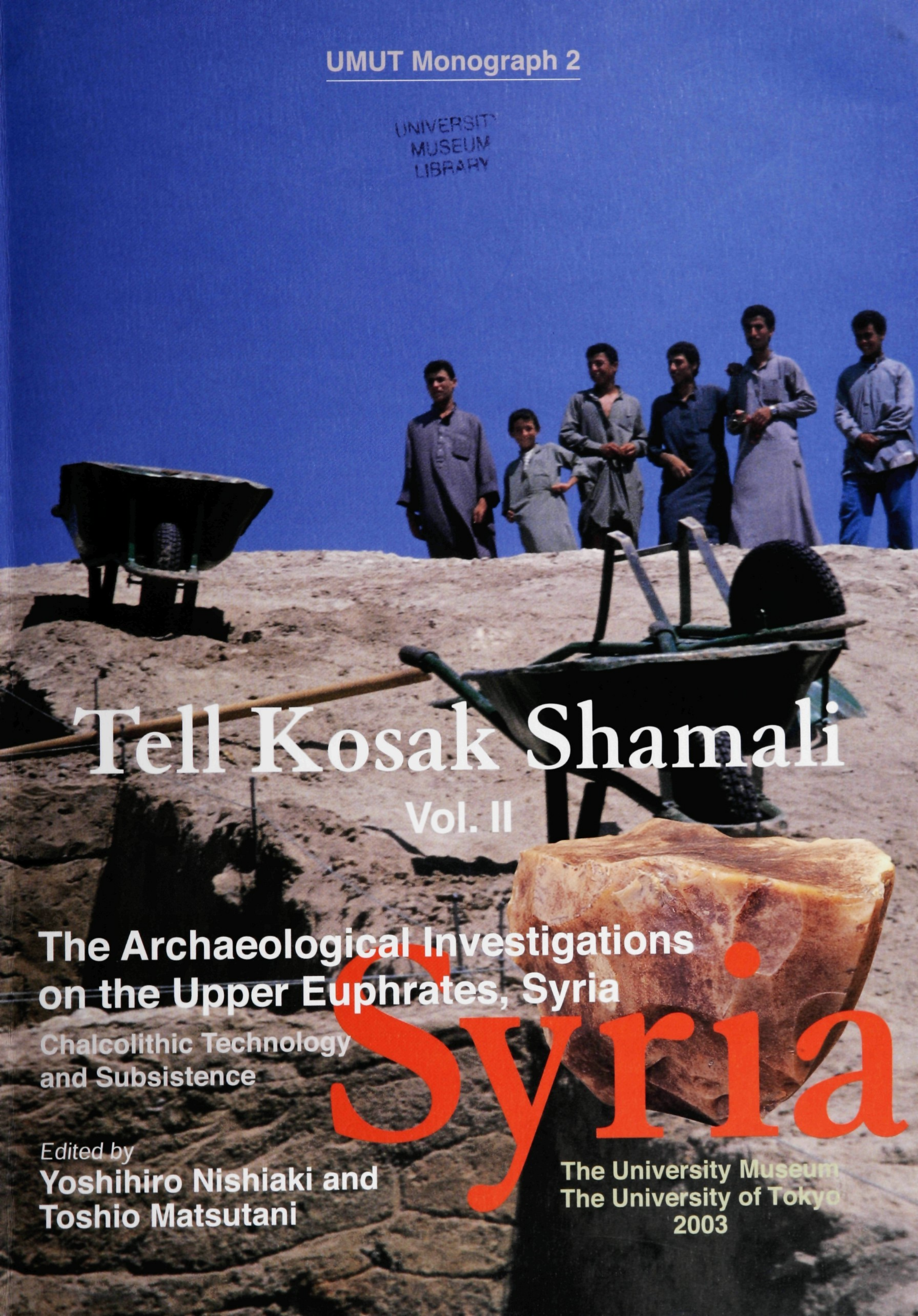


UMUT Monograph 2

Tell Kosak Shamali

Vol. II

The Archaeological Investigations on the Upper Euphrates, Syria

Chalcolithic Technology and Subsistence

Syria

Edited by
Yoshihiro Nishiaki and Toshio Matsutani

The University Museum
The University of Tokyo
2003

UMUT
Monograph 2

UMUT Monograph 2

Printed in Japan

UMUT Monograph 2

Tell Kosak Shamali

The Archaeological Investigations on the Upper Euphrates, Syria

Vol. II

Chalcolithic Technology and Subsistence

Edited by

Yoshihiro Nishiaki and Toshio Matsutani

The University Museum
The University of Tokyo

2003

Yoshihiro Nishiaki and Toshio Matsutani (eds.) 2003
Tell Kosak Shamali
–The Archaeological Investigations on the Upper Euphrates, Syria
Vol. II Chalcolithic Technology and Subsistence
Tokyo: The University Museum, The University of Tokyo

Issued March 31, 2003
Designed by Yae Kosugi
Printed by Yoshida Printing Inc., Japan
ISSN 1346-6356

Hardbound copies of this volume are directly available from Oxbow Books, Park End Place, Oxford, OX1 1HN, U.K / The David Brown Company, PO Box 511, Oakville, CT 06779, U.S.A.

The general view of Tell Kosak Shamali
Top: Tell Kosak Shamali seen from Qalat Najem, 1995.
Bottom: Tell Kosak Shamali with its top on the Tishreen dam lake, 2001.

CONTRIBUTORS

Hideo Akanuma, Iwate Prefectural Museum, Morioka, Japan

Ludovic Bellot-Gurlet, LADIR, UMR2, Thiais, France

Céline Bressy, UMR 6636, CNRS, Institut Dolomieu, Grenoble, France

Jacques Connan, UMR 7509, CNRS, E.C.P.M.-Université
Louis Pasteur-Strasbourg, Strasbourg, France

Lionel Gourichon, UMR 5647, CNRS, Maison de l' Orient Méiterranéen, Lyon, France

Daniel Helmer, UMR 5647, CNRS, Maison de l' Orient Méditerranéen, Lyon, France

Seiji Kadowaki, Department of Anthropology, University of Toronto, Toronto, Canada

Toshio Matsutani, professor emeritus, the University of Tokyo, Tokyo, Japan

Yoshihiro Nishiaki, Laboratory for Prehistory of West Asia, the University Museum,
the University of Tokyo, Tokyo, Japan

