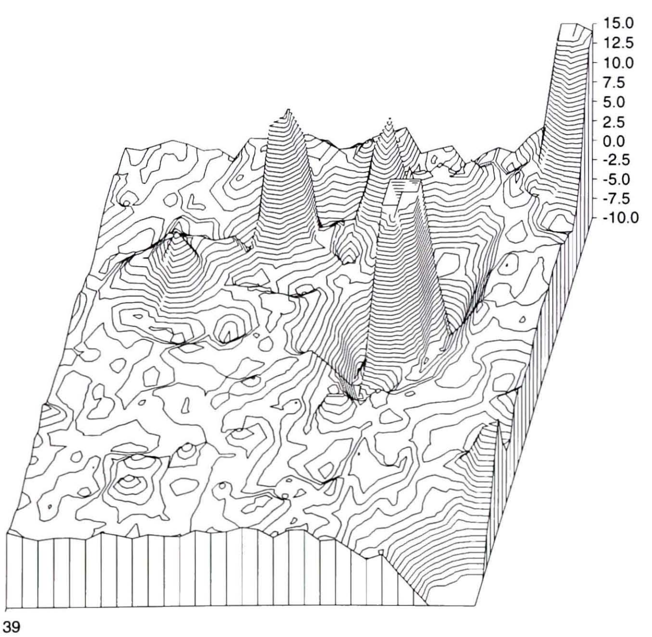
Notes

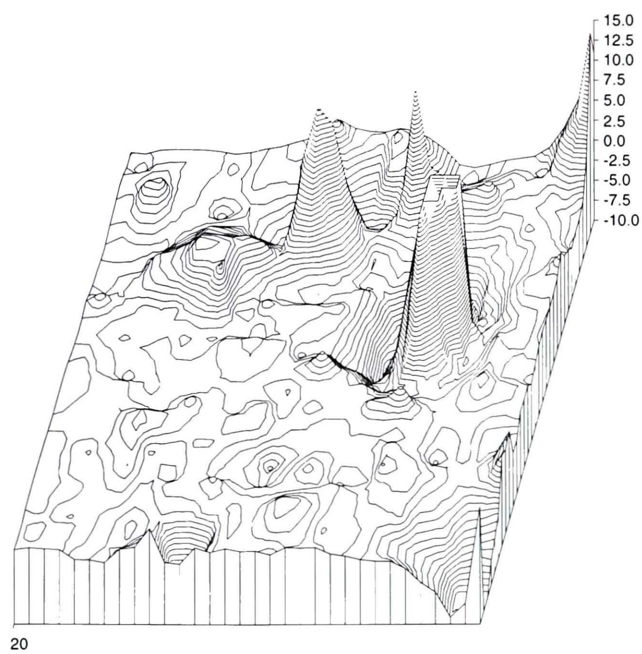
26. For Troy, note also now Becker, Fassbinder, and Jansen 1993, and Becker and Jansen 1994.

APPENDIX 4.1

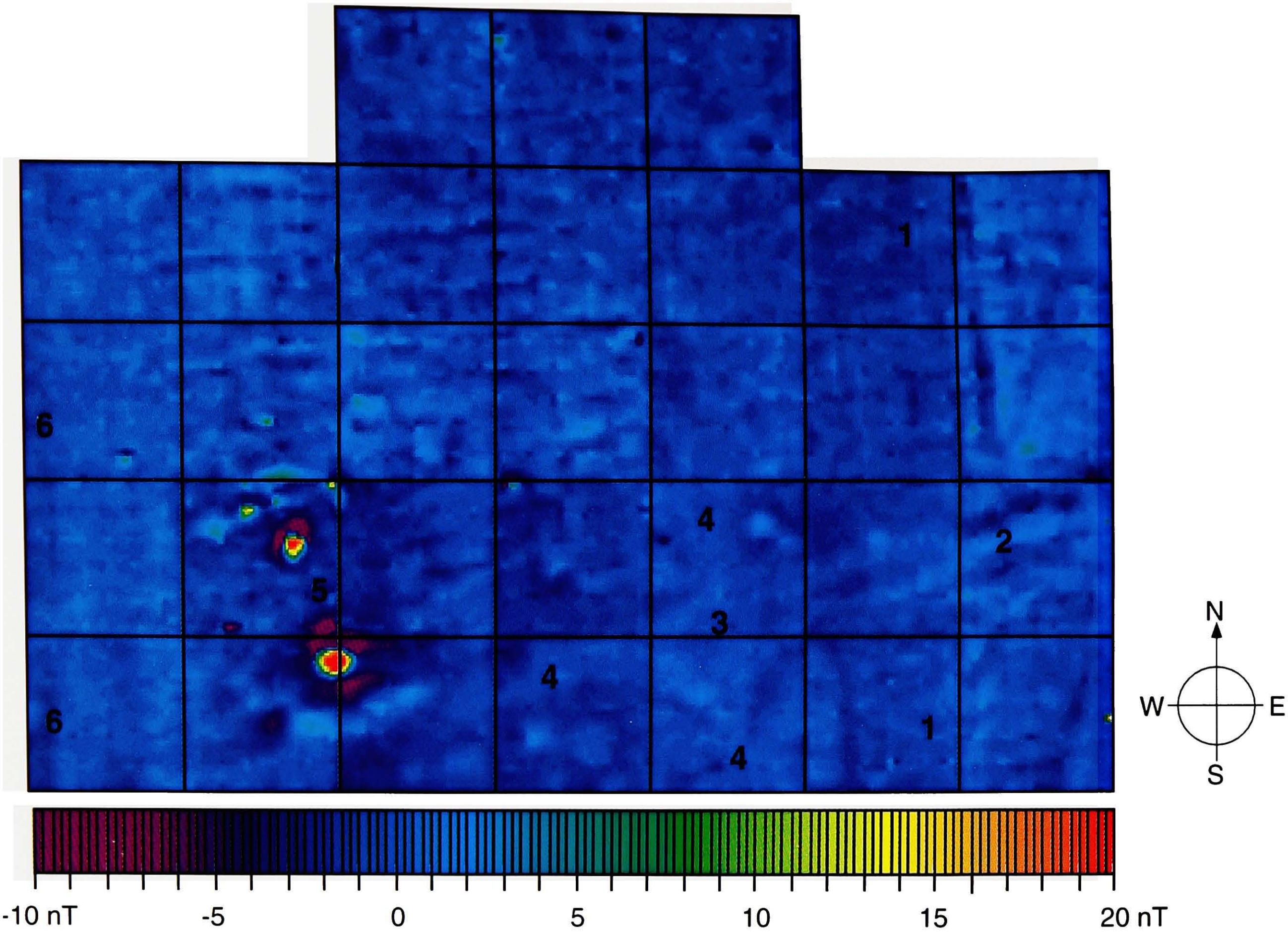


a. Color-filled contour map of Operation 16 area at 0.5 collection interval with excavated remains overlaid.





b, c. Raised contour maps of Operation 16 at 0.5 m interval and at 1 m interval.



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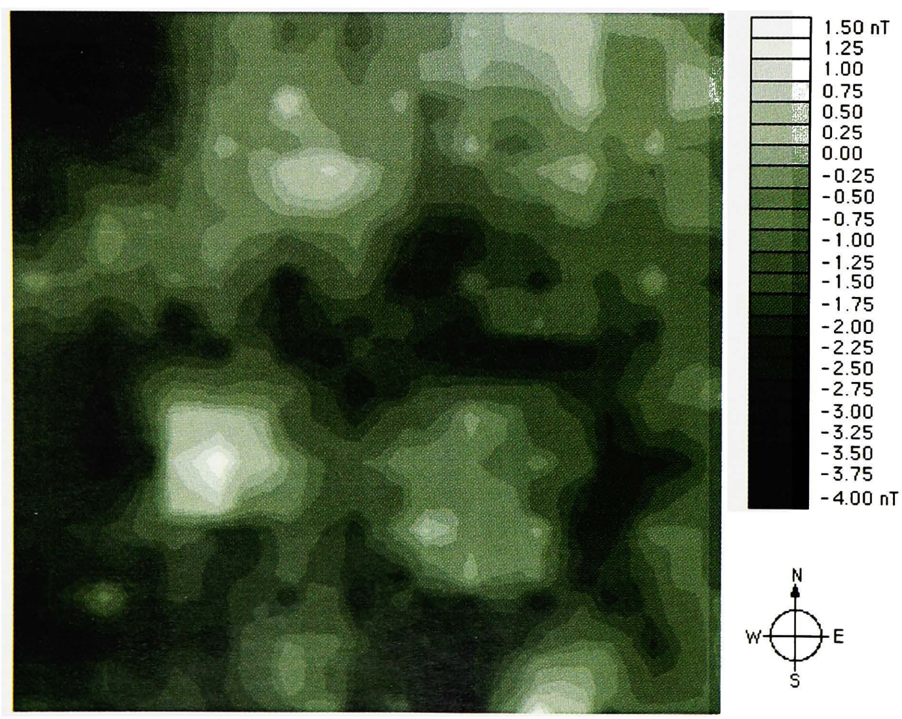
d. Color contour map of Block 1: outer fortification wall (1); gate (2); intersection of east-west and north-south streets (3); streets (4); room blocks and kilns (5); inner fortification wall (6).



e. Contour map showing a room with hearth (?) in the northwestern corner. The room is in the center square of the bottom (southern) row of squares in (d) above.

5

REGIONAL SURVEYS AND EXCAVATIONS

Michael D. Danti

While diverse in terms of the specific research interests and methodological approaches of its team members, the Tell es-Sweyhat project as a whole shares the goal of understanding state formation, urbanization, and urban collapse. Since these processes entail region-wide demographic, economic, social, and political transformations, regional studies complement our site-based research.

Regional work in the Sweyhat area was first conducted by Maurits van Loon in 1964–1965 for the Tabqa Dam Project (van Loon 1967; Freedman 1979). T. J. Wilkinson initiated the first systematic survey of the Sweyhat area in 1973–1974, combining geomorphological investigations, traditional site survey, and off-site survey (n.d. a, 1976, 1994). Wilkinson's primary research interest was modeling the ancient dry-farming economy; therefore, he focused his attention on the Sweyhat embayment. The site survey demonstrated that occupation along the fringe of the floodplain has remained relatively constant from 5000 B.C. to modern times. Occupation extended into the embayment in only two periods—the Early Bronze Age (EBA) and the Roman to early Islamic periods (A.D. 300–1000). Off-site survey indicated these two episodes were likely associated with the intensive dry farming of the embayment. Wilkinson completed his regional study in 1992, and in 1993 the University of Pennsylvania Museum initiated a new phase of regional work involving excavations and the extension of survey coverage to the Balikh-Euphrates uplands.

The Preliminary Survey

Several findings at Sweyhat encouraged us to survey the uplands. Faunal studies of Sweyhat assemblages have documented the importance of pastoralism throughout the EBA, and have revealed a particular emphasis on hunting, especially of upland species such as onager and gazelle, in the late EBA (Miller and Weber 1996:28, fig. 2). Botanical analyses have provided strong evidence for the pasturing of animals in both the embayment and the uplands, demonstrating that plant domesticates, field weeds, and steppic plants were consumed by livestock (see Ch. 6, pp. 102–103).

The Balikh-Euphrates uplands contain high plateau (Arabic *jebel*) and lower undulating hills incised by numerous seasonal watercourses, or wadis. Today the uplands bordering the Euphrates valley still provide an important source of seasonal pasture for the region's sedentary inhabitants—former transhumant pastoralists and nomads. Moreover, local villagers highly regard dry-farmed fields in the jebel, which produced a better crop in 1993 than dry-farmed embayment fields. This may partly be the result of localized fluctuations in rainfall visible on distribution maps (Fig. 5.1) (see de Brichambaut and Wallén 1963:47). An additional explanation may be that certain areas of the uplands adjacent to the high plateau receive large amounts of runoff and water-born silts brought down by branching wadi systems from the high plateau. Settlements and fields located along major wadi channels can utilize the concentrated runoff of a large catchment, reducing the effects of rainfall fluctuations (Kennedy 1995:277). As shown on the SPOT[27] satellite image (Fig. 5.2), the wadis channeling runoff to the Sweyhat embayment do not penetrate east into the high plateau. Nearly all runoff flows southeast for 40 km, away from the Euphrates, to the Wadi Khirbet Hamie, which turns abruptly south to join the Euphrates at Hammam. Fifteen km east of the Sweyhat embayment, the wadis level out after descending the high plateau. At this point, runoff flow slows. This area is clearly visible on satellite imagery as a patchwork of dry-farmed and pump-irrigated fields. Prior to sedentarization, this region was important for its wells and was one of the first areas resettled, indicating a high relative potential for the pre-industrial subsistence economy. If a similar land-use pattern existed in the EBA, it would increase estimates of the productivity of urban centers along the river.

To date, the area (Fig. 5.3) has received little attention from archaeologists; a single season at Arslan-Tash (see Fig. 5.1), located in the region's northern extremity, repre-

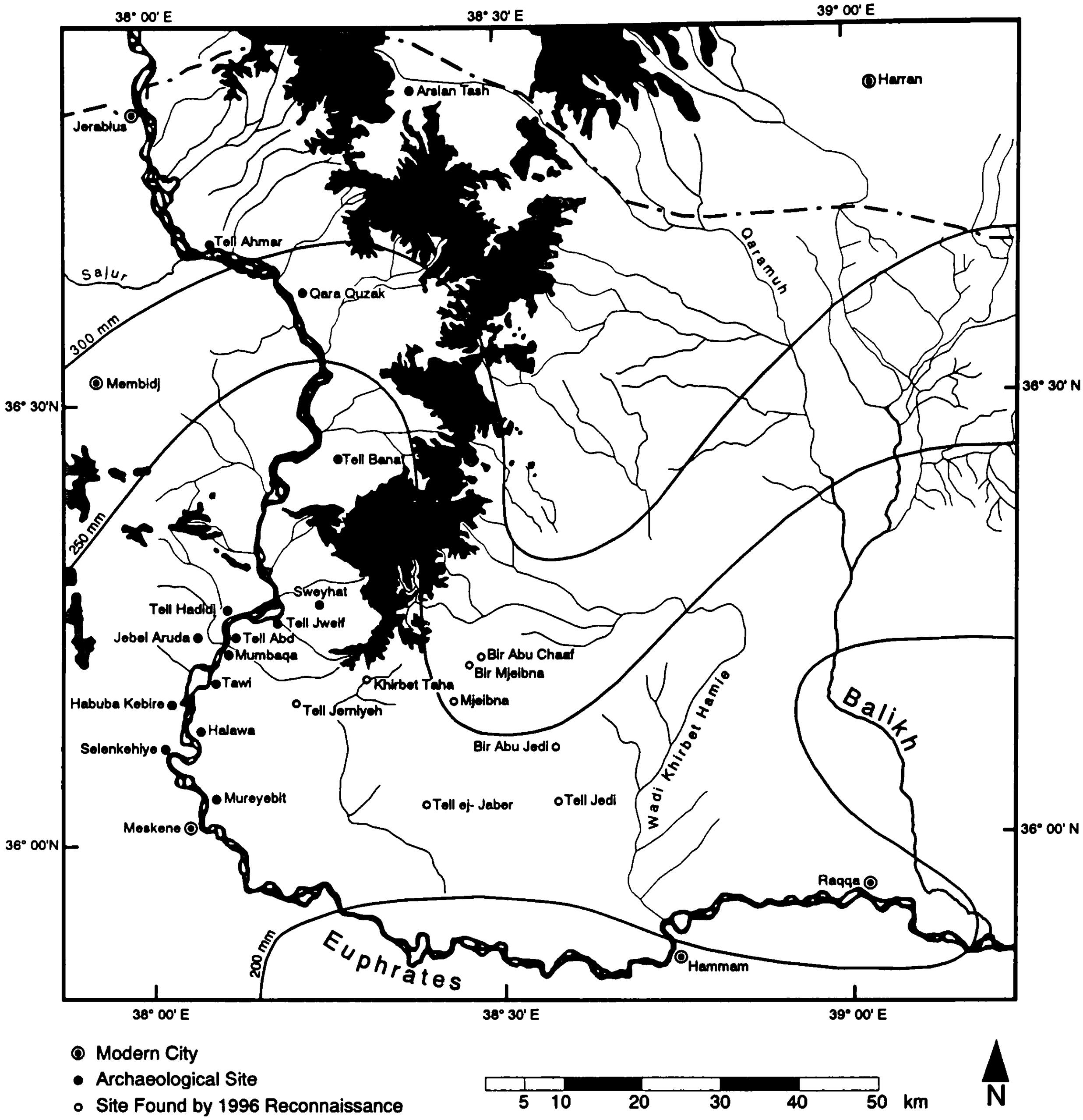


Fig. 5.1. Map of the Balikh-Euphrates Uplands, showing the major rainfall zones. Shaded areas represent uplands (high plateau) in excess of 500 m A.M.S.L.

sents the only excavation (Thureau-Dangin et al. 1931). The northern portion of the region, primarily the course of the Qaramuh, a seasonal tributary of the Balikh, was surveyed by B. Einwag (1993b). A number of archaeological projects have surveyed the valleys of the Balikh and Euphrates rivers which border the uplands. The Euphrates valley has been divided into several segments: from Halabiya/Zalabiya north to Tabqa (Kohlmeyer 1984, 1986); the Tabqa Dam area (van Loon 1964; Wilkinson n.d. a, 1976); the Tishreen Dam area studied by McClellan and Porter; from Qara Qozaq to Jerablus/Carchemish including the Sajur River (Sanlaville 1985); and the Carchemish and Bireçik Dam areas (Algaze 1989; Algaze et al. 1991, 1994). A number of separate projects have dealt with the Balikh River and its tributaries (Akkermanns 1984, 1990; Bartl 1994; Cauvin 1972; Copeland 1979, 1982; Córdoba 1988; Curvers 1990; Mallowan 1946; Wilkinson 1995, 1996).

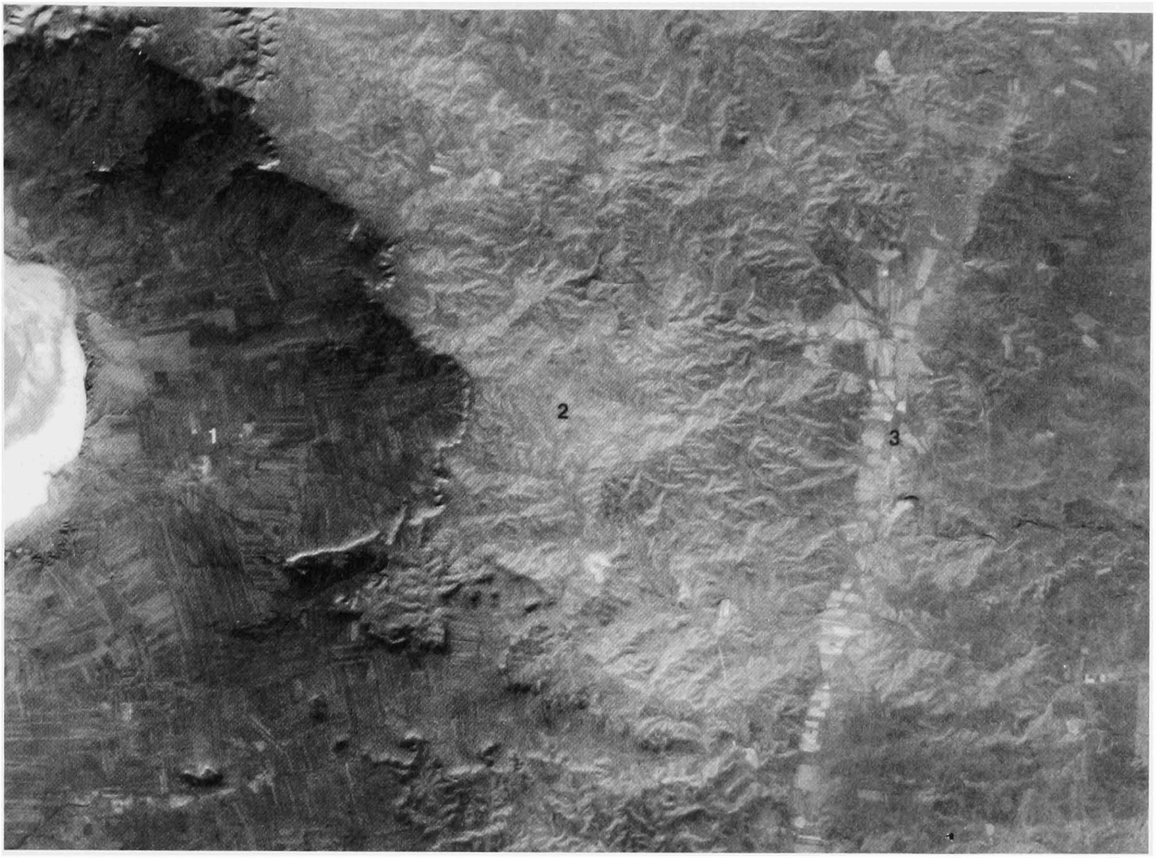


Fig. 5.2. SPOT image of the (1) Sweyhat embayment, (2) adjacent high plateau, and (3) lower-lying uplands that receive high amounts of runoff.

The new regional project has several specific objectives. The first and broadest is to thoroughly document the cultural landscape of the upland zone throughout its occupational history. Data from our archaeological survey, remote sensing, travelers' accounts, historical sources, and ethnographic documentation will provide the basis for the reconstruction of settlement and land-use patterns. Determining the limits of the Sweyhat region during the late third millennium is one of the more important aspects of this work. Another objective is to determine whether parts of the jebel were under dry-farming cultivation in the third millennium, and, if so, to what extent. This will be determined using off-site archaeological methods developed by Wilkinson (1989, 1992, 1993, 1994).

A related aim of the landscape study is to gather information on the ancient pastoral economy. Pastoralism paired with dry farming forms the traditional northern Mesopotamian "mixed economy" (Barth 1973). Today, a great deal of dry-farmed barley in northern Syria is utilized as conserved winter fodder for sheep and goats (Tully 1984:58–59; Tully et al. 1985:210–213). In winter, in-field fodder becomes unavailable, and upland and steppe pastures have been largely exhausted. Recent studies of modern pastoral production have shown close correlations between the amounts and quality of dry-farmed land and herd size (Tully 1984:17). Unfortunately, pastoralism has been largely neglected by archaeologists since it typically leaves few and ephemeral traces on the landscape (Cribb 1991:65–68).

Several factors suggested that the mixed economy practiced in the late pre-industrial period replicated conditions in antiquity to a significant degree. French maps of the survey area record the major landforms, a few tells, and water sources used by nineteenth century and earlier nonsedentary groups (Institut Geographique National 1941 and 1951). They also plot some of the villages established in the nineteenth and early twentieth centuries under resettlement programs of the Ottoman and French Mandate governments (Charles 1942:43–44, 64; Lewis 1987:27–37, 154–165). Combining these maps with panchromatic SPOT imagery (10m^2/pixel resolution) in a geographic information system (GIS) revealed a high degree of locational correlation between tells, premodern wells, and eighteenth and early nineteenth century villages, which antedate the widespread introduction of cash crops, pump irrigation, mechanized agriculture, and government-sponsored agricultural development (al-Ashram 1990:178–180). This suggests that site-choice parameters of the nineteenth and early twentieth centuries, reflective of pre-industrial dry-farming and pastoral production strategies, were to some extent similar to those of antiquity. This implies long-term continuities in upland land use and strengthens the validity of analogies drawn from ethnoarchaeological observations. Furthermore, such continuities are supported by the ethnohistorical record. Textual sources of the early second millennium from Mari indicate the region was utilized by transhumant pastoralists who held fields along the Euphrates (Dossin 1946: pl. 6). Travelers' accounts of the nineteenth and early twentieth century reveal a similar situation (Sachau 1900; Sykes 1907; Sarre 1909; Bell 1910, 1911). These sources typically mention the Bu Šaʿbân tribal confederation: transhumant sheep/goat pastoralists who also engaged in gardening and opportunistic dry farming (Chesney 1868:229–243; Bell 1910:516–517; von Oppenheim 1939:208–214; Charles 1942:39–48). Mark Sykes characterized the area between the Balikh and Euphrates as "a stony region of bare and forbidding hills, arid, repulsive, and uninteresting. There is one brief season when it is attractive, and that is in early spring..." (1907:240). Most authors are less critical, telling of encounters with the various sheep-herding Arab tribes, typically of the Bu Šaʿbân confederation, that frequented the banks of the Euphrates and the jebel beyond it (Chesney 1868: 229–243; Bell 1910: 516–517).

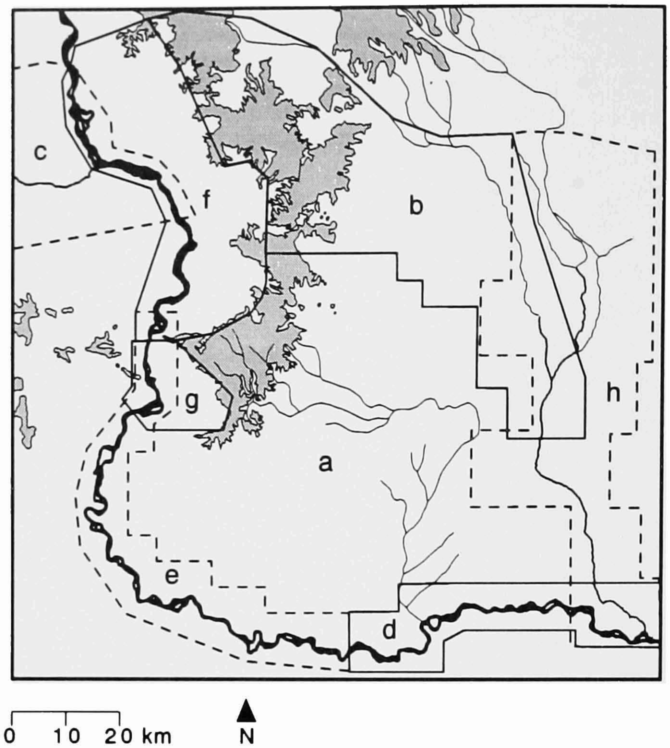


Fig. 5.3. The Balikh-Euphrates Uplands showing survey areas: (a) unsurveyed uplands; (b) Einwag 1993b; (c) Sanlaville 1985; (d) Kohlmeyer 1986; (e) van Loon 1967; (f) Tishreen Salvage Area; (g) Wilkinson n.d. a, 1976; (h) various Balikh catchment surveys.

In May 1996, the project conducted a two-week study to develop strategies for implementing the upland survey, to refine its methodological approach, and to test initial hypotheses on upland land use. The feasibility study demonstrated that (1) ancient pastoral sites were recoverable; (2) the uplands were settled during the EBA; (3) the uplands are currently used intensively for herding and dry-farming; (4) recent, and possibly ancient, water harvesting facilities are present.

In all, 23 sites were recorded dating from the early third millennium to the nineteenth and early twentieth centuries A.D. (Fig. 5.1). The majority of sites fell within either the EBA or the Roman to early Islamic periods, paralleling the peak periods of settlement in the embayment. Three sites were apparently pastoral emplacements (sheepfolds, corrals) devoid of domestic architecture and dating from Roman to early Islamic times. Three probable pastoral camps of similar date with tent outlines, outbuildings, and animal pens were also found. Eight individual tombs and tomb groups were recorded; they were of the tumuli type similar to those at Tell el-ʻAbd (Bounni 1979:57–61), Mumbaqat (Orthmann and Kühne 1974:66–67), and Tell Jweif (Heinrich et al. 1969:33). Seven tells were discovered, ranging from 0.10 to 10 ha. Four sites had wells; one of these, Tell ej-Jaber, consisted of a large well with the ruins of a substantial stone-block watch tower. An isolated watch tower atop the jebel overlooking Tell Jerniyeh, visited by Gertrude Bell in 1909 (Bell 1910:517), was surveyed as well.

The study also revealed a potential area of runoff agriculture/water harvesting near the modern village of Bir Abu Chaaf. A wadi had been diverted into a low-lying region to form a small lake. Three of the tells found during survey lay in this region, one of which, Tell Jedi, dates to the EBA. All three of these tells were located on wadi branches, and two, Bir Abu Jedi and Bir Mjeibna, were the sites of medieval Islamic and Ottoman period wells and were resettled before A.D. 1940.

Excavations

The excavations undertaken in conjunction with the regional project were initiated to investigate early to mid-third millennium B.C. occupation in the embayment—the initial phase of nearly all Bronze Age settlement there (see Fig. 1.3). With the possible exception of Sweyhat, each of these sites covers less than 0.5 ha. Determining the chronological sequence, site function(s), demographic profile, and developmental history of each site is critical to reconstructing the degree of socioeconomic integration, centralization, and specialization among embayment settlements through the third millennium. To some extent archaeological survey meets these objectives, providing data on site size, distribution, and periodization. Off-site methods expand on this, providing an overview of resource distribution and land-use patterns. However, some factors limit the interpretive potential of survey data. Especially significant in the upper Euphrates region is the poor chronological resolution afforded by the ceramic assemblage of the third millennium B.C. There are few well-defined, chronologically restricted diagnostics to assist in making meaningful chronological distinctions. The third millennium assemblage, especially the first half of it, may be characterized as relatively static. Most forms and wares span long periods of time with little change, one type blending gradually into the succeeding one. The pottery is also relatively devoid of surface treatments such as painting and incising. These obstacles are compounded by the extremely small amounts of surface material found at most of the region's sites, especially the smaller ones.

These difficulties aside, several shortcomings plague interpretations based solely on survey data, particularly the difficulty of consistently positing site function and determining the relationship of surface finds and site size to subsurface conditions, especially at multiphase sites. Our soundings at a select number of small sites neighboring Tell es-Sweyhat will help to minimize these problems. The results of our first excavation have provided us with some encouraging, albeit tentative, results.

Site 3 (Tell Hajji Ibrahim)

In 1993, we discovered evidence of looting at nearly all the small mounds surrounding Sweyhat (especially sites 2, 3, and 9). Site 3, dubbed Tell Hajji Ibrahim after the former land owner who frequently camped near the tell, had been damaged by eight looter pits. Excavations at Hajji Ibrahim held the promise of providing data on regional developments during the early periods of Sweyhat's urban growth. We were also intrigued by the tell's proximity to Sweyhat, and its height and rectilinear form visible on low-level aerial photos (Fig. 5.4). The site lies only 500 m beyond the southeast corner of Tell

Fig. 5.4. View of Tell Hajji Ibrahim from the northwest in 1993.

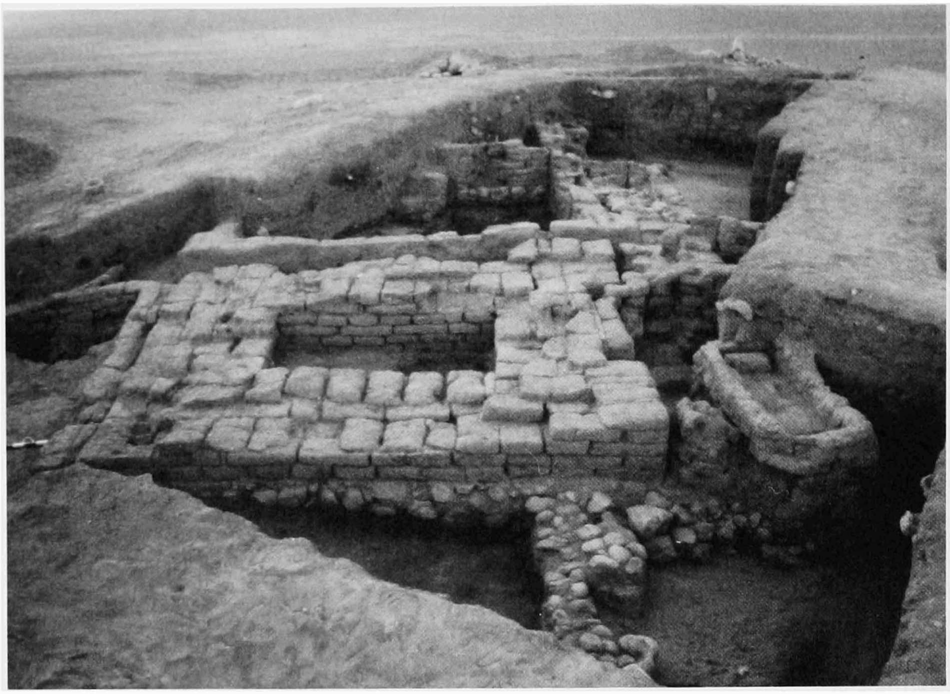


Fig. 5.5. Tell Hajji Ibrahim; mud-brick silo of Phase B from the west in 1995.

Fig. 5.6. The central building from the southeast in 1995.

es-Sweyhat's outer town wall (around 900 m from the summit of the main mound), along an east-west running wadi. The mound is approximately 0.25 ha in size and rises 2.60 m above the surrounding plain. The tell's square shape and abrupt rise in elevation suggested some form of circumvallation.

In 1993, a single 5 by 5 m sounding (Operation 1) was laid out on the mound's summit to establish the site's chronology and function. This operation was extended to the east to incorporate a large looter hole. Excavations revealed three phases of Early Bronze Age occupation (phases A–C) and a later, probably Roman or Byzantine, cemetery (Phase D). The excavations continued in 1995 with two more 5 by 5 m units (Operations 2 and 3) northwest of Operation 1, forming a northwest - southeast running trench across the mound. This operation was also extended in several places to incorporate recently-filled looter holes—the loose fill in them proved impossible to maintain in the sections.

The site's first occupational phase, Phase A, lies directly atop sterile soil. Phase A remains have only been reached in Operation 1. Ceramic evidence indicates a date sometime during the early third millennium, but little material has been recovered from these levels. Phase A architectural remains consist of poorly preserved stone footings of rectilinear structures oriented northwest-southeast.

Architecture of Phase B, the later of the two early third millennium phases, consists of a single building and courtyard, which was apparently surrounded by a series of rectangular mud-brick structures constructed atop stone footings (Fig. 5.5). The remains of these structures are responsible for the mound's height and shape. At least three, possibly four, such structures may be inferred from the current excavated area, although two were badly damaged by looting. One of these structures, preserved from two to five brick courses high, was entirely excavated. Curiously, the structure was niched on at least two sides, possibly on a third (northern). The western (outer) side of the structure was definitely not niched. Its overall dimensions were 4.60 by 3.80 m, with 1.20 m thick walls; individual mud bricks averaged 35 by 50 by 9 cm. The structure had no ground-level entry. The interior and exterior wall surfaces were heavily coated with mud plaster and the floor was lime plastered. These structures are preliminarily interpreted as silos or storerooms based on their form and corroborating data recovered from associated contexts.

The central building (Fig. 5.6), with five successive plastered floors and associated fill, was utilized over a long period of time. The total accumulation between the first and last floor was 1 m thick. The building's layout was modified at least twice after the initial construction. In the final phase of modification, the excavated room was divided with a partitioning wall. A grinder, storage jars, and cooking pots were set into the two earliest floors of the building. Large accumulations of ash, charcoal, and carbonized seed and plant remains had accumulated atop each floor. Analysis of botanical samples indicates the plant material represents the remains of barley processing (N. F. Miller, pers. comm. 1997).

It seems likely that during the early to mid-EBA, the site served as a grain storage and processing center, finding basic parallels with contemporary storage facilities in the middle Khabur region; however, Tell Hajji Ibrahim differs in key ways (Curvers and Schwartz 1990; Schwartz and Curvers 1992; Fortin 1995). The middle Khabur facilities are associated with villages and were situated in a rural hinterland for the production, collection, and water-borne mass shipment of cereal surpluses to urban centers (Schwartz 1994b; but see also Hole 1991 and McCorriston 1995). Conversely, Hajji Ibrahim lacks substantial domestic architecture; the reconstructed plan of Phase B occupies nearly the entire area of the mound. Moreover, the site was located too far from the Euphrates (3 km) for efficient transport. Hajji Ibrahim's proximity to Sweyhat (900 m) argues against it serving as a satellite settlement situated to increase Sweyhat's agricultural territory by minimizing travel and transport costs. Additionally, at less than 5 ha, Sweyhat was no more than a village in the early EBA, making it an unlikely candidate for importing surpluses.