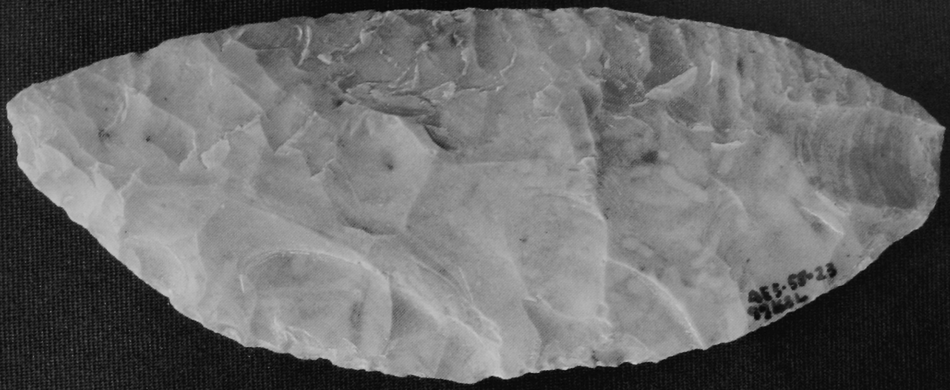
Hughes Pessin, Institut de Préhistoire Orientale, CNRS, Jales, Berrias 07460, France

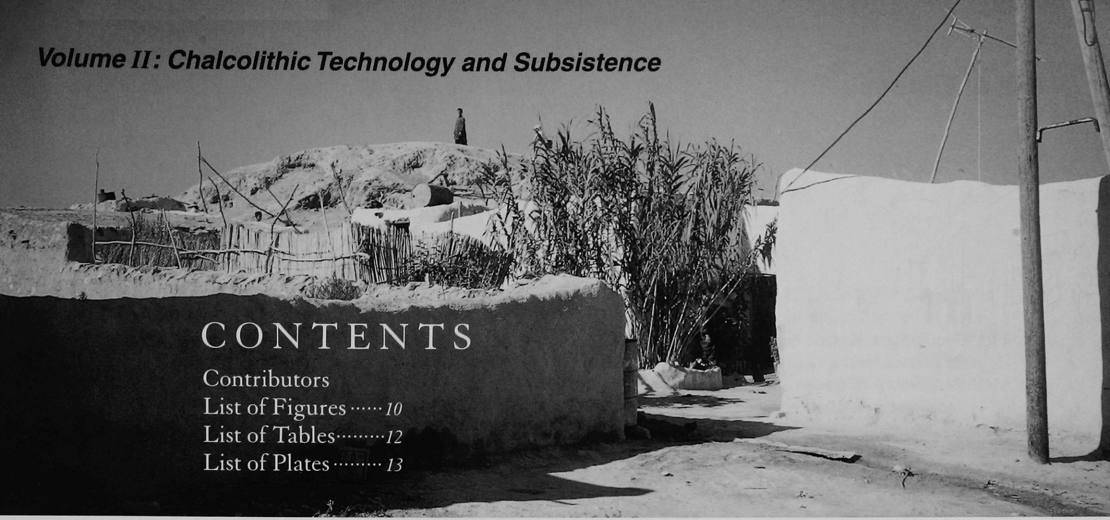
Gérard Poupeau, Centre de Recherche en Physique Appliquée à l' Archéologie,
UMR 5060 IRAMAT, CNRS-Université Bordeaux 3, France

Hiroshi Sudo, Department of Archaeology, Waseda University, Tokyo, Japan

George Willcox, Institut de Préhistoire Orientale, CNRS, Jales, Berrias 07460, France

Volume I: Chalcolithic Architecture and the Earlier Prehistoric Remains





Volume II: Chalcolithic Technology and Subsistence

CONTENTS

List of Figures

List of Tables

List of Plates

CHAPTER 11

Chronological developments of the Chalcolithic flaked stone industries at Tell Kosak Shamali

Yoshihiro Nishiaki

11.1 Introduction

The four seasons of excavations at Tell Kosak Shamali yielded about 33,000 flaked stone artifacts from the Chalcolithic levels (Table 11.1). The artifacts, mostly made of flint and obsidian, were derived from seventeen Ubaid levels in Sector A (Levels 17-1), and one Ubaid (Level 7), two Post-Ubaid (Levels 6-5), and four Uruk levels (Levels 4-1) in Sector B. This stratified collection provides us with the first opportunity to study full details of the lithic manufacturing activities and their development of this time range in the Upper Euphrates valley, Syria.

The aims of this chapter are to present basic techno-typological inventories of the lithic implements, in order to place the Kosak Shamali lithic industries in their proper time-space context. The chapter will be rather descriptive and the discussion will focus mainly on chronological changes of the techno-typological features

Table 11.1 Chalcolithic flaked stone artifacts from Tell Kosak Shamali.

Sector A	Level																		
	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	Later pits	Mixed	Total
Flint	**165**	**51**	**324**	**636**	**2313**	**1806**	**2469**	**2536**	**1282**	**2133**	**1819**	**1602**	**1220**	**1815**	**318**	**309**	**282**	**150**	**347**	**21577**
Cores	(12)	(2)	(17)	(65)	(111)	(64)	(121)	(177)	(108)	(125)	(128)	(71)	(62)	(72)	(17)	(17)	(20)	(14)	(24)	**(1227)**
Debitage	(146)	(46)	(282)	(500)	(1932)	(1549)	(2157)	(2160)	(1051)	(1844)	(1553)	(1449)	(1080)	(1596)	(265)	(260)	(240)	(116)	(274)	**(18500)**
Tools	(7)	(3)	(25)	(71)	(270)	(193)	(191)	(199)	(123)	(164)	(138)	(82)	(78)	(147)	(36)	(32)	(22)	(20)	(49)	**(1850)**
Obsidian	**1**	**4**	**4**	**17**	**25**	**15**	**17**	**12**	**5**	**9**	**11**	**1**	**3**	**7**	**1**	**1**	**0**	**0**	**0**	**133**
Cores	(0)	(0)	(0)	(1)	(0)	(0)	(0)	(1)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	**(2)**
Debitage	(1)	(4)	(3)	(13)	(21)	(9)	(10)	(7)	(4)	(5)	(7)	(0)	(2)	(3)	(1)	(0)	(0)	(0)	(0)	**(90)**
Tools	(0)	(0)	(1)	(3)	(4)	(6)	(7)	(4)	(1)	(4)	(4)	(1)	(1)	(4)	(0)	(1)	(0)	(0)	(0)	**(41)**
Total	**166**	**55**	**328**	**653**	**2338**	**1821**	**2486**	**2548**	**1287**	**2142**	**1830**	**1603**	**1223**	**1822**	**319**	**310**	**282**	**150**	**347**	**21710**

Sector B	Level								
	7	6	5	4	3	2	1	Later pits	Mixed	Total
Flint	**999**	**3905**	**2027**	**2301**	**796**	**328**	**464**	**51**	**287**	**11158**
Cores	(111)	(150)	(114)	(105)	(36)	(11)	(16)	(3)	(19)	(565)
Debitage	(742)	(3486)	(1713)	(1959)	(650)	(276)	(402)	(43)	(238)	(9509)
Tools	(146)	(269)	(200)	(237)	(110)	(41)	(46)	(5)	(30)	(1084)
Obsidian	**4**	**8**	**4**	**7**	**1**	**1**	**1**	**0**	**0**	**26**
Cores	(0)	(0)	(1)	(2)	(0)	(0)	(0)	(0)	(0)	(3)
Debitage	(4)	(7)	(2)	(5)	(1)	(1)	(1)	(0)	(0)	(21)
Tools	(0)	(1)	(1)	(0)	(0)	(0)	(0)	(0)	(0)	(2)
Total	**1003**	**3913**	**2031**	**2308**	**797**	**329**	**465**	**51**	**287**	**11184**

within the site. In view of the general ignorance of lithic remains by researchers at these late prehistoric periods, detailed descriptions of the techno-typological aspects need to be addressed at the outset. They will offer a reliable database on which future more activity-related analyses, including that of the *chaîne opératoire* of the Chalcolithic inhabitants, can be undertaken with confidence.