Perhaps Tell Hajji Ibrahim and similar embayment sites (2 and 9) lay at the center of small agricultural territories located along wadis. In such areas, fields would have been more drought-resistant and seasonal runoff would have minimized reliance on wells. These land holdings might have been cultivated by transhumant pastoralists who moved their flocks between the embayment for conserved winter feed and the uplands for seasonally available pasture. Faunal analyses have clearly demonstrated the importance of herding at both Hajji Ibrahim and Sweyhat (Miller and Weber 1996). The consumption of plant domesticates, field weeds, and upland plants by livestock in the EBA—substantiated by botanical evidence from Tell es-Sweyhat and Tell Hajji Ibrahim (see Ch. 6, pp. 102–103)—presents a strong argument that herds were pastured in both the embayment and the uplands, a standard pattern today. Finally, as previously mentioned, faunal remains from Sweyhat have also shown wild upland species were heavily hunted in the late EBA (Miller and Weber 1996).

Phase C remains were poorly preserved due to erosion, looting, and disturbance caused by Phase D burials. Only bits and pieces of architecture were recovered. A large number of whole vessels were found in the stratigraphically intact portions of Phase C. Predominantly metallic wares (Fig. 5.7), they find excellent parallels with pottery recovered from the tombs at Sweyhat dated to the third quarter of the third millennium.

Conclusions

Along with other large embayment sites of the middle Euphrates "transitional" zone, such as Tell Banat, Tell es-Sweyhat differs markedly from local riverbank settlements and, further afield, the better-known city-states of northern Mesopotamia and Syria. Unlike these larger state systems, which under normal conditions were supported by dry-farming production at surplus levels, Wilkinson's study has indicated that in the late third millennium Sweyhat's dry-farming economy probably operated at deficit levels of production in most years (1994:504). It is situated in the middle of an arid, highly variable climatic zone. Irrigation along the floodplain probably did not alleviate such deficits (Wilkinson 1994:484). Evidence of ancient irrigation in the region is unlikely to be found owing to the unsuitability of most of the middle Euphrates for feeding canals. Moreover, the annual Euphrates flood in April would have inundated floodplain fields just before the cereal harvests in May and June, making winter-spring farming of the floodplain high-risk. This raises several questions concerning how the region's inhabitants compensated for such deficits and how state-level infrastructure was supported.

The postulated food deficits were not limited to the human population. Given the high degree of sedentism and the prevalence of pastoral production in the third millennium, herds would have required a large amount of grain and fodder in winter. If factored into Wilkinson's model, such requirements would lead to acute grain shortages nearly every year. Did the return on pastoral production, horticulture and wild resources compensate for such economic shortfalls, and were they sufficient to maintain the large, centralized state polity implied by late third millennium Sweyhat? Short of a resounding "yes," we are left with an urban state conspicuously located amid an agriculturally marginal environment, supported by an unreliable subsistence base and possessing no other discernible economic *raison d'être*—e.g., location on a major trade route, mineral resources, etc. Alternatively, revisions to the regional subsistence model might be sought.

First, dry-farming production might have been higher than previously calculated; the 1996 archaeological survey has already found possible candidates for small, surplus-producing satellites in the uplands contemporary with the two major episodes of embayment settlement. The difficulty comes in linking them to regional state systems inasmuch as they seem to lie 10–30 km from any known large contemporary sites.

Furthermore, pastoralism, horticulture, and wild resources definitely provided substantial additions to the diet. Pastoralism complemented the dry-farming economy in other ways. As is the practice today, during dry years failed crops would have been grazed by flocks (Mazid and Hallajian 1983:17). Hence, the detrimental effects of short-term climatic fluctuations are, in part, counteracted by the ability to efficiently salvage partial production and channel it to a longer-term investment—the building up of herds. During longer droughts, other adjustments must be made. Additionally, pastoral production was well suited to exploiting the pockets of cultivable land located in the Balikh-Euphrates uplands. While smaller settlements in the more productive upland zones, like Tell Jedi, may have been situated too far from the major riverine centers for the effective export of grain surpluses to them, they might well have served as permanent stations for the production and storage of conserved feed for the region's flocks. As in more recent times, these sites also would have provided wells for watering livestock, thereby extending grazing areas further into the uplands, beyond the range of day-long forays from the river or the sparse, naturally occurring upland water sources. A network of feeding/watering stations situated amid the seasonal pasture of the uplands would have greatly enhanced regional pastoral production.

Second, regional demand for grain for human consumption was probably lower than previously thought. Geomagnetic survey and excavations in Sweyhat's outer town suggest a modest population density during the site's floruit.

Third, the importance of dry-farmed cereals in the local diet may have been overestimated. One need only look to the late 1800s and early 1900s for evidence of this. Prior to state-motivated settlement, the "Sheep Tribes" of the middle Euphrates region appear to have subsisted on minimal amounts of cereal production, using opportunistic cultivation as a supplemental source of food and fodder. With the development of a sedentary population and the expansion of the market for pastoral products and cash crops in the 1930s and 1940s, the entire Sweyhat embayment rapidly came under cultivation. Thus, twentieth century dry-farming intensification and urbanization were not initially driven by population growth, as Wilkinson has posited for the third millennium (1994:503). Rather, it was spurred by the strengthening of state control in the area and a sudden shift in pastoral production strategies associated with the privatization of pasture and water resources, reduced pastoral mobility, and external incentives for surplus production beyond the exigencies of household subsistence.

In light of this, future research will explore an alternative proposition to account for the proliferation of extra-riverine settlement and the intensification of dry-farming in the EBA. These factors are symptomatic of the reduced availability and/or over-exploitation of regional pastures, which increased reliance on conserved feed—i.e., grain and stubble fodder. Two complementary mechanisms may have led to this: (1) the maximization of pastoral production brought on by an external demand for surpluses; (2) reduced mobility in the annual pastoral cycle. As large, multi-polity state networks such as Mari and Ebla emerged in the mid-third millennium, and their influence moved gradually up the Euphrates, less permeable borders would have developed up and down the middle Euphrates, hindering even the short seasonal movements characteristic of transhumant sheep pastoralists (D'Hont 1994:209–211). Moreover, it is clear Mari and Ebla had an economic stake in this region and probably were providing incentives for surplus production (Meyer 1996:166–167). Increasing emphasis on conserved feed fits well with the results of the excavations at Tell Hajji Ibrahim—a grain storage/processing facility associated with little or no sedentary population.

Notes

27. Satellite Pour l'Observation de la Terre.

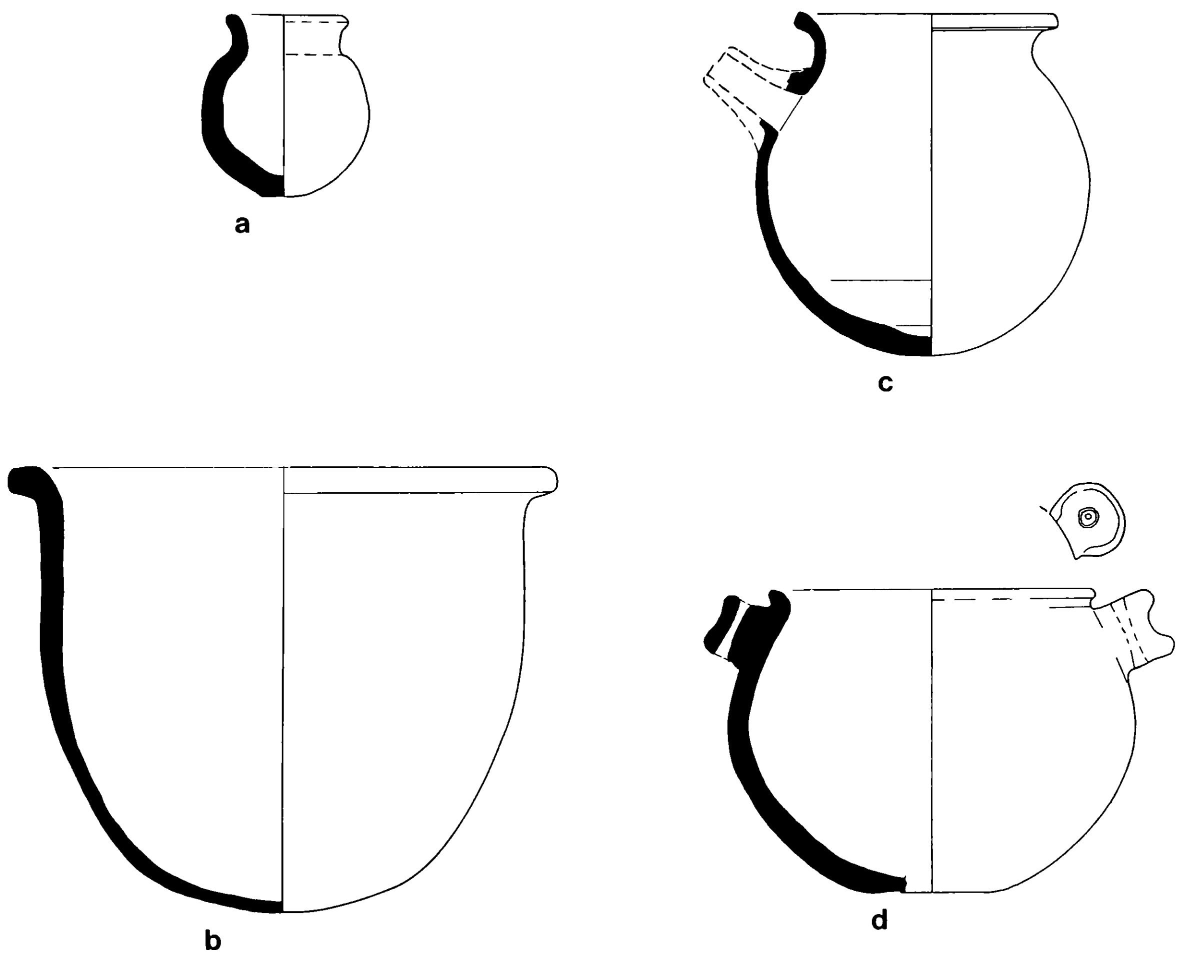


Fig. 5.7. Phase C pottery from Tell Hajji Ibrahim (continued on next page). a–d: simple ware. Scale 1:3.

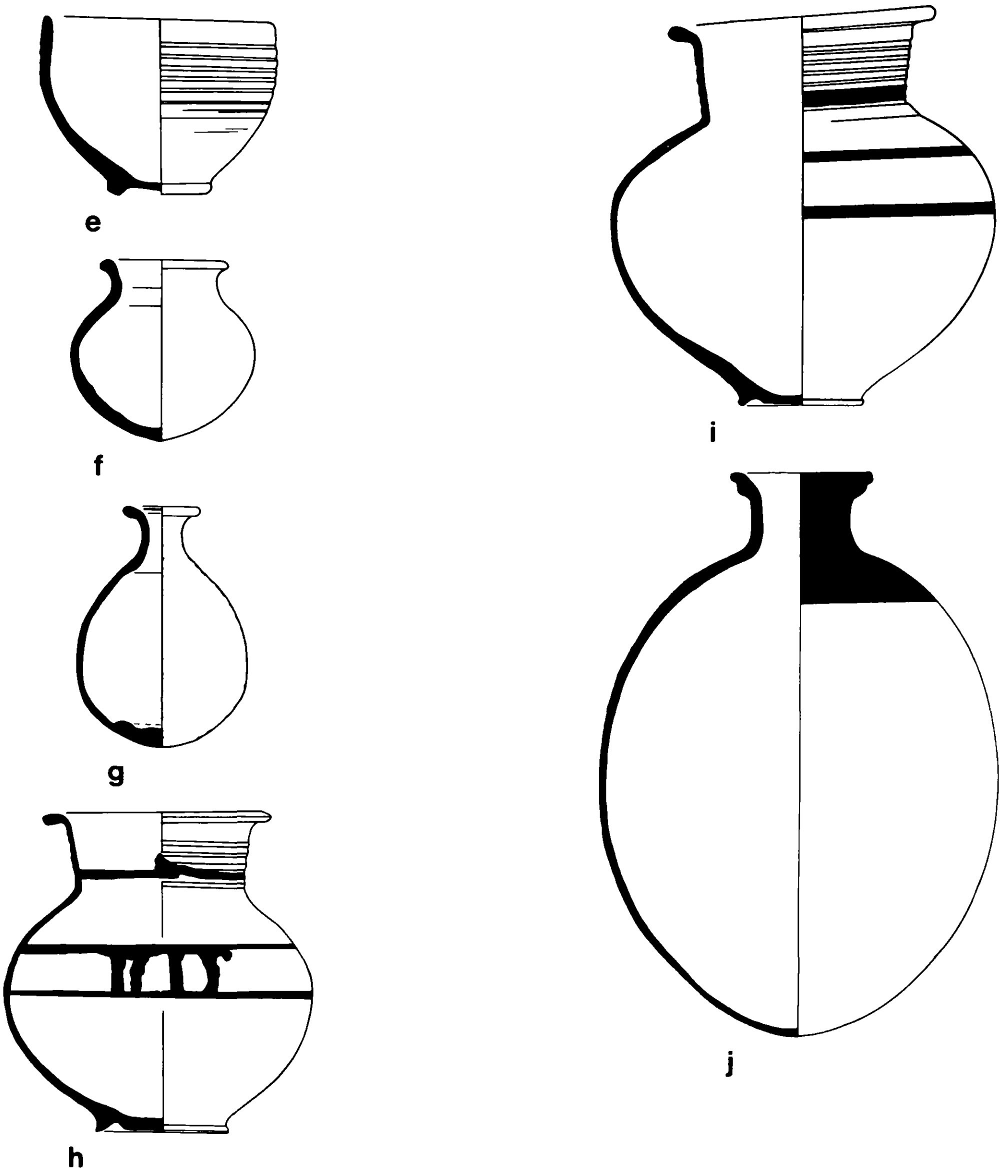


Fig. 5.7. Phase C pottery from Tell Hajji Ibrahim. e–j: metallic and band-painted wares.

6

SWEYHAT AND HAJJI IBRAHIM: SOME ARCHAEOBOTANICAL SAMPLES FROM THE 1991 AND 1993 SEASONS

Naomi F. Miller

Tell-es Sweyhat is situated on a terrace at the southern edge of the rainfall agriculture zone.[28] University of Pennsylvania Museum excavations carried out in 1991 and 1993 included areas placed on the main mound (Operations 1 and 2) and in the outer town (Operations 4, 9, 12). A small (0.25 ha) mound identified as Site 3 (Wilkinson 1993) was also tested. Informally known as Hajji Ibrahim, it lies 0.9 km from the center of Sweyhat.

Excavators were asked to take flotation samples of about 8–10 liters from features (e.g., hearths, ovens, pits), clearly ashy or charcoal-rich deposits, and a selection of "control" samples from deposits within which the features were found. Flotation was carried out with a manual system based on the one described by Minnis and Leblanc (1976). The mesh size in which the heavy fraction was caught was about 1 mm; thus, tiny seeds may be underrepresented.

In the laboratory, samples were chosen for analysis according to several criteria: the director's priorities, sample richness, and the desire to obtain at least some representation for the different excavation areas and deposit types. For this report, 38 flotation samples extracted from about 289 liters of soil from Tell es-Sweyhat were selected for identification and analysis, along with 2 samples (from 20 liters of soil) from Hajji Ibrahim (Apps. 6.1, 6.9). A number of unexamined samples are stored in the MASCA Ethnobotanical Laboratory.

As reported below, the charred assemblage from Sweyhat reflects an agropastoral economy which produced barley and relied heavily on uncultivated steppe for grazing.

Archaeobotanical Research at Sweyhat and Nearby Contemporary Sites

A team from the Ashmolean Museum at Oxford, led by T. Holland, excavated at Sweyhat from 1973 to 1975. Plant remains from a burnt building in a presumed administrative quarter of the upper town were recovered. Virtually pure crop remains from storage contexts were analyzed by W. van Zeist and J.A.H. Bakker-Heeres (1985[1988]: 308–310). There were concentrations of two-row barley (*Hordeum vulgare* var. *distichum*) and grasspea (*Lathyrus sativus*), mixed with small quantities of a few other types. Also present was a jar of wild caper buds (*Capparis spinosa*).

In 1989, R.L. Zettler expanded excavations on the acropolis (Operations 1 and 2) and put in a series of trenches at different places in the outer town (Operations 3 and 4). Due to the shallowness of the deposits in the outer town, preservation was poor, and the density of both seed and charcoal remains was low. Unlike the seeds from the 1973–1975 excavations, these charred remains did not come from burned structures. Nevertheless, the goal of providing a comparison with the upper town was reached. Christine Hide, who analyzed the 1989 assemblage, concluded that the outer town charred material was, indeed, from settlement debris, and that many of the seeds came from dung fuel (Hide 1990). The recently analyzed material from the outer town is virtually indistinguishable from that examined by Hide, and her cultural interpretation stands.

The upper town samples of this report (Operation 1) probably come from the kitchen and storage areas of an as yet unexcavated central administrative area (Chapter 9). The outer town has at least one large residence (Operation 4). Operation 9 in the outer town is difficult to characterize, but it does have parts of at least three structures and includes non-industrial work areas (see Chapter 3). The upper town samples are generally much richer in charred material, but this is probably due to post-depositional processes; the Operation 1 material from later seasons was more deeply buried, and therefore less subject to disturbance. As no additional burnt buildings were examined, the pit and hearth contents and

Table 6.1. Crop and food taxa from Syrian sites near the Euphrates*

	Sweyhat	Selen-kahiye	Hadidi (MB)	Jouweif (MB)	Hajji Ibrahim
Hordeum vulgare var. *distichum*	x	x	x	(x)	x
Triticum aestivum/ durum	x	x	x	x	.
Triticum dicoccum	x	x	.	.	.
Triticum monococcum	x	x	.	.	.
Cicer	.	x	x	.	.
Lathyrus	x	x	x	x	x
Lens	x	x	x	.	x
Pisum	x	x	x	.	.
Vicia ervilia	x	x	.	.	.
Carthamus tinctorius	.	x	.	.	x
Pistacia	.	x	.	.	.
Capparis	x	x	.	.	.
Ficus	x	x	.	.	.
Olea	x	x	.	.	.
Vitis	x	x	.	.	.

* Few samples were analyzed from Hadidi, Jouweif, and Hajji Ibrahim, which accounts for the comparatively low number of types at those sites. See van Zeist and Bakker-Heeres 1985[1988] for Sweyhat, Selenkahiye, and Hadidi; see Miller n.d. for Jouweif.

other charred materials from the current excavations also probably came from dung fuel.

Material from several other roughly contemporary sites is available for comparison (Table 6.1). Selenkahiye is contemporary with Sweyhat, and Hadidi, with its Middle Bronze Age deposits, is a little later (van Zeist and Bakker-Heeres 1985[1988]). Many of the samples from these sites have very high proportions and amounts of cultigens which appear to come from storage contexts. Some are nearly pure, cleaned crop samples. The archaeological context of the assemblages from these sites and deposits are therefore not comparable to those of Zettler's excavations at Sweyhat, with the exception of a few samples. These latter are described as coming from "cultural fill," and have a fair number of weed seeds and rachis bits.

Samples consisting of trashy debris from Jouweif, a Middle Bronze Age hamlet located right on the Euphrates, are similar in aspect to those of the current Sweyhat study (Miller n.d.), with only minimal differences in their respective plant assemblages. The range of wild and domesticated plants is similar, and as at Sweyhat, charcoal comes from species of the floodplain forest and steppe, and from transported wood.

The Taxa (Appendices 6.2–6.5, 6.7)

Preservation of plant macroremains at Sweyhat was primarily through charring. Of the cultigens, two-row barley (*Hordeum vulgare* var. *distichum*) predominates. However, wild and weedy seeds considerably outnumber cereals by estimated count (App. 6.2), with small-seeded legumes (Fabaceae) and grasses (Poaceae) making a big contribution to the assemblage.

Cultigens

Cereals. Cereals commonly occur in identifiable but fragmentary form, and most researchers list whole grain equivalents in their data tables. For that reason, Appendices 6.3–6.5 give counts of cereals based on the number of whole grains and an estimated number based on fragments greater than 1 mm. These rough approximations are based on the weight of barley grains in SW 2372 (about 0.72 g per 100 grains). Although there are too few wheat grains to obtain an accurate average weight, it would be about the same or a little lower than the barley. Bits of straw were also seen, but only culm nodes were counted.

Barley (*Hordeum vulgare*). In absolute quantity and frequency, barley is the most important cultigen at Sweyhat. Van Zeist and Bakker-Heeres report only two-row barley (*H. vulgare* var. *distichum*) from the site. Two-row barley is more drought resistant than the six-row type (*H. vulgare* var. *hexastichum*), and is more likely to have been grown successfully. Note, however, that in two-row barley the grains are all straight, but in six-row barley, each spikelet also has two lateral florets which develop twisted grains. A large number of the grains in the present samples appear to be slightly twisted, and there are a few obviously twisted grains. Some of the deformation could be a result of charring; therefore, even though six-row barley may have been grown, I am unwilling to assign these grains to the six-row type.

Contextually, the Sweyhat samples are most similar to "cultural fill" material mentioned by van Zeist and Bakker-Heeres (1985[1988]). The barley measurements (App. 6.6a,b) are within the range that they observed at Selenkahiye, where samples from "cultural fill" were similar to those from cleaned grain deposits. The "cultural fill" material therefore should not be construed as the tail-grain from crop-processing debris (van Zeist and Bakker-Heeres 1985[1988]: 275).

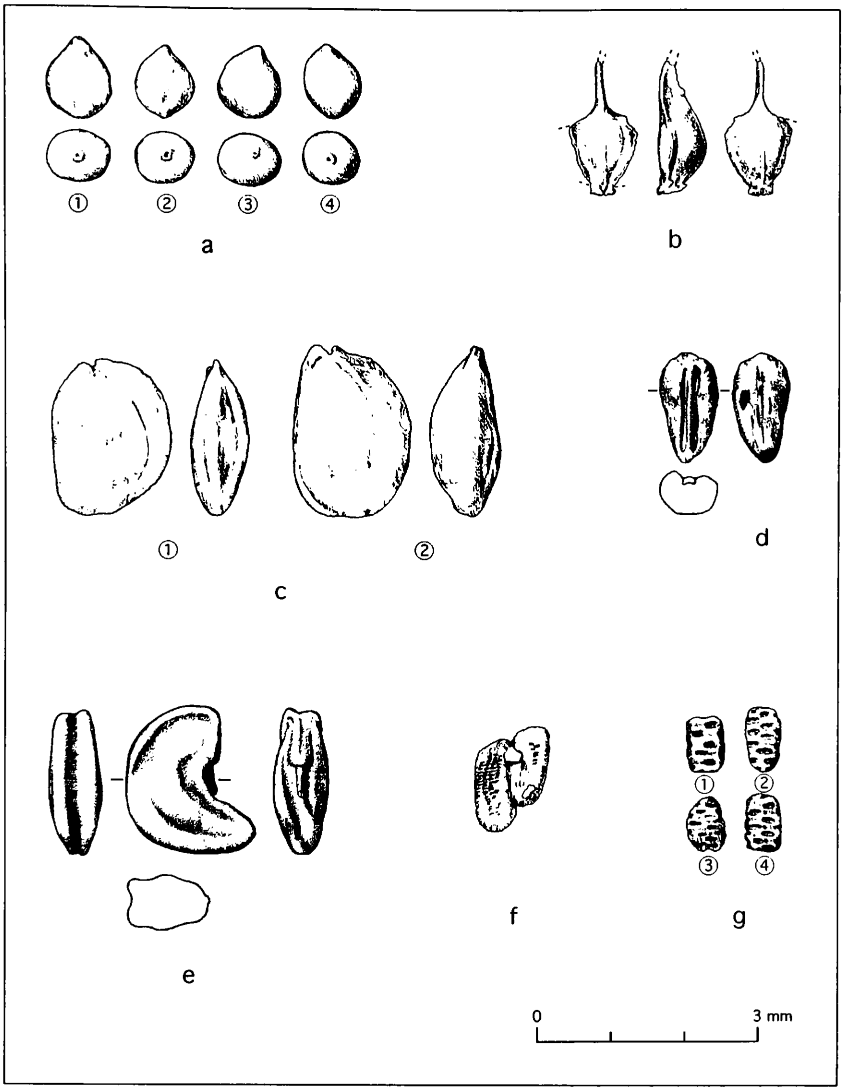


Fig. 6.1 a. *Helianthemum* (SW 2351)
b. *Ceratocephalus* (SW 93.1688)
c. cf. *Alyssum* (SW 93.1688)
d. *Crucianella* (SW 2351)
e. SW.Malvaceae-11 (SW.93.1688)
f. *Hypericum* (SW 93.0904)
g. *Verbascum* (SW 93.1688)

Wheat: bread or hard wheat (*Triticum aestivum* or *T. durum*), emmer (*T. dicoccum*), and einkorn (*T. monococcum*). The wheats represent only a small proportion of the identified cereals, whether as grain or rachis fragments. As the wheats tend to have a higher water requirement than barley, and this area is so marginal for rainfall agriculture, it is likely that the occurrence of wheat in the Sweyhat samples is from incidental field contamination. At most, wheat would have been a minor crop.

Pulses. Pulses occur in low quantities and frequency, and are found in the same trashy deposits as the other seeds. They include grasspea *(Lathyrus)*, lentil (*Lens culinaris*), and pea (cf. *Pisum;* App. 6.6c). A concentration of grasspea occurs at Sweyhat in a burnt building, and there are similar large deposits of grasspea and lentil at Middle Bronze Age Hadidi (van Zeist and Bakker-Heeres 1985[1988]: 302). This demonstrates that at least at those sites, grasspea and lentil were crops in their own right. Their low quantity in the present samples from Sweyhat and those from other sites of the north Syrian Euphrates may just mean that the seeds did not become incorporated in dung fuel because they were not used for fodder.

Fruit. Fig (*Ficus carica*). A single fig seed was found in these samples. Fig is not unexpected, however, as it has a small but consistent presence at nearby Selenkahiye.

Grape (*Vitis vinifera*). Grape remains consist of one seed fragment and one peduncle (flower stalk). A few grape seeds also occur at Selenkahiye.

Wild and Weedy Plants

As most of the plants represented are unfamiliar to non-botanists, Appendix 6.2 lists the plants alphabetically by family as they appear on the seed list, with what I hope are helpful comments. The discussion below is therefore limited to matters not easily condensed into the table. Uncommon, nondescript, or poorly preserved types are just listed without further comment.

The present work adds considerably to the list of wild and weedy plants documented at Sweyhat, because the samples analyzed by van Zeist and Bakker-Heeres consisted of nearly pure crop remains and those done by Christine Hide had few seeds of any sort, which limited the variety of seed types recovered. Several types not previously attested at north Syrian Euphrates sites are also seen: *Alhagi*, *Hypericum*, and *Ceratocephalus*.

Asteraceae. In addition to several identified members of the daisy family (cf. *Artemisia*, *Centaurea*), SW.Asteraceae-3 is represented by its achene (seed; Fig. 6.2a) and capitulum (flower head; Fig. 6.2b) (SW 1565). A flower head without seeds was encountered in sample SW 93.0748.

Boraginaceae. I treat the uncharred boraginaceous nutlets (seeds) separately because their circumstances of preservation differ from the other seeds. Some are almost definitely modern, others may well be ancient. Fortunately, there are not that many of them, so conclusions based on overall seed counts still stand. (Problems might occur in trying to interpret individual deposits, however.) It is interesting that the proportion of uncharred boraginaceous seeds is substantially lower in the upper town samples of Operation 1 than in the outer town samples. If the uncharred seeds are ancient, it would mean that these heavily silicified seeds are sturdier than charred ones, and so survive in disproportionately high numbers in the shallower deposits of the outer town. If modern, it would just mean that they are more prevalent in upper soil levels. In the spring of 1995 I saw parts of the outer town covered with a boraginaceous plant that may be *Arnebia*, which might explain the high density of borages in outer town samples.

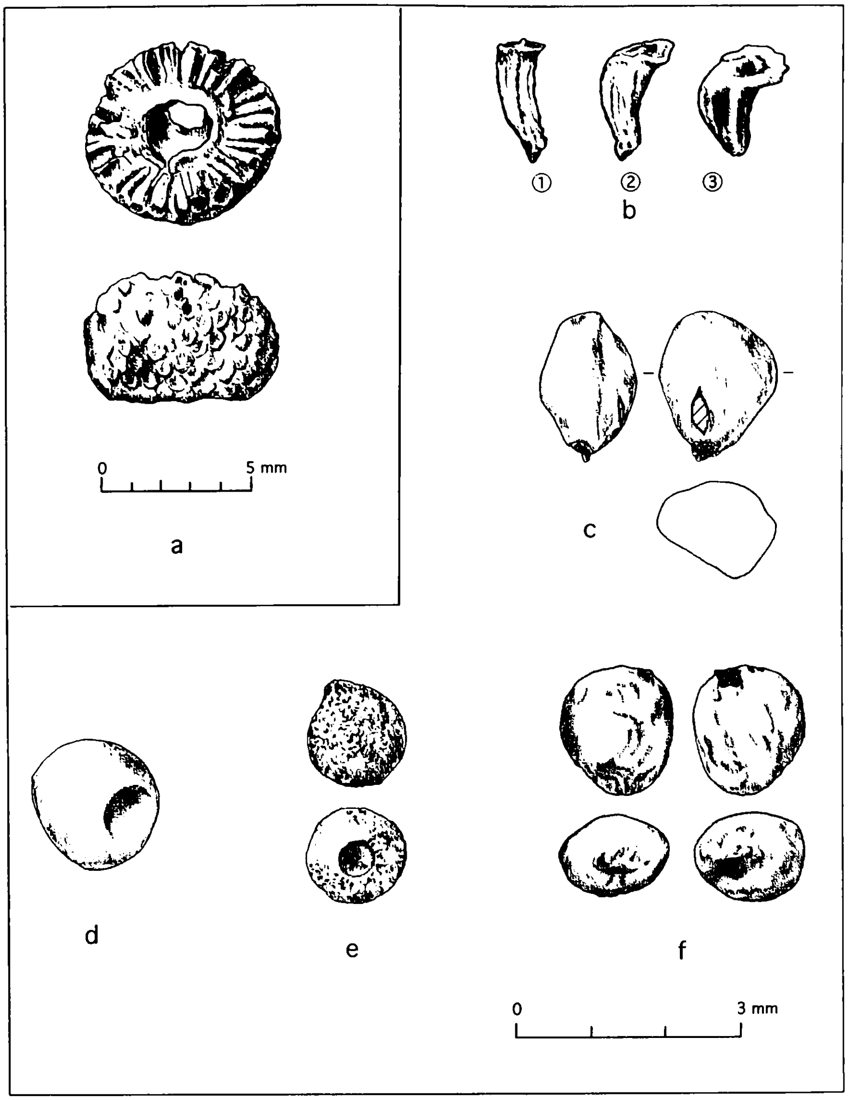


Fig. 6.2 a. SW.Asteraceae-3, capitulum (SW 1565)
b. SW.Asteraceae-3 (SW 1565)
c. SW.unknown-10 (SW 93.0748)
d. SW.Liliaceae-3 (SW 93.0904)
e. SW.Liliaceae-4 (SW 2351)
f. SW.Liliaceae-5 (SW 93.0748)

Fabaceae. Small-seeded legumes comprise the vast majority of seed remains from Sweyhat. Although their bulk is relatively low,[29] their ecological significance is great. Some could be field weeds (*Trifolium/ Melilotus*), others are almost definitely from the steppe (*Trigonella*). In addition to seeds, some cf. *Onobrychis* and cf. *Alhagi* pod fragments were seen in SW 93.0748.

Hypericaceae. Hypericum species yield essential oils and "are considered more or less medicinal" (Townsend and Guest 1980:364). They are poisonous to livestock if eaten in large quantities. Figure 6.1f illustrates two *Hypericum* seeds that have fused with charring.

Liliaceae. Several members of the lily family are tentatively distinguished, but remain unidentified (Fig. 6.2d–f). Note that SW.Liliaceae-5 may just be SW.Liliaceae-3 with the seed coat adhering.

Linaceae. Two flax-like seeds (cf. *Linum*) are only about 1 mm long, and are likely to be wild.

Poaceae. The variety of grass caryopses (seeds) is high, but compared to the legumes, they are not that important a component of the assemblage. Though some are undoubtedly steppe plants, others are likely to be agricultural weeds.

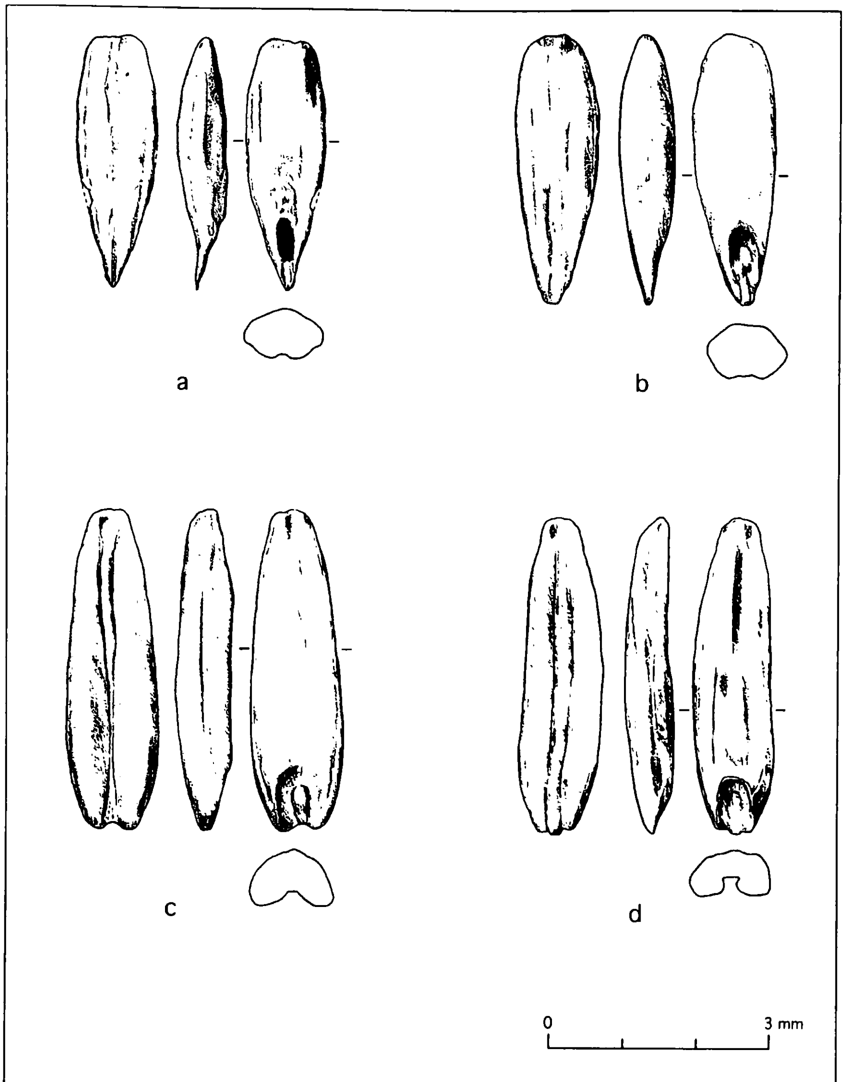


Fig. 6.3 a, b. SW.*Hordeum*-1 (SW 93.1688)
c, d. cf. *Taeniatherum* (SW 93.1688)

Trachynia distachya (Fig. 6.4a) refers to a type that resembles "Gramineae type C" as illustrated and described in van Zeist and Bakker-Heeres (1985[1988]: fig. 7.1, 7.2, 7.3). With regard to this type, van Zeist writes, "I arrived at the conclusion that it should be *Trachynia distachya* (L.) Link (*Brachypodium distachyon* [L.] P. Beauv.). The Selenkahiye specimens, and those of other sites I examined since then, match modern (carbonized) caryopses of this grass" (letter dated June 2, 1994).