11.2 The techno-typology for the Chalcolithic flaked stone industry

The lithic assemblages from the Chalcolithic levels also contained a good number of Neolithic and Palaeolithic pieces. These intrusive materials have been studied separately (Nishiaki 2001a, 2001b). The collection referred to here consists solely of Chalcolithic artifacts. A classification system was devised on the basis of techno-typological features, basically following that developed for the Late Neolithic industries of the Khabur basin, Syria (Nishiaki 1991, 2000; also see 2001b), but including a range of modifications to accommodate unique elements observed in the Chalcolithic specimens. In the following, the system and the classification results will be described. It should be stressed that the present system was designed specifically for the Tell Kosak Shamali collection, with no intention to enlarge its applicability to materials from a wider geo-cultural region. Flint and obsidian artifacts will be treated separately because of their obviously different techno-typological features.

11.2.1 Flint artifacts

(1) Cores

Classification here is based on the form of blank removals, the number of platforms and exploited surfaces. The estimated stage of abandonment was also taken into consideration. Cores abandoned in the early stage consist of chunks and semi-flaked cores, which are distinguished by their undeveloped technological traits. Those in the final stage correspond to exhausted cores, which are too heavily exploited to retain traces of the earlier preparation. Cores of the middle stage refer to those with sufficient evidence to show flaking technology. They were first divided into blade and flake cores according to the dominant shape of blank removal scars, and then classified into several types by the number/location of platforms and exploited surfaces (Single-, Opposed-, and Multiple-platform cores, and Change-of-orientation cores).

Chunks

These are flint pebbles or natural flakes probably brought into the settlement as raw material for cores but unused for unknown reasons. Flint pebbles recovered from Tell Kosak Shamali are generally small, rarely exceeding 10 cm in length while natural flakes tend to be larger.

Semi-flaked cores

These are flint pebbles or natural flakes with limited flake scars on their surface (e.g. Fig. 11.15: 1). They are considered pieces abandoned after testing to examine the knapping quality.

Single-platform cores

Flat type: single-platform cores, whose main flaking surface is limited to one face only (e.g. Fig. 11.8: 1). The transversal section is relatively flat. The back is usually covered with the original cortex. Pebbles or natural flakes were preferred as core blanks, but thick flakes were also used as cores. In the latter case, the ventral surface was used as either a striking platform or a main flaking surface.

Prism type: single-platform cores, whose main flaking surface extends around the periphery of the platform (e.g. Fig. 11.11: 2). The transversal section is rather thick, but thinner specimens are also present. This variability may represent different reduction stages. Relatively thin cores tend to have two main flaking surfaces converging at one end (e.g. Fig. 11.12). When viewed from the top, the platform plan is a narrow triangle. Cores of this kind would have become shorter in the course of continuous reduction. Prismatic cores with blank production scars on all sides are rare. Most still retain traces of a cortical surface.

Opposed-platform cores

These are cores whose platforms are set at both ends (e.g. Fig. 11.29: 1). The main flaking surface is present on one face only. The cores with opposed-platforms from Tell Kosak Shamali take no standardized forms such as the Naviform core of the Neolithic. Instead they seem merely a type of change-of-orientation core resulting from continuous reduction of single-platform cores.

Multiple-platform cores
These are cores whose platforms are set around the periphery (e.g. Fig. 11.28: 1). The main flaking surface is exploited in a centripetal direction and overall shape is discoidal. Cores of this type can also be interpreted as representing a form in the continuous reduction of single-platform cores.

Change-of-orientation cores
Change-of-orientation cores have more than one main flaking surface, flaked from different platforms. These, too, may represent forms arising from repeated reduction of single-platform cores. They are subdivided according to the number and mutual relationship of the main flaking surfaces.
Crossed type: cores that have two main flaking surfaces exploited from different platforms or core surfaces (e.g. Fig. 11.11: 4). The main flaking surfaces are crossed to form a nearly perpendicular angle. The transversal section is relatively thick.
Bifacial type: cores with main flaking surfaces on both sides (e.g. Fig. 11.25: 3). The blank production on the back ran either in the same, opposed or in a crossed direction to that on the front.
Globular type: cores that have three or more main flaking surfaces exploited from different platforms or core surfaces (e.g. Fig. 11.8: 7). Their overall shape is globular.

Exhausted cores
These cores are so thoroughly exploited that formal classification is unproductive (e.g. Fig. 11.34: 2). The original cortex or weathered surface is rarely preserved on them.

Unidentified cores
Cores with heavy damage by thermal fractures are grouped under this category.

(2) Debitage
Debitage refers to all the knapping products from cores except those modified by subsequent retouch. It comprises two major technological groups: core trimming pieces, and flakes and blades.

(Core trimming pieces)
These are considered pieces produced as by-products of core preparation or core rejuvenation processes.

Crested pieces
Type 1: Flakes or blades with a central ridge made by bifacial flaking (e.g. Pl. 11.5: 6). They naturally have a triangular section. These pieces are considered to have served the first guiding blade or flake for subsequent blank removals from a prepared core.
Type 2: Flakes or blades with a central ridge made by a unifacial flaking. Flake scars to make a central ridge originate from a flat versant of the blank (Inizan *et al.* 1999: 138). They have a triangular or scalene triangular section. This kind of piece is often produced from reshaping of the existing core.

Plunging pieces
Plunging pieces are flakes or blades with the distal end carrying part of the opposite end of a core. They can be produced either by uncontrolled knapping or intentional core reshaping.

Core tablets
Core tablets are tabular flakes whose dorsal surface is completely covered with a striking platform or a main flaking surface of the core. They could have been detached intentionally or accidentally.

Core-edge pieces
These are flakes or blades retaining on one side the edge of the main flaking surface or platform of a core.

(Flakes and Blades)
Cortical flakes
These are flakes with cortex that covers half or more of the dorsal surface.

Partially cortical flakes
These are flakes with cortex that covers less than half the dorsal surface.

Flakes
These are flakes without cortex.

Partially cortical blades
These are blades with cortex that covers less than half the dorsal surface. Blades with more cortex are included in the cortical flakes category.

Blades
Blades are non-cortical flakes whose length is equal to or more than twice its width. A different definitions is employed for broken pieces whereby blades are classed as non-cortical flakes with more or less parallel dorsal ridges and edges. A special type of blade, the Canaanean blade, is represented in the present collection. Canaanean blades are long, wide, regular blades with parallel lateral edges and dorsal ridges, and having a set of deep negative scars accompanied by lateral spurs at the proximal end (e.g. Fig. 11.46: 4). A medium-grained, cream to beige flint, probably non-local in origin, was used for the Canaanean blades from Tell Kosak Shamali. The exploitation of a specific type of raw material aids in the identification of broken pieces. For further discussion on Canaanean blades see Rosen (1997: 46-49).

Chips and fragments
Any debitage smaller than 2cm in maximum diameter falls into this category. They include thermally fractured pieces.

(3) Tools
Sickle elements
These are pieces either showing visible sickle gloss or morphologically similar to those with sickle gloss. The latter can be termed "shape-defined sickle-elements". The "sickle gloss" may have been caused on flakes or blades through their use as threshing sledge elements. This possibility certainly deserves consideration, especially for those pieces from Late Chalcolithic levels (Anderson and Inizan 1994), but is difficult to test without careful use-wear analysis. Therefore the term "sickle elements" will be applied to possible threshing sledge elements as well.

The sickle elements from Tell Kosak Shamali were classified into six major types, and one additional type, according to general morphology. For classification purposes, all specimens are placed with their glossed edge oriented to the right. The specific shapes were produced by a variety of methods including direct retouch, snapping and anvil retouch. This classification system does not incorporate types of retouch on cutting edges (e.g. denticulated, nibbled, intermittently retouched...). When observed this is recorded separately.

Type 1: Rectangular shape (e.g. Fig. 11.10: 4). Glossed pieces whose ends and/or a lateral edge are retouched or snapped to form a rectangular shape.
Type 2: One-corner pointed shape (e.g. Fig. 11.16: 6). Glossed pieces with one end that has a pointed corner made by continuous, often concave, truncation retouch. The other end is retouched or snapped. The gloss is visible on a longer lateral edge.
Type 3: Crescent shape (e.g. Fig. 11.16: 5). Glossed pieces that have a curved back made by continuous abrupt retouch.
Type 4: Lozenge shape (e.g. Fig. 11.16: 7). Glossed pieces whose ends were diagonally truncated parallel to each other to form a lozenge shape.
Type 5: One-corner pointed shape with a gloss on a shorter lateral edge (e.g. Fig. 11.44: 5). Sickle elements of this type have the same morphological features with Type 2 pieces but are distinguished from each other by the different position of the gloss.
Type 6: Canaanean blades with a visible gloss (e.g. Fig. 11.50: 6). They represent a special type of Type 1 sickle elements.
Type 7: Others. They include pieces which are so badly broken that it is impossible to reconstruct their original shape.

Borers
Pieces with one or more than one pointed tip made by continuous retouch. Blanks can be flakes, blades or pebbles. Borers were divided according to the number and location of the pointed tips, and blank types.
Type 1: Borers that have a single pointed tip made on a flake (e.g. Fig. 11.8: 4).
Type 2: Borers that have more than one pointed tips made on a flake (e.g. Fig. 11.47: 4).
Type 3: Borers that have a single pointed tip made on a blade (e.g. Fig. 11.20: 2).
Type 4: Borers that have a single pointed tip made on a thick bilaterally retouched blade

(e.g. Fig. 11.9: 2). The pointed tip is not such that it is clearly separated from the body and these types might be better called reamers.

Type 5: Borers that have a single pointed tip made on a small thin blade (e.g. Fig. 11.41: 9). Their tiny size suggests use as a drill-bit hafted to a shaft.

Type 6: Borers made on a thick flake whose pointed tip is made by convergent retouch along both sides (e.g. Fig. 11.32: 3). They are morphologically similar to picks.

Burins

Pieces with burin facets. However, "burin facets" were occasionally employed at Tell Kosak Shamali not only to produce a working edge but also to prepare blanks for other tool classes, notably for segmenting blades into adequate lengths for use as sickle elements. Therefore, the burins here refer to those whose facets are considered as possible working edges in principle.

Type 1: Angle burins on break (e.g. Fig. 11.8: 6). Burin facets are made using a natural break or a snapped surface of one end as a striking platform.

Type 2: Angle burins on truncation (e.g. Fig. 11.44: 4). Burin facets are made using a truncated (retouched) end as a striking platform.

Type 3: Dihedral burins (e.g. Fig. 11.42: 1). Burin facets intersect at one end of the blank.

Type 4: Flat burins (e.g. Fig. 11.9: 7). This is a variety of angle burins, which have burin facets with a flat face originating from a natural break or a snapped surface of one end of the blank.

Type 5: Transversal burins. Burin facets are made by one or more blows delivered to a lateral edge of the blank without previous preparation. This technique was sometimes employed to segment sickle elements to a desired length; therefore the transversal burins in this chapter may include non-glossed sickle elements.

Type 6: Composite burins (e.g. Fig. 11.14: 2). Pieces with more than one burin facet made by a combination of the above-mentioned methods.

Splintered pieces

These correspond to *pièces esquillées* in the French literature. Whether they were tools or cores has been a matter of discussion, but the present specimens seem to have functioned as tools and are clearly too small to have produced sizeable tool blanks.

Type 1: Flakes or blades with a splintered edge at one end (e.g. Fig. 11.25: 7).

Type 2: Flakes or blades with splintered edges at both ends (e.g. Fig. 11.16: 3).

Denticulates

Pieces with one or more serrated edges or ends made by continuous retouch.

Type 1: Denticulates with a serrated edge on a lateral edge (e.g. Fig. 11.21: 7).

Type 2: Denticulates with a serrated edge at the distal end (e.g. Fig. 11.9: 3).

Type 3: Denticulates with a round or convergent serrated edge (e.g. Fig. 11.13: 1).

Type 4: Denticulates with serrated edges on both lateral edges (e.g. Fig. 11.13: 2).

Notches

Pieces with one or more notched edges or ends made by retouch.

Type 1: Notches with a working edge made by continuous retouch on a lateral side (e.g. Fig. 11.9: 6).

Type 2: Notches with a working edge made by continuous retouch at the distal end (e.g. Fig. 11.36: 1).

Type 3: Notches with a working edge made by Clactonian retouch on a lateral edge (e.g. Fig. 11.13: 3).