One unnamed grass, SW.Poaceae-15 (Fig. 6.7d,e), is similar to such small-seeded types as *Phleum* and *Eragrostis*. Another, SW.Poaceae-19 (Fig. 6.6e,f), looks like "Gramineae type B" from Selenkahiye (van Zeist and Bakker-Heeres 1985[1988]: fig. 7.4, 7.5, 7.6). The grasses SW.Poaceae-2, -10, -11, -12, -17, -18, -20, and -21 are also illustrated (Figs. 6.4b–d; 6.5a–d; 6.6a–d, g; 6.7c).

In addition to grass caryopses, there are a number of *Aegilops* glume fragments.

Ranunculaceae. Ceratocephalus (Fig. 6.1b) is not commonly reported from archaeological sites, though I have seen it in samples from Umm el-Marra, Syria, and Gordion, Turkey. It is native to the steppe region of southwest Asia, and grows in a variety of disturbed and undisturbed habitats.

The most numerous grass is *Eremopyrum*. Many species grow in dry steppe or subdesert conditions, but some may also grow as field weeds (Townsend and Guest 1968:228ff.).

SW.*Hordeum*-1 is a small-seeded wild barley (Fig. 6.3a,b) that compares well with several in the comparative collection housed at MASCA (*Hordeum murinum, H. geniculatum, H. glaucum*).

Taeniatherum has been tentatively identified by comparison with fresh specimens. The seeds are relatively long (mean length 4.2 mm [3.3–4.9], L:B 4.2 [3.7–5.0]; N=11); the ventral furrow is relatively wide and deep (Fig. 6.3c,d). *Taeniatherum* is an annual grass which provides good spring forage (Townsend and Guest 1968:264ff.).

Several other named and unnamed types are illustrated: cf. *Alyssum* (Fig. 6.1c), *Helianthemum* (Fig. 6.1a), SW.Malvaceae-1, (Fig. 6.1e), *Crucianella* (Fig. 6.1d), cf. *Verbascum* (Fig. 6.1g), SW.unknown-10 (Fig. 6.2c); plant parts SW.unknown-7 (Fig. 6.7a) and SW.unknown-12 (Fig. 6.7b).

Wood Charcoal of Trees and Shrubs

Previous work on the Sweyhat wood charcoal remains (Hide 1990) documented the presence (in order of importance) of poplar and/or willow (*Populus/Salix*), a chenopodiaceous shrub (Chenopodiaceae), and one piece each of tamarisk (*Tamarix*), ash (*Fraxinus*), and tentatively identified oak (*Quercus*).

Most of the fragments in the flotation samples are very small. I was able to identify a few more pieces, but no new types were found. The presence of oak is confirmed, and the riparian forest trees willow/poplar and tamarisk are the most important constituents of the assemblage (App. 6.7a,b). The fact that I tried to identify only fragments with at least one complete growth ring (or, in the case of the chenopodiaceous shrub, fragments big enough to handle comfortably—i.e., larger than 5 mm on a side) might tend to underrepresent shrubs.

The presence of woodland taxa (oak at Sweyhat, and oak, cedar, pine, hornbeam, and blackthorn-type at Selenkahiye and Hadidi) might be accounted for by the transport of timber and firewood downstream (van Zeist and Bakker-Heeres 1985 [1988]). It is probably no accident that Sweyhat, lying some distance from the river, yields evidence of a shrub of the steppe; trees were probably more scarce there.

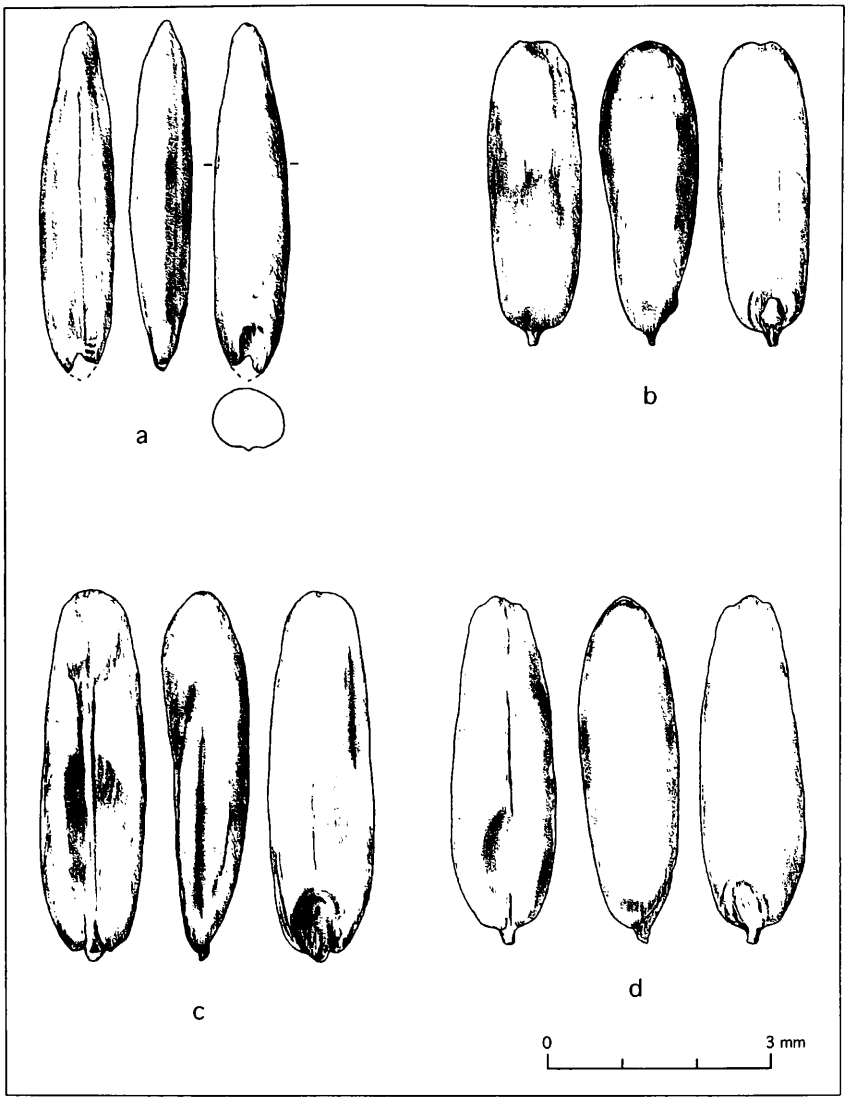


Fig. 6.4 a. *Trachynia distachya* (SW 2351)
b, c, d. SW.Poaceae-10 (SW 93.1688)

Discussion and Interpretation

Agriculture

The new samples are fully consistent with the broad outlines of agricultural practice described by van Zeist and Bakker-Heeres (1985 [1988]).

1. The staple crop was barley. There is a possibility, however, that in addition to the two-row type, six-row barley was also grown.
2. Wheat was at best a minor crop, and possibly not even that.
3. Some pulses were grown as crops, though the newly reported Sweyhat samples do not provide significant additional evidence.
4. There is no particular archaeobotanical evidence for irrigation. In fact, the barley from both Selenkahiye and Sweyhat tends to be a little smaller on average than that from the better-watered northern Euphrates sites of Tepecik and Korucutepe (van Zeist and Bakker-Heeres 1985[1988]: 284), supporting this conclusion.

Vegetation Reconstructions Based on Analysis of Fuel Remains

A common approach to explaining archaeobotanical assemblages involves the use of ethnographic models. One model considers crop-processing a major source of charred plant remains (Hillman 1981, 1984). Another, specifically developed to explain charred assemblages in the Near East, suggests that (1) plant materials arriving in a settlement are used and deposited in a variety of ways (e.g., cess and trash deposits), (2) burning of fuel routinely occurs in the controlled setting of hearths, ovens, and fireplaces, (3) trash is less likely to be burned within the confines of the settlement, (4) charred remains scattered in the trash deposits that are most analogous to archaeological "cultural fill" are likely to be remnants of fuel, (5) many seeds persist in burnt dung. Therefore, in the absence of good archaeological

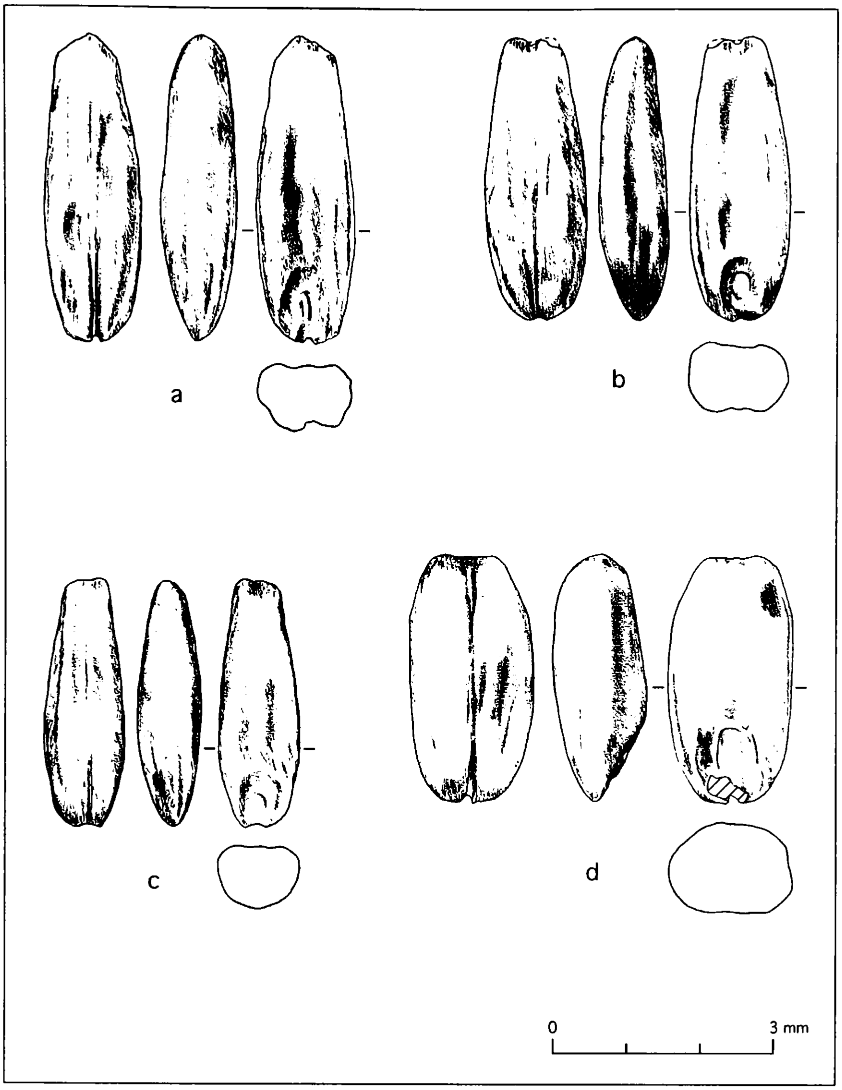


Fig. 6.5 a, b, c. SW.Poaceae-11 (SW 2351)
d. SW.Poaceae-18 (SW 2372)

high S:C ratios are associated with dung-burning, and low ones with wood-burning. The S:C ratio based on the weight in grams of material larger than 2 mm is primarily a comparison between cultigens and wood fuel, because cereals comprise most of the seed material greater than 2 mm. It would be interesting to compare such ratios in flotation samples from Sweyhat and the nearby river sites, but the only data available are from six samples from Jouweif. At Jouweif the value of S:C is 0.19, whereas in the Sweyhat Operation 1 samples it is 0.70 (excluding outlier sample SW 1301), what we would expect if wood fuel was scarcer at Sweyhat. The ratios exhibit a strongly overlapping distribution at the two sites, which suggests that even if the differences between them are real, they are minimal. The average ratio of the count of wild and weedy type seeds to the weight of wood charcoal is well under 200 at Jouweif and over 700 at Sweyhat (even excluding outlier SW 2351). With almost no overlap, these figures might reflect differences between the two sites in the sources of fodder (see section below on pastoralism and intensive farming).

Comparison with Turkish sites along the Euphrates is instructive. It is clear that as one goes north into the moister parts of the Euphrates valley, woodlands become more prominent and wood becomes an ever more popular fuel source (see Chapter 7, this volume).

contextual evidence to the contrary, charred seeds from "cultural fill" on Near Eastern sites are likely to have come from dung burning (Miller 1984a, b). Some seeds, from spiny (*Alhagi*) or unpalatable (*Peganum* and *Hypericum*) plants, may not fit this hypothesis, though even in these cases the dried forms may be eaten by animals[30]; also, dung cakes could include some stray grains from the straw used as temper during their manufacture.

For purposes of this discussion, I consider the cereals and the wild and weedy types as a group to have originated in dung fuel (Miller 1984a, b), and wood charcoal to be the incompletely burned remnants of wood fuel. Seed-to-charcoal (S:C) ratios therefore suggest the relative availability of woody vegetation; that is,

A Few Unusual Deposits

Reference has been made to a few samples that are "outliers" for various characteristics. Unfortunately, it is difficult to explain these unusual samples.

Jar 3 was set in a floor of the Phase 2 occupation, its rim sheared off. The sample from the top (SW 93.0904) was ashy, but with a low density of macroscopic charred material. The bottom (93.0748) had an unusually large number of *Aegilops* glume fragments and *Eremopyrum* seeds, which might just represent hearth sweepings rather than the original contents.

SW 2351 is a trashy deposit from an abandoned room; it has a very high proportion of wild seeds relative to cereal, thanks to phenomenal numbers of small legumes, especially *Trigonella*. There is some precedent for this at sites on the steppes of southwest Asia, most notably the early agricultural site of Ali Kosh, in Iran (Helbaek 1969). At Gordion, the single most numerous type is *Trigonella*. There is good reason to believe that the seeds come from animal dung (see Miller 1996a).

Data Comparison with Selenkahiye

Van Zeist and Bakker-Heeres (1985[1988]: 286–288) compared the percentages of Mureybit and Selenkahiye's wild and weedy seed types to show how assemblage differences between those two river sites reflected vegetation changes associated with the onset of agriculture. I calculated similar figures for Sweyhat, using the 12 samples from Operation 1 that had more than 100 wild or weedy seeds.[31]

As Sweyhat is located farther from the river, the differences between it and contemporary Selenkahiye should reflect a heavier reliance on steppe resources. Indeed, the primary constituent by count of the Sweyhat seed samples is probable steppe legumes (more than 50% of the average sample), especially *Trigonella* sp., *T. astroites*, and *Astragalus*. *T. astroites*, for example, is a plant of open steppe or degraded steppe (Townsend and Guest 1974, vol. 3:102). At Selenkahiye, seeds of these plants constitute less than 10% of the average sample. Forage was not limited to steppe plants, since several of the seed types van Zeist identifies with relatively little ambiguity as stemming from agriculture are also present at Sweyhat (i.e., *Aegilops*, *Eremopyrum* and other grasses, *Trifolium/Melilotus*).

Pastoralism and Intensive Farming

A survey of botanical remains from sites located along the Euphrates (Kurban Höyük, Hacınebi, and Sweyhat) suggests that, all things being equal, wheat and barley cultivation follows rainfall. In particular, as rainfall declines, the prevalence of barley increases. Furthermore, if most of the seeds come from dung fuel, the wild seed to cultivated cereal ratio is an indicator of what the herds and flocks ate (Chapter 7, this volume).

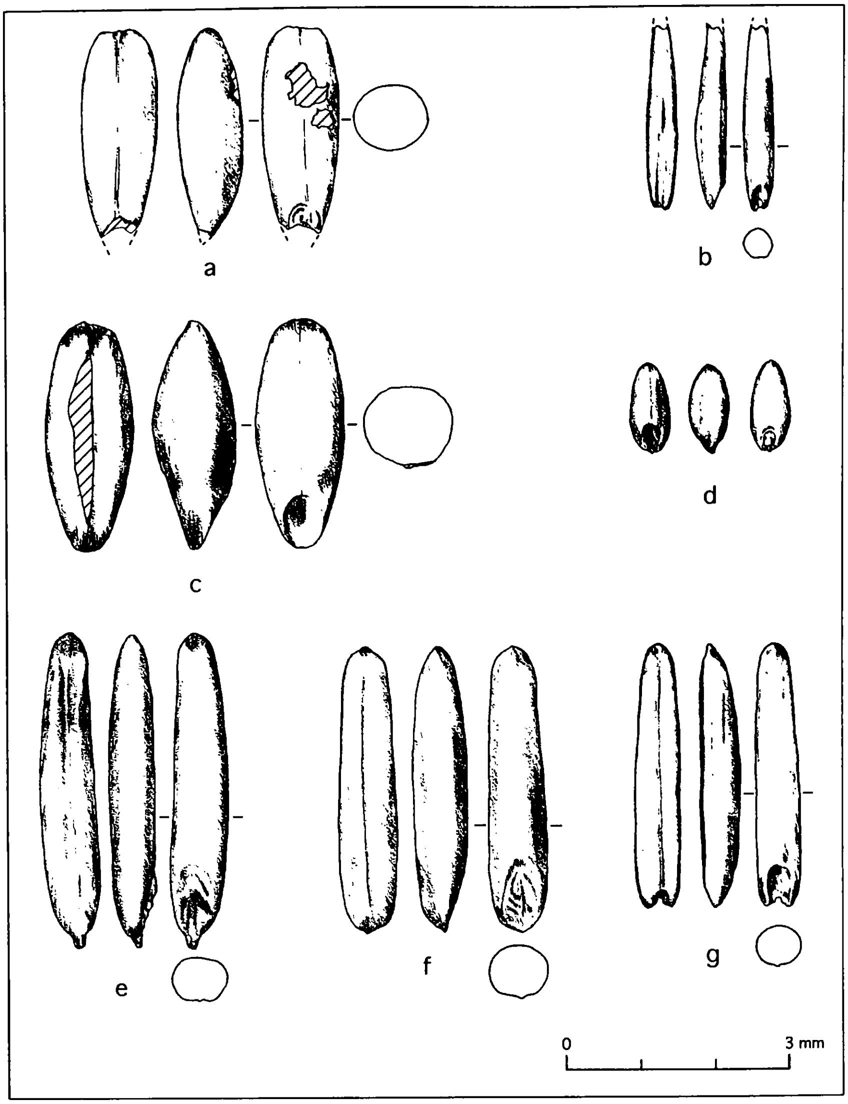


Fig. 6.6 a, c. SW.Poaceae-2 (SW 2026, SW 93.0748)
b. SW.Poaceae-12 (SW 2351)
d. SW.Poaceae-17 (SW 2351)
e, f. SW.Poaceae-19 (SW 2351)
g. SW.Poaceae-20 (SW 2026)

Quantifying seed remains is problematic. In many samples, the category of wild and weedy seeds barely tips the scales, so seed counts are most appropriate. On the other hand, weight is a more accurate measure of *quantity* of the extant cereal remains, due to the high number of identifiable fragments. I have calculated the ratio of wild and weedy seeds as one of number to weight; Appendix 6.8 lists cereals by weight.

Given the relatively high value of this ratio at Sweyhat compared to those of the upstream sites that are out of the steppe zone, it would seem that the animals were eating non-cultivated food. In particular, the small-

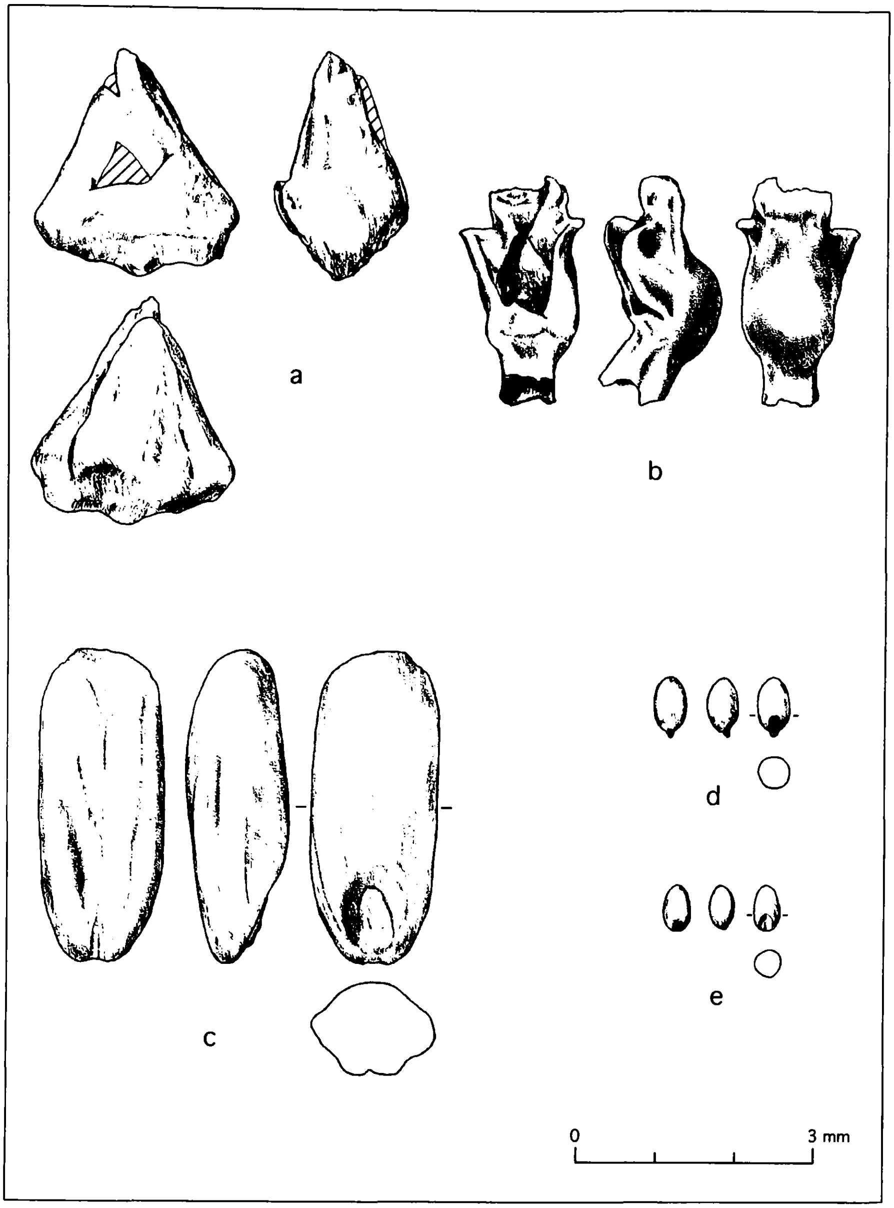


Fig. 6.7 a. SW.unknown-7 (SW 1316)
b. SW.unknown-12 (SW 2026)
c. SW.Poaceae-21 (SW 93.0748)
d, e. SW.Poaceae-15 (SW 93.1688)

seeded legumes appearing in high quantities are most probably steppe plants.

Wilkinson (1982) found evidence for a ring of intensive manuring around Sweyhat dating to the florescence of the urban center. The archaeobotanical evidence from the same period strongly suggests the economy had a major pastoral component. These two results need not be contradictory. One can easily imagine a situation in which the land most suitable for agriculture (perhaps the narrow floodplain east of the Euphrates, along with the band of cultivated land around the settlement) was devoted to crops that would be used to feed people living in the city. Flocks could then be sent to graze out on the steppe, where they would cause no damage to the crops. Such specialization of agricultural labor at the end of the third millennium B.C. is well-attested at Ebla (Archi 1984, 1990a).

Hajji Ibrahim (Site 3)

Two samples were examined from this small early third millennium site: oven contents (SW 93.1680), and the material outside the oven (SW 93.1688). Both samples had substantial quantities of charred material (App. 6.5). If anything, the area outside the oven had a higher density of charred remains than the oven itself. In sample SW 93.1688, the ratio of wild and weedy seed to cereal (count/ weight in grams) is similar to that of the Sweyhat samples, but there is almost no wood charcoal. Unlike samples I have seen from Sweyhat itself, there is a very large quantity of straw fragments.[32] The remarkable amount of straw remains might suggest the seed remains are from field weeds rather than steppe plants. Note further that the major identified grass represented is *Eremopyrum*, which, as mentioned above, is likely to be a field weed. Grasses are an extremely important part of the assemblage of wild and weedy plants (85% of charred seeds), more so than in any other sample reported among agricultural sites of the Syrian Euphrates.[33] Also in contrast to the Sweyhat remains, the small-seeded legume content of the area outside the oven is quite low. I do not have a definitive explanation for these peculiarities, but possibilities to consider include:

1. The remains represent crop-processing debris rather than dung fuel
2. The remains represent straw fuel rather than dung fuel
3. There is some microhabitat near Hajji Ibrahim (either

cultivated or not) that favored grasses over legumes
3a. The microhabitat is cultivated land, which was the source of most animal fodder; the grasses are field weeds rather than steppe plants, indicating animals were not sent out to the steppe to graze
4. In the early third millennium, grasses were more common on the steppe than later
5. There is a seasonal difference (unlikely; the grasses and legumes tend to ripen at about the same time)
6. Chance preservation or small sample size
7. Some combination of the above

Possibilities (1) and (2) are both consistent with Hajji Ibrahim being a grain storage site (see Chapter 5). Crop-processing debris could account for SW 93.1688, given the remarkable lack of wood charcoal. As Hillman suggests (1981), a pure deposit of the sieved by-products of crop-processing should be of fairly uniform size, depending on the mesh used. In this sample, the charred remains consist of a variety of sizes (i.e., 1.70 g of the seed material, primarily barley, and 0.35 g of the straw are greater than 2 mm), although most of the charred remains fall through a 2 mm mesh (2.68 g of seed and 2.79 g of straw between 1 mm and 2 mm). Nevertheless, the sample makes a visual impression of uniform size, so an interpretation of crop-processing debris sieved through a slightly larger than 2 mm mesh cannot be excluded. The archaeological context is also consistent with this interpretation: M. Danti reports that the oven appears to be in a large, open space.

Alternatively, the high density of straw could point to a straw-fueled fire. This is not far-fetched. For example, to make bread, women at Malyan, Iran, fueled fires with straw, dried sesame stalks, or other herbaceous material, though all other fires were made with dung, wood, or kerosene (Miller 1982:90–91; see also Sweet 1974:133). If Hajji Ibrahim was a grain depot and processing station, the most readily available fuel would have been from primary crop-processing debris, i.e., straw.

Consider, too, the implications of option (3a). Hajji Ibrahim lies well within the late third/second millennium intensive manuring zone reported by Wilkinson (1982) at Sweyhat. At that time, the specialized pastoral economy involved pasturing animals off site, on the steppe. The earlier Sweyhat settlement, the one contemporary with Hajji Ibrahim, was small and its territory was not heavily manured. Perhaps the Hajji Ibrahim evidence shows a situation, as seen in late fourth millennium Kurban Höyük, of a less specialized agricultural economy, where domestic subsistence production required smaller numbers of animals, and devoted agricultural land to (human) food production (see Chapter 7). Alternatively, the agricultural emphasis of the Hajji Ibrahim assemblage may reflect the site's proposed role as a grain depot for pastoralists (see Chapter 5). That is, it represents a seasonally and functionally restricted range of activities. Clearly, more work at Hajji Ibrahim holds great promise for resolving this problem.

Acknowledgments

Thanks are due to Clare Jones and Nancy Mahoney, who sorted some of the Sweyhat samples, and to Tony Wilkinson for permission to discuss the Jouweif material.

Notes

28. Tell-es Sweyhat is a large (35 ha) late third/early second millennium B.C. site about 3 km from the Euphrates River in northwestern Syria.

29. The over 10,000 *Trigonella* seeds in SW 2351 fit easily into a 5 ml vial.

30. When I pointed to some *Alhagi* and *Peganum* growing near my flotation tank, a retired farmer (Ekrem Bekler) from Yassihöyük, Turkey, assured me that the animals would eat those plants if they were dried.

31. Following van Zeist and Bakker-Heeres, I include the Boraginaceae in calculating the percentages. The results are similar even if SW 2351 (the one with over 10,000 *Trigonella*) is omitted.

32. At Sweyhat, the average ratio of "miscellaneous" (primarily straw and rachis fragments) charred material to wood charcoal is 0.11 (ranging from 0 to 0.91); in sample SW 93.1688 from Hajji Ibrahim it is 1.35.

33. Figures for samples relatively rich in grasses include two Roman samples at Hadidi (under 30%), and some barley samples from Selenkahiye (up to 60%).

AUTHOR'S NOTE

As this publication went to press, the author realized that the seed type designated "*Verbascum*" or "cf. *Verbascum*" is more likely to be *Scrophularia*. Available seed illustrations did not show a clear distinction between the two genera. Direct comparison with modern seeds, however, showed that *Scrophularia* has clear and deep indentations, whereas the surface of *Verbascum* is more undulating.—*N.F.M.*

APPENDIX 6.1

CATALOG OF SAMPLES ANALYZED

SW #	Op.	Loc.	Lot	Prov. type	Phase	Millennium*	Notes
Sweyhat							
615	1	1	9	ash layer	6	L3/E2	
626	1	3	1	mixed ashy layer	6	L3/E2	
627	1	3	1	mixed ashy layer	6	L3/E2	
1001	1	5	3	mixed	6	L3/E2	
1049	1	1	26	ash layer	6	L3/E2	
1301	1	1	26	ash layer	6	L3/E2	
1316	1	1	30	fireplace?	6	L3/E2	
1560	1	9	2	trash	5	L3	
1565	1	9	2	trash	5	L3	
2026	1	13	2	room	4	L3	"kitchen building"
2157	1	15	1	ashy	5	L3	assoc. w/ loc. 9
2260	1	16	8	room	4	L3	"kitchen building"
2261	1	16	9	room	4	L3	"kitchen building"
2351	1	9	14	trash	5	L3	
2372	1	15	6	trash	4	L3	
93.0478	1	15	22	pit (ash-filled)	4	L3	"kitchen building"
93.0748	1	27	3	Jar 3	2	M3?	
93.0904	1	27	2	ash (bottom Jar 3)	2	M3?	
93.1608	1	30	16	charcoal	1	E3	willow/poplar
786	4	3	4	room		L3	
1147	4	14	6	room		L3	above floor
1148	4	14	6	room		L3	above floor
1624	4	18	4	oven		L3	cut into loc. 18.03
1625	4	18	4	oven		L3	cut into loc. 18.03
1629	4	18	4	oven		L3	cut into loc. 18.03
1639	4	18	3	lime plaster floor		L3	
1645	4	23	2	oven		L3	precedes loc. 18
1847	4	31	3	bread oven		L3	outside area
2460	4	22	5	vessel contents		L3	sw corner of room
2515	4	7	1	vessel contents		L3	
2537	4	21	3	hearth		L3	assoc w/ SW 2538
2538	4	21	3	control sample		L3	assoc w/ SW 2537
2541	4	36	2	pit		L3	below floor, loc. 6
2542	4	36	2	control sample		L3	assoc w/ SW 2541, 2547
2547	4	36	5	pit		L3	below floor, loc. 6
988	9	4	2	fill		L3	
2143	9	4	2	vessel contents		L3	on virgin soil
2116	9	5	3	storage jar contents		L3	
2144	9	4	2	fill		L3	
Hajji Ibrahim							
93.1680	1/2	12	2	oven contents		E3	
93.1688	1/2	11	7	outside the oven		E3	

* Millennium: L3 = late 3rd, M3 = mid 3rd, E3 = early 3rd

APPENDIX 6.2

SWEYHAT WILD AND WEEDY TYPES

Taxon	Life form†	Comments+
Aizoaceae		
*Aizoon**	?	
Apiaceae		carrot family (Umbelliferae), ≥ 2 types
Bupleurum	h	freq. dry, open land
Torilis-type	ah	open land
Asteraceae		daisy family (Compositae), ≥ 3 types (Fig. 6.2a,b)
cf. *Artemisia**	h, s	wormwood; freq. steppe
Centaurea	h	
Boraginaceae		borage family
*Arnebia decumbens**	h	gravelly uncultiv. land
*Arnebia linearifolia**	h	stony slopes
Heliotropium	h	
Lithospermum tenuiflorum	ph	
Brassicaceae		mustard family
cf. *Alyssum*	h	likely steppe plant (Fig.6.1c)
Lepidium	h	edible herb/forage
Neslia	ah	disturbed ground
cf. *Ochthodium*	ah	disturbed ground
Caryophyllaceae		pink family
Gypsophila	h	
Silene	h	
Chenopodiaceae		goosefoot family
cf. *Atriplex*	h, s	
cf. *Salsola*	h, s	saltwort; freq. salty soils
Cistaceae		
*Helianthemum**	s, h	usu. open ground (Fig. 6.1a)
Cyperaceae	h	sedge family; usu. moist ground; sev. types
Euphorbiaceae		spurge family
cf. *Euphorbia*	h	milky sap; unpalatable
Fabaceae		pea family (Leguminosae); usu. good forage
cf. *Alhagi*	s	camel thorn; sharp spines
Astragalus	h, s	
cf. *Hippocrepis*	ah	steppe, open slopes
Medicago	h	
*Medicago radiata**	h	steppe
cf. *Onobrychis**	ph, s	steppe, slopes
Prosopis	s	*shauk* (Arabic)
Trifolium/Melilotus	h	clover/melilot
Trigonella	ah	usu. steppe, slopes
*T. astroites-type**	ah	steppe and other habitats
Hypericaceae		
Hypericum	ph, s	not good for livestock (Fig. 6.1f)
Lamiaceae		mint family (Labiatae)
*Ajuga**	h	uncultivated land
*Teucrium**	ph	freq. rocky ground
cf. *Ziziphora**	h	
Liliaceae		lily family, some with edible bulbs, ≥ 2 types (Figs. 6.2d–f)
Linaceae		flax family
cf. *Linum*	h	a small-seeded wild flax
Malvaceae		mallow family (Fig. 6.1e)
cf. *Malva*	h	disturbed ground
Papaveraceae		poppy family
Fumaria	ah	
Glaucium	h	

APPENDIX 6.2 (CONT'D)

SWEYHAT WILD AND WEEDY TYPES

Taxon	Life form†	Comments+
Plantaginaceae		plantain family
cf. *Plantago*	h	
Poaceae	h	grass family (Gramineae), usu. good forage, ≥10 indeterminate types (Figs. 6.4b-d; 6.5a-d; 6.6a-g; 6.7c-e)
Aegilops	h	
Avena	h	oat, probably wild
Bromus sterilis-type*	h	prob. weedy
Eremopyrum	ah	steppe, uncultiv. land
SW.Hordeum-1	h	wild barley, a small-seeded type (Fig. 6.3a,b)
Hordeum cf. *spontaneum**	h	wild barley, a large-seeded type
Phalaris	h	
Secale cf. *cereale*	h	rye, cultigen; here, prob. weed
cf. *Setaria*	h	disturbed ground
cf. *Taeniatherum*	ah	prob. steppe, slopes (Fig. 6.3c,d)
Trachynia distachya	ah	steppe or fields (Fig. 4a)
Polygonaceae		knotweed family
Polygonum	h	knotweed; freq. damp, disturbed ground
Rumex	h	dock; freq. damp, disturbed ground
Primulaceae		primrose family
Androsace	h	
Ranunculaceae		buttercup family
Adonis	h	
Ceratocephalus	ah	open places (Fig. 6.1b)
cf. *Ranunculus*	h	buttercup
Rubiaceae		
cf. *Crucianella**	h	(Fig. 6.1d)
Galium	h	usu. uncultivated land
Scrophulariaceae		
cf. *Verbascum*	h	(Fig. 6.1g)
Veronica persica-type	h	disturbed land
Solanaceae		nightshade family
cf. *Hyoscyamus*	h	henbane
Thymelaeaceae		
*Thymelaea**	h, s	prob. steppe, dry slopes
Valerianaceae		
Valerianella	ah	
V. cf. *coronata**	ah	open and disturbed land
Zygophyllaceae		
Peganum harmala	ph	wild rue; unpalatable to animals

† Life form: h = herbaceous, s = shrubby; p = perennial, a = annual
+ Misc. notes culled from *Flora of Iraq* (Townsend and Guest 1966–85), *Flora of Turkey* (Davis 1965-88), or personal observation; for additional information, see relevant plant discussions by van Zeist and Bakker-Heeres 1985(1988).
* Identification based primarily on illustrations in van Zeist and Bakker-Heeres 1982(1985), 1984(1986), 1985(1988); comparative material not available.

APPENDIX 6.3

PLANT REMAINS FROM OPERATION 1

Operation	1	1	1	1	1	1	1	1	1
Locus	1	1	1	1	3	3	5	9	9
Lot	9	26	26	30	1	1	3	2	2
SW #	615	1301	1049	1316	626	627	1001	1560	1565
soil vol (l)	10	8	8	8	8	8	8	8	8
flot. vol (cc)	2.5	5	5	15	10	10	16	25	25
charcoal (>2 mm; g)	0.05	0.01	0.08	0.65	0.17	0.05	1.10	0.53	0.61
seed (>2 mm; g)	0.09	0.10	0.04	0.41	0.06	0.14	0.25	0.55	0.97
misc (>2 mm; g)	.	.	.	+	0.01	+	0.01	0.02	0.56
density (g/l)	0.01	0.01	0.02	0.13	0.03	0.02	0.17	0.14	0.27
seed/charcoal (g/g)	1.80	10.00	0.50	0.63	0.35	2.80	0.23	1.04	1.59
wild & weedy, charred (#)	35	30	41	315	40	37	328	689	1523
w&w/charcoal (#/g)	700	3000	513	485	235	740	298	1300	2497
w&w/cereal (#/g)	1167	200	1025	606	364	308	1312	1094	1904
w&w, uncharred	61	88	106	91	66	45	14	0	195
w&w, % charred	36	25	28	78	38	45	96	100	89
CULTIGENS									
Hordeum	3	9	5	47	7	8	26	49	78
Triticum aestivum/ durum	.	.	.	.	1	6	.	2	6
Triticum dicoccum	.	.	.	.	.	.	.	.	1
Triticum monococcum	.	.	.	.	.	.	.	.	.
Triticum sp.	.	1	.	.	.	.	1	.	.
Cereal indet.	1	10	1	28	7	4	13	33	17
Lathyrus	.	.	.	.	.	1	.	.	.
Lens culinaris	.	+	.	.	.	.	.	1	.
Lens/Pisum	.	.	.	.	.	+	.	.	.
Pisum/Vicia	.	+	.	.	.	.	.	.	.
cf. Pisum	.	.	.	.	.	.	.	.	.
large legumes	.	.	.	.	.	.	.	.	+
Vitis	.	.	.	.	.	.	.	.	.
Ficus	.	.	.	.	.	.	.	.	.
WILD AND WEEDY									
Aizoon	.	.	.	.	.	.	.	.	.
Bupleurum	.	.	.	.	.	.	1	.	.
Torilis-type	.	.	.	.	.	.	.	.	.
Apiaceae	.	.	.	.	1	.	.	.	.
cf. Artemisia	.	.	.	.	.	1	.	1	.
Centaurea	.	.	.	1	.	.	.	.	1
SW.Asteraceae-1	.	.	.	.	.	.	2	.	.
SW.Asteraceae-3	.	.	.	2	.	.	.	33	60
Heliotropium	.	.	.	5	.	.	3	1	1
cf. Alyssum	.	.	.	.	.	.	.	.	1
Lepidium	.	.	.	.	.	.	.	.	.
Brassicaceae indet.	.	.	.	.	.	.	1	.	2
Gypsophila	.	.	2	.	.	1	.	6	.
Silene	.	1	1	7	.	3	8	9	22
Caryophyllaceae indet.	.	.	.	1	.	.	.	1	1
cf. Atriplex	.	1	.	.	.	.	.	.	.

APPENDIX 6.3 (CONT'D)

PLANT REMAINS FROM OPERATION 1

Operation	1	1	1	1	1	1	1	1	1
Locus	1	1	1	1	3	3	5	9	9
Lot	9	26	26	30	1	1	3	2	2
SW #	615	1301	1049	1316	626	627	1001	1560	1565
cf. Salsola	.	.	.	2	.	.	.	1	.
Helianthemum	.	.	.	.	.	.	.	2	1
Cyperaceae	.	.	.	.	.	.	.	1	.
cf. Alhagi	.	.	.	.	.	.	.	.	.
Astragalus	3	3	3	73	4	2	44	46	204
cf. Hippocrepis	.	.	.	.	.	.	.	.	.
Medicago	.	.	.	.	.	1	.	.	35
Medicago radiata	.	.	.	.	.	.	.	.	2
cf. Onobrychis?	.	.	.	.	.	.	.	.	.
Prosopis (estimate)	1	.	.	.	.	.	2	.	2
Trifolium/Melilotus	.	4	.	10	10	12	36	11	15
Trigonella	13	.	3	50	12	2	29	165	277
Trigonella astroites-type	.	1	3	45	1	2	22	148	332
Fabaceae indet.	10	2	18	79	4	3	132	203	466
Hypericum	.	.	.	.	.	.	.	.	.
Ajuga	.	.	.	.	.	.	.	.	.
Teucrium	.	.	.	.	3	.	1	2	1
Lamiaceae	.	.	.	.	.	.	.	1	.
SW.Liliaceae-1	.	.	.	.	.	.	.	.	.
SW.Liliaceae-2	.	2	.	.	.	.	.	.	.
SW.Liliaceae-3	.	3	.	.	1	.	.	.	.
SW.Liliaceae-4	.	.	.	.	.	.	.	.	.
SW.Liliaceae-5	.	.	.	.	.	.	.	.	.
cf. Linum	.	.	.	2	.	.	.	.	.
cf. Malva	.	.	.	2	.	1	.	8	2
Malvaceae indet.	.	.	.	.	.	.	9	.	2
Fumaria	.	.	.	.	.	.	.	.	.
Glaucium	.	.	.	2	.	.	.	1	4
cf. Plantago	.	.	.	.	.	.	.	1	.
Aegilops	1	.	1	1	.	1	1	.	5
Avena	.	.	.	.	.	.	.	.	.
Bromus sterilis-type	.	3	.	.	.	.	.	.	.
Eremopyron	1	7	1	9	1	1	21	9	54
SW.Hordeum-1	.	.	1	.	.	.	.	.	.
Hordeum cf. spontaneum	.	.	.	.	1	.	.	.	.
Hordeum	.	.	.	.	.	.	.	.	1
Phalaris	1	.	3	.	.	.	.	.	.
Secale cf. cereale	.	.	.	.	.	.	.	.	.
cf. Setaria	.	.	.	.	.	.	.	.	.
Trachynia distachya	.	.	.	2	.	.	3	10	1
SW.Poaceae-2	.	.	.	.	.	.	.	.	.
SW.Poaceae-3	.	.	.	.	.	.	.	.	.
SW.Poaceae-4	.	.	.	.	.	.	.	.	.
SW.Poaceae-5	.	.	.	.	.	.	.	.	.
SW.Poaceae-6	.	.	.	.	.	.	.	.	.
SW.Poaceae-7	.	.	.	.	.	.	.	.	.
SW.Poaceae-10	.	.	.	.	.	.	.	.	.
SW.Poaceae-11	.	.	.	.	.	.	.	.	.
SW.Poaceae-12	1	.	.	2	.	.	2	15	5
SW.Poaceae-15	.	.	.	.	.	.	.	1	.
SW.Poaceae-17	.	.	.	1	.	.	.	1	.

APPENDIX 6.3 (CONT'D)

PLANT REMAINS FROM OPERATION 1

Operation	1	1	1	1	1	1	1	1	1
Locus	1	1	1	1	3	3	5	9	9
Lot	9	26	26	30	1	1	3	2	2
SW #	615	1301	1049	1316	626	627	1001	1560	1565
SW.Poaceae-18	.	.	.	.	1	.	.	.	.
SW.Poaceae-19	1	.	.	.	.	.	1	1	.
SW.Poaceae-21	.	.	.	.	.	.	.	.	.
Poaceae indet.	2	2	2	11	.	2	4	3	3
Polygonum	1	.	.	.	.	.	.	.	.
Rumex	.	.	.	.	.	.	.	.	.
Androsace	.	.	.	1	.	.	.	.	2
Adonis	.	.	.	.	.	.	.	.	1
Ceratocephalus	.	.	.	.	.	.	.	.	.
cf. Crucianella	.	.	.	.	.	.	.	.	1
Galium	.	.	.	.	.	.	.	.	.
cf. Verbascum	.	.	.	.	.	.	.	.	.
Veronica persica-type	.	.	.	.	.	.	.	.	.
cf. Hyoscyamus	.	.	.	.	.	.	.	.	.
Thymelaea	.	.	.	2	.	.	1	.	7
Valerianella	.	.	.	1	.	.	1	1	2
cf. coronata	.	.	.	.	.	.	.	.	.
Peganum harmala	.	.	.	.	1	.	2	2	1
SW.unknown-7	.	.	.	.	.	.	.	.	.
SW.unknown-10	.	.	.	.	.	.	.	.	.
unknown misc.	.	1	3	4	.	5	2	5	9
PLANT PARTS									
Hordeum internode	.	.	.	37	3	5	31	.	28
H. 'spontaneum' int.	.	.	.	.	.	.	.	.	.
Triticum aestivum/									
durum int.	.	.	.	.	.	.	1	.	.
cf. Triticum int.	.	.	.	.	.	.	.	.	.
T. mono/dicoccum sf	.	.	1	.	.	.	1	.	.
SW.Asteraceae-3									
head with ca. 100 seeds	.	.	.	.	.	.	.	.	1
Asteraceae head	.	.	.	.	.	.	.	.	.
Brassicaceae silique frg.	.	.	.	.	.	.	.	.	.
cf. Alhagi pod frgs.	.	.	.	.	.	.	.	.	.
Onobrychis pod frg.	.	.	.	.	.	.	.	.	1
grass culm nodes	.	.	.	6	1	.	11	.	73
Aegilops glume base	.	.	.	.	.	.	1	.	.
Aegilops glumes	.	.	.	.	.	.	.	.	.
Ranunculus									
pericarp frgs.?	.	.	.	.	.	.	.	.	.
SW.unknown-12	.	.	.	.	.	.	.	.	.
UNCHARRED SEEDS									
Arnebia decumbens	22	4	5	.	4	1	1	.	10
A. linearifolia	.	.	.	.	.	6	.	.	.
Arnebia/Lithospermum	36	84	96	37	61	34	3	.	148
Heliotropium	1	.	.	.	.	.	.	.	.
Lithospermum tenuiflorum	2	.	5	54	1	4	7	.	35
Lithospermum sp.	.	.	.	.	.	.	3	.	2
Glaucium (white)	.	.	.	.	.	.	.	.	.

APPENDIX 6.3 (CONT'D)

PLANT REMAINS FROM OPERATION 1

Operation	1	1	1	1	1	1	1	1	1
Locus	9	13	15	15	15	16	16	27	27
Lot	14	2	1	6	22	8	9	3	2
SW #	2351	2026	2157	2372	93.0478	2260	2261	93.0748	93.0904
soil vol (l)	8	10	1.75	8	1.25	10	0.5	10	10
flot. vol (cc)	30	50	20	100	25	5	<5	30	25
charcoal (>2 mm; g)	0.03	3.96	1.68	11.78	1.62	0.08	0.06	0.73	0.40
seed (>2 mm; g)	0.01	1.05	0.32	2.24	0.55	0.02	0.01	0.71	0.12
misc (>2 mm; g)	.	0.07	0.02	0.28	.	0.04	.	0.28	0.01
density (g/l)	0.01	0.51	1.15	1.79	1.74	0.01	0.14	0.17	0.05
seed/charcoal (g/g)	0.33	0.27	0.19	0.19	0.34	0.25	0.17	0.97	0.30
wild & weedy, charred (#)	13553	1093	995	4478	47	50	6	275	19
w&w/charcoal (#/g)	451767	276	592	380	29	625	100	377	48
w&w/cereal (#/g)	71332	950	3827	1882	392	833	n/c	372	56
w&w, uncharred	176	165	38	149	2	14	0	23	75
w&w, % charred	99	87	96	97	96	78	100	92	20
CULTIGENS									
Hordeum	14	124	19	200	7	5	1	26	13
Triticum aestivum/ durum	.	1	3	5	.	.	.	.	.
Triticum dicoccum	.	.	.	2	.	.	.	.	.
Triticum monococcum	.	.	.	1	.	.	.	.	.
Triticum sp.	.	.	.	.	.	.	.	.	.
Cereal indet.	18	34	13	120	10	3	.	76	35
Lathyrus	.	.	1	.	.	.	.	.	.
Lens culinaris	.	1	.	.	.	.	.	.	2
Lens/Pisum	.	.	.	.	.	.	.	.	2
Pisum/Vicia	.	.	.	.	.	.	.	.	.
cf. Pisum	.	1	1	.	79	.	.	37	.
large legumes	.	+	.	.	.	.	.	5	.
Vitis	.	.	.	.	.	.	.	+	.
Ficus	.	.	.	.	1	.	.	.	.
WILD AND WEEDY									
Aizoon	3	.	.	.	.	.	.	.	.
Bupleurum	4	.	.	2	.	.	.	.	.
Torilis-type	1	.	.	.	.	.	.	.	.
Apiaceae	1	.	2	.	1	.	.	.	1
cf. Artemisia	.	.	.	1	.	.	.	.	.
Centaurea	24	.	.	8	.	.	.	.	.
SW.Asteraceae-1	.	.	.	2	.	.	.	.	.
SW.Asteraceae-3	11	.	3	5	.	.	.	.	.
Heliotropium	2	2	1	5	.	.	.	.	.
cf. Alyssum	.	.	.	.	1	.	1	.	.
Lepidium	1	.	.	.	.	.	.	.	.
Brassicaceae indet.	3	.	5	6	.	.	.	1	.
Gypsophila	6	.	2	3	.	.	.	2	.
Silene	19	26	1	37	.	2	1	4	.
Caryophyllaceae indet.	2	.	.	.	.	.	.	.	.
cf. Atriplex	.	.	1	.	.	.	.	.	.

APPENDIX 6.3 (CONT'D)

PLANT REMAINS FROM OPERATION 1

Operation	1	1	1	1	1	1	1	1	1
Locus	9	13	15	15	15	16	16	27	27
Lot	14	2	1	6	22	8	9	3	2
SW #	2351	2026	2157	2372	93.0478	2260	2261	93.0748	93.0904
cf. Salsola	3	.	.	1	.	.	.	1	.
Helianthemum	271	7	18	64	.	.	.	.	.
Cyperaceae	1	.	.	1	.	.	.	.	.
cf. Alhagi	22	1	4	1	.	.	.	.	.
Astragalus	836	88	40	545	.	2	.	10	.
cf. Hippocrepis	.	.	.	5	.	.	.	.	.
Medicago	.	.	.	4	.	.	.	5	.
Medicago radiata	2	.	1	.	.	.	.	.	.
cf. Onobrychis?	.	.	.	1	.	.	.	.	.
Prosopis (estimate)	1	.	.	10	.	.	.	1	.
Trifolium/Melilotus	94	60	18	55	.	6	.	.	.
Trigonella	10752	439	407	1734	.	9	1	1	.
Trigonella astroites-type	.	233	286	726	.	3	.	.	.
Fabaceae misc.	1089	72	108	774	.	11	.	12	1
Hypericum	.	.	.	.	.	.	.	.	2
Ajuga	.	1	.	.	.	.	.	1	.
Teucrium	5	.	.	4	.	.	.	.	.
Lamiaceae	.	.	.	.	.	.	.	.	.
SW.Liliaceae-1	.	.	.	.	.	.	.	2	.
SW.Liliaceae-2	.	.	.	.	.	.	.	.	.
SW.Liliaceae-3	3	.	.	6	4	.	.	3	3
SW.Liliaceae-4	.	.	.	.	.	.	.	2	.
SW.Liliaceae-5	2	.	.	.	.	.	.	.	.
cf. Linum	.	.	.	.	.	.	.	.	.
cf. Malva	.	.	8	17	2	.	.	2	.
Malvaceae indet.	18	3	1	6	.	.	.	.	.
Fumaria	.	.	.	.	26	1	.	.	2
Glaucium	2	.	.	7	.	.	.	.	.
cf. Plantago	.	.	.	.	.	.	.	.	.
Aegilops	5	7	6	12	.	1	1	37	1
Avena	.	.	1	1	.	.	.	.	.
Bromus sterilis-type	.	.	1	1	.	.	.	1	.
Eremopyron	77	53	28	42	.	8	.	110	5
SW.Hordeum-1	2	.	.	3	1	.	.	.	.
Hordeum cf. spontaneum	.	1	.	2	.	.	.	.	.
Hordeum	.	.	.	.	.	1	.	.	.
Phalaris	.	.	1	1	.	.	.	.	.
Secale cf. cereale	.	.	2	.	.	.	.	.	.
cf. Setaria	.	.	.	1	.	.	.	.	.
Trachynia distachya	4	.	.	4	.	.	.	1	.
SW.Poaceae-2	3	3	.	.	.	.	.	5	.
SW.Poaceae-3	.	2	.	4	.	.	.	.	.
SW.Poaceae-4	.	2	.	.	.	.	.	.	.
SW.Poaceae-5	.	2	.	.	.	.	.	.	.
SW.Poaceae-6	.	4	.	.	.	.	.	.	.
SW.Poaceae-7	.	1	.	.	.	.	.	.	.
SW.Poaceae-10	.	10	.	3	.	.	.	.	.
SW.Poaceae-11	18	1	2	3	.	.	.	9	.
SW.Poaceae-12	3	5	.	9	.	.	.	.	.
SW.Poaceae-15	.	.	.	.	.	.	.	.	.
SW.Poaceae-17	21	.	1	.	.	.	.	.	.
SW.Poaceae-18	.	.	.	3	.	.	.	.	.

APPENDIX 6.3 (CONT'D)

PLANT REMAINS FROM OPERATION 1

Operation	1	1	1	1	1	1	1	1	1
Locus	9	13	15	15	15	16	16	27	27
Lot	14	2	1	6	22	8	9	3	2
SW #	2351	2026	2157	2372	93.0478	2260	2261	93.0748	93.0904
SW.Poaceae-19	9	.	1	9	.	1	.	3	.
SW.Poaceae-21	.	.	.	.	.	.	.	1	.
Poaceae misc.	44	17	17	34	2	2	2	32	3
Polygonum	.	.	.	.	.	.	.	.	.
Rumex	.	.	.	1	.	.	.	.	.
Androsace	50	4	7	13	.	.	.	2	.
Adonis	1	.	.	8	9	1	.	.	.
Ceratocephalus	4	1	.	4	.	.	.	.	.
cf. Crucianella	2	1	.	4	.	1	.	1	.
Galium	.	1	.	.	.	.	.	.	.
cf. Verbascum	2	.	.	.	.	.	.	.	.
Veronica persica-type	2	.	.	.	.	.	.	.	.
cf. Hyoscyamus	.	.	.	.	.	.	.	1	.
Thymelaea	4	2	1	3	.	.	.	.	.
Valerianella	.	2	.	1	.	.	.	.	.
Valerianella cf. coronata	.	.	.	.	.	1	.	.	.
Peganum harmala	94	2	19	19	.	.	.	1	.
SW.unknown-7	.	.	.	.	.	.	.	2	.
SW.unknown-10	.	.	.	.	.	.	.	2	.
unknown misc.	30	34	2	263	1	.	.	22	1
PLANT PARTS									
Hordeum internode	203	123	21	164	1	16	.	16	.
H. 'spontaneum' int.	.	.	.	2	.	.	.	.	.
Triticum aestivum/ durum int.	.	.	.	.	.	.	.	.	.
cf. Triticum int.	.	1	.	.	.	.	.	.	.
T. mono/dicoccum sf	3	1	.	10	.	1	.	.	.
SW.Asteraceae-3 head with seeds	.	.	.	.	.	.	.	.	.
Asteraceae head	.	.	.	.	.	.	.	1	.
Brassicaceae silique frg.	.	.	3	.	.	.	.	.	.
cf. Alhagi pod frgs	.	.	.	.	.	.	.	2	.
Onobrychis pericarp frg.	.	.	.	.	.	.	.	2	.
grass culm nodes	11	17	4	152	2	5	.	23	1
Aegilops glume base	2	11	2	8	.	.	.	33	5
Aegilops glumes	.	.	.	.	.	.	.	429	11
Ranunculus pericarp frgs.?	.	.	.	.	.	.	.	2	1
SW.unknown-12	.	5	.	.	.	.	.	.	.
UNCHARRED SEEDS									
Arnebia decumbens	.	29	.	10	.	1	.	.	.
A. linearifolia	.	2	.	1	.	.	.	.	1
Arnebia/Lithospermum	138	66	36	97	2	9	.	18	62
Heliotropium	.	.	.	.	.	.	.	.	.
Lithospermum tenuiflorum	37	16	2	33	.	4	.	5	12
Lithospermum sp.	.	52	.	7	.	.	.	.	.
Glaucium (white)	1	.	.	1	.	.	.	.	.

Abbreviations: w&w = wild and weedy types; n/c = not calculable; int. = internode; sf = spikelet fork; + = present in unmeasurable quantity

APPENDIX 6.4

PLANT REMAINS FROM OPERATIONS 4 AND 9

Operation	4	4	4	4	4	4	4	4	4	4
Locus	3	7	14	17	18	18	18	18	21	21
Lot	4	1	6	6	3	4	4	4	3	3
SW #	786	2515	1148	1147	1639	1624	1629	1625	2537	2538
soil vol (l)	8	1	8	8	10	8	8	8	10	10
flot. vol (cc)	<5	<1	<5	<5	<5	<5	<5	<5	<5	<5
charcoal (>2mm; g)	.	.	0.01	.	.	.	.	+	.	.
seed (>2mm; g)	0.02	.	+	0.01	+	0.02	.	+	+	0.01
misc (>2 mm; g)	+	+	.	+	+	+	.	+	+	.
density (g/l)	+	+	+	+	+	+	+	+	+	+
seed/charcoal (g/g)	n/c	n/c	n/c	n/c	n/c	n/c	n/c	n/c	n/c	n/c
wild & weedy, charred (#)	72	.	1	2	.	11	.	3	2	2
w&w/charcoal (#/g)	n/c	n/c	100	n/c	n/c	n/c	n/c	n/c	n/c	n/c
w&w/cereal (#/g)	n/c	n/c	100	1	n/c	n/c	n/c	n/c	n/c	n/c
w&w, uncharred	6	1	3	4	5	9	12	10	37	19
w&w, % charred	92	0	25	33	0	55	0	23	5	10
CULTIGENS										
Hordeum	.	.	1	4	.	1	.	.	.	.
Cereal indet.	1	.	1	1	.	1	.	.	.	.
Lathyrus	1	.	.	.	.	.	.	.	.	.
Pisum/Vicia	.	.	.	.	.	1	.	.	.	.
cf. Pisum	.	.	.	.	.	.	.	.	.	.
large legumes	.	.	.	2	+	.	.	.	.	.
WILD AND WEEDY										
Gypsophila	1	.	.	.	.	.	.	.	.	.
Silene	2	.	.	.	.	.	.	.	.	.
cf. Euphorbia	.	.	.	.	.	.	.	.	.	1
Astragalus	.	.	.	1	.	.	.	1	.	.
Medicago	1	.	.	.	.	.	.	.	.	.
Trifolium/Melilotus	57	.	.	.	.	1	.	.	.	.
Trigonella	8	.	.	1	.	6	.	.	2	.
Trigonella astroites-type	.	.	.	.	.	.	.	.	.	.
SW.Liliaceae-3	1	.	.	.	.	.	.	.	.	.
Aegilops	.	.	.	.	.	.	.	.	.	.
Eremopyron	.	.	1	.	.	.	.	1	.	.
SW.Poaceae-12	.	.	.	.	.	2	.	.	.	.
SW.Poaceae-17	.	.	.	.	.	.	.	.	.	.
Poaceae misc.	.	.	.	.	.	1	.	1	.	.
Adonis	1	.	.	.	.	.	.	.	.	.
Thymelaea	.	.	.	.	.	.	.	.	.	1
unknown misc.	1	.	.	.	.	1	.	.	.	.
PLANT PARTS										
Triticum monococcum/ dicoccum sf	1	1	.	.	.	.	.	.	.	.
Vitis peduncle	.	.	.	.	.	.	.	.	1	.
UNCHARRED SEEDS										
cf. Apiaceae	.	.	2	.	.	.	.	.	.	.
Arnebia decumbens	4	.	.	.	.	2	4	.	4	3

APPENDIX 6.4 (CONT'D)

PLANT REMAINS FROM OPERATIONS 4 AND 9

Operation	4	4	4	4	4	4	4	4	4	4
Locus	3	7	14	17	18	18	18	18	21	21
Lot	4	1	6	6	3	4	4	4	3	3
SW #	786	2515	1148	1147	1639	1624	1629	1625	2537	2538
A. linearifolia	.	.	.	1	.	1	.	1	.	.
Arnebia/Lithospermum	1	.	.	.	.	2	1	4	8	3
Heliotropium	.	.	.	1	.	.	.	.	7	2
Lithospermum sp.	.	.	.	.	.	.	1	.	.	.
L. tenuiflorum	1	1	.	1	5	4	6	5	17	6
Boraginaceae	.	.	.	.	.	.	.	.	.	.
cf. Brassica	.	.	.	.	.	.	.	.	.	.
Brassicaceae indet.	.	.	.	.	.	.	.	.	.	.
Gypsophila	.	.	.	.	.	.	.	.	.	2
Silene	.	.	1	1	.	.	.	.	.	2
cf. Ochthodium	.	.	.	.	.	.	.	.	.	.
Euphorbia	.	.	.	.	.	.	.	.	1	1

Operation	4	4	4	4	4	4	9	9	9	9
Locus	22	23	31	36	36	36	4	4	4	5
Lot	5	2	3	2	2	5	1	2	2	3
SW #	2460	1645	1847	2541	2542	2547	988	2143	2144	2116
soil vol (l)	10	8	10	8	4	10	4	10	2	10
flot. vol (cc)	<5	5	<5	5	<5	5	<5	<5	<5	5
charcoal (>2mm;g)	.	.	.	.	.	.	.	.	.	+
seed (>2mm;g)	.	0.02	0.03	0.01	.	.	.	+	0.02	+
misc (>2;g)	.	.	0.06	+	0.02	.	.	.	0.04	+
density (g/l)	0.00	+	0.01	+	+	0.00	0.00	+	0.03	+
seed/charcoal (g/g)	n/c	n/c	n/c	n/c	n/c	n/c	n/c	n/c	n/c	n/c
wild & weedy, charred (#)	1	5	181	.	1	.	3	.	.	2
w&w/charcoal (#/g)	n/c	n/c	n/c	n/c	n/c	n/c	n/c	n/c	n/c	n/c
w&w/cereal (#/g)	n/c	n/c	n/c	0	n/c	n/c	n/c	n/c	n/c	67
w&w, uncharred	42	50	36	19	7	10	29	10	8	35
w&w, % charred	2	9	83	0	13	0	9	0	0	5
CULTIGENS										
Hordeum)	.	.	.	.	.	.	.	.	.	1
Cereal indet.	.	13	.	3	.	.	.	.	.	3
Lathyrus	.	.	.	.	.	.	.	.	.	.
Pisum/Vicia	.	.	5	1	.	.	.	.	.	+
cf. Pisum	.	.	.	.	.	.	.	.	.	.
large legumes	.	.	.	.	.	.	.	.	.	.
WILD AND WEEDY										
Gypsophila	.	.	.	.	.	.	.	.	.	.
Silene	.	.	4	.	.	.	1	.	.	.
cf. Euphorbia	.	.	.	.	.	.	.	.	.	.
Astragalus	.	.	.	.	.	.	.	.	.	.
Medicago	.	.	.	.	.	.	.	.	.	.
Trifolium/Melilotus	1	.	.	.	.	.	.	.	.	.

APPENDIX 6.4 (CONT'D)

PLANT REMAINS FROM OPERATIONS 4 AND 9

Operation	4	4	4	4	4	4	9	9	9	9
Locus	22	23	31	36	36	36	4	4	4	5
Lot	5	2	3	2	2	5	1	2	2	3
SW #	2460	1645	1847	2541	2542	2547	988	2143	2144	2116
Trigonella	.	2	145	.	.	.	1	.	.	.
Trigonella astroites-type	.	.	30	.	.	.	.	.	.	.
SW.Liliaceae-3	.	.	.	.	.	.	.	.	.	.
Aegilops	.	1	.	.	.	.	.	.	.	1
Eremopyron	.	.	.	.	.	.	.	.	.	.
SW.Poaceae-12	.	.	.	.	.	.	.	.	.	.
SW.Poaceae-17	.	.	1	.	.	.	.	.	.	.
Poaceae misc.	.	1	1	.	.	.	.	.	.	.
Adonis	.	.	.	.	.	.	1	.	.	.
Thymelaea	.	.	.	.	.	.	.	.	.	1
unknown misc.	.	1	.	.	1	.	.	.	.	.
PLANT PARTS										
Triticum monococcum/ dicoccum sf	.	.	.	.	.	.	.	.	.	.
Vitis peduncle	.	.	.	.	.	.	.	.	.	.
UNCHARRED SEEDS										
cf. Apiaceae	.	.	.	.	.	.	.	.	.	.
Arnebia decumbens	6	.	1	2	.	3	3	.	.	9
A. linearifolia	.	.	2	.	.	1	.	.	2	2
Arnebia/Lithospermum	11	42	21	1	.	.	19	5	.	3
Heliotropium	1	.	.	.	.	.	.	.	.	2
Lithospermum sp.	.	.	.	.	.	.	.	.	.	.
L. tenuiflorum	24	8	12	16	6	5	7	5	6	15
Boraginaceae	.	.	.	.	.	.	.	.	.	1
cf. Brassica	.	.	.	.	.	.	.	.	.	1
Brassicaceae indet.	.	.	.	.	.	.	.	.	.	1
Gypsophila	.	.	.	.	.	1	.	.	.	.
Silene	.	.	.	.	.	.	.	.	.	.
cf. Ochthodium	.	.	.	.	.	.	.	.	.	1
Euphorbia	.	.	.	.	1	.	.	.	.	.

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w&w = wild and weedy; n/c = not calculable; sf = spikelet fork; + = present in unmeasurable quantity

APPENDIX 6.5

PLANT REMAINS FROM HAJJI IBRAHIM

Operation	1/2	1/2
Locus	11	12
Lot	7	2
SW #	93.1688	93.1680
soil vol (l)	10	10
flot. vol (cc)	50	ca. 12
charcoal (>2mm; g)	0.26	0.06
seed (>2mm; g)	1.70	0.31
misc (>2mm; g)	0.35	0.06
density (g/l)	0.23	0.04
seed/charcoal (g/g)	6.54	5.17
wild & weedy, charred (#)	3424	314
w&w/charcoal (#/g)	13169	5233
w&w/cereal (#/g)	1600	551
w&w, uncharred (#)	692	15
w&w, % charred	83	95
CULTIGEN		
Hordeum	249	28
Triticum sp.	1	.
Cereal indet.	76	50
Lathyrus	1	.
Lens culinaris	1	.
Pisum/Vicia	.	1
WILD AND WEEDY		
Aizoon	1	.
Carthamus cf. tinctorius†	1	.
Centaurea	5	1
SW.Asteraceae-1	.	3
SW.Asteraceae-3	82	6
Heliotropium	6	1
cf. Alyssum	102	3
Neslia	1	3
Brassicaceae indet.	5	.
Gypsophila	2	1
Silene	.	1
Atriplex	22	.
Euphorbia	.	1
Astragalus	16	4
Trifolium/Melilotus	4	3
Trigonella	12	10
Fabaceae indet.	7	.
cf. Ziziphora	1	1
SW.Liliaceae-3	10	.
SW.Liliaceae-5	1	.
Liliaceae indet.	.	1
Malva	144	17
SW.Malvaceae-1	13	2
Aegilops	22	6

Operation	1/2	1/2
Locus	11	12
Lot	7	2
SW #	93.1688	93.1680
Avena	4	.
Bromus sterilis-type	15	.
Eremopyron	1664	93
SW.Hordeum-1	49	.
cf. Taeniatherum	26	.
Trachynia distachya	56	2
SW.Poaceae-1	.	12
SW.Poaceae-2	48	.
SW.Poaceae-10	35	.
SW.Poaceae-11	.	3
SW.Poaceae-12	1	5
SW.Poaceae-13	.	1
SW.Poaceae-15	18	.
SW.Poaceae-16	1	.
SW.Poaceae-19	10	1
Poaceae misc.	979	115
Adonis	1	.
Ceratocephalus	12	3
Crucianella	2	.
cf. Verbascum	24	1
Valerianella	1	.
Peganum harmala	14	.
unknown misc	7	11
PLANT PARTS		
Hordeum internode	.	25
Triticum mono/dicoccum sf	.	8
Straw culm node	many	9
Brassicaceae, silique frg.	.	3
Atriplex, whole fruit	*15	.
Malva pericarp fragments	several	.
Aegilops glume base	.	4
grass internode, indet.	23	.
SW.unknown-12	.	3
unknown	21	.
UNCHARRED SEEDS		
Arnebia decumbens	.	3
A. linearifolia	.	1
Arnebia/Lithospermum	692	.
Lithospermum cf. arvense	.	8
L. tenuiflorum	.	3
Adonis	.	+

† Carthamus cf. tinctorius could be cultivated
* seeds in Atriplex fruit included in seed total
+ present in unmeasurable quantity

APPENDIX 6.6A–C

6.6A. BARLEY MEASUREMENTS FROM SW 2372

N=32	L (mm)	B (mm)	T (mm)	L/B	T/B
minimum	3.8	1.7	1.3	1.68	0.61
mean	5.3	2.6	2.0	2.09	0.77
maximum	6.1	3.2	2.5	2.45	0.96

6.6B. BARLEY MEASUREMENTS FROM HAJJI IBRAHIM, SW 93.1688

N=23	L (mm)	B (mm)	T (mm)	L/B	T/B
minimum	4.2	1.8	1.1	1.71	0.62
mean	5.5	2.5	1.9	2.22	0.75
maximum	6.7	3.5	2.8	2.80	0.89

6.6C. PEA MEASUREMENTS FROM SW 2372

N=22	D	T	D/T
minimum	2.2	1.9	0.96
mean	2.8	2.4	1.15
maximum	3.4	3.3	1.30

APPENDIX 6.7A, B

6.7A. SWEYHAT CHARCOAL FROM OPERATION 1 (COUNT)

Locus	1	3	5	13	15	15	15	27	
Lot	30	1	3	2	1	6	22	3	
SW #	1316	0626	1001	2026	2157	2372	93.0478	93.0748	Total
Populus/Salix	1	1	2	4	2	.	1	1	12
Tamarix	.	.	.	2	.	4	1	.	7
cf. Tamarix	.	.	2	.	1	.	.	.	3
Quercus	.	.	.	.	.	.	4	.	4
Chenopodiaceae	.	.	.	.	.	1	.	1	2
Fraxinus	1	.	.	.	.	.	.	.	1
cf. Fraxinus	.	.	.	.	.	1	.	.	1
cf. Monocot	.	.	.	.	.	.	.	+	+
unknown	.	.	.	.	1	2	.	1	4

6.7B. SWEYHAT CHARCOAL FROM OPERATION 1 (WEIGHT, G)

Locus	1	3	5	13	15	15	15	27	
Lot	31	1	3	2	1	6	22	3	
SW #	1316	0626	1001	2026	2157	2372	93.0478	93.0748	Total
Populus/Salix	0.01	0.08	0.03	0.22	0.10	.	0.01	0.04	0.49
Tamarix	.	.	.	0.39	.	0.83	0.01	.	1.23
cf. Tamarix	.	.	0.11	.	0.05	.	.	.	0.16
Quercus	.	.	.	.	.	.	0.17	.	0.17
Chenopodiaceae	.	.	.	.	.	0.22	.	0.02	0.24
Fraxinus	0.01	.	.	.	.	.	.	.	0.01
cf. Fraxinus	.	.	.	.	.	0.07	.	.	0.07
cf. Monocot	.	.	.	.	.	.	.	0.03	0.03
unknown	.	.	.	.	0.04	0.88	.	0.03	0.95

APPENDIX 6.8

WEIGHT OF CEREAL GRAINS (G)

Op.	Locus	Lot	SW #	Hordeum	Triticum aestivum/durum	T. dicoccum	T. monococcum	Triticum sp.	Cereal indet.
Sweyhat									
1	1	9	615	0.02	.	.	.	.	0.01
1	1	26	1301	0.07	.	.	.	0.01	0.07
1	1	26	1049	0.03	.	.	.	.	0.01
1	1	30	1316	0.32	.	.	.	.	0.20
1	3	1	626	0.05	0.01	.	.	.	0.05
1	3	1	627	0.07	0.02	.	.	.	0.03
1	5	3	1001	0.16	.	.	.	+	0.09
1	9	2	1560	0.37	0.02	.	.	.	0.24
1	9	2	1565	0.64	0.04	+	.	.	0.12
1	9	14	2351	0.06	.	.	.	.	0.13
1	13	2	2026	0.90	0.01	.	.	.	0.24
1	15	1	2157	0.15	0.02	.	.	.	0.09
1	15	6	2372	1.44	0.03	0.03	0.01	.	0.87
1	15	22	93.0478	0.05	.	.	.	.	0.07
1	16	8	2260	0.04	.	.	.	.	0.02
1	16	9	2231	+	.	.	.	.	.
1	27	3	93.0748	0.19	.	.	.	.	0.55
1	27	2	93.0904	1.09	.	.	.	.	0.25
4	3	4	786	.	.	.	.	.	+
4	7	1	2515	.	.	.	.	.	.
4	14	6	1148	+	.	.	.	.	0.01
4	17	6	1147	0.04	.	.	.	.	+
4	18	3	1639	.	.	.	.	.	.
4	18	4	1624	+	.	.	.	.	+
4	18	4	1629	.	.	.	.	.	.
4	18	4	1625	.	.	.	.	.	.
4	21	3	2537	.	.	.	.	.	.
4	21	3	2538	.	.	.	.	.	.
4	22	5	2460	.	.	.	.	.	.
4	23	2	1645	.	.	.	.	.	0.09
4	31	3	1847	.	.	.	.	.	.
4	36	2	2541	.	.	.	.	.	0.02
4	36	2	2542	.	.	.	.	.	.
4	36	5	2547	.	.	.	.	.	.
9	4	1	988	.	.	.	.	.	.
9	4	2	2143	.	.	.	.	.	.
9	4	2	2144	.	.	.	.	.	.
9	5	3	2116	0.01	.	.	.	.	0.02
Hajji Ibrahim									
1/2	11	7	93.1688	1.59	.	.	.	+	0.55
1/2	12	2	93.1680	0.21	.	.	.	.	0.36

APPENDIX 6.9

SWEYHAT LABORATORY PROCEDURES

1. Fill in SW data sheet provenience information (see next page)

2. If sample is larger than about 1 film cannister full, weigh entire sample and record volume (cc). Use sample splitter to obtain about one film cannister of material, and weigh the material to be sorted and record volume (cc). (For each halving, put in separate containers so that it will be possible later to do additional fractions of approximately equal size).