Type 4: Notches with a working edge made by Clactonian retouch on the distal end (e.g. Fig. 11.33: 3).

Type 5: Notches with multiple working edges (e.g. Fig. 11.32: 4).

Scrapers

Pieces with one or more round scraping edges made by continuous retouch. They include both side- and end-scrapers.

Type 1: Side scrapers with a working edge on a single lateral edge of the blank (e.g. Fig. 11.9: 5).

Type 2: Side scrapers with working edges on both lateral edges of the blank (e.g. Fig. 11.16: 2).

Type 3: Side scrapers with a round/convergent working edge on the blank (e.g. Fig. 11.13: 4).

Type 4: End scrapers with a working edge on

one end of the blank (e.g. Fig. 11.41: 4).
Type 5: Small end scrapers with a round working edge on one end of the blank (e.g. Fig. 11.21: 5). They are often described as thumbnail scrapers in the literature.
Type 6: Crescent-shaped scrapers with a working edge made by a series of intensive retouch (e.g. Fig. 11.13: 5).

Retouched blades
They refer to all the retouched and/or utilized blades that cannot be classified in the above-mentioned types.
Type 1: Blades with marginal continuous scars left by retouch and/or use (e.g. Fig. 11.46: 1).
Type 2: Blades with invasive continuous scars left by retouch (e.g. Fig. 11.34: 4).
Type 3: Blades with non-continuous scars left by retouch and/or use (e.g. Fig. 11.39: 3).
Type 4: Blades with a steeply retouched lateral edge (e.g. Fig. 11.41: 6). These may fall into a separate category - backed blades.
Type 5: Retouched blade segments. They could be fragments of other formal blade tools.
Type 6: Retouched Canaanean blades (e.g. Fig. 11.46: 4). This is a special type of blade, characterized by its large width and particular butt probably resulting from the use of a metal tool for detachment (see above).

Retouched flakes
These refer to all the other retouched and/or utilized flakes that cannot be classified among the above-mentioned types.
Type 1: Flakes with marginal continuous scars left by retouch and/or use.
Type 2: Flakes with invasive continuous scars left by retouch (e.g. Fig. 11.31: 5).
Type 3: Flakes with non-continuous scars left by retouch and/or use.
Type 4: Retouched flake segments. They could be fragments of other formal flake tools.

Retouch flakes
Not to be confused with retouched flakes above, these are by-products from retouching tools. Many retouch flakes must exist in the present collection, but they are often very difficult to identify. Burin spalls are the only type that can be identified with reasonable reliability (e.g. Fig. 11.31: 2). Other retouch flakes may be included in the category of chips.

Bifaces
Tools manufactured on pebbles with bifacial retouch (e.g. Fig. 11.28: 7). They resemble hand-axes of the Lower Palaeolithic, but are easily separated by their far more fresh surface condition. Invasive retouch was applied to both surfaces except for the butt area, which was probably left as a grip. The bifaces here do not include disk-shaped pieces even though they exhibit the use of bifacial retouch. The retouched edges of the disk-shaped pieces are rarely sharp enough to serve as a cutting edge. They will be dealt with in the chapter for grinding and ground stone tools (Chapter 13).

Choppers
Pebbles with sharp unifacial retouch forming an edge that is usually round (e.g. Fig. 11.26: 6).

Picks
These are heavy tools with a pointed tip made by continuous bilateral retouch at the distal end. Picks are on pebbles or massive flake blanks.
Type 1: Picks with a pointed tip made by direct unifacial retouch (e.g. Fig. 11.42: 3). The transversal section of the tip is rectangular.
Type 2: Picks with a pointed tip made by "trifacial" retouch: one surface of the tip is made by retouch from another surface (e.g. Fig. 11.30: 1). The transversal section of the tip is triangular.

Rods
These are thick flakes or pebbles with both sides are steeply retouched by a series of rough flaking (e.g. Fig. 11.10: 1). Unlike picks they do not have a clear pointed tip but resemble an elongated rod in shape.

Hoe
This is a hoe-shaped piece made by continuous retouches along the edges (e.g. Fig. 11.27). There is a single specimen in the Tell Kosak Shamali collection.

11.2.2 Obsidian

Obsidian pieces from Tell Kosak Shamali can be classified under the same system applied to the flint artifacts. However their typological variability is much more restricted. Only several of the above types were identified: cores are all exhausted pieces, core-trimming pieces are all core-edge flakes, and the tools consist of retouched blades, sickle elements, notches, denticulates, splintered pieces, and truncated blades only. The last group represents a unique tool type for the obsidian collection. They are blades with one end truncated by either obverse or inverse retouch (e.g. Fig. 11.52: 9). Because of the paucity of pieces in any of the above categories their sub-type division is often impractical.

11.3 Raw materials for the flaked stone artifacts

Flint was the most commonly exploited raw material for flaked stone artifacts at Tell Kosak Shamali. Flint color and quality vary greatly. To illustrate this variability, a sample from a locus BD7-14 in Level 1 of Sector B was examined in detail and the following types were defined:

Dark brown, fine-grained flint;
Honey yellow, fine-grained flint;
Reddish yellow, fine-grained flint;
Grayish brown, medium-grained flint containing numerous inclusions;
Cream to beige medium-grained flint.

Today, the first four types of flints are mostly available on the banks of the Euphrates and on Eocene flint bedded limestone terraces near the settlement, hence they are local material. In fact the excavated assemblages of these flints include all categories of cores, debitage and tools, emphasizing their local nature. However, the last flint type, the cream-to-beige, medium-grained flint is perhaps an import. It is exclusively used for Canaanean blades for which the manufacturing debris is not present on the site. There is no doubt that the relative use of these different types of flint fluctuated by period, and other levels or squares have yielded other types of flint that may have been non-local to Tell Kosak Shamali. However this remains to be tested in a future study.

In addition to the flint, sandstone and limestone were also exploited in small numbers for flaked tools. The river gravels of the Euphrates contain abundant sandstone cobbles which range in color from light brown, yellowish brown to reddish brown. These are very hard and coarse-grained, and when knapped exhibit flaking properties similar to those of flint. Sandstone cobbles were mostly used for grinding and ground stones (see Chapter 13), but were occasionally used for the production of choppers, flakes, and miscellaneous retouched flakes. Limestone, obviously ubiquitous in this region, represents another non-flint raw material for flaked stone artifacts. It occurs in the form of angular flakes dispersed on the terraces behind the settlement and is also mixed with the mound deposits. A few flakes, choppers and a hoe were manufactured on limestone. Since sandstone and limestone artifacts account for only a small percent of the total, and are both local, as are most of the flints, they are included with the flint in the following description.

Very little obsidian was used. Obsidian artifacts never exceed 3 % of the assemblage of each level and is generally less than 1 %. Trace element analysis was undertaken at Grenoble to determine possible obsidian sources. The results indicate that obsidian from two well-known source areas, i.e. Cappadocia and Nemrut Dağ, were both present at Tell Kosak Shamali (see Chapter 12). Obsidian artifacts will be described separately below.

11.4. Flint artifacts

11.4.1 Early Northern Ubaid

According to the pottery chronology, Levels 17 to 10 of Sector A correspond to the Early Northern Ubaid. No levels of this time period were excavated in Sector B.

Level 17 (Fig. 11.8: 1-4)

This level produced 165 flint artifacts (Table 11.1). They were not associated with any architectural remains, but were from the loosely deposited reddish brown soil layers (Nishiaki *et al.* 2001). This small collection is dominated by debitage (88.5 %), followed by cores (7.3 %) and tools (4.2 %). All cores show broad flake removal scars on their main flaking surfaces. There are no blade cores. Flake cores are mostly simple single-platform cores of either the flat (Fig. 11.8: 1 and 3) or prism types. Change-of-orientation and multiple-platform cores are relatively rare in this level (Fig. 11.8: 2; Table 11.2), as are rotation of platforms on a single core. Traces of careful core preparation using the cresting method are uncommon. The unpopularity of blade production is further indicated by the rare occurrence of blades in the debitage assemblage (Table 11.3), where they form 8.6 % (9/105) of the total, excluding chips and fragments.

There are only seven retouched tools, mostly on blade blanks (Table 11.4), and consist of three retouched blades, one borer (Fig. 11.8: 4), one burin, one denticulate, and one sickle element. While the tool assemblage is small, the scarcity of sickle elements should be noted as a characteristic trait shared with the other lowest levels of Sector A (see below).

Level 16 (Fig. 11.8: 5-7)

The flint collection from this level is quite small, consisting of 51 pieces (Table 11.1). The general composition is almost the same as in the Level 17 assemblage; dominated by debitage (90.2 %), with a smaller number of cores (3.9 %) and tools (5.9 %). The core assemblage includes a single change-of-orientation core (Fig. 11.8: 7) and a semi-flaked core (Table 11.2). The flaking technology reconstructed from the debitage also resembles that of Level 17, characterized by the predominant production of flake blanks and rare presence of blades (1/38, or 2.6 %; Table 11.3).

Only three pieces, i.e. two burins (Fig. 11.8: 5 and 6; Pl. 11.3: 15) and a retouched flake comprise the tool assemblage. Although the small sample the dominance of burins is remarkable.

Level 15 (Figs. 11.9 & 11.10)

There are 324 flint artifacts in the Level 15 collection (Table 11.1), composed of debitage (87.0 %), cores (5.2 %) and tools (7.8 %). The cores include two pieces with blade removal scars (Fig. 11.9: 1), accounting for 11.8 % of the cores (2/17). The ratio of blades in the debitage assemblage is nearly the same as for cores (19/217, or 8.8 %). While blade cores show no traces of careful core preparation, the presence of a crested element (Table 11.3) indicates use of the cresting method for initial core preparation. Semi-flaked cores are relatively common in this level (Table 11.2), but there is no evidence of their association with particular living contexts. Single-platform cores are the dominant core type as in the core assemblages of the earlier levels.

Denticulates (Fig. 11.9: 3) and sickle elements (24.0 % each) are the most common tool types. The sickle elements characteristically include Type 1 pieces made on large blades (Fig. 11.10: 3 and 4), a trend shared with earlier levels, but becoming less conspicuous in the later levels. A smaller number of burins (Fig. 11.9: 7), retouched flakes, notches (Fig. 11.9: 4 and 6), a borer (Fig. 11.9: 2), a retouched blade, a rod (Fig. 11.10: 1) and a scraper (Fig. 11.9: 5) are also present.

Level 14 (Figs. 11.11-11.14)

636 flint artifacts, consisting of 65 cores (10.2 %), 500 pieces of debitage (78.6 %), 71 tools (11.2 %), were recovered from this level (Table 11.1). The most common cores, excluding chunks and semi-flaked cores, are single-platform flake cores (Fig. 11.11: 1-3), followed by change-of-orientation cores (Fig. 11.11: 4; Table 11.2). While blades are rare among the debitage (26/403, or 6.5 %), the core assemblage includes two well-made single-platform, blade cores, both on carefully made biface blanks (Figs. 11.11: 5; 11.12; Pl. 11.1: 7). The specimen shown in Fig. 11.12, abandoned at the initial stage of reduction, enables a detailed reconstruction of blank production technology. The core blank was prepared to form a boat-shaped biface, after which a large plain platform was created by a longitudinal blow from the pointed end. A few blades were removed from the pointed end, perhaps with by direct percussion.

A variety of retouched tools were recovered, the most common being denticulates (Fig. 11.13: 1 and 2; Pl. 11.2: 4 and 6), notches (Fig. 11.13: 3; Pl. 11.2: 14), and retouched flakes,

Table 11.2 Cores from the Early Northern Ubaid levels of Tell Kosak Shamali.

	Sector A																	
Type	17	%	16	%	15	%	14	%	13	%	12	%	11	%	10	%	Total	%
(Early stage)																		
Chunk	0	0.0	0	0.0	0	0.0	4	6.2	1	0.9	3	4.7	2	1.7	5	2.8	15	2.6
Semi-flaked	0	0.0	1	50.0	5	29.4	14	21.5	18	16.2	7	10.9	14	11.6	23	13.0	82	14.4
(Blade cores)																		
Single-platform	0	0.0	0	0.0	1	5.9	2	3.1	11	9.9	2	3.1	1	0.8	4	2.3	21	3.7
Flat	(0)		(0)		(1)		(1)		(7)		(0)		(0)		(1)		(10)	
Prism	(0)		(0)		(0)		(1)		(4)		(2)		(1)		(3)		(11)	
Opposed-platform	0	0.0	0	0.0	1	5.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2
Multiple-platform	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Change-of-orientation	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.6	1	0.2
Crossed	(0)		(0)		(0)		(0)		(0)		(0)		(0)		(0)		(0)	
Bifacial	(0)		(0)		(0)		(0)		(0)		(0)		(0)		(1)		(0)	
Globular	(0)		(0)		(0)		(0)		(0)		(0)		(0)		(0)		(0)	
(Flake cores)																		
Single-platform	8	66.7	0	0.0	5	29.4	23	35.4	34	30.6	24	37.5	38	31.4	71	40.1	203	35.7
Flat	(4)		(0)		(5)		(12)		(23)		(17)		(18)		(41)		(120)	
Prism	(4)		(0)		(0)		(11)		(11)		(7)		(20)		(30)		(83)	
Opposed-platform	0	0.0	0	0.0	1	5.9	0	0.0	0	0.0	0	0.0	4	3.3	4	2.3	9	1.6
Multiple-platform	1	8.3	0	0.0	2	11.8	3	4.6	11	9.9	1	1.6	18	14.9	3	1.7	39	6.9
Change-of-orientation	2	17.0	1	50.0	0	0.0	13	20.0	32	29.0	23	36.0	31	26.0	51	29.0	153	26.9
Crossed	(2)		(0)		(0)		(3)		(12)		(7)		(11)		(27)		(62)	
Bifacial	(0)		(1)		(0)		(1)		(4)		(5)		(3)		(3)		(17)	
Globular	(0)		(0)		(0)		(9)		(16)		(11)		(17)		(21)		(74)	
(Final stage)																		
Exhausted	0	0.0	0	0.0	1	5.9	5	7.7	3	2.7	3	4.7	6	5.0	10	5.6	28	4.9
Unidentified	1	8.3	0	0.0	1	5.9	1	1.5	1	0.9	1	1.6	7	5.8	5	2.8	17	3.0
Total	12	100.0	2	100.0	17	100.0	65	100.0	111	100.0	64	100.0	121	100.0	177	100.0	569	100.0