3. For portion to be identified, sift into 4.75 mm, 2 mm, 1 mm, and 0.5 mm sieves.

4. Totally sort charred material larger than 2 mm into wood, seed and seed fragments, straw and stem fragments. Also separate other materials, like bone/shell.
   a. weigh charcoal and record
   b. weigh seeds and seed fragments as a group and record
   c. weigh rachis, straw, and other charred fragments as a group and record
   d. put bone/shell, unidentified carbonized material in separate containers with labels (SW # and substance; for bone and shell put full provenience)
   e. identify the large seeds; record (see below).

5. For the material between 1 and 2 mm, separate whole seeds, identifiable seed fragments (mainly cereal), and rachis internodes; record.

6. For material between 0.5 and 1 mm remove only whole seeds and rachis internodes, and record. Scan the material smaller than 0.5 mm (which usually has very little identifiable material), and extract whole seeds and identifiable rachis internodes, and record.

Recording:

1. Taxa that are frequently found in identifiable fragments include many economically important ones such as cereals (wheat, barley, indeterminate cereal), pulses (grass pea, bitter vetch, lentil et al.), grape, nutshell, etc. They should be recorded by count and weight (of whole ones and of fragments) for material larger than 2 mm and between 1 and 2 mm.

2. For wild and weedy seeds smaller than 2 mm, only counts are necessary. Many taxa may be identified by some unique anatomical feature; a "minimum number of individuals" based on fragmentary remains should be indicated (e.g., 3 whole seeds and 2 distinctive parts can be noted as "3 + 2 MNI").

3. Plant parts should be recorded separately (e.g., rachis internodes, straw, fruit skins, etc.).

4. Obviously modern seeds and not so obviously modern seeds should be recorded as such.

SWEYHAT FLOTATION 199

Tag no.	Op.	Locus	Lot	Other Prov.	Type	Date	Excavator's comment:

Vol.	Vol. (cc)	Charcoal,>2mm		Seed > 2mm		Misc>2		1>seed>2mm		Coll Dt	Flt Dt	sort	id	T
		Lt	Hv	Lt	Hv	Lt	Hv	Lt	Hv	/ /	/ /	/ /	/ /	

GRAIN / NUT	>2	<2	<1
ct			
wt whl			
wt frg			
ct			
wt whl			
wt frg			
ct			
wt whl			
wt frg			
ct			
wt whl			
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wt frg			
ct			
wt whl			
wt frg			
ct			
wt whl			
wt frg			

SEEDS (charred)	>2	<2	<1

MISC. PLANT PARTS	>2	<2	<1

HEAVY FRACTION CHECK LIST

_____ Bone _____ Botanical
_____ Shell
_____ Metal
_____ Ceramic
_____ Other:

LIGHT FRACTION MISC.

	removed	tossed
_____ Snail shell	_____	_____
_____ Bone		
_____ Other		
_____ Rootlets	_____	_____

SEEDS (uncharred, modern?)	>2	<2	<1

GRAIN etc.

NUTSHELL & GRAPE

LEGUME etc.

COMMENTS

7

FARMING AND HERDING ALONG THE EUPHRATES: ENVIRONMENTAL CONSTRAINT AND CULTURAL CHOICE (FOURTH TO SECOND MILLENNIA B.C.)

Naomi F. Miller

Determining the degree to which environmental conditions constrained agriculture and pastoral production in ancient times is no easy task. To approach this topic with archaeological materials, it helps to be able to compare sites from the same time period in different but adjacent environmental zones, or different time periods of one site. The present chapter examines some of these issues as they relate to the agropastoral economy at a few sites along a 200 km stretch of the Euphrates River in northwestern Syria and southeastern Turkey: Tell es-Sweyhat, Hacınebi Tepe, Kurban Höyük, and Hassek Höyük (Fig. 7.1). These sites date between the late fourth and early second millennia B.C., though the time periods are not equally represented. The longest archaeobotanical sequence comes from Kurban Höyük. The assemblages of plant remains from the other sites each represent a single time period: late fourth millennium for Hacınebi and Hassek, and late third/early second millennium for Sweyhat. The last of these is the only one that can be considered a city.

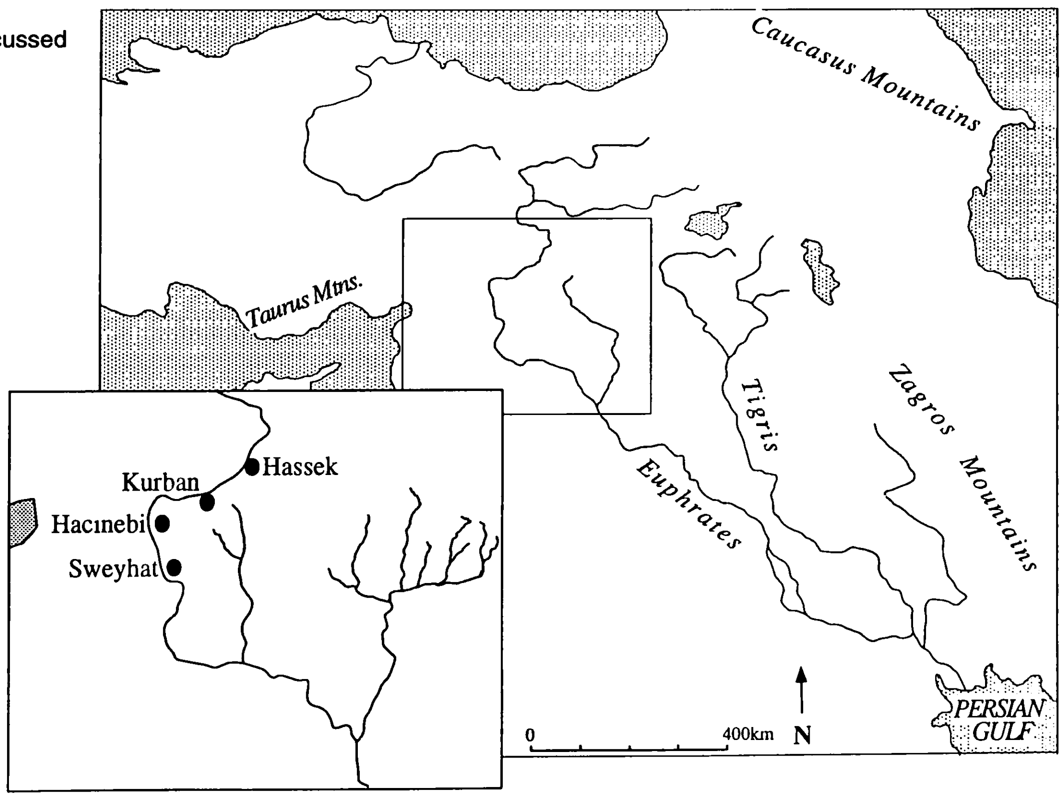


Fig. 7.1. Sites discussed in the text.

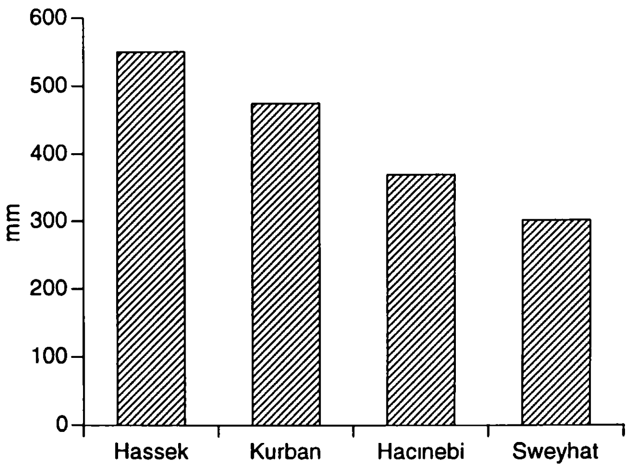


Fig. 7.2. Modern annual precipitation.

A key variable for life in the four Euphrates communities was precipitation, which increases from south to north (Fig. 7.2). Sweyhat is near the lower limit of where rainfall agriculture is possible, and in any given time period, it would have experienced the driest conditions. Precipitation is a major *non-cultural* limiting factor for vegetation, but people and their domesticated animals have a strong influence, too, through fuel-gathering and grazing.

With a higher moisture requirement, woody vegetation would be more densely distributed toward the north. The vegetation around Sweyhat would have been steppe, or steppe with a few trees, whereas oak woodland would have surrounded the sites in present-day Turkey. None of these sites is more than a few kilometers from the river, which would have supported the growth of willow, poplar, and tamarisk.

Climate fluctuations over the past 6000 years cannot be totally discounted as influences on natural vegetation and agricultural economies. Indeed, there is some evidence for a moister climate than today in the Negev and elsewhere in the Near East during the late fourth millennium (Goldberg and Rosen 1987). And some researchers claim there was a sudden and catastrophic drought toward the end of the third millennium in northern Syria, if not in the entire Near East (Weiss et al. 1993). Unfortunately, archaeobotanical evidence by itself is not that useful for identifying climate fluctuations, because the reasons people change agricultural strategies and patterns of plant use are too complex to be reduced to rainfall. For example, the rapid spread of agriculture out of the Levant during the Pre-Pottery Neolithic B period was a result of migration and/or cultural transmission rather than climate change in the source or receiving areas (Byrd 1992:53).

The data discussed here come from archaeobotanical remains excavated and analyzed between 1981 and 1994, during which time excavation and recovery strategies and my own laboratory procedures changed (Miller 1986, 1994a,b, 1996b; see also Chapter 6, this volume).[34] There are also inevitable gaps in the sequence sampled, which make it very difficult to do controlled comparisons between sites and time periods. Several explicit but arguable assumptions also require some discussion.

All of the botanical material discussed here is charred, and except for the Hassek remains, none of it comes from burnt structures. Rather, the archaeological contexts of the material include hearths, ash lenses, trashy deposits, and other cultural fill. The first assumption, therefore, is that the material comes primarily from fuel remains, either from wood or, in the case of seeds, from animal dung. A corollary is that the seeds of cultivated cereals as well as wild plants came from dung. Many archaeobotanists working in the Near East do not accept these premises, and consider crop-processing debris a more significant source of seed remains (see also Hillman 1984). Note that fuel is frequently and intentionally burned, whereas crop-processing debris is only episodically produced, and even if it were burned would be of comparatively small volume. It therefore seems unlikely that a large proportion of charred debris from hearths and trashy deposits would be from crop-processing. Arguments summarized in the previous chapter and presented in detail in other publications explain why these are plausible assumptions (Miller 1984a, 1984b; Miller and Smart 1984). Further non-quantified support can be gleaned from reported seed and charcoal assemblages; those from forested regions

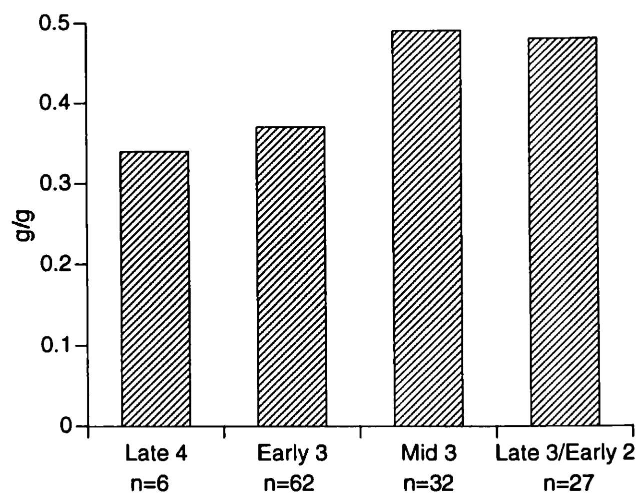
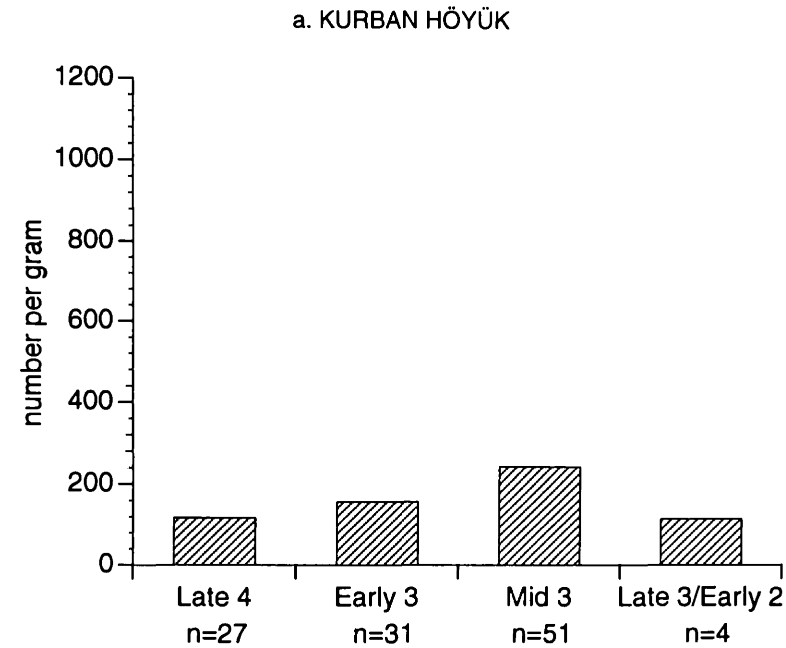
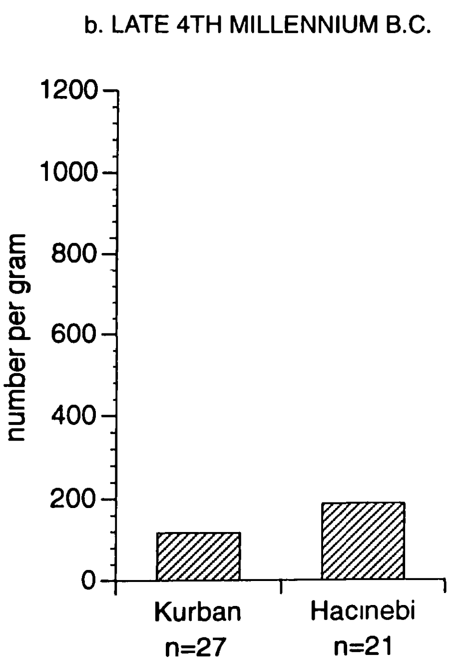
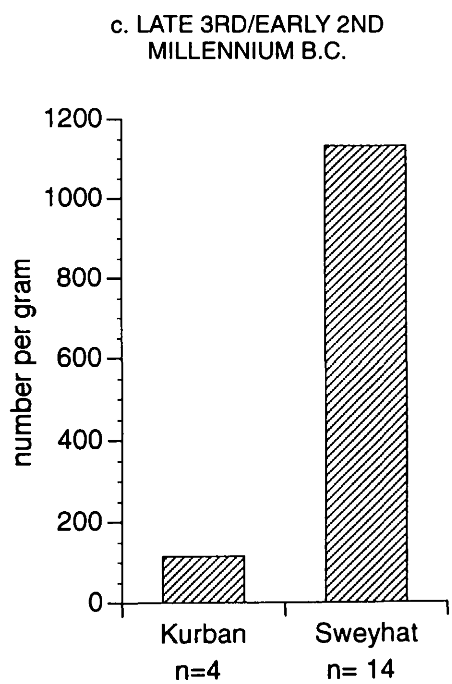


Fig. 7.3. Kurban Höyük, seed:charcoal.
Source: unpublished data

Fig. 7.4a–c. Wild seed:cereal (number per gram).
Sources: Sweyhat: Chapter 6, this volume. All Operation 1 samples except SW 2261 (unmeasurable cereal), SW 2351 (outlier), and Jar 3. Hacınebi: Miller (1996b). Charcoal sample HN 2149 and "Uruk" samples omitted. Kurban Höyük: unpublished data, samples with no cereal omitted







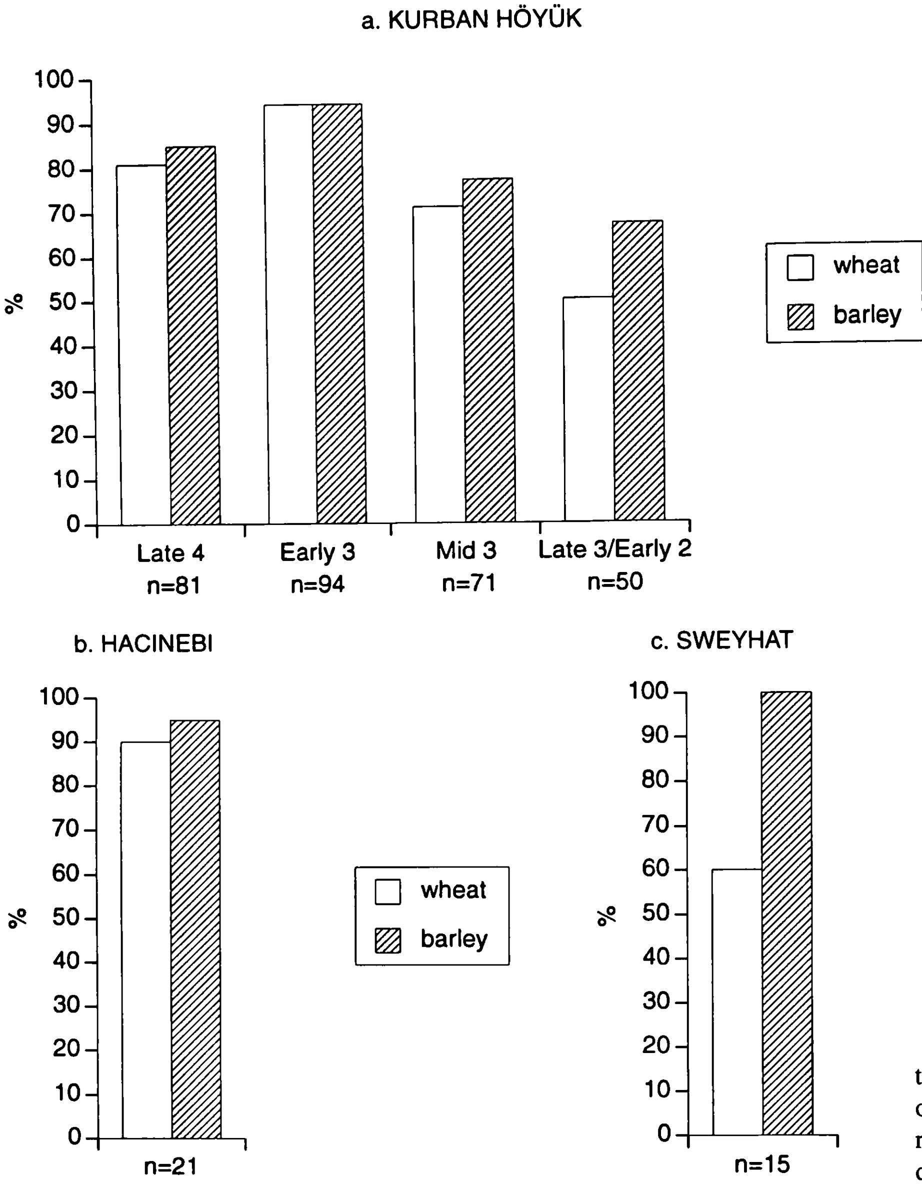


Fig. 7.5a–c. Wheat and barley frequency.
Sources: Sweyhat: Chapter 6, this volume. All Operation 1 samples except SW 2261 and Jar 3. Hacınebi: Miller (1996b). Charcoal sample HN 2149 and "Uruk" samples omitted. Kurban Höyük: unpublished data

tend to have high concentrations of wood charcoal and low concentrations of seeds, whereas the converse holds in assemblages from the steppe (see Miller 1991: 154–155 for sites and references).

Archaeological wood charcoal provides direct evidence of ancient fuel use, for it is a common fuel residue. Although people select fuel from the broader botanical environment, they are likely to collect types that are relatively close to hand. Therefore, wood charcoal is an incomplete, but fairly good indicator of local vegetation (see Miller 1985). The charcoal from Hacınebi and early third millennium levels at Kurban is consistent with vegetation reconstructions (see Zohary 1973 and van Zeist and Bottema 1991: fig. 45), as it consists mainly of oak and a few other steppe forest types. Even today, two relict oaks on a bluff above Kurban and unirrigated pistachio orchards which dot the land around Hacınebi show that full-grown trees can grow in the region with rainfall alone.

A major deforestation episode occurred between the early and mid-third millennium; a sharp increase in the average seed to charcoal ratio by weight suggests dung fuel use increased relative to that of wood (Fig. 7.3). The Sweyhat samples postdate that northern deforestation, but people there still had some access to oak. Not surprising for this dry area, the main woods burned were the riverine types, poplar and tamarisk. In contrast to the more northern sites, Sweyhat also had a few pieces of a chenopodiaceous shrub, which is true steppe vegetation.

To get a general picture of agricultural practices, one can consider two basic characteristics of the flotation samples: the number of wild seeds relative to the weight of

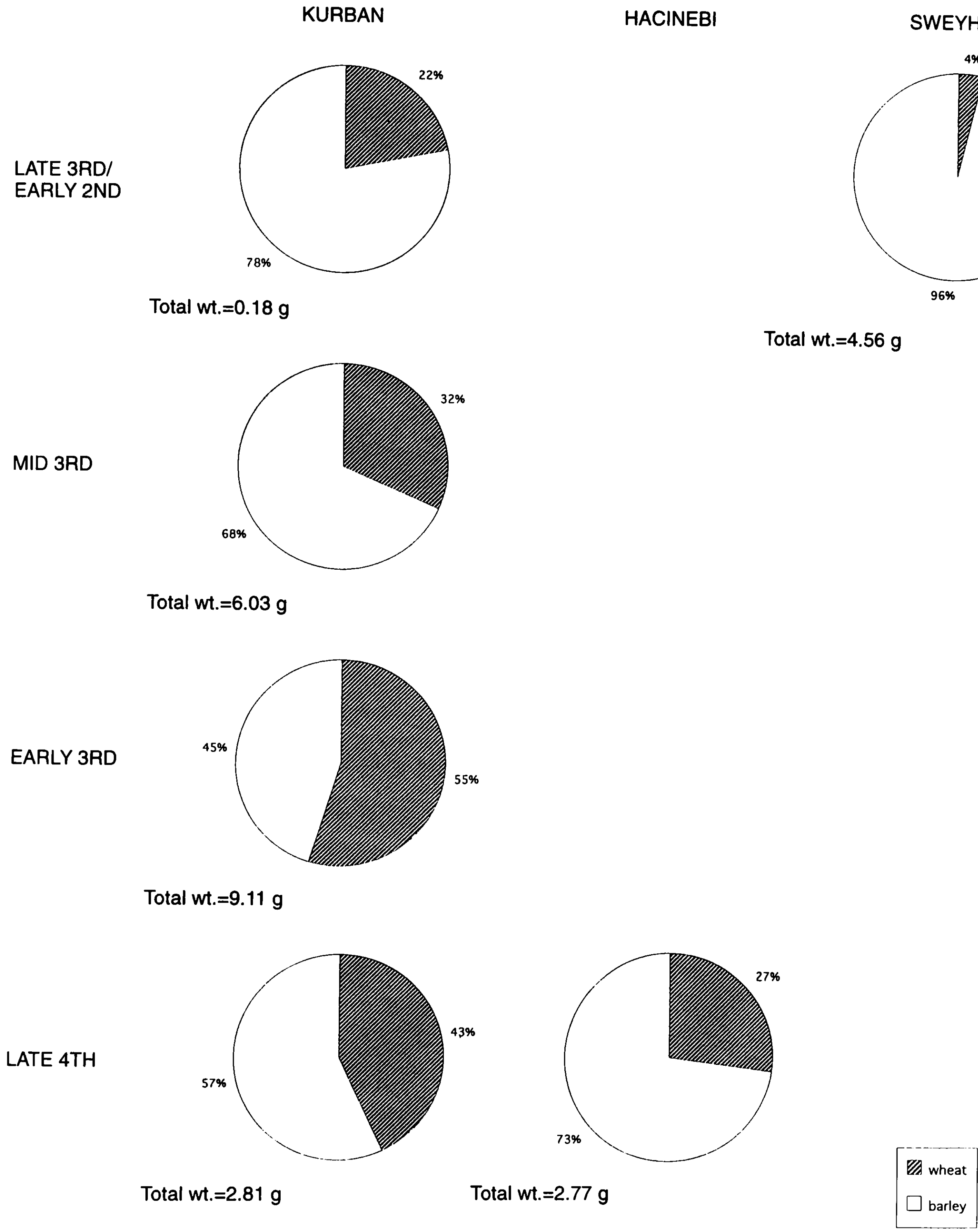


Fig. 7.6. Wheat and barley amounts.
Sources: Sweyhat: Chapter 6, this volume. All Operation 1 samples except SW 2261 and Jar 3. Hacınebi: Miller (1996b). Charcoal sample HN 2149 and "Uruk" samples omitted. Kurban Höyük: unpublished data

cereal grains, and the amount of wheat relative to barley.

An Archaeobotanical Indicator for the Importance of Pastoral Production

Insofar as the seeds come from dung fuel, the wild seed to cultivated cereal ratio quantifies foddering practices. In feeding their flocks, herders must take into account the needs of the animals, the seasonal availability of natural pasture and field stubble, and the cost of labor. It is much less labor intensive to let animals graze than it is to grow fodder for them, and labor cost is a major limiting factor for fodder production (Tully et al. 1985:213). Nevertheless, animals may be foddered. Winter snow cover and depleted pastures (Tully 1984:58) or summer drought (Sweet 1974:96) prevent the animals from grazing for some portion of the year. Indeed, the limiting factor for herd size in northern Syria is the winter fodder supply; during the rest of the year the animals graze on stubble and steppe where available (Tully 1984:50). Foddering may be necessary to protect the steppe plants from grazing at some points in the growing season (Shoup 1990:196). If agricultural fields cover the land, it might become very important to limit the places the animals could trample by stall-feeding them.

It is worth noting that at Tell Toqaan, nomads' flocks of sheep would travel as far as 60–70 km to steppe pastures, but the village flocks and cattle herds would stay in the village (Sweet 1974:97–100). It therefore seems likely that when sheep and goat husbandry is emphasized, people are more likely to let the *animals* do the walking and put them out to graze. On the other hand, when agricultural fields cover the landscape, herders would have to exercise careful control over where the animals roamed, so the value of large herds would be offset in part by the cost of herd management. Cattle and pigs, more easily confined to the settlement, might become more attractive. For this reason I am using the wild seed to cereal ratio as a rough way to monitor the economic emphasis on pastoralism (Fig. 7.4).[35]

The category "wild seed" includes plants that are identified to family or genus, so their exact habitats cannot be determined. However, by far the greatest number at all sites are legumes like *Trigonella* and *Astragalus*, which are most probably endemic steppe plants. I think it fair to say that near Sweyhat the marginal conditions for agriculture and correspondingly suitable conditions for grazing encouraged an economy based on pastoralism, which is reflected in the extraordinarily high proportions of wild plant seeds. If I had included the statistically outlying sample in which I assiduously counted each of 13,553 wild seeds, the average wild seed to cereal ratio would have jumped to nearly 6000.

Hacınebi follows the same pattern. In the late fourth millennium, when the best evidence from charcoal suggests both Kurban and Hacınebi had access to forest woods for fuel, evidence from fodder suggests Hacınebi animals ate more wild plants than those at Kurban Höyük. The wild seed to cereal ratio at Kurban is much closer to that of Hacınebi than it is to that of Sweyhat, however.

Crop Choice

Like fodder choice, crop choice, too, is influenced by both environmental and cultural factors. The major cereals, wheat and barley, are grown for grain and straw, and are eaten in several forms by people and animals. Although the varieties of wheat and barley each have their own requirements, it is generally the case that barley has a shorter growing season and so needs less water than wheat. The straw is softer and more suited to animal fodder, and the husks are attached to the grains by a layer of cells, so removing them requires milling. Farmers in much of the Near East grow barley primarily for fodder (e.g., Sweet 1974:73; Miller 1982; Tully 1984:43). People are most likely to consume it in the form of beer.[36] Wheat, on the other hand, tends to be preferred for human food. The relatively large amounts of barley in the charred material from most of these assemblages presumably reflects its preferred use as fodder; barley eaten as food might show up in cess deposits, as it did in a late third millennium deposit at Malyan (Miller 1982:363–365), but no such deposits have been found on the sites discussed here.

Barley occurs in almost all the samples, regardless of time and place (Fig. 7.5). Wheat is less common, and as one goes from north to south, that is, from wetter to drier conditions, wheat declines in popularity. This generalization looks more dramatic if one considers the total quantity of wheat and barley rather than just frequency (Fig. 7.6).[37] Wheat is nearly always more important at Kurban than it is at Hacınebi, and what little wheat occurs at Sweyhat may just be occasional weed contamination; similar low quantities of wheat were recovered from Selenkahiye, which lies right on the Euphrates about 30 km south of Sweyhat.

Further supporting the view that wheat was not grown as a separate crop at these Syrian sites is the fact that analyzed cereal remains from a burnt building at Sweyhat had stores of barley, but no wheat at all (van Zeist and Bakker-Heeres 1985[1988]). In fact, after considering the ethnographic and ethnohistoric data for northern Syria, Michael Danti (see Chapter 5) suggests that the large storage structures like those at Sweyhat, Hajji Ibrahim, and Raqā'i might have been intended for storing winter fodder, not food (see McCorriston 1995:36). Undoubtedly, people living in these steppe settlements consumed cereal grains and other plant foods, but these data do not speak directly to this issue.

Archaeobotanical Indicators at Kurban Höyük

Kurban Höyük provides a long sequence at a single site. The work of Wilkinson (1990), Wattenmaker (1990), Wattenmaker and Stein (1986), Algaze (1990), and Miller (1986) allows us to begin to specify several interrelated land-use variables, including settlement distribution and population levels, agricultural intensity, and herd management strategies (Table 7.1, Fig. 7.7).[38]

The late fourth millennium settlement at Kurban was relatively large, and Wilkinson has proposed an agricultural pattern of short fallow (i.e., 1- to 2-year intervals between cropping). The vegetation was probably open oak woodland, and pig bones predominate in the assemblage. The association between oak forest and pig husbandry has ethnographic parallels in the Mediterranean region, where acorn-eating pigs are herded (Parsons 1962), but it has not been determined whether the Kurban pigs were free-ranging among the oak trees or confined to sties in town. The number of cow and caprid bones is about the same, and the animal fodder emphasized cultivated plants.

The early third millennium saw the decline of Uruk influence, a greatly diminished Kurban, and a general reduction in settlement area within the site's catchment. Wilkinson associates these changes with a lower intensity land use (with fallow periods of up to 8 years). The faunal and floral remains are consistent with this view; there is no evidence for forest disturbance (the seed to charcoal ratio has not changed), and a smaller proportion of land was devoted to fodder production (the proportion of wild plants relative to cereals sharply increases). In addition, caprid bones now dominate the assemblage. Thus, animals (primarily sheep-goat) were now brought to pasture, but their dung was not yet needed to stretch fuel resources.

The pattern of animal management suggested by this high proportion of sheep-goat relative to pig and cattle and foddering practices emphasizing non-cultivated plants continues into the mid-third millennium, despite the fact that substantial social change and vegetation disturbance occurred. In particular, archaeological analyses by Algaze (1990), Wattenmaker (1990), and Wilkinson (1990) suggest that Kurban was integrated into a larger political or economic system in the mid-third millennium B.C., at which time it reached its maximum size. Wattenmaker (1990) finds evidence that the inhabitants of Kurban began to raise animals for distribution outside their own households. Wilkinson concludes that although land was not intensively manured near the site, it was cropped annually, and land on the upper terrace was not settled at all. I think it likely that this unoccupied area was left for grazing rather than cultivation. It is also in this period that the effects of deforestation are first felt. Both the presumed specialization of pastoral

Table 7.1. Kurban Höyük, settlement and land use summary

Period† (millennium, general period Kurban sequence)	Kurban population*	Catchment population (per sq km)*	Fallow interval (inferred)*	Landscape (inferred)
Late 3/Early 2 Early-Mid Bronze Kurban III, H	relatively small	38	1–4 years	degraded oak woodland
Mid 3 Mid-Late EBA Kurban IV, G	maximum	86	1 year	deforestation, degraded oak woodland
Early 3 Early EBA Kurban V, F	small	21 (dispersed hamlets)	1–8 year	oak woodland
Late 4 Late Chalco Kurban VI, E	relatively large	61	1–2 year	oak woodland

† Kurban sequence designations: Roman numerals in Algaze (1990), letter in Wilkinson (1990)
* Wilkinson (1990)

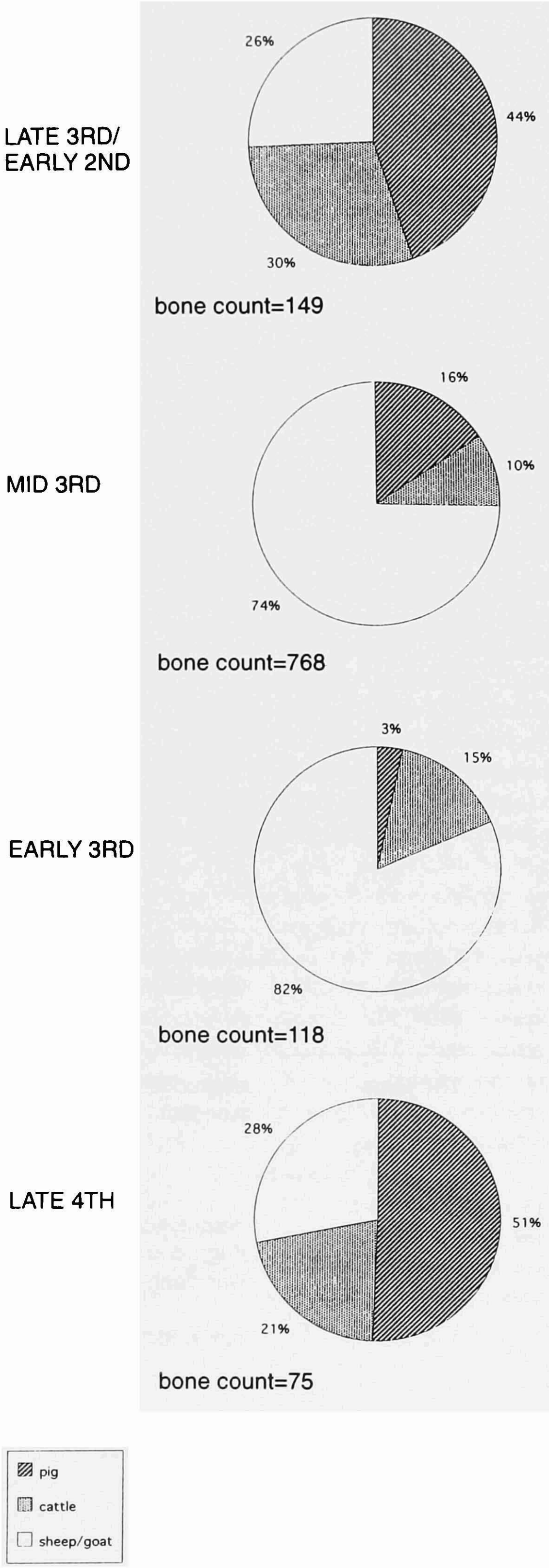


Fig. 7.7. Kurban Höyük domestic ungulates.
Source: Wattenmaker and Stein (1986)

production and the reduction in forest occur at a time of high population density.

In the late third/early second millennium, the intensity of land use seems to have lessened. Population levels fell; Wilkinson posits a return to a short fallow system. Archaeologically, pig and cattle bones predominate, and Wattenmaker says that the faunal assemblage reflects herding strategies geared once again toward household production and consumption. Corresponding to the decline in sheep-goat bones, the wild seed to cereal ratio drops. Wood fuel use seems to continue at the same rate as in the previous period.

Dependence on pig (and cattle, too, in later times) and feeding animals cereals is associated with the short fallow system. Perhaps, as Wattenmaker suggests, the fallow fields provide land on which small flocks can be pastured without disrupting cultivation. Two distinct land-use patterns can be seen in periods when sheep and goat predominate: a low-intensity land use pattern favored sheep and goat herding in the early EBA, but pastoral production complemented intensive annual cropping in the mid-to-late EBA.

If one compares contemporary occupations along the Euphrates, emphasis on wheat or barley cultivation seems to reflect the clinal distribution in precipitation. That is, settlements in areas with higher precipitation grew more wheat. Can cereal preference be extended to cover precipitation shifts through time, as well? Weiss and colleagues (1993) suggest deforestation was one result of a massive drought that hit the Near East at the end of the third millennium B.C. The occupation of Kurban Höyük spans this period, so it provides an opportunity to test this hypothesis.

As discussed above, the biggest decline in wood fuel use at Kurban occurred between the early and mid-third millennium, and associated deforestation is likely to be correlated with high population densities rather than climate change. During a prolonged dry spell farmers might respond more directly to adverse conditions by planting more drought-tolerant crops, like barley. The Kurban evidence, however, suggests barley production began to expand between the early and mid-third millennium. It therefore seems likely that there was no great drought, and climate did not dictate the economic choices made over time by the ancient people of Kurban.

Wilkinson inferred the history of fallowing around Kurban from sherd scatters and estimated population levels (Table 7.1). At the fairly gross taxonomic levels considered here, population levels do not seem to have determined crop choice or herd animal preference. On the other hand, evidence suggests people considered both crop production and animal husbandry in choosing how to allocate their time and land resources. Of all the variables considered in this discussion, the changes in the proportion of barley are negatively associated with changes in the wild to cultivated ratio and the proportion of sheep-goat, and positively with pig (Table 7.2). In short, wild and cultivated fodder are negatively associated, wild fodder and sheep-goat are positively associated.

As a very preliminary assessment of these data, I would suggest that fodder crops were least important when the available animals could fend for themselves in the grazing lands around the settlement. When wild plants were not as available for fodder (for whatever reason), it made economic sense to plant fodder (i.e., barley) for the animals.

Table 7.2. Directional changes in agriculture and settlement variables at Kurban Höyük

	Late 4- Early 3	Early 3- Mid 3	Mid 3- Late 3-Early 2
% barley	-	+	+
wild/cereal	+	-	-
% sheep-goat	+	-	-
% pig	-	+	+
% cattle	-	-	+
population	-	+	-

Crop Choice at Hassek Höyük

An appreciation of environmental constraints allows one to pinpoint a possible "ethnic" factor in crop choice by examining clear evidence of food remains from Hassek Höyük. Upstream from Kurban, Hassek enjoys the highest rainfall of all the sites under discussion. It also appears to be one of those walled Uruk enclaves built and inhabited by people from the south and surrounded by a local settlement (Behm-Blancke 1989), like Hacınebi just downstream (Stein and Mısır 1994) or Godin Tepe in the Zagros mountains (Weiss and Young 1975). H.-J. Gregor (1992) has identified stored crop remains, which presumably represent human food, from a burnt building. The field crops found were barley, chickpea, and lentil, without a grain of wheat. There are no non-Uruk late fourth millennium samples from Hassek with which to compare these finds directly, but given the north-to-south gradient in wheat and barley popularity along the Euphrates during the fourth and third millennia, it looks like the Uruk transplants may have brought some of their food habits with them. This interpretation is far from certain, as there are plausible alternative explanations. For example, the building might have burned in the late spring, after the barley harvest but before the wheat harvest.

Summary

Although the available sample makes it very difficult to control for both space and time, emphasis on herding as indicated by a high ratio of wild seeds to cultivated cereals decreases as precipitation rises. The wild seed quantities are also higher in situations where there is independent faunal evidence for the importance of sheep and goat husbandry. As for the cereals, the popularity of wheat relative to barley tends to be lower in areas of low rainfall, but the proportion of wheat cannot be predicted from rainfall data alone. In short, foddering practices and crop choice are strongly influenced by environment, but social and economic factors operate as well, and can be recognized through the analysis of archaeobotanical evidence.

The conclusions presented here are in no way definitive. The number of samples is small and the amount of material is also small. Note, for example, that the identified cereals in the Sweyhat assemblage considered in Tables 6 and 7 consisted of 4.37 g of barley and 0.19 g of wheat, which can be converted to a cereal grain equivalent of about 456 seeds, averaging no more than a few seeds a year. It is also unfortunate that there is only one multi-period sequence, the one from Kurban. Nevertheless, it is my conviction that even small amounts of material interpreted according to their archaeological context can begin to show regularities that at least raise interesting questions. What is needed is more archaeobotanical laboratory and field work to increase the assemblage available for study. If the patterns hinted at here are real, and not just a happy statistical accident, this work has two significant results. First, it demonstrates how understanding the archaeological context of archaeobotanical remains enables us to integrate the study of the agricultural and pastoral economies, not just along the Euphrates, but any place where dung is burned. Second, it suggests an approach to isolating and assessing the strength of environmental and cultural variables in the subsistence economy. As direct evidence of ancient vegetation and land use, plant remains can help us understand and monitor not just environmental conditions and changes, but also the economic and cultural patterns that prevailed.

Acknowledgments

I would like to thank Lee Marfoe, Gil Stein, and Richard Zettler, directors (respectively) of the excavations at Kurban Höyük, Hacınebi Tepe, and Tell es-Sweyhat, and Wilma Wetterstrom for her ever-helpful comments.

Notes

34. The material from Hassek Höyük was analyzed by H.-J. Gregor (1992). Botanical remains from other sites along the Euphrates have been published, but the archaeological contexts are not trashy, the quantity of material is insufficient, or the samples are reported in insufficient detail for direct comparison. See the volume bibliography for references.

35. As Bottema (1984) demonstrated, the seed content of dung is quite variable and depends on what the animal has eaten. Seeds do not necessarily occur in dung fuel, but when they do, at least some may be preserved.

36. In season, green barley may be cooked and served in place of rice, in a dish called *frika* (personal experience, Nefileh, Syria, June 8, 1995).

37. Korucutepe is a couple of hundred kilometers upriver from Kurban. It enjoys a similar rainfall pattern, but is a bit cooler on average. In their report, van Zeist and Bakker-Heeres (1975: Table 1) include four Chalcolithic samples comparable in archaeological context to those discussed in this chapter. Wheat represents 71% of the identified cereal, a higher proportion than at any of the sites to the south.

38. Though methodologically problematic, I present sums of animal bone counts by period to give a rough idea of the material. For this argument, one need not estimate the amount or relative importance of the meat and milk products provided by the three categories: pig, cattle, and sheep-goat.

8

FAUNAL REMAINS FROM TELL ES-SWEYHAT AND TELL HAJJI IBRAHIM

Jill A. Weber

Analysis of animal bone from archaeological sites can provide a picture of ancient patterns of animal production, consumption, and procurement. When compared within and between sites, these patterns can reflect differences in area or site functions and status. Preliminary analysis of vertebrate species represented at Sweyhat and Hajji Ibrahim suggests considerable differences between the two sites. This analysis also highlights differences between Sweyhat and other urban centers in northern Mesopotamia.

Excavations were begun at Sweyhat in the early 1970s (Holland 1976) and the animal remains from those excavation were published by Buitenhuis (1983). This study is based on the continued excavations, beginning in 1989. Only mammal bones from the 1989, 1991, and 1993 seasons are included here, as they were shipped to the University of Pennsylvania Museum and made available for study. Included are the bone remains from excavations beginning in 1993 at the 0.25 ha. site of Hajji Ibrahim. A very brief preliminary report on both sites appears in Zettler et al. 1996.

Unfortunately, the Sweyhat and Hajji Ibrahim samples are not directly comparable at this time. The 1993 Hajji Ibrahim assemblage was analyzed before the present protocol was put in place; at some point, it will be re-evaluated in order to standardize the information analyzed from the two sites. The biggest difference is that the Hajji Ibrahim material was counted, but not weighed. In addition, the 1995 material (from both sites) analyzed in the field has been weighed but not counted. This will be remedied at a later date, and remains from the 1995 and 1997 seasons, as well as all bird, reptile, and fish bones, will be included in a subsequent report.

Sampling Methodology

Different loci sampled at Sweyhat included inside and outside areas of domestic spaces, trash dumps, street deposits, industrial areas, and a "kitchen" building. Other contexts not yet sampled will probably do little to change the overall character of the faunal assemblage, except in terms of intrasite variability. An exception might be material from the earliest occupation at Sweyhat. Little of that phase has been excavated and thus new material could produce a different picture. Samples from Hajji Ibrahim are mainly from domestic rooms and courtyards. Grain storage installations did not yield any animal bones and, to date, no large trash pits have been encountered. Any new finds (especially trash pits) could drastically change the nature of the Hajji Ibrahim faunal assemblage.

Bone from both sites was routinely collected during the course of excavation. Screening was not routine, but smaller bones (phalanges, loose teeth) of medium-sized animals such as sheep and goat are well represented, as are the long bones and teeth of rodents, birds, and reptiles. An exception is a collection of burials from classical levels at Hajji Ibrahim: all of the soil from these burials was screened. The result was a plethora of rodent bones. Rodent bones were common, however, from all areas of excavation (screened as well as unscreened). This suggests that no systematic bias towards larger bones and larger animals was introduced by the workers. However, the fact that, at Sweyhat, 67% of the "small animal" bones were identified to subfamily or better, as compared to 41% and 38% for medium- and large-sized animals, respectively, suggests that the skeletal remains of smaller animals were more complete than those of larger animals. In 1995, a more systematic sieving program was introduced, which will provide more information on possible sampling bias. In a similar vein, soil sent to flotation for botanical remains often contained animals bones as well. I examined the heavy fractions from flotation, and the majority of animal bones present were tiny, unidentifiable pieces. The only exception were whole ceramic vessels whose entire soil contents were floated and found to contain a wealth of bird bones. Bird remains are frequently picked out of the soil, and it is probable that the bones in the pots would also have been picked out.

Bones were washed and cleaned in the field and further analysis followed Zeder's (1990) two-phase plan for bones from Near Eastern sites. Phase I is a sort by taxon, in which all fragments from all contexts are counted and weighed, and the more complete bones are measured (mainly after Driesch 1976; also Eisenmann 1986 for equid measurements not found in Driesch). Following completion of Phase I, a sample of bones from secure contexts is chosen for Phase II analysis. This phase is more detailed, and includes identification of element and symmetry, gathering data on age and sex, and noting the presence of butchery, burning, and gnawing marks. Only a very small fraction of the material has undergone Phase II analysis. Therefore, this report deals mainly with interpretations possible from knowing only the relative abundance of species and the measurements of some of their bones. Where possible, I will include the very preliminary Phase II results.

Preservation

The bone is relatively well preserved. No data on the percentages of burnt, gnawed, or butchered bone will be available until the completion of Phase II. However, I observed burnt bone ranging from slightly charred to calcined, and both carnivore and rodent gnawing were visible on the surface of some bones. Many bones also had visible cut marks. Further analysis will include an examination of pre- and postdepositional breakage, both ancient and modern. Many of the bones had fresh breaks which could be joined, but many others remained with newly missing fragments. A further sign of predepositional damage is the spiral break of a bone from a percussion blow to extract marrow. The tibiae in Figure 8.1 show this. More specific information on bone fragmentation is discussed below.

Sample Size and Quantification

The total bone sample from Sweyhat is 10,853 fragments, totaling 58,438 g in weight. An additional 6,168 g of uncounted fragments come from the 1995 season. As the latter has not yet been treated in the same fashion as the other material, it will not be discussed here, except in extraordinary cases. The Hajji Ibrahim material is not directly comparable at this time. The bones analyzed were counted but not weighed. Conversely, the 1995 material, like that from Sweyhat, was weighed but not counted. Thus, we have 235 bones from pre-1995 excavations and 809 grams from 1995.

All "counts" are of the Number of Individual SPecimens, or NISP. Each bone fragment is counted, unless it is demonstrably associated with another bone (e.g., two articulating bones, a tooth in a mandible, etc.). NISP is being used rather than Minimum Number of Individuals (MNI) for two reasons. First, MNI would require completion of Phase II, and analysis of data on bone element and symmetry. Secondly, NISP may be better suited than MNI to compare the relative abundances of species, especially with small samples (Grayson 1984). A further measure of relative abundance is bone weight. All bones are weighed to the nearest gram (or half gram if total weight is less than 1 g). Weight may more adequately convey the dietary significance of different types of animals. This is due to the relative size of different species, as meat weight is directly related to bone weight. For example, 10 bones of a sheep-sized animal will yield less meat than 10 bones of a cattle-sized animal.

Of all the counted fragments from Sweyhat, 38% (4085 of 10,549) were identified to the level of subfamily or better—mainly genus—while 44% (104 of 235) from Hajji Ibrahim were identified to that level. From Sweyhat, 52% were identified as mammal, and further broken down within that category by size. Large mam-

Fig. 8.1. Tibiae (l. to r.): fallow deer, red deer, domestic sheep, domestic goat, gazelle.

Table 8.1. Comparative percentages, by weight (g), of animal remains

	# id	weight	# meas	Frag	MI
Bos	404	8588	50	21.26	12.38
Equus	345	12292	97	35.63	28.12
Cervid	51	1119	20	21.94	39.22
Ovis/Capra	2986	17724	27	5.9	17.6
Gazella	26	242	15	9.308	57.69

mal (22%) includes cattle, equids, and red deer. Medium mammal (77%) represents animals from medium-sized dog and gazelle to fallow deer, while small mammal (1%) includes small carnivores such as red fox. Ten percent of the total sample could only be identified as "mammal," and approximately 1% could not be identified further than "bone."

Differences in bone fragmentation (as opposed to completeness) between species of similar size, or between the same species over time, may be an indicator of variations in animal exploitation (i.e., dairying), processing, or discard. Table 8.1 is a summary of the average weight per fragment (Frag) of the major species, in addition to a "measurability index," MI (after Boessneck and Driesch 1975), which helps to quantify the relative fragmentation of individual species. This index is computed as the number of measured bones over the number of identified bones per species, multiplied by 100. This information is for Sweyhat only, as the sample from Hajji Ibrahim is too small to be statistically meaningful.

Larger Mammals

Artiodactyl

Animals of the Bovidae and Cervidae families constitute the vast majority of the animal bones. On the whole, identification of the various artiodactyls was made more complex by the multitude of species making up a continuous size scale, from gazelle at the small end to cattle at the large end (see Fig. 8.2). Compounding matters further is the identification of wild sheep, an animal with a size intermediate between domestic sheep and fallow deer. In addition, wild cattle is likely present in the Sweyhat assemblage. However, the large size of the aurochs typically precludes confusion with other artiodactyls.

Bovidae

Bos. Domestic cattle, *Bos taurus,* constitutes 10% (NISP) of the identified animal bones from Sweyhat, and 11.5% from Hajji Ibrahim. From Sweyhat, there are also two bones, a fragment of an orbit and a complete accessory carpal, which are possibly of wild cattle, the aurochs. Conversely, they could represent a larger domestic species, or simply unusually large (male) taurines. The cattle measurements (App. 8.1) marked with a dagger (†) are the especially large elements. As was also noted by Buitenhuis (1983) for the material from the earlier excavations, the cattle bones were very fragmented. They had the lowest measurement index (the number of measurable bones divided by the total number of identified cattle bone) of any of the main mammals, at 12%, and the lowest weight per fragment of any of the larger mammals (including the general "Cervid" category, which includes some smaller, sheep/goat-sized animals). As a result, their relative abundance is probably overrepresented according to NISP. High fragmentation should not affect their relative contribution according to bone weight, however, and by that measure they total 22% of the main mammals. One possibility for the fragility of the cattle bones is thinner cortical bone brought about by calcium depletion (see Horwitz and Smith 1991). In other words, perhaps the majority of cattle were older cows, kept for milking. Unfortunately, few horn cores were preserved and the ones that were are too fragmentary to reconstruct. There are also no sexable pelvis fragments.

Ovis and Capra. Sheep (*Ovis aries*) and goat (*Capra hircus*) are the most common animals among all identified species. Nineteen (36%) of the 52 identified bones of the main food animals from Hajji Ibrahim and 2,986 (ca. 75%) of these bones from Sweyhat were identified as sheep or goat. Between the two, sheep is the single most common animal, with a sheep to goat ratio of just over 2:1. Most of the bones in the skeletons can be dis-

Fig. 8.2. Artiodactyl, first phalanx (l. to r.): fallow deer, wild sheep, domestic sheep (3), domestic goat, gazelle.

tinguished by their articular ends. Distinctions used here are based on the traits published by Boessneck (1969) and also on some others communicated to me by Drs. Melinda Zeder (see Zeder 1991) and Richard Meadow.

Two bones definitely from wild sheep are present in this assemblage. Both are first phalanges with a greatest length (GL) a full centimeter longer than the largest of the other first phalanges. In general, the size of the domestic sheep and goat are comparable to those from nearby Halawa (Boessneck and Driesch 1989). Among the bones measured, a few more are unusually large relative to the other measured bones (these are marked with a dagger in App. 8.2). The total number of wild bones may actually exceed two. Most of the larger bones have been identified as sheep. Other than the two long phalanges, these large elements may represent whethers in the sheep population. Long bones of castrated animals fuse at a later age than females and uncastrated males, resulting in greater size. Castrates may have been valued for their superior wool coats. A further possibility is that these bones merely represent large males. If the sheep and goat were seasonally transhumant, they may have developed better musculature than "sedentary" animals, approximating wild sheep in size.

At present, the abundance of sheep and goat together with the marginal climate suggests that transhumance would have been practiced. This is impossible to conclude at the moment, however. The fraction of teeth and mandibles that have been analyzed for age data show that, during all periods, animals of all ages are present, suggesting they were locally raised. The ages cannot be quantified at present.

Gazella. Gazelle are present in small numbers at both sites. At Hajji Ibrahim, 2 bones (of 235) were from gazelle, with possibly 8 more. Twenty-six come from Sweyhat. Measurements are in Appendix 8.3. The species identification (*subguttorosa*) is still tentative, but seems most probable based on size and geographical boundaries. A few complete horn cores are well preserved but have only been counted at this point. These should provide the surest evidence for species identification.

Cervidae

Cervus and Dama. Several species of cervid are present at Tell es-Sweyhat. Deer identified from the recent excavations are red deer (*Cervus elaphus*) and fallow deer (*Dama mesopotamica*). In addition, the quantity of bones identified by Buitenhuis (1983) as belonging to the roe deer (*Capreolus capreolus*) made this animal the single most abundant wild species. There have not yet been any roe deer identified from the present excavations. The presence of so many medium and large artiodactyls has caused some confusion. Though distinct, bones of cervids and bovids are quite similar. Unfortunately, there do not appear to be any distinct size classes at Sweyhat, but rather a continuous scale from gazelle up to red deer (see Fig. 8.1). Roe deer and gazelle are only slightly smaller and more gracile than sheep and goat. Large individuals of domestic sheep and goat overlap with the fallow deer. Wild sheep (which are present) are even more similar in size to fallow deer. Female cattle can overlap with the largest fallow deer, and large male cattle equal the red deer.

Within the Cervidae family, I have not distinguished between fallow and red deer. However, there appear to be more of the former. The measurements indicate a predominance of fallow deer.

Suidae. Neither the domestic pig (*Sus domesticus*) nor the wild boar (*Sus scrofa*) are of any significance at Tell es-Sweyhat. Only two fragments, both from Operation 5, were identified as *Sus* from over 10,000 total fragments. The two fragments are both of teeth, and their size suggests they were domestic. Thus, no wild pig has yet been discovered at Sweyhat. Conversely, the residents of Tell Hajji Ibrahim seem to have raised pig. Nine pig bones were identified, which is 17% of the 52 bones identified to the group of main food animals. It is unclear why Hajji Ibrahim and Sweyhat practiced such different subsistence strategies, especially as relates to pig. Other researchers of sites from the Euphrates Valley region close to Sweyhat have noted the absence of pig and mainly attributed this to poor environmental conditions for pig breeding (Boessneck and Driesch 1989). This certainly seems logical, but Hajji Ibrahim is less than 1 km away from Sweyhat and was surely subject to the same environmental conditions. Also, this does not explain the lack of wild pig. Wild boar were abundant in the region at least through the 19th century (Blunt 1879). How well that correlates to the amount present in antiquity along the Euphrates gallery forests remains to be discovered.

Of the 9 Hajji Ibrahim bones identified as pig, only 2 were measurable, 1 scapula and 1 ulna:[39]

	SLC		BPC	DPA	SDO
Scapula	20.5 mm	Ulna	17.0	29.4	22.0

I have inferred the domestic status of the pig from Hajji Ibrahim based on the small size of these two bones. The wild boar is a large animal. The teeth from Sweyhat were too fragmentary to measure.

Perissodactyla

Equidae

Equid bones form a substantial portion of the entire assemblage from Sweyhat, but are absent entirely from Hajji Ibrahim. The earliest occupation phase (from Operation 1) has the largest percentage of equid bones. Almost 20% of the counted fragments of the major food animals from this phase are equid and almost 45% of the bone weight represents equid. Of 12 separate areas or phases of occupation, 4 have a greater than 10% (NISP) proportion of equid among the major animals, and another 8 have a greater than 5% proportion.

In Bronze Age north Syria, the likely candidates for the equid remains are *Equus asinus* (the domestic ass), *Equus hemionus* (the wild half-ass), and even possibly *Equus caballus* (the horse). Absolute size of the measurable bones indicates that the latter is not present, for no element approaches the size of the true horse. A further complicating factor is the "Syrian onager," *Equus hemionus hemippus.* It has been suggested that this subspecies of hemione was found throughout northern Syria. It is thought to have been much smaller than the "Persian onager," but this is based on remnant wild animals and zoo specimens. It is unclear whether such a small animal existed in the second and third millennia B.C. It is also difficult to establish the size of the domestic ass in antiquity. The possible presence of a donkey/hemione hybrid must also be mentioned. This hybrid is listed in Sumerian texts as a domestic animal with great strength and much of the speed of its wild parent—probably the mother, but in some cases the sire was a hemione (Postgate 1986). While this hybrid was present in southern Mesopotamia through ca. 2000 B.C., its geographical expanse is not known.

This report is not intended to be the definitive evaluation of the equid material. Equids are notoriously difficult to distinguish according to species, especially when ass and half-ass are in question. Tooth morphology and long-bone robustness (or slenderness) are typically cited as distinguishing features between hemiones and asses. However, the ability to distinguish individual teeth within an assemblage has been called into question due to extensive intraspecific variation. As such, tooth morphology may only be useful to characterize a given assemblage (Zeder 1986:373). As for long bones, hemiones do appear to have long bones that are more gracile—based on an index of bone length and shaft breadth—than those of ass, but in archaeological assemblages complete long bones are rare. In an effort to understand more clearly the character of the equid assemblage, I reexamined the bones in light of distinctive morphological traits, mainly from the edited volume *Equids in the Ancient World* (Meadow and Uerpmann 1986). Measurements and morphology were treated separately in order to see if there was agreement (see App. 8.4).

Scapula. Morphologically, two differences between asses and hemiones can be found in the spine and in the thoracic margin leading to the glenoid cavity (Meadow 1986; Uerpmann 1986). Hemiones show stronger development of the spinal tuberosity, which also overhangs caudally. Also in hemiones, the thoracic margin is flattened or rounded as it approaches the caudal rim of the glenoid; in asses, this margin remains sharp. There were five scapula complete enough to examine morphologically, and all were hemione-like. One had both a well-developed spinal tuberosity, overhanging caudally, and a flattened thoracic margin posterior to the caudal rim of the glenoid cavity. Another had a rounded thoracic margin, and three others had a developed, caudally overhanging, spinal tuberosity. Three of these five bones were also measurable. Two of them measured as expected for onager, while the third was much smaller than expected. In all, of six scapula that were either measurable or had the distinctive morphological characteristics, five can be identified as hemione. The sixth was morphologically hemione-like and ass-like in absolute size.

Humerus. Of three distally complete humeri, two had a fairly straight and level proximal border on the articular surface of the trochlea, characteristic of hemiones. A separate partial humerus did not exhibit the "fairly reliable character in asses" of the muscular line on the midline of the cranial shaft (Uerpmann 1986).

Radius. One complete radius was completely hemione-like in character, being offset laterally with a rounded medial margin (Meadow 1986). One unfused proximal radius was ass-like, sitting straighter over its axis with a flaring medial margin. A further characteristic of hemione radii is a "blocky" appearance of the distal end due to a deeper (dorso-volarly) articular surface in relation to the length of the surface. Using the "index of distal articular breadth (Bfd) to depth (Dfd)" (after Meadow 1986), the complete radius (above) measures 1.68, which can be used to compare the other, more fragmentary radii. Four other measures were 1.67, 1.65, 1.59, and 1.55. A few other distal ends appeared blocky, but were not measurable. The fragment whose index is 1.55 is likely an ass, while those of greater than 1.65 are probably hemiones. However, this is not reliable with a sample size of only five. Certainly, more measurable distal articular surfaces will be of aid in this determination.

Metacarpus. Both Uerpmann (1986) and Meadow (1986) note the volar edge of the proximal metacarpal as a distinguishing feature. In hemiones, this edge is straight, while it can be sinuous or even notched in asses. Only two proximal metacarpals are preserved in the Sweyhat assemblage. One is deeply notched and must come from an ass. The other has a straight edge, and is likely a hemione.

Astragalus. The dorso-plantar depth of the distal articular surface is deeper (relative to breadth) in hemiones than in asses. In addition, asses develop more strongly the medial, muscular tubercle. Viewed distally, this tubercle barely extended past the articular surface in all 9 astragali I examined. In addition, I compared the breadth of the distal articulation (BFd) to the depth (DFd) in each specimen (DFd/BFd). Six of the 9 clustered tightly around 0.73, with a range of 0.58 to 0.78. The bone with the smallest index (0.58) came from a very young animal and cannot be considered. The other bone with a relatively low index value (0.63) may come from an ass. The bone with the largest value (0.78) clearly does not come from an ass.

Calcaneus. The calcaneus of a hemione is said to have a more slender tuber than does that of an ass (Meadow 1986). This characteristic is difficult to apply to individual bones. However, many of the calcanea in this assemblage articulated with astragali. The astragali proved amenable to identification to species, and thus many of the calcanea could be so identified. Upon further observation, the aspect of a "slender tuber" seems to be manifest visually in the relation of either the depth or breadth of the proximal process. Relative to the proximal process, the tuber appears "waisted," resulting in more of a "V" (rather than a straight-sided "U") shape. This needs to be tested further with a sample of ass bones, however.

In all, 20 individual bones (not including calcanea) could be identified specifically as *hemionus* on the basis of morphological characteristics. Only three or four, morphologically, could be said to be from ass. Metrically, a similar situation exists, with most of the measurements falling within the size range of the onager, and few falling definitively into the size range of the domestic ass. Unfortunately, the bones that are probable ass bones are either metrically or morphologically analyzable, but not both. The chances of a large amount of donkey x onager hybrids seem slim. Buitenhuis (1983) was unwilling to attribute any of the larger (non-caballine) remains to the hemione, but referred instead to "hemione or mule," "mule" being a blanket category for either donkey/horse or donkey/hemione hybrids.

If hybrids were present, one would expect a greater number of donkeys to be present at Sweyhat, unless the hybrids were bred elsewhere and imported. A more parsimonious explanation is that equids larger than the ass were onager hunted on the Syrian steppe. Though declining in number, the hemione was still present at the confluence of the Euphrates and Khabur around 1920 (Kumerloeve 1975). *Equus hemionus* and *Gazella subguttorosa* (also present at Sweyhat) are adapted to the same steppe environment and sometimes form groups together (Groves and Willoughby 1981).

Further work that needs to be done with the equid bones includes estimating age-at-death based on long-bone fusion and tooth eruption. While such work will not provide positive specific identifications, certain assumptions can be made. For instance, a preponderance of juvenile and subadult animals might indicate a wild, hunted population rather than a domestic ass population which may be kept to an older age for draught value. Once complete, the equid assemblage from Tell es-Sweyhat should be valuable for examining interspecific metrical and morphological characteristics of equid populations. The state of preservation is exceptional, especially for the denser bones (such as astragali).

Lagomorpha

Leporidae

There are hare remains from both Sweyhat and Hajji Ibrahim. In Buitenhuis's earlier report, he lists *Lepus europeaus* as the species present. *Lepus capensis* has been identified at most other sites in the upper Euphrates Valley of Syria (Mumbaqa: Boessneck and Driesch 1986; Tell Habuba Kabira: Driesch 1993; Hadidi: Clason and Buitenhuis 1978; Halawa: Boessneck and Driesch 1989), and it is likely the species present at Sweyhat and Hajji Ibrahim.

Two hare bones were measurable, a tibia from Hajji Ibrahim and a pelvis from Sweyhat.[39]

	Bp	SD	Dd	GL
Tibia	17.2	6.0	8.6-	124.8

	LA	LAR	BA	SH	LFo	GL
Pelvis	12.43	10.61	10.07	10.46	15.25	83.9

Carnivora

Felidae

So far only 1 cat (wild?) bone, a distal humerus, has been identified from Sweyhat. No further identification has been attempted at this time. Hajji Ibrahim had quite a few cat bones. The 30 fragments identified to Felis makes this genus second only to rodents in terms of relative abundance. However, the bones only represent 2 or 3 cats. Although a nearly complete skull was among the remains, no identification further than genus has been attempted yet. Most of the cat (and rodent) remains come from a level of disturbed burials at Hajji Ibrahim and may be modern. However, the excavator reports that it is possible that one of the cats was deliberately placed in a burial (Danti, pers. comm. 1997). This cat, about the size of a modern domestic, has not been further identified. Some of these remains may represent the caracal (*Felis caracal*), which is at home on the steppe and may have denned in the abandoned home of the fox (see below).

Canidae

All of the measurable canid bones from Hajji Ibrahim (indicated by an asterisk) are of the size of the red fox (*Vulpes vulpes*) from Korucutepe (Boessneck and Driesch 1975).[39] It is likely that 8 of the 10 bones identified to the family Canidae are from that animal. These animals may be recent, having used the soft soil from graves and human debris to burrow into. There was evidence of carnivore gnawing, and dog was positively identified in the 1995 field season.

	SD	Bd
*Humerus	7.4	20.0

	Bp	DC	SD
*Femur	25.0	11.6	
*Femur			7.5

The canid bones from Sweyhat are larger than those from Hajji Ibrahim and are probably from the domestic dog. The measurements place the animals in the size range of the domestic dog from Halawa (Boessneck and Driesch 1989).[39]

	Bp
Radius	16.16

	LA	LAR	BA
Pelvis	25.19	24.36	24.25

	GL	Bp	SD	Bd
Phalanx 1	30	10.7	7	8.2

Rodentiae

Approximately 15% (NISP) of the total assemblage from Hajji Ibrahim (35 of 235) was rodent. This percentage rises to 34% when only the bones identified to subfamily or better are considered. However, due to the great size difference between rodents and other mammals, it is likely that very few rodent bones are included in the remaining total. It is difficult to surmise their true proportion, as rodents are frequently recovered as complete or partial skeletons. Most of them were probably recent, as the majority were recovered from burials disturbed by rodent holes. Rodents were, however, found in six other contexts. Their small size makes them extremely difficult to find in unsieved contexts. This leads me to the conclusion that—especially at Hajji Ibrahim—there is no bias toward larger bones. At this point it is unclear whether the overall incidence of rodents was greater at Hajji Ibrahim or whether the workers were more diligent in locating bone.

Three members of the order Rodentia have been positively identified. Two genera of Muridae, *Tatera* and *Meriones*, were identified based on their teeth. A third genus, *Spalax* (or *Nannospalax*), is possible. In addition to the more common rodents, I have tentatively identified an insectivore of the genus *Neomys*. The identification was based on a single right mandible with one tooth (M2), and a tooth row length (I1 to M3) of 10.5. The single tooth appears to belong to *Neomys* (after Hillson 1986). Although this species is the water shrew, I have not seen reference to it—or any other species of insectivore—from sites in the Euphrates Valley.

Another unusual find is the single femur of a beaver (*Castor fiber*), identified on the basis of very distinct trochanters on the proximal end (see Fig. 8.3), with the following measurements[39]:

	Bp	DC
Femur	39.0	15.73

While beaver bones are relatively rare, in the last several years single finds have occurred at many sites in the upper Euphrates Valley of Syria. Beaver was not important as a food animal, but these recent archaeological remains are significant for the history of that animal in the Euphrates Valley. Previous finds of beaver have come from Abu-Hureyra in Aceramic Neolithic levels (Legge and Rowley-Conwy 1986), the Late Uruk period from Habuba Kabira, and Early and Middle Bronze

Fig. 8.3. Beaver femur.

deposits from Tell Habuba Kabira (Driesch 1993), EB and MB deposits from Halawa (Boessneck and Driesch 1989), and MB levels from Hadidi (Buitenhuis 1990). The beaver from Sweyhat is from the Early/Middle Bronze transition.

Pathology

As noted earlier, Phase II analysis has only just begun. While the whole population has not been thoroughly analyzed, the presence of some pathologies has been noted. For instance, several fused dog vertebrae with extensive bony accretions have been found, as well as a second phalanx from a sheep or goat that is deformed with severe exostosis. For both, see Figures 8.4 and 8.5. In addition, several bones (typically phalanges) have small but visible accretions.