Table 11.3 Debitage from the Early Northern Ubaid levels of Tell Kosak Shamali.

	Sector A																	
Type	17	%	16	%	15	%	14	%	13	%	12	%	11	%	10	%	Total	%
Core trimming pieces																		
Crested pieces, Type 1	0	0.0	0	0.0	0	0.0	0	0.0	2	0.1	1	0.1	0	0.0	4	0.2	7	0.1
Crested pieces, Type 2	0	0.0	0	0.0	1	0.4	0	0.0	2	0.1	0	0.0	4	0.2	3	0.1	10	0.1
Plunging pieces	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.1	2	0.1	0	0.0	4	0.0
Core tablets	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1	2	0.1	1	0.0	4	0.0
Core-edge pieces	4	2.7	0	0.0	8	2.8	5	1.0	25	1.3	20	1.3	27	1.3	14	0.6	103	1.2
Flakes and Blades																		
Cortical flakes	15	10.3	14	30.4	61	21.6	87	17.4	320	16.6	261	16.8	334	15.5	333	15.4	1425	16.2
Partially cortical flakes	33	22.6	9	19.6	68	24.1	148	29.6	578	29.9	482	31.1	686	31.8	634	29.4	2638	30.1
Flakes	48	32.9	14	30.4	69	24.5	142	28.4	628	32.5	487	31.4	633	29.3	505	23.4	2526	28.8
Partially cortical blades	1	0.7	1	2.2	5	1.8	8	1.6	60	3.1	58	3.7	48	2.2	65	3.0	246	2.8
Blades	8	5.5	0	0.0	14	5.0	18	3.6	113	5.8	61	3.9	96	4.5	95	4.4	405	4.6
Chips and fragments	37	25.3	8	17.4	56	19.9	92	18.4	204	10.6	176	11.4	325	15.1	506	23.4	1404	16.0
Total	146	100.0	46	100.0	282	100.0	500	100.0	1932	100.0	1549	100.0	2157	100.0	2160	100.0	8772	100.0

followed by sickle elements (Fig. 11.14: 3 and 5-7), scrapers (Fig. 11.13: 4 and 5; Pls. 11.3: 2; 11.5: 7), burins (Fig. 11.14: 2; Pl. 11.3: 17), borers (Fig. 11.14: 1; Pl. 11.3: 5), and splintered pieces. One scraper (Fig. 11.13: 5; Pl. 11.5: 7) is of particular interest; it is a bifacially flaked, crescent shaped piece in a brownish gray, medium-grained flint, with a small patch of cortex on one surface. The blank was perhaps either a flake from nodular flint, rather than a river pebble, or even tabular flint from seams in the limestone bedrock. The uniformity of the overall thickness, ca. 1.4cm, is very impressive, given its large size (14.0cm x 5.6cm), suggestive perhaps of soft hammer working. The straight side, with a comparatively sharp edge, may have been a cutting edge. Accordingly this specimen could also be referred to as a bifacial knife (cf. Rosen 1997: 81).

Level 13 (Figs. 11.15-11.18)

As an obvious consequence of enlargement of the excavation area (Nishiaki *et al.* 2001), the levels from Level 13 on yielded a much larger artifact collection. Level 13 produced 111 cores (4.8 %), 1932 pieces of debitage (83.5 %) and 270 tools (11.7 %) (Table 11.1). The cores include a relatively large number of single-platform blade cores (Table 11.2; Fig. 11.15: 2 and 3; Pl. 11.1: 8 and 9), a trend reflected in the frequency of blades among the debitage assemblage where blade blanks are slightly higher in this level (173/1699, or 10.2 %). Crested blades from careful blade core preparation are also present (Table 11.3). In addition to blade cores, single-platform flake cores are the most common (Fig. 11.15: 4), but change-of-orientation cores and multiple-platform cores are also present. The relative frequency of the latter two is significantly higher than in the earlier levels.

The Level 13 retouched tools consist of sickle elements (Fig. 11.16: 5-8), denticulates, notches (Fig. 11.16: 4; Pl. 11.2: 10), scrapers (Fig. 11.16: 1 and 2; Pl. 11.3: 1), splintered pieces (Fig. 11.16: 3), and so on. The range of these tool types is almost the same as in earlier levels, but the proportion of two particular types distinguishes the Level 13 assemblage from previous assemblages: a dramatic increase of sickle elements which constitute over half of the tool assemblage, and decrease of burins (Table 11.4). The relatively common presence of sickle elements is also noted for the later levels of the Early Northern Ubaid. Type 2

Table 11.4 Retouched tools from the Early Northern Ubaid levels of Tell Kosak Shamali.

	Sector A																	
Type	17	%	16	%	15	%	14	%	13	%	12	%	11	%	10	%	Total	%
Sickle element	1	14.3	0	0.0	6	24.0	8	11.3	159	58.9	89	46.1	40	21.2	52	26.1	355	37.1
Type 1	(0)		(0)		(2)		(2)		(24)		(17)		(9)		(9)		(63)	
Type 2	(0)		(0)		(1)		(3)		(45)		(38)		(12)		(20)		(119)	
Type 3	(0)		(0)		(1)		(0)		(21)		(9)		(10)		(15)		(56)	
Type 4	(0)		(0)		(0)		(0)		(35)		(15)		(7)		(4)		(61)	
Type 5	(0)		(0)		(1)		(1)		(19)		(2)		(0)		(2)		(25)	
Others	(1)		(0)		(1)		(2)		(15)		(8)		(2)		(2)		(31)	
Borer	1	14.3	0	0.0	1	4.0	4	5.6	2	0.7	5	2.6	7	3.7	8	4.0	28	2.9
Type 1	(1)		(0)		(0)		(2)		(1)		(2)		(5)		(4)		(15)	
Type 2	(0)		(0)		(0)		(0)		(0)		(0)		(0)		(0)		(0)	
Type 3	(0)		(0)		(0)		(2)		(1)		(3)		(1)		(2)		(9)	
Type 4	(0)		(0)		(1)		(0)		(0)		(0)		(1)		(2)		(4)	
Type 5	(0)		(0)		(0)		(0)		(0)		(0)		(0)		(0)		(0)	
Type 6	(0)		(0)		(0)		(0)		(0)		(0)		(0)		(0)		(0)	