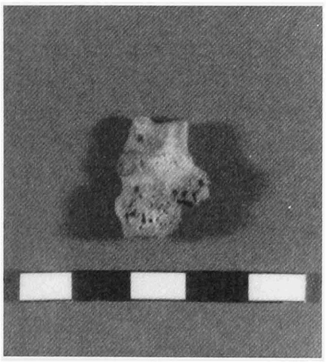
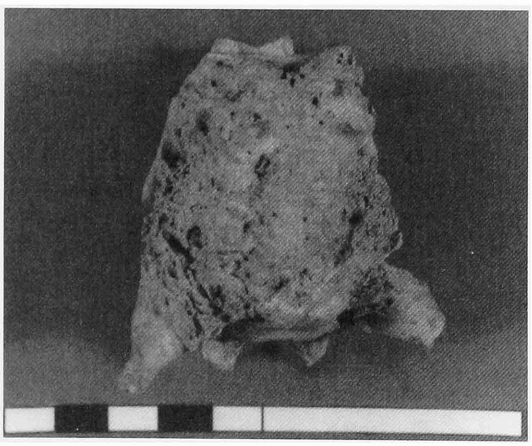


Fig. 8.4 (left). Sheep/goat second phalanx with pathology.

Fig. 8.5 (below). Canid vertebrae with accretions.



Intrasite Variability

It is premature to judge intrasite variability at this point. However, some trends can be observed in the data. Differences can mainly be based on the faunal results from the 1970s excavations and on the results from the renewed excavations. Buitenhuis (1983) had access to material from eight different areas of the tell. These were not separated by area, and thus it is impossible to know the variability within his sample. However, much of the earlier material was from the burnt remains of a (presumably) administrative complex. In general, these would not have been trash deposits (such as garbage pits), but perhaps a general accumulation of waste yet to be discarded. The majority of material in this report is from Operations 1 and 12, with smaller amounts from Operations 4–7, 13–18, and a small amount from Area IV.

Two taxa of mammal that were present in Buitenhuis's sample have yet to be identified in the present sample. These are *Camelus* cf. *dromedarius* and *Capreolous capreolus*. Only one camel bone was found by Buitenhuis, whereas the roe deer was the second most common wild animal after the hare. Conversely, animals identified in the present sample but not in the earlier one are *Castor fiber, Bos primigenius, Felis* sp., *Neomys* sp., and the other identified rodents. In addition, Buitenhuis attributes most of the equid remains to domestic animals—*Equus asinus and Equus caballus*—with the remainder the proposed hybrid. There is not yet any evidence for horse from the present excavations. The positive identification of the equids will be a priority of future analysis. Wild sheep, *Ovis orientalis*, was tentatively identified by Buitenhuis, and its identification is now verified. Buitenhuis also identified several species of bird, and it remains to be discovered whether all of the species present in the earlier sample are present in material from the later excavations.

Operation 1 has been broken down as much as possible by its stratigraphy according to occupation phase. When viewed by phase, some trends are visible (see Apps. 8.5 and 8.6). For most of the site's occupation, equids were relatively significant. In the first phase, they account for the mass of the material. A change occurs in Phase 5 when, by both fragment count and weight, equids decrease in importance. Even so, it is not until Phase 6 that sheep and goat provide the majority of mass to the assemblage.

NISP and bone weight do not appear to be directly proportional across phases of occupation in Operation 1. In Phase 5, the bone fragments of the equids are smaller than in the other phases. Unfortunately, Phase 5 is the only phase from which equids could not be specifically identified on the basis of their morphological traits; in addition, there are no measurable equid bones from Phase 5. It is really not clear how to interpret this. It is possible that a different species of equid (donkey?) is predominant in this phase. The per fragment weight of the cattle bones also seems to change in Phase 5, but in contrast to the equids, it seems to increase. It is possible that there was a change in processing or discard procedures. Also, if high fragmentation of cattle bone is related to calcium depletion through dairying (see section "Bos," above), then perhaps Phase 5 cattle remains represent animals that had not been milked. These questions can only be answered with further sampling of Phase 5 material.

Ancient Subsistence Patterns

It is difficult to characterize the Hajji Ibrahim assemblage. The first sample (n=249, of which 14 were human) contained many bones that were likely from some sort of commensal animal (i.e., non-food). And, while the wild animal remains definitely approximate zero (especially when the weights from the 1995 season are considered), a few wild animals are present, such as lepus and gazelle. The ancient food remains from Hajji Ibrahim paint a picture of a small farming village. Sheep, goat, cattle, and pig were the main animals exploited, and occasionally a hare or gazelle was hunted. The herds were probably very small, much the same as in the modern village of Nefileh, where an individual family owns a herd of 10–20 sheep and goat. This is a small enough herd to graze adequately in the agricultural fields, and Miller (this volume) suggests that the animals were, in fact, grazing on field weeds.

A picture of herding and hunting practices at Sweyhat is largely dependent on the specific identification of the equids. Based on morphology and measurements, the majority of the equid bones may be identified as *Equus hemionus.* As such, they are likely the remains of hunted wild animals. For the site as a whole, wild animals (equids, gazelle, and deer) constitute 11% (NISP) of the food animals. When bone weight is considered, this figure is 34%. Bone weight may be a better indicator of relative abundance in terms of diet. Onager and gazelle are both animals of the steppe. They are even known to form mixed groups (Groves and Willoughby 1981). The cape hare is also a steppe animal. It is possible that onager were the main focus of the hunt and the gazelle a byproduct. Fallow deer can be found in gallery forest which would have been present along the Euphrates, which is also where beaver, fish, and some bird may have been found. Red deer and aurochs are comfortable in open woodland, and were probably found in remnant stands of open oak forest. Wild sheep prefer hilly, wooded areas, and their domestic counterparts would have been at home on the steppe or the fallow agricultural fields. The animals of the gallery forest may have been exploited as a consequence of gathering fuel, as "the gallery forest trees willow/poplar and tamarisk are the most important constituents of the assemblage" (see Ch. 6). Perhaps the reason wild boar were not also exploited lies in their ferociousness. These large animals would not have been easy prey and the fallow deer were certainly less formidable opponents.

Herds of sheep and goat were probably substantial and are likely to have been seasonally transhumant. Miller (Ch. 6) reports that steppe plants make up the majority of the botanical assemblage and that herds were probably grazed on the steppe. It is difficult, at this time, to say how large the herds of cattle may have been. They have greater water requirements than sheep and goat and were probably kept closer to the site. Also, cattle were historically kept for their dairy products. The presence of some quite large cattle (but not wild) may indicate oxen, which would have been employed in plowing the fields.

Botanical evidence (see Ch. 6) suggests that some degradation of the environment had occurred by the time of Sweyhat's occupation. The result of this may have been an increased presence of steppe animals, such as onager and gazelle. As Sweyhat's location makes dry farming a risky activity, perhaps the inhabitants attempted to broaden their subsistence base by exploiting more stable wild resources. The percentage of wild animal remains (particularly equid) reaches a maximum when Sweyhat's population is at its highest. Conversely, the smaller population of Hajji Ibrahim could have subsisted on the food they produced. Further analysis of the faunal material will help to clarify the relations between population, environment, and resource exploitation.

Subsistence in the Euphrates Valley Region

An almost complete reliance on domestic sheep, goat, pig, and cattle is considered typical of third millennium animal exploitation. Analysis has shown that this is possibly the case for Hajji Ibrahim, but that Sweyhat deviates from this pattern, with remains from both domestic and wild animals in atypical quantities. However, when examined from the viewpoint of other sites in similar environmental settings, the situation is reversed. Hajji Ibrahim would seem to have an atypical assemblage, especially as regards pig raising. In terms of economic significance of a particular animal, the weight of the bone (a relative indicator of meat weight) may correlate better than NISP for relative abundance of different species. In terms of bone weight, sheep and goat may not be as dominant as often supposed. The use of bone weight as a quantitative measure of relative abundance may produce a slightly different picture for many sites.

For patterns to be representative of environmental constraints, rather than cultural patterning, sites with the same environmental conditions should exhibit less variability than sites in other environments. Several sites in close proximity to Sweyhat and in the same environmental zone (low rainfall, bordering steppe/semi-desert) can be compared. Then these sites can be compared to those along the Euphrates further north in modern Turkey. These areas are wetter, with correspondingly lusher grasslands (no true steppe). A summary of these sites and dates of their occupation is given in Appendix 8.7.

The overall pattern between the two areas is stunningly different (Appendix 8.7). All of the more northerly sites have subsistence patterns in which sheep, goat, pig, and cattle constitute more than 95% of the animal remains. Wild animals are inconsequential. By contrast, the more southerly sites have much higher percentages of sheep and goat, much less cattle, and little to no pig. Even by NISP, wild animals make up 10–20% percent of the assemblages. One exception is Late Uruk Habuba Kabira, with a ca. 2% wild animal count. Unfortunately, bone weights are not available for many of the sites. The comparison of these two regions (the more northerly sites with higher rainfall, and the more arid southerly sites) yield results that are slightly different from Zeder's (1995a) findings from the Khabur Basin. Zeder (1995a:31) noted that "the greatest dietary eclecticism seems to be found...in the more arid frontier." This diversity is represented in the more southerly Euphrates sites by the greater amounts of wild animal species. However, these same sites show the greatest dependence (by NISP) on a narrower range of domestic species.

Clearly, the inhabitants of Euphrates Valley sites in northern Syria practiced a subsistence strategy much different than their neighbors to the north. This accords well with the findings of Miller (see Ch. 7). Just as she found that wheat farming follows the rain, so, it seems, does pig raising. Pig have greater water requirements than do the domestic bovidae (see Zeder 1995b). Although located on or near the Euphrates, the inhabitants of these more southerly sites were constrained by the arid climate and steppe environment. Hajji Ibrahim is an exception. It was, however, situated on a wadi, and this may have provided a microhabitat suitable for small-scale pig raising. Perhaps onager meat functioned as a dietary replacement for pig flesh.

The importance of this study for our greater understanding of the Euphrates Valley is tremendous. Patterns of faunal exploitation across the area as a whole are rather uniform. However, whether this is based on environment-specific strategies for meat consumption or is a consequence of a shared "culture" or ethnic background remains to be tested. Methods in which this could be tested in the future could involve analyzing the cost in terms of time and technology of exploiting different animal species, the "fit" of the animals to the specific environment, and changes in species exploitation over time. These are questions that will not be answered by the animal bones alone, but rather must be supplemented by other aspects of material culture such as tool assemblages, and any evidence (such as tomb assemblages) that has bearing upon the social and political milieu.

Acknowledgments

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Notes

39. Abbreviations for measurements mainly follow Driesch 1976; but see also Eisenman 1986 for equid measurements.

APPENDIX 8.1

BOS MEASUREMENTS[39]

Scapula			SLC	GLP	LG	BG
91.2705	1	10	57.7		61.9	56.4

Radius			Bp	Bfp	Bd	Bfd
91.2593	6	19			>71.7	>66.5
91.2467	8	3		66.6		

Metacarpal			Bp	Dp	Bd	Dd	SDd
91.2038	1	13			59.8		
91.2559	6	14		48.6	28.6	19.5	
93.0681	12	6		54.8	30.7		
Metapodial							
89.0352	1	7			48.4	22.1	
93.0907	1	30				30.8	24.7
91.2633	5	17				30.0	22.0

Astragalus			GLl	GLm	Dl	Dm	Bd
93.0567	12	6	62.8	58.4	36.4	36.9	42.6
*93.1720	1,2	1	52.4	49.0	27.8	25.9	31.2

Ulna			BPC
91.2241	7	18	45.3

CQ Tarsal			GL	GB
89.0139	2	7	45.6	43.1

Tibia			Bp	Bd
91.1586	1	9		62.3
91.2705	1	10		62.4
91.2038	1	13	84.7	
91.1955	6	12		56.4
*93.1800	1,2	14		55.3

Calcaneum			Dl
93.0057	1	9	52.8

* = bone from Tell Hajji Ibrahim
† = very large bones
A minus sign after a number indicates an approximate measurement

APPENDIX 8.1 (CONT'D)

BOS MEASUREMENTS

Phalanx 1			GL	Bp	Sd	Bd	
91.1050	1	1	61.2	33.9	29.3	31.4	pathology
91.1337	1	3	57.1		25.2	28.9	
91.2015	1	9	57.9	25.8	32.4		
91.2271	1	9	56.6	25.1	20.8	23.5	
91.2715	1	9	50.9		23.5	24.4	
†91.1738	1	10	66.7	32.3	25.9	28.7	
93.0704	1	21	50.0	26.6	22.0	24.9	
93.0910	1	30		30.7	25.4	27.2	
91.2609	5	17	58.4				
91.2593	6	19	55.5				
91.1934	7	7	61.4			27.8	
93.0580	12	6	53.8	27.0-	21.1	23.5	
93.0309	13	1			25.0	30.4	

Phalanx 2			GL	Bp	Sd	Bd
†91.0650	1	1	55.2	44.8	30.5	
†91.0650	1	1	56.7	44.7	30.8	
91.1558	1	1	45.0	30.2	23.5	25.0
91.2152	1	9	32.9	22.8	31.1	35.7
91.2359	1	9	48.9	30.4	25.1	26.6
91.2359	1	9	48.4	30.8	25.0	26.0
93.0491	1	21	32.7	25.9	21.6	21.8
00.0119	2	4	39.6	26.5	22.2	23.5
89.0430	2	4	42.7	26.2	19.8	23.0
91.0136	2	6	43.5	31.7	25.0	25.0-
92.0520	4	20	44.8	31.5	24.3	26.8
91.1794	5	14	40.7	34.0	27.8	28.4
91.0650	1	1	39.9	24.6	19.8	21.8
91.0650	1	1	39.9	26.2	21.2	22.7

Phalanx 3			DLS	Ld	HP	
91.1714	1	10	77.8	61.1	39.1	
93.0704	1	21	55.2	33.9		
93.0704	1	2			35.7	
93.0740	1	28	74.6	52.6	24.5	
91.2647	5	18	46.6	38.8	28.3	young

APPENDIX 8.2

SHEEP AND GOAT MEASUREMENTS[39]

Mandible			1	2	3	4	5	6	7	8	9	10	11	12	13	15	16	17	18
Sheep or Goat																			
91.2022	1	9				12.5			72.7	53.9	30.7	21.4	36.6						
91.2715	1	9							74.5	52.8	22.3	25.4	9.9				21.0	18.1	
91.2715	1	9							73.4	51.0	21.6	23.8							
91.2715	1	9															21.6		
91.2715	1	9																	
91.1473	6	1							71.2	46.4	24.5	L=22.4				31.9	21.0	14.3	
91.1473	6	1				117.0			78.5	54.0	23.5		39.0			38.8	22.0	15.8	
91.2755	6	20			47.1											41.2			
93.1552	12	2	172.8		57.2	116.9	124.8	143.7	71.8	50.1	21.0	23.3	36.4			41.2	23.5	19.8	14.5
93.0580	12	6			50.1		130.8	146.3	83.7	54.8	28.3			60.6	64.8	36.4	20.9	17.3	13.6
92.0750	IVN	22	173.9	190.8	38.1	128.1	127.3	148.4	76.2	52.5	22.1	19.0	42.5	69.4	64.9	37.6	24.0	17.7	13.7

Atlas			GB	GL	BFcr	GLF	LAD	H	BFcd	Bcdc	Hcdc	HAv
Sheep												
93.0070	1	9		46.2	42.5	44.5		36.3	43.4	21.6	21.6	15.2
Sheep or Goat												
91.2011	1	9			54.3	50.9	44.4				21.9	14.9
91.2359	1	9			47.4			31.7				
91.2715	1	9						47.0	56.5	25.8	26.6	16.9
91.2194	1	16	63.2	53.3	40.0	40.9		33.3	46.6	21.1	20.8	

Axis			LCDe	BFcr	BPacd	SBV
Sheep or Goat						
91.2011	1	9				33.0
91.2194	1	16		44.0		
91.2275	1	16		42.8	26.0	20.5
91.0838	1	19		47.4		
89.0139	2	7		51.3		30.5
91.2316	7	19	58.2			

APPENDIX 8.2 (CONT'D)

SHEEP AND GOAT MEASUREMENTS

Scapula			SLC	GLP	LG	BG	HN	LP
Goat								
91.0634	1	1	22.7	36.9	25.0	24.7	11.9	
91.2359	1	9	25.0	37.6	27.6	25.4		
91.1714	1	10	19.1	29.7	20.5	20.1	20.2	10.5
91.2038	1	13	22.6	35.9	24.8	23.5	16.5	9.9
91.2028	1	14	19.3		23.0	21.8	15.7	
93.0494	1	15	20.2	34.2	25.0	21.5	15.7	9.6
91.2279	1	16	19.5	34.5	25.2			
93.0608	1	24				23.3		
93.0988	12	6				20.3		
Sheep or Goat								
89.0352	1	7	23.0	36.8	24.4	24.0	19.4	9.9
91.1738	1	10	22.2	35.4	27.6	24.7	19.7	8.7
91.2392	1	15	19.3				18.8	
Sheep, Goat, or Gazelle								
*93.0396	1/2	11	19.6	25.9-	21.2	19.8		
*93.0371	1/2	8		26.7-	19.0	19.5		
Sheep								
91.0625	1	3		32.0	24.3			
91.1734	1	9	19.2	31.9	24.7	20.9		7.9
91.2289	1	11	21.2	35.7	25.8	22.2	17.5	9.2
91.2042	1	16		34.3	24.5	21.7		8.2
91.2177	1	16	22.9	36.0	27.2	23.2	21.9	9.0
93.0804	1	27	19.1			19.3	16.2	5.9
93.0053	1	SECT	23.2	35.8				
93.0053	1	SECT	24.8	38.2	25.7	25.3		
91.1925	7	4	20.5			20.1	18.0	
91.1917	7	4	19.8	34.3	23.3	21.3	15.7	9.4
91.2316	7	19				18.5	16.5	
93.1552	12	2	20.3	31.9	23.6	20.0	12.0	8.7
93.1032	18	3				19.4		

* = bone from Tell Hajji Ibrahim

APPENDIX 8.2 (CONT'D)

SHEEP AND GOAT MEASUREMENTS

Humerus			Bp	SD	Bd	Bt
Goat						
91.2177	1	16			29.4	27.9
91.0838	1	19				28.8
93.0926	1	31			30.8	28.0
91.1917	7	4			33.8	31.7
92.0900	IVN	20			31.0	30.4
Sheep						
91.0632	1	3			32.7	30.4
†91.0640	1	5			36.7	34.1
89.0092	1	6				29.0
89.0098	1	6			31.6	30.0
91.0831	1	9			32.2	29.9
91.1723	1	9			25.6	22.8
91.1723	1	9			29.3	28.1
91.2011	1	9			29.8	30.0
93.0057	1	9			34.4	32.7
91.1714	1	10			35.3	33.2
91.1738	1	10			31.8	30.4
91.2183	1	10				34.8
91.2038	1	13			29.7	28.4
91.2038	1	13			32.2	29.7
93.0460	1	13			28.5	27.0
93.0494	1	15			28.9	27.8
91.2177	1	16			30.4	28.9
93.1616	1	30				31.1
89.0130	2	5			28.5	28.6
92.0410	5	32			31.5	29.7

Humerus			Bp	SD	Bd	Bt
Sheep or Goat						
91.1037	1	3				33.5
91.0640	1	5				
89.0212	1	7			35.7	31.3
91.1586	1	9				27.6
93.0057	1	9			29.5	28.0
93.1616	1	30				32.0
89.0139	2	7				30.4
92.0050	5	30		45.6?		
91.1586	6	0				30.9
91.2228	6	14			34.2	31.7
91.1934	7	7			32.0	
91.2472	8	3			30.0	28.2
93.0958	12	2				28.1
91.1939	7	17				27.2
*93.0391	1/2	8			30.1	28.4
Sheep, Goat or Gazelle						
91.2609	5	17				25.3 burnt
Sheep						
92.0460	5	32		14.4	29.0	28.0
91.0705	6	1				27.8
91.1511	7	4				32.5
91.1511	7	4				30.1
91.1934	7	7			31.5	29.3
91.2303	7	19			31.3	29.3
91.2413	7	/			31.5	31.3
93.1032	18	3			31.1	26.1

APPENDIX 8.2 (CONT'D)

SHEEP AND GOAT MEASUREMENTS

Radius			Bp	Bfp	SD	Bd	Bfd	GL
Goat								
†91.1050	1	1	38.3	36.0				
91.0622	1	2	31.5	28.5				
†91.0359	1	8	38.0	36.0				
91.2169	1	13	31.0					
91.0205	1	13	26.8	26.2	13.2			
91.2252	1	15				29.2	23.6	
91.2376	1	15	34.8	29.2				
93.0939	1	30	31.7	29.2				
91.0136	2	6	30.0	29.0				
89.0134	2	6	29.7	21.8				
91.2467	8	3				31.7	26.7	
93.0349	13	4	31.7	27.7				
93.0234	14	9	31.0	29.2				
92.0750	IVN	22	30.5	29.0				
Sheep or Goat								
91.0894	7	3	29.3	27.8				
Sheep, Goat, or Gazelle								
91.1756	5	11	27.7	25.0				

Radius			Bp	Bfp	Bd	Bfd	GL
Sheep							
91.1558	1	1	33.5	30.5			
91.0622	1	2	34.4	31.3			
91.0647	1	5			30.9	25.2	
89.0092	1	6			32.0	26.6	
91.0359	1	8	33.8	30.0			
91.2011	1	9	33.6	30.4	32.0	30.2	166.6
91.2359	1	9			29.5	22.4	
93.0057	1	9	35.4	18.2			
91.2252	1	15	28.6	27.2			
93.0519	1	21	32.4	29.9			
93.1610	1	30	29.8	28.4			
91.2386	1	13?			28.6	27.2	
00.0119	2	4			30.6	28.1	
89.0430	2	13	31.8	28.3			
91.2054	5	14			34.5*	26.5*	
91.2250	6	17	34.5	30.5			
91.2417	7	19	35.0	31.6			
91.2413	7	/	32.0	28.4			
93.0664	12	6	31.1	28.1			
93.0881	15	10			29.5	24.3	
93.1032	18	3	29.8	27.5			

APPENDIX 8.2 (CONT'D)

SHEEP AND GOAT MEASUREMENTS

Ulna			BPC	DPA	SDO	LO
Goat						
91.0359	1	8	27.7			
91.2169	1	13	23.2	25.7		
93.0939	1	30	22.9	27.9		
91.0136	2	6	23.0			
93.0234	14	9	23.8			
92.0750	IVN	22		26.0		
Sheep or Goat						
91.2472	8	3			22.8	
*93.0375	1/2	10			19.8	35.3
Sheep						
91.0622	1	2	20.9			
91.0647	1	5	18.9	26.3	22.7	43.7
91.1586	1	9	24.9	35.1	33.7	
91.1723	1	9	19.7	27.6		
91.2022	1	9	17.1	27.1	23.1	41.7
91.2359	1	9	18.2	26.4	23.6	39.6
91.2359	1	9	12.6	20.7	15.9	
91.2365	1	9		26.6	22.6	37.9
91.2038	1	13	16.8	25.1		
91.1944	7	18	20.4	28.7	24.0	45.5
91.2316	7	19	17.6			
93.0964	12	3	18.8	26.6	21.6	40.6

Pelvis			LA	LAR	BA	TAR	TAB	LFo
Sheep or Goat								
91.0359	1	8	30.4	25.2				
91.0359	1	8						
91.0359	1	8			27.1			36.5
91.1738	1	10	34.4	30.8	27.6	24.7		
91.1744	1	12	30.7	27.7		4.4		
91.2285	1	16	32.3	28.4				
93.0704	1	21	31.1	26.1				
91.1520	7	2	33.0	29.5				
91.1925	7	4	28.2	24.3	26.0			
*93.1678	1/2	11	29.0	23.0				
Goat								
91.2359	1	9	29.4	26.5	24.9		3.1	
Sheep								
91.1572	1	9	35.0	31.2				
91.2715	1	9	31.7	28.8	26.0	9.0	7.3	
91.2725	1	9	31.9	28.0				
91.2705	1	10	36.0	30.0	28.0	5.9	8.3	
93.0724	1	28				6.8		

SHEEP AND GOAT MEASUREMENTS

Metacarpal			Bp	Dp	SD	Bd	Dd	SDd	GL	GLe
Goat										
91.2381	1	15				25.1	15.3	9.7		
91.2472	8	3					17.0	10.8		
93.1777	16	5				26.4	15.6	9.6		
Sheep										
91.1572	1	9	24.5	18.3	14.6	26.6	13.0	17.8	149.2	132.3
91.1586	1	9				29.0	19.0	13.5		
91.2721	1	9				26.2				
†93.0299	1	13	29.3	19.9	18.4	31.5	19.3	14.0	149.4	145.7
91.2038	1	13					16.2	11.0		
91.2381	1	15	22.9	17.5		24.4	15.6	10.9		120.8
91.2177	1	16				24.5	16.4	11.4		
91.2279	1	16				24.6	16.3	10.9		
92.0570	4	21				26.5	16.2	10.9		
91.2633	5	17					17.0	11.8		
91.2593	6	19				24.7	11.7	16.8		
91.1925	7	4				19.5	14.8	11.7		
91.2343	7	/				25.8	17.2	11.2		
91.0875	7	?	25.4	17.2	14.0	26.0	17.6	12.5		
91.2467	8	3				27.6	17.6	12.0		
92.?	11	5					17.0	12.0		
93.1555	12	2				25.4	16.0	10.7		
93.0576	12	9				29.3	18.0	13.2		

Metacarpal			Bp	Dp	SD
Sheep or Goat					
91.1558	1	1	22.9	16.5	
91.0622	1	2	23.6	17.5	
91.0636	1	5	24.4	16.6	
89.0352	1	7	23.0	16.3	
91.0359	1	8	26.7	19.1	
†91.1586	1	9	31.7	23.0	
91.2022	1	9	24.3	16.7	
91.2359	1	9	26.1	18.8	
†91.2715	1	9	28.8		
91.2359	1	9	24.0		
†91.2038	1	13	29.4	20.4	
91.2050	1	13	22.2	15.9	
91.2252	1	15	24.3	17.2	
91.2177	1	16	24.5	17.6	
91.2275	1	16	23.6	17.2	
93.0821	1	31	23.3	16.7	13.0
89.0430	2	4	28.0		
92.0520	4	20	23.4	16.9	
91.2651	5	15	25.4	16.2	
91.2085	5	18	23.8	17.9	
91.0726	6	1	23.0	16.5	
91.0894	7	3	23.0	16.4	
91.1944	7	18	25.5	18.0	
91.2347	7	19	26.7		
93.0973	12	6	22.6	16.1	
93.0580	12	6	23.1	15.9	

APPENDIX 8.2 (CONT'D)

SHEEP AND GOAT MEASUREMENTS

Pelvis			LA	LAR	BA	TAR	TAB	LFo
Sheep or Goat								
91.0359	1	8	30.4	25.2				
91.0359	1	8						
91.0359	1	8			27.1			36.5
91.1738	1	10	34.4	30.8	27.6	24.7		
91.1744	1	12	30.7	27.7		4.4		
91.2285	1	16	32.3	28.4				
93.0704	1	21	31.1	26.1				
91.1520	7	2	33.0	29.5				
91.1925	7	4	28.2	24.3	26.0			
*93.1678	1/2		11	29.0	23.0			
Goat								
91.2359	1	9	29.4	26.5	24.9		3.1	
Sheep								
91.1572	1	9	35.0	31.2				
91.2715	1	9	31.7	28.8	26.0	9.0	7.3	
91.2725	1	9	31.9	28.0				
91.2705	1	10	36.0	30.0	28.0	5.9	8.3	
93.0724	1	28				6.8		

Femur			Bp	DC	Bd	BTP	
Goat							
93.0063	1	9		21.4			
Sheep							
91.0625	1	3	43.0	20.4			
91.1723	1	9		19.8			
91.1723	1	9		19.7	burnt		
89.0385	1	10		22.1			
†91.2467	8	3	50.0	22.7			
†93.0958	12	2	54.0	24.3			
Sheep or Goat							
91.0622	1	2		21.5			
89.0352	1	7		21.4			
89.0382	1	9		20.5			
93.0068	1	9				19.7	
91.0831	1	9		21.5			
91.2038	1	13			38.1		
91.2050	1	13			41.5	19.3	
91.2252	1	15		20.3			
91.2381	1	15			39.7		
91.1934	7	7			38.0	28.6	
91.2341	7	19			32.7	11.7	gaz?

SHEEP AND GOAT MEASUREMENTS

Tibia			Bp	SD	Bd
Goat					
89.0092	1	6			25.3
91.1723	1	9			29.4
89.0130	2	5			31.2
92.0570	4	21			25.4
89.0139	2	7?			29.7
Sheep or Goat					
91.1018	1	1		14.8	
91.2166	1	5			26.4
91.2022	1	9	44.2		
91.2038	1	13	36.7	38.2	
91.2190	1	16			28.4
91.1511	7	4			27.1
93.0958	12	2			22.6
*93.1708	1/2	11			24.5
*93.0395	1/2	11			21.7
Sheep					
91.1342	1	1			25.6
91.0622	1	2			25.0
91.1599	1	9			28.5
91.2022	1	9			25.5
91.2359	1	9			26.0
91.2715	1	9			22.7
91.2038	1	13			28.5
91.0845	1	14			28.6
93.1610	1	30			30.1
89.0139	2	7			28.3
92.0180	5	32			25.6
91.1913	7	15			25.7
92.1720	11	5			29.0

Patella			GL	GB
Sheep or Goat				
91.1699	5	14	31.5	22.6
89.0092	1	6	30.6	19.6
91.2050	1	13	25.7	21.7
91.1925	7	4	19.4	26.6

APPENDIX 8.2 (CONT'D)

SHEEP AND GOAT MEASUREMENTS

Astragalus			GLl	GLm	Dl	Dm	Bd	Bp
Goat								
91.1011	1	1	27.2	25.0	14.5	15.2	16.7	17.2
91.1011	1	1	30.3	28.6	15.4		18.4	17.4
91.1011	1	1	29.7	27.4	15.4	17.8		18.0
91.1011	1	1	26.5		13.3			16.7
91.2050	1	13	27.2	22.5	15.1		18.2	18.6
89.0405	2	6	30.0	28.0	15.6	16.5	18.0	18.6
92.0570	4	21		30.9	17.9		21.2	
91.1473	6	1	27.4	25.6	13.5	16.5	18.0	
91.2479	8	3	26.3	24.5	14.8	14.5-	16.2	16.4
93.1523	18	3	29.2	27.3	15.9	16.9	19.1	20.3
Sheep								
91.1011	1	1	30.9	29.2	16.9			
91.1011	1	1			17.5			
91.1011	1	1	29.2	28.1	16.1	17.2		18.5
91.1011	1	1		28.0		17.7	18.7	
91.1011	1	1		27.5	15.8			16.4
91.1011	1	1						19.8
91.1011	1	1	31.5	30.0	17.7			21.0
91.1011	1	1		27.2				
91.0632	1	3	31.5	30.2	17.7		19.3	20.9
91.0636	1	5	30.0	29.2	19.0			
91.1723	1	9	30.3	29.8	16.9		19.2	20.7
91.1723	1	9	30.3	28.9	16.5		19.5	19.4
91.2365	1	9	31.8	30.3	18.1	19.0	20.7	19.8
91.2715	1	9	31.1	30.3	16.9		19.4	21.3
91.2715	1	9	29.5		16.0		18.5	
91.2721	1	9	26.2	25.1	14.5		17.0	17.0
93.0063	1	9	28.9	27.3	16.1	16.6	17.2	18.5
91.1738	1	10	31.0	29.0	16.5		19.5	22.3
91.1738	1	10	31.6	29.4	17.6		20.1	21.2

Astragalus			GLl	GLm	Dl	Dm	Bd	Bp
Sheep or Goat								
91.1011	1	1	29.4	28.2				
91.1011	1	1	29.1		16.2			
91.1011	1	1	32.6					
91.1011	1	1	<30.1					
91.1042	1	1	30.3	28.4	16.1 worked			
91.1044	1	1	27.9		16.4		18.6	
89.0388	1	9	31.4	29.3			20.6	
91.2038	1	13	28.1	25.8	16.0		17.3	18.1
89.0552	2	18	28.4	27.4			18.5	
93.0244	14	3						22.3
Sheep								
91.0841	1	13	29.0	27.7	15.3	17.2	18.3	19.6
91.2028	1	14	29.0	28.1	15.6		18.1	18.1
91.2177	1	16	32.7	30.3	17.9	17.9	20.9	21.8
93.0624	1	21						21.1
93.0722	1	29	27.7	26.7	15.7	15.8	18.5	19.0
93.0923	1	30	27.9	25.0	15.2			17.2
93.1610	1	30	28.0	25.1	14.3		18.0	17.7
91.1392	5	11	29.7	28.0	16.8	17.8	19.5	20.0
92.0180	5	32	29.8	27.4	16.5		28.3	19.6
91.0894	7	3	34.8	32.9	19.6		22.8	24.0
91.1511	7	4	31.9	28.8	17.8	<16.6	19.9	21.6
91.1925	7	4	30.0	27.7	16.5	17.0	18.7	20.8
91.1917	7	4	32.7	30.8	18.5		21.2	21.5
91.1542	7	13	29.3	28.4	15.6		18.7	20.6
93.0661	12	6	27.5	25.8	15.9	14.9	17.4	18.7
93.1651	12	6	30.1	28.3	17.0	17.8	19.7	21.4
93.0846	12	6	29.4	27.4	16.2		19.0	worked?
93.0246	14	9	29.4	27.6	16.5	18.5	18.4	20.5
93.0894	18	3	28.8	26.7	14.8			18.5
92.0900	IVN	20	30.4		17.2		20.0	

APPENDIX 8.2 (CONT'D)

SHEEP AND GOAT MEASUREMENTS

Calcaneum			GL	GB	Dl	GLe
Goat						
91.1734	1	9	57.9	21.0	20.4	
91.1738	1	10	64.0	22.8	26.8	
91.2050	1	13	59.9	19.2	23.5	
Sheep						
91.1572	1	9	58.8			
91.2022	1	9	58.4	19.7		
91.2359	1	9	61.3	22.7		
91.1738	1	10		21.4	24.9	
91.1744	1	12	58.1	20.8	23.7	
91.1744	1	12		20.5	24.3	58.4
93.0507	1	22	62.2		25.2	
Sheep or Goat						
91.2715	1	9	55.7	17.8		
92.0070	5	30	56.0			
91.0894	7	3	62.7			
93.0324	13	1	55.5	21.5		
Sheep						
93.0718	1	23	63.5			
89.0130	2	5	62.0	22.3		
89.0425	2	12	58.5	19.5	23.1	
92.0180	5	32	58.4	20.0		
91.1542	7	13		26.0		
91.2241	7	18				51.0
92.0900	IVN	20	56.6	19.8	23.1	

Metatarsal			Bp	Dp	SD	Bd	Dd	SDd	GL
Goat									
91.1684	5	13				24.0	16.5	10.0	
92.0460	5	32	19.6	17.8	12.1	24.2	14.8	9.3	111.5
Sheep									
91.1734	1	9				24.8	15.8	10.5	
Sheep or Goat									
91.1306	1	1	22.8	23.1					
89.0352	1	7	22.0	20.9					
91.1586	1	9	20.2	20.3					
91.1723	1	9	22.0		22.4				
91.2715	1	9	20.6	20.7					
91.2715	1	9	17.1	20.3					
91.2252	1	15	24.2	21.8					
91.2376	1	15	23.4	21.7					
91.2190	1	16	22.4	23.2					
91.2190	1	16	20.8	22.0					
Sheep or Goat									
89.0425	2	12	22.3	22.0					
91.1925	7	4	22.8	21.5					
91.2316	7	19	23.3	22.8					
91.2413	7	/	20.3	20.0					
93.0985	12	2	23.0	21.9					
93.0999	12	6	21.9						
93.0567	12	6	23.1	21.5					
93.0309	13	1	22.0	21.5					
92.0870	IVN	20	20.2	20.9					

APPENDIX 8.2 (CONT'D)

SHEEP AND GOAT MEASUREMENTS

Metapodial			Bd	Dd	SDd
Goat					
91.0875	7	?	25.0	16.7	10.8
91.1723	1	9	32.4	17.4	11.4
91.2152	1	9	25.3	16.9	10.7
93.0061	1	9	28.5	17.2	11.0
89.0395	1	13		16.7	10.4
91.2050	1	13			11.2
91.2050	1	13		17.6	10.8
91.2169	1	13		18.8	11.6
91.0838	1	19	23.3	15.1	9.7
93.0942	1	32		18.3	11.5
93.0942	1	32		18.3	11.4
91.1794	5	14		15.1	9.0
93.0999	12	6	27.4	16.7	10.4
93.0691	12	6		16.7	10.3
92.0830	IVN	22		13.4	8.2
Sheep or Goat					
91.1406	6	3		14.5	9.4
91.1511	7	4			13.0

Metapodial			Bd	Dd	SDd
Sheep					
91.1011	1	1		18.0	11.9
91.0622	1	2	23.6	16.2	11.2
91.1037	1	3		17.0	11.8
89.0092	1	6		17.5	11.4
89.0382	1	9	24.2	15.6	11.9
89.0382	1	9		17.6	12.1
91.1586	1	9	24.7	16.8	11.0
91.2152	1	9	22.5	16.1	10.6
91.2294	1	12		16.6	11.8
91.2388	1	15		16.8	11.9
89.0134	2	6		15.5	10.7
92.0460	5	32		15.4	10.5
91.0875	7	?	26.2	17.8	12.9
93.0843	12	3		18.4	13.1
Sheep or Goat					
93.0982	12	2		16.2	10.4
92.0900	IVN	20	25.4	17.6	11.6

APPENDIX 8.2 (CONT'D)

SHEEP AND GOAT MEASUREMENTS

Phalanx 1			GL	Bp	Sd	Bd	
Goat							
91.0622	1	2	39.5	13.6	11.8	13.1	
91.2166	1	5	36.9	11.9	9.7	12.1	
89.0382	1	9	39.6	13.8	10.1	12.5	
91.1586	1	9	36.1	11.5	9.1	11.6	
91.1734	1	9	38.0	12.6	10.7	12.5	
91.2022	1	9	35.5	12.7	8.8	10.7	
91.2022	1	9		12.6	10.8		
91.2359	1	9	33.4	11.6	9.4	11.1	
91.2294	1	12	36.8	12.5	10.4	11.7	
91.2038	1	13	42.1	14.5	13.5	15.7	
91.2038	1	13	34.2	11.8	9.4	10.5	
91.2050	1	13	40.1	13.8	11.5	13.4	
91.2050	1	13	40.2	14.1	11.9	13.6	
91.2050	1	13	40.8	14.5	12.1	13.8	
91.2050	1	13	41.1	13.6	12.0	13.9	
91.2259	1	15	37.1	12.2	10.4	11.7	
91.2177	1	16	38.4	12.9	10.7	12.5	
93.0491	1	21		12.6	11.6		
93.0491	1	21	35.9	13.7	10.7	12.2	
93.0519	1	21	40.0	13.2	9.6	12.0	
91.0136	2	6	31.0	11.9	10.5	11.0	
91.2647	5	18	30.3	9.5	7.5	9.1	young
91.2647	5	18				12.2	young
91.0875	7	?	39.5	12.0	8.7	11.0	
93.0958	12	2	42.4	13.7	11.4	14.3	
93.0985	12	2	38.6	11.8	9.2	11.0	burnt
93.0975	12	2	40.4	13.1	9.9	12.2	
93.0999	12	6	45.4	14.9	13.6	15.2	
92.0900	IVN	20	43.3	14.8	11.6	13.3	burnt
92.0750	IVN	22	36.8	13.2	10.9	12.6	

Phalanx 1				GL	Bp	Sd	Bd	
Sheep								
91.1019	1	1		38.7	13.1	10.3	11.8	
91.0647	1	5			13.0	10.7		
91.0359	1	8		42.1	13.9	10.9	12.5	
91.1572	1	9	wild	51.1	16.4	11.9	15.1	
91.2152	1	9		36.6	13.2	10.4	11.9	
93.0057	1	9		43.0	12.7	15.3	12.9	
91.1723	1	9		34.5	11.4	8.7	10.3	
91.1723	1	9		38.6	12.5	10.5	12.2	
91.1723	1	9		40.2	14.3	11.4	13.2	
91.2359	1	9		40.2	13.2	10.1	11.8	
91.2038	1	13		33.7	12.5	10.5	11.7	
91.2038	1	13		38.6	13.0	10.7	12.5	
91.2050	1	13		38.0	12.2	9.7	11.6	
93.0074	1	16		36.2	12.0	9.4	10.5	burnt
91.2177	1	16		40.4	13.8	10.2	12.0	
91.2190	1	16		39.1	12.2	10.3	12.0	
91.2177	1	16		37.0	12.8	9.2	12.4	
91.2177	1	16					11.9	
93.0907	1	30		36.1	12.8	9.3	11.8	
93.0920	1	30		38.6	12.2	9.4	11.1	
93.0053	1	SECT	wild	51.8	16.6	12.2	15.0	
89.0421	2	12		41.4			13.0	
91.1392	5	11		35.6	12.7	9.7	10.9	
91.1765	5	13		36.0	18.0	10.0	12.0	
91.1511	7	4		38.4	12.7	9.5	11.5	
93.0999	12	6		40.3	13.6	10.5	12.3	
93.0973	12	6		39.6	13.8	11.4	13.0	
93.0594	12	6		39.5	12.4		11.7	
93.1814	16	5		41.1	13.0	9.7	11.8	
92.0770	IVN	22		39.8	13.4	10.4	12.7	

APPENDIX 8.2 (CONT'D)

SHEEP AND GOAT MEASUREMENTS

Phalanx 1			GL	Bp	Sd	Bd	
Sheep or Goat							
89.0083	1	5		12.0			
91.0640	1	5				10.7	
89.0366	1	8				12.6	
89.0382	1	9				9.8	
91.2701	1	9				12.5	
91.2252	1	15		12.1			
91.0838	1	19	38.5	13.4	10.3	12.1	
89.0430	2	4			9.3	11.0	
89.0130	2	5				12.9	
91.1396	5	12	>39		10.1	>11.5	
91.1699	5	14		12.0			
91.1794	5	14	35.6	11.5	8.8	10.6	
91.1934	7	7		15.6			
91.1934	7	7				10.5	
93.0985	12	2		12.7			burnt
93.1669	12	6				11.6	
91.2303	7	19	39.8	13.9	11.6	13.7	
*93.1800	1/2	14		12.5			

Phalanx 2			GL	Bp	Sd	Bd	
Goat							
91.1572	1	9	21.7	12.4	9.0	9.1	
91.1586	1	9	26.7	13.3	10.1	11.0	
91.1738	1	10	26.4	12.6	9.1	10.4	
91.2050	1	13	24.8	13.3	9.7	10.9	
91.2169	1	13	27.1	15.5	11.5	13.1	
91.2169	1	13	25.8	15.6	11.5	13.4	
93.0926	1	31	26.0	16.5	12.3	13.6	
91.2647	5	18			8.9	9.6	young
91.2647	5	18	20.2	11.0	7.4	9.1	young
91.2341	7	19	21.7	13.2	9.6	10.5	
Sheep or Goat							
91.2045	1	13		11.7	9.0	9.3	
91.2050	1	13	21.3	11.1	7.4	9.4	
89.0134	2	6		12.3	9.0		
89.0134	2	6		12.2			
91.1756	5	11	24.0	13.6	10.5	11.0	
91.2647	5	18			6.3	7.9	
91.1925	7	4		10.0			
91.2479	8	3	24.0	12.6	9.6	10.6	
93.0952	12	2				10.3	

APPENDIX 8.2 (CONT'D)

SHEEP AND GOAT MEASUREMENTS

Phalanx 2			GL	Bp	Sd	Bd	
Goat							
91.1572	1	9	21.7	12.4	9.0	9.1	
91.1586	1	9	26.7	13.3	10.1	11.0	
91.1738	1	10	26.4	12.6	9.1	10.4	
91.2050	1	13	24.8	13.3	9.7	10.9	
91.2169	1	13	27.1	15.5	11.5	13.1	
91.2169	1	13	25.8	15.6	11.5	13.4	
93.0926	1	31	26.0	16.5	12.3	13.6	
91.2647	5	18			8.9	9.6	young
91.2647	5	18	20.2	11.0	7.4	9.1	young
91.2341	7	19	21.7	13.2	9.6	10.5	
Sheep or Goat							
91.2045	1	13		11.7	9.0	9.3	
91.2050	1	13	21.3	11.1	7.4	9.4	
89.0134	2	6		12.3	9.0		
89.0134	2	6		12.2			
91.1756	5	11	24.0	13.6	10.5	11.0	
91.2647	5	18			6.3	7.9	
91.1925	7	4		10.0			
91.2479	8	3	24.0	12.6	9.6	10.6	
93.0952	12	2				10.3	

Phalanx 3			DLS	Ld	HP
Goat					
91.1342	1	1	36.1	30.0	16.3
91.0636	1	5	39.8	33.1	17.0
91.2038	1	13	29.6	22.0	14.9
93.1651	12	6	31.9	26.5	16.1
Sheep					
91.0359	1	8			16.4
91.2022	1	9	32.8	25.8	15.7
91.2050	1	13	34.3	27.2	16.7
91.2028	1	14			15.7
89.0139	2	7	33.0	27.5	18.4
92.0770	IVN	22			17.0

APPENDIX 8.3

GAZELLE AND CERVID MEASUREMENTS[39]

GAZELLE

Ulna			BPC	DPA	SDO
93.0250	14	9	13.7	20.5	17.2

Pelvis			LA
91.1947	7	18	26.5

Tibia			Bp	Bd
91.2715	1	9		21.8
91.1462	6	1		21.0
91.2467	8	3	33.0	

Phalanx 1			GL	Bp	Sd	Bd
91.2011	1	9	40.3	9.4	7.2	8.1
91.1714	1	10		10.0	7.0	8.0
91.1714	1	10	36.6	9.7	6.7	8.0

Phalanx 3			DLS	Ld
91.1595	1	1	20.0	15.6

Radius			Bp	Bfp
*93.1687	1/2	13	21.8	20.3-

Metcarpal			Bd	Dd	SDd
91.2609	5	17	18.4	13.6	10.2
93.0999	12	6	14.2	10.1	
Metapodial					
93.0945	1	30	20.6	15.5	11.0
Metatarsal					
91.2271	1	9	18.8	14.1	10.1

Calcaneum			Dl
91.1738	1	10	21.7

* = bone from Tell Hajji Ibrahim

APPENDIX 8.3 (CONT'D)

GAZELLE AND CERVID MEASUREMENTS

CERVID

Mandible			12	13	14	15a
91.1586	1	9	93.9	57.8	35.3	23.1

Scapula			GLP	LG	BG	HN	LP
91.1511	7	4	54.5	40.1	38.7	20.7	16.1

Metcarpal			Bp	Dp	Bd	Dd	SDd
93.0053	1	SECT			33.2	20.8	14.5
92.0750	IVN	22			28.8	18.0	13.4
Metapodial							
89.0418	2	11				20.0-	
Metatarsal							
91.2370	1	17			39.6	24.0	16.6
93.0053	1	SECT			32.8	20.7	15.4
92.0750	IVN	22	26.4	27.9			

Astragalus			GLl	GLm	Dl	Dm	Bd	Bp
91.2009	1	19	44.3	41.9	24.4	25.6	26.8	27.9
91.2343	7		46.4	44.7	26.4	27.0	28.5	31.4

Humerus			Bd	Bt
91.2359	1	9	42.3	39.7

Pelvis				LA	LAR	BA	SH
91.1723	1	9		47.4	40.5	31.6	
91.2422	7	19	fem		27.5	24.0	11.7

Tibia			Bd
91.1342	1	1	42.1
91.1586	1	9	33.0
91.2009	1	19	38.7

Calcaneum			GL	GB
91.2289	1	11	102.6	35.2

Phalanx 1			GL	Bp	Sd	Bd
91.2359	1	9	56.4	19.5	13.7	17.2
91.2359	1	9		19.6		

APPENDIX 8.4

EQUID MEASUREMENTS[39]

Atlas			Bcdc	Hcdc
91.1744	1	12	37.1	40.1

Axis			LCDe	BFcr	BPacd	GL	BD	Bcrc
93.0074	1	16	110.6	69.7		136.3	29.0	
89.0418	2	11	110**	74.0	48.0-		30.0	20.0

Scapula				SLC	GLP	LG	BG	HN	DHA	Ld
91.2022	1	9	H	53.5	>65	44.1	37.4			
91.2252	1	15	H	52.0	69.8	41.8	40.2	46.2		
93.0507	1	22	?			36.7	35.9			
89.0438	2	15	H	42.0	71.5	45.2	39.7	46.0	240**	124**

Humerus				Bd	Bt
91.1586	1	9		59.8	59.3
93.0494	1	15	H	62.2	63.6
91.1944	7	18			59.0
93.0696	12	2			62.8
93.0664	12	6	H	59.6	60.7

Patella			GL	GB
91.2376	1	15	53.7	52.9

Radius				Bp	Bfp	SD	CD	Bd	Bfd	Dfd	GL	GLed	GLlRU	GLRU
89.0366	1	8	?					58.5	46.2	29.1				
93.0288	1	9	H					60.9	50.6					
91.1714	1	10	H						52.0	31.5				
91.2194	1	16	H	66.4	59.2	33.4	118.3	58.5	51.0		288.0		338.1	343.0
91.2285	1	16	H											
89.0556	2	19	H	64.3	56.4	29.0	94.0					246**		
91.2347	7	19	H?					65.5**	58.9**					
93.1669	12	3	?					63.8	53.5	34.4				

** = unfused epiphysis

APPENDIX 8.4 (CONT'D)

EQUID MEASUREMENTS

Ulna				BPC	Dpa	SDO
91.2194	1	16	H	34.2	55.5	41.9
89.0556	2	19	H	36.5		

Pelvis			LA	LAR	BA
93.0053	1	SECT	59.0	54.3	47.1

Femur			Bp	Dp	DC	Bd	Bmd
93.0288	1	9				74.7	99.7
93.0290	1	16				78.0	103.3
93.0188	12	4	98.0	>77	46.0		

Tibia			Bp	Dp	Bd	Dd	
91.2715	1	9			55.7	38.6	
91.2725	1	9			57.2	39.1	fusing
89.0552	2	18	81.4	71.3	<58.0	40.7	

Astragalus				GH	GB	BFd	Lmt	Bt	DFd	Dm
91.1037	1	3		44.3-	41.7-	38.0	42.9		22.2	
91.1303	1	8	H		51.2	43.9		24.3	30.2	
91.1586	1	9	H	51.0	46.4	38.2	51.0	23.0	28.9	40.0
91.2705	1	10	H	52.7	50.0	38.5	53.0	22.8	30.0	43.6
91.1744	1	12	H	55.7	49.6-	44-	53.8	26.0	32.2	44.4
89.0395	1	13	H	52.6	48.9	38.8	50.6	21.6	28.4	41.4
93.0608	1	24	H	55.0	51.7	42.4	53.3	24.0	27.0	42.7-
93.0907	1	30	H	52.0		42.0		23.2	29.8	
89.0552	2	18	H	53.0-	50.4	43.0	51.8	24.0	31.6	41.8
91.2309	7	18	?				47.9			
92.1540	11	5	H	54.3						

APPENDIX 8.4 (CONT'D)

EQUID MEASUREMENTS

Calcaneum				Gl	GB	Dl/Dp	SDT	LTub	Bp
91.1586	1	9	H	96.0	39.8		14.8		
91.2365	1	9		92.9		42.0			
93.0061	1	9	H	94.6	40.9				
91.2705	1	10	H	95.0	40.1	43.8	15.6-	65.7	27.0
91.1744	1	12	H	95.2	43.2	44.7		69.0	
89.0395	1	13	?	93.7	45-	44.0	15.9	67.9	28.3
89.0552	2	18	H			43.0	16-	64.3	27.3
91.1542	7	13			45.0				
91.2347	7	19	H	92.5	43.0-	39.6			28.3
92.1540	11	5	H		42.5				

Metcarpal				Bp	Dp	SD	Bd	Dd	SDd
91.2715	1	9				25.0	35.9	29.0	23.0
91.0841	1	13	H?	41.0	28.5				
93.0821	1	31	A?	39.9	26.2				
91.1258	7	?					36.5		

Metapodial									
91.1334	1	1					40.5	30.8	26.3

Phalanx 1				GL	Bp	BFp	Dp	SD	BFd	Dd
91.1572	1	9		78.1	44.5	39.8	32.8	24.5	33.2	20.0
91.1586	1	9		71.5	37.8	35.7	28.8	22.8	30.4	17.3
91.2285	1	16				36.1	30.0			
93.0814	1	28		78.0					36.8	20.0
91.1473	6	1		73.2	39.3		33.7	30.0		
91.1934	7	7		79.0		28.3	29.3		34.4	
91.1944	7	18	ant?	69.4	43.4		29.6	22.4	31.5	

APPENDIX 8.4 (CONT'D)

EQUID MEASUREMENTS

Phalanx 2				Gl	Bp	BFp	Dp	SD	Bd	Bfd
91.1738	1	10		39.9		38.9	25.6			36.9
91.1473	6	1		40.3		33.5	26.7			37.8
91.1934	7	7		41.0		41.9	25.0			38.5
91.1944	7	18	post?	39.3	38.7	33.7	25.8	34.8	37.2	
91.1944	7	18			37.3	33.0	24.6	30.9		
91.2347	7	19	ant?	40.3			38.5		38.3	
91.2347	7	19		43.2		41.8	27.5			
91.2315	7	19		38.0-			25.0			
93.0952	12	2		40.0		34.2	26.3			33.5

Phalanx 3				GL	Ld	HP	LF	Bf	GB	
91.0359	1	8		46.0	38.8	27.9	13.8	36.1	51.5	
91.1738	1	10		48.9	43.0	32.4	21.0	36.0	50.5	
91.1744	1	12		47.2	56.3		36.7			
89.0405	2	6	post?	34.6	31.6	26.6	17.7	33.0	39.7	A
91.1473	6	1		47.1	45.2	32.0		34.0	50.0	
91.1944	7	18	ant	53.4	45.0	35.0	23.0	36.2	56.0	
91.1944	7	18	post	46.4	41.8	31.0	29.4	33.0	48.7	
91.2347	7	19	post	48.4	41.4	<32.0	<19.5	38.2		
91.2347	7	19	ant?		<42.0	<34.0	19.7	34.9		

APPENDIX 8.5

SPECIES (COUNT) BY OPERATION AND PHASE

	TELL ES-SWEYHAT													HAJJI IBRAHIM	
Taxon	Operation 1				Op 12	Op 1	Op 2	Op 4	Op 13-18	Op IV	Op 5	Op 6	Op 7	All operations	
	Ph 1	Ph 2-3	Ph 4-5	Ph 5-6		Ph 4-6								ct	wt
sheep/goat	44	90	968	361	298	1509	128	7	98	66	132	52	503	19	+
sheep	6	10	142	41	17	197	18	1	9	5	13	7	32		
goat	2	5	63	14	10	82	7		7	7	8	5	11		
sh/gt/gaz			17			17	3				7	2	4	8	+
gazelle	2		12	2	3	14			2		2	3		2	
pig											2			9	+
cattle	7	31	73	94	21	197	39	4	15	9	25	15	31	6	+
cervid		3	30	6	1	36	2					2	4		
bov/cerv	1		8	2		11	6		2			1	1	8	
equid	13	10	135	23	34	177	24		5	2	12	13	43		
canid		1	12			12	3		1	1	3	2	1	10	+
bird			12	2	2	16			3	15		6	1		+
fish			2												
reptile			1			1			1		2			2	
rodent			37		5	38	5			3		1		36	+
lepus			10		1	10								1	
shell		1	20	17	5	37			1	1	5	2	1	1	
felid														30	
beaver			1												
mammal															
small	2	1	26	10	2	48			2	1			1	4	+
medium	47	86	1462	399	371	2189	467	59	161	125	416	141	454	21	+
large	14	25	232	135	144	503	73	12	37	13	121	14	256	8	+
unidentified		5	83	15	96	288	249	5	22	7	128	81	219	57	+
other	10		42	25		67	7		30		21	12	1	14	
Total	148	270	3386	1146	1010	918*	1031	88	396	255	897	359	1563	235	

* This total reflects the total of phases 4 through 6, after subtracting the number included in other columns.

+ = presence in the 1995 sample

APPENDIX 8.6

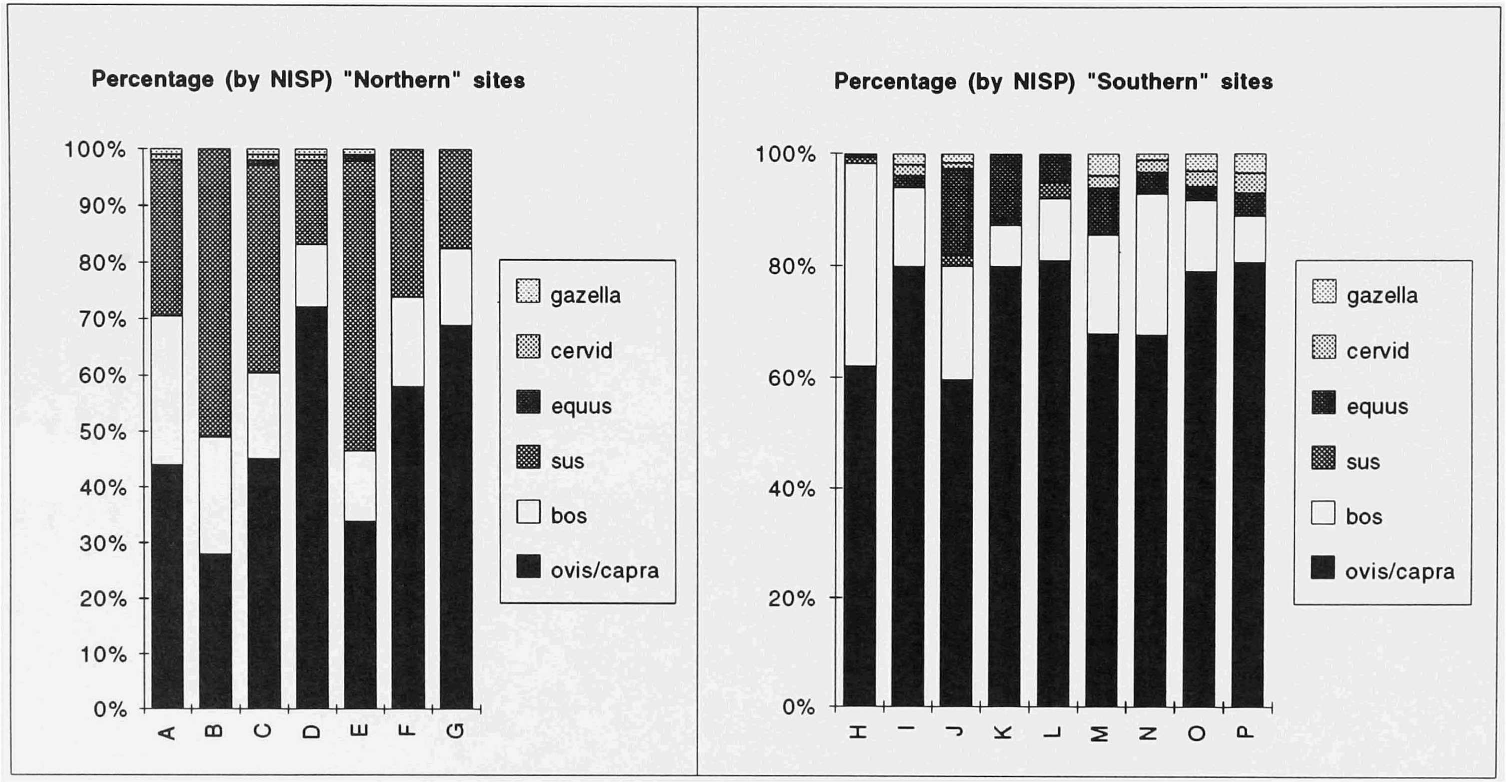
PERCENTAGES (BY NISP) OF ANIMAL REMAINS BY OPERATION AND PHASE

TELL ES-SWEYHAT

Taxon	**Operation 1**				**Op 12**	**Op 2**	**Op 4**	**Op 13-18**	**Op IV**	**Op 5**	**Op 6**	**Op 7**
	Ph 1	Ph 2-3	Ph 4-5	Ph 5-6								
sheep/goat	59	60	68	67	78	59	58	72	74	68	54	81
sheep	8	7	10	8	4	8	8	7	6	7	7	5
goat	3	3	4	3	3	3	0	5	8	4	5	2
gazelle	3	0	18	3	4	0	0	3	0	3	6	0
pig	0	0	0	0	0	0	0	0	0	3	0	0
cattle	9	21	5	17	5	18	33	11	10	13	15	5
cervid	0	2	2	1	0	1	0	0	0	0	2	1
equid	18	7	9	4	9	11	0	4	2	6	13	7
# of bones	74	149	1423	541	384	218	12	136	89	194	97	624

APPENDIX 8.7

INTERSITE COMPARISONS



A	Hacınebi	Chalcolithic	Stein 1996
B	Kurban	Chalcolithic	Wattenmaker 1990
C	Hassek	Late Uruk	Boessneck 1992
D	Hacınebi	Late Uruk	Stein 1996
E	Hassek	Early Bronze	Boessneck 1992
F	Kurban	Early Bronze	Wattenmaker 1990
G	Gritille	Early Bronze	Stein 1988

H	Habuba Kabira	Late Uruk	Driesch 1993
I	Halawa	2700–2500	Boessneck and Driesch 1989
J	Hadidi	Bronze	Clason and Buitenhuis 1978
K	Sweyhat	Bronze	
L	Selenkehiye	Bronze	Ducos 1973
M	T. Hab. Kabira	Early Bronze	Driesch 1993
N	Halawa	2300-2000	Boessneck and Driesch 1989
O	T. Hab. Kabira	Middle Bronze	Driesch 1993

9

CONCLUSIONS

Richard L. Zettler

Though we have been limited to five months in the field, our work has contributed substantially to reconstructing the late third millennium natural environment and to understanding the ecology of settlement along the Euphrates on the "margins" of the dry farming zone. We have shed light on the earlier third millennium settlement of Tell es-Sweyhat and been able to answer at least some of the questions we posed regarding northern Mesopotamian urban form. In addition, we have initiated a new phase of regional survey and excavations that promises not only to shed light on the process of Tell es-Sweyhat's growth and evolution over time, but also to document more fully long-term settlement trends in the southern part of the region between the Euphrates and the Balikh. Here we will try to pull together some of our more important conclusions, at least those related to the environment and Tell es-Sweyhat. We will leave a detailed discussion of regional work for a subsequent report.

Natural Environment and the Ecology of Settlement

Botanical and faunal remains give indications of the late third millennium landscape, already deforested, but somewhat different from that of today. A riparian forest, including willow and/or poplar and tamarisk, grew along the Euphrates, 3 km from the settlement; scattered oaks would probably have stood in the embayment, with denser stands of trees away from human habitation.

In terms of subsistence economy, where Wilkinson has earlier postulated areas of intensive agriculture near the settlement in the late third millennium, the botanical remains from the current series of excavations, particularly the wild seed to cultivated cereal ratio (numbers/weight), suggest an equally heavy reliance on pastoralism, much like today. Indeed, the wild seed to cultivated seed ratio for Sweyhat is substantially higher than for sites farther up river such as Hacınebi Tepe and Kurban Höyük, as well as for sites to the west such as Umm al-Mara in the Jabbul Basin (N.F. Miller, pers. comm. 1996). The faunal remains, while supporting the reliance on pastoralism, also attest to the exploitation of nearby wild animal resources: fish and beaver, fallow and red deer, onager and gazelle. Such substantial percentages of wild animals in the faunal assemblage perhaps illustrate how populations in marginal and higher-risk environments "tailored" their subsistence economies to meet localized needs (Zeder 1994:120).

Earlier Third Millennium Settlement

The early third millennium settlement of Tell es-Sweyhat was probably no larger than the area of the "high mound" and may have included both sedentary and semi-sedentary populations. By the third quarter of the third millennium the settlement had expanded from the original core area to include much of the northern and eastern lower town, to as far as the late third millennium outer fortification wall on the east. The settlement was probably 10–15 ha, but whether occupation was continuous or dispersed remains uncertain.[40] A cemetery that may have covered 1 ha and included 100–150 shaft-and-chamber tombs was located on the northwestern edge of the settlement. If Tell es-Sweyhat is to be identified with Burman of Ebla's Royal Palace G archives, it would seem more likely than not that this is the relatively small settlement those texts refer to (Astour 1992:35, n. 213; Meyer 1996:167, n. 120; but see Bonechi 1993: 82–83).[41]

While Tell es-Sweyhat's growth was more gradual or not as punctuated as we had previously assumed, the settlement nearly tripled in size by the end of the third millennium.

Urban Form in the Late Third Millennium

Late third millennium Tell es-Sweyhat consisted of (1) a walled center or citadel in the area of the original settlement; (2) a lower town surrounded by a fortification wall; and (3) a walled area to the south, the so-called lower town south. Whether the lower town south represented a trading colony (*karum*) or simply a walled suburb remains uncertain, but the lack of substantial deposition in the area suggests that it was occupied for only a short period of time.

The construction of a wall enclosing the "citadel" and extensive terracing documented in Operation 1 suggest substantial investment in the reorganization of the center of the settlement in the late third millennium. Though our excavations to date have focused only on the western edges of the mound, the Area IV building, with evidence of grain storage and metal working, and our "kitchen building" appear to have been ancillary structures. The core building(s) with which they were probably associated were built on a level several meters higher and farther to east.

The construction of a fortification wall surrounding the lower town, like the reorganization of the "citadel," presupposes considerable available labor and would have necessitated substantial organization and time. As our Operation 25 excavations show, the outer enclosure consisted of a 17 m wide rampart with sloping stone revetment and interior retaining wall. The rampart would have served as a base for a defensive wall. The pattern produced by magnetic mapping of the northern wall is not inconsistent with such a construction, though the situation of the northwestern outer wall is problematic. The rampart base for the outer fortification wall alone would have required moving more than 170,000 m^3 of earth and doubtless involved tens of thousands of person days.[42]

By the late third millennium Tell es-Sweyhat, with its outer and inner fortification walls and terraced central mound, would have come to resemble the sort of tiered city ostensibly described in Naram-Suen's inscription commemorating his conquest of Ebla and Armanum (Kraus 1948:81–92; Foster 1982:27–36; Gelb and Kienast 1990:253–264). It would also have resembled western cities as depicted on much later Assyrian reliefs such as one from Tiglathpileser III's "Southwest Palace" (Barnett and Falkner 1962:29, 140–141).

As for urban infrastructure, our magnetic surveys have perhaps located a gate in the eastern outer fortification wall and a network of streets. A system of water conduits in Operation 9 suggests that wells constituted a major source of water for the settlement, with the conduits funneling water to at least parts of the lower town.

The lower town seems to have been a complex of built and open or undeveloped spaces. Our magnetic mapping project will eventually provide us with a ratio of occupied to unoccupied space and, so, a key to a more accurate estimation of the lower town's population.

Relatively large, perhaps two-story houses stood in the lower town. The house uncovered in Operation 4 provided evidence of household production such as spinning and/or weaving activities.

The lower town and lower town south were the loci of at least some industrial production. We suggest that stone working went on in the northwest part of the lower town. In the east central part of the lower town, we uncovered the remains of pyrotechnic industries, e.g., pottery production, though we have not yet determined whether the excavated kilns are contemporary with the late third millennium center or the smaller early second millennium settlement. We also located magnetic anomalies that may represent the remains of kilns in the lower town south. The existence of pyrotechnic industries in the east central lower town or in the lower town south would make sense given a predominant wind from the northwest. We have not yet found any evidence for metal working in the lower town similar to that uncovered in the 1970s excavations in the inner town (Area IV), perhaps suggesting that the technology was restricted to the inner town.

Future Research

Perhaps a major difference between applied and "pure" research is the open-endedness of the latter. Archaeological projects with broad research goals, such as the Tell es-Sweyhat Project, require an indeterminate number of field seasons. As work proceeds, questions are answered and new, perhaps unanticipated, research possibilities arise. In the next few field seasons, we intend to maintain our focus on the topography of the late third millennium urban settlement. We will continue our excavations on the west side of the high mound (Operations 1, 20, and 12), and geomagnetic mapping and both test and horizontal excavations in the lower town, particularly the southern end, and lower town south. At the same time, we want to dedicate increased resources to understanding Tell es-Sweyhat's anomalous growth at the end of the third millennium. We intent to expand Operation 25 on the eastern edge of the lower town to increase our exposure of mid-to-late third millennium building levels and continue excavations of the shaft-and-chamber tombs on the northernwestern edge of the site. Regionally, we hope to continue test excavations at nearby early third millennium sites and to expand our survey coverage in the Euphrates-Balikh uplands.

Parallel to field work, we face equal challenges of analyzing ecofacts and artifacts we have collected since 1989. We hope to complete the analysis of the botanical and faunal remains, as well as the study of the pottery from our Operation 1, 20, and 12 sounding in the near future.

Notes

40. The so-called wall painting building uncovered in Operation 5 on the southern end of the high mound may also date to

the third quarter of the third millennium, though that is not absolutely clear based on published pottery (Holland 1993/1994).

41. Both Astour and Meyer base their identification of Burman with Tell es-Sweyhat on the assumption that Tell es-Sweyhat was a much larger fortified settlement at the time of the Ebla archives.

42. Our calculations assume a 6 m high rampart roughly trapezoidal in section, 17 m at the base and 8 m at the top. Such a rampart would require 81 m^3 per linear meter (and Tell es-Sweyhat's outer fortification wall was in excess of 2100 m long). Late third millennium administrative documents from southern Mesopotamia give a standard of 3 m^3 of earth per day for each worker in the construction of various embankments (Civil 1994:128).

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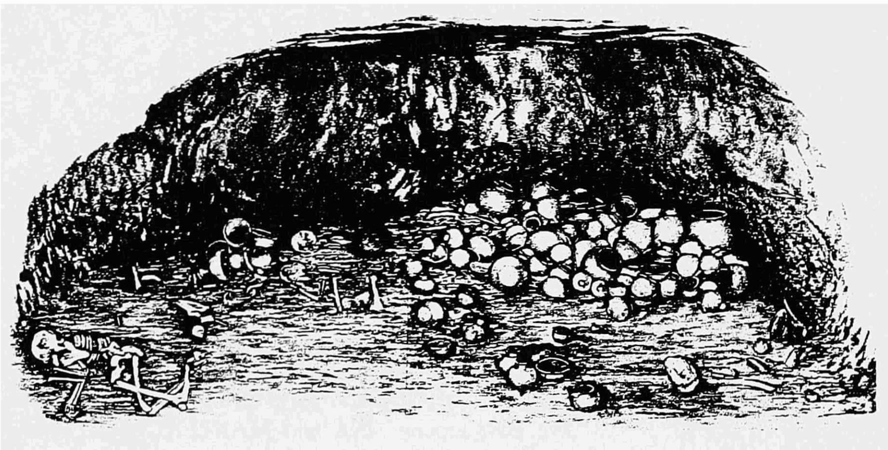

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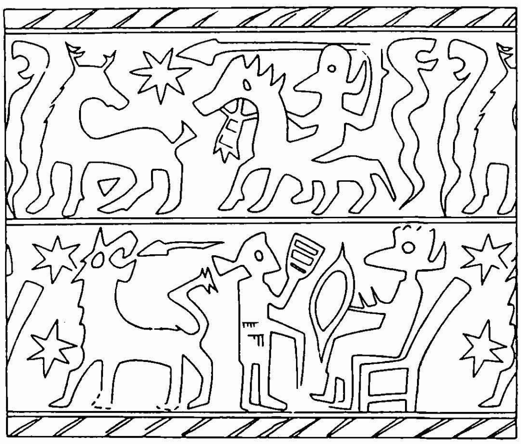

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