	Sector A																	
Type	17	%	16	%	15	%	14	%	13	%	12	%	11	%	10	%	Total	%
Burin	1	14.3	2	66.7	3	12.0	5	7.0	4	1.5	4	2.1	4	2.1	3	1.5	26	2.7
Type 1	(1)		(1)		(1)		(5)		(3)		(2)		(2)		(1)		(16)	
Type 2	(0)		(1)		(0)		(0)		(0)		(1)		(0)		(0)		(2)	
Type 3	(0)		(0)		(0)		(0)		(0)		(0)		(1)		(1)		(2)	
Type 4	(0)		(0)		(1)		(0)		(0)		(0)		(0)		(0)		(1)	
Type 5	(0)		(0)		(1)		(0)		(0)		(0)		(1)		(1)		(3)	
Type 6	(0)		(0)		(0)		(0)		(1)		(1)		(0)		(0)		(2)	
Spall	(0)		(0)		(0)		(0)		(0)		(0)		(0)		(0)		(0)	
Splintered	0	0.0	0	0.0	0	0.0	1	1.4	1	0.4	0	0.0	0	0.0	1	0.5	3	0.3
Type 1	(0)		(0)		(0)		(0)		(0)		(0)		(0)		(1)		(1)	
Type 2	(0)		(0)		(0)		(1)		(1)		(0)		(0)		(0)		(2)	
Denticulate	1	14.3	0	0.0	6	24.0	14	19.7	27	10.0	30	15.5	46	24.3	39	19.6	163	17.0
Type 1	(0)		(0)		(3)		(5)		(12)		(15)		(25)		(17)		(77)	
Type 2	(0)		(0)		(1)		(3)		(5)		(5)		(7)		(9)		(30)	
Type 3	(1)		(0)		(2)		(5)		(9)		(9)		(12)		(8)		(46)	
Type 4	(0)		(0)		(0)		(1)		(1)		(1)		(2)		(5)		(10)	
Notch	0	0.0	0	0.0	2	8.0	13	18.3	18	6.7	10	5.2	19	10.1	20	10.1	82	8.6
Type 1	(0)		(0)		(2)		(4)		(11)		(2)		(7)		(4)		(30)	
Type 2	(0)		(0)		(0)		(1)		(3)		(0)		(3)		(1)		(8)	
Type 3	(0)		(0)		(0)		(6)		(2)		(8)		(3)		(8)		(27)	
Type 4	(0)		(0)		(0)		(2)		(2)		(0)		(2)		(2)		(8)	
Type 5	(0)		(0)		(0)		(0)		(0)		(0)		(4)		(5)		(9)	
Scraper	0	0.0	0	0.0	1	4.0	7	9.9	8	3.0	6	3.1	10	5.3	8	4.0	40	4.2
Type 1	(0)		(0)		(1)		(2)		(4)		(2)		(2)		(1)		(12)	
Type 2	(0)		(0)		(0)		(0)		(1)		(0)		(0)		(0)		(1)	
Type 3	(0)		(0)		(0)		(2)		(0)		(0)		(3)		(2)		(7)	
Type 4	(0)		(0)		(0)		(2)		(3)		(3)		(3)		(5)		(16)	
Type 5	(0)		(0)		(0)		(0)		(0)		(1)		(2)		(0)		(3)	
Type 6	(0)		(0)		(0)		(1)		(0)		(0)		(0)		(0)		(1)	
Ret. blade	3	42.9	0	0.0	1	4.0	8	11.3	23	8.5	23	11.9	20	10.6	17	8.5	95	9.9
Type 1	(2)		(0)		(1)		(7)		(15)		(17)		(14)		(15)		(71)	
Type 2	(0)		(0)		(0)		(0)		(7)		(5)		(4)		(1)		(17)	
Type 3	(0)		(0)		(0)		(0)		(0)		(0)		(1)		(0)		(1)	
Type 4	(0)		(0)		(0)		(0)		(1)		(1)		(0)		(1)		(3)	
Type 5	(1)		(0)		(0)		(1)		(0)		(0)		(1)		(0)		(3)	
Ret. flake	0	0.0	1	33.3	3	12.0	11	15.5	27	10.0	26	13.5	45	23.8	48	24.1	161	16.8
Type 1	(0)		(0)		(0)		(2)		(14)		(8)		(16)		(17)		(57)	
Type 2	(0)		(0)		(0)		(2)		(5)		(3)		(10)		(17)		(37)	
Type 3	(0)		(1)		(3)		(4)		(4)		(11)		(9)		(6)		(38)	
Type 4	(0)		(0)		(0)		(3)		(4)		(4)		(10)		(8)		(29)	
Biface	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Chopper	0	0.0	0	0.0	1	4.0	0	0.0	0	0.0	0	0.0	0	0.0	2	1.0	3	0.3
Pick	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Type 1	(0)		(0)		(0)		(0)		(0)		(0)		(0)		(0)		(0)	
Type 2	(0)		(0)		(0)		(0)		(0)		(0)		(0)		(0)		(0)	
Rod	0	0.0	0	0.0	1	4.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1
Hoe	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	1	0.1
Total	7	100.0	3	100.0	25	100.0	71	100.0	270	100.0	193	100.0	191	101.1	199	100.0	957	100.0

(Fig. 11.16: 6) is the most common of the sickle element types in Level 13, followed by Type 4 (Fig. 11.16: 7 and 8) (Table 11.4), a new type that makes its first appearance in this level. Burins become very rare, forming only 1 or 2 % from this level onward, in significant contrast to earlier levels. These may well reflect a change in tool manufacturing tradition.

While the sickle elements of Level 13 are particularly interesting because of their frequency, they also include an exceptionally well preserved piece (Figs. 11.17 and 18; Pl. 11.4: 1). It is a long sickle discovered in a stone wall of Room 1301. The sickle, 33.4 x 4.5 x 3.4 cm, has five flint elements embedded with bitumen in a slightly curved handle. The handle itself was nearly completely decayed, but in one small area, fragments attached to the bitumen indicate it was made of bone. This specimen enables a number of detailed observations on sickle hafting methods in the Early Northern Ubaid. Firstly, the elements were hafted parallel to the handle (cf. Nishiaki 1997, in press). Secondly, different types of sickle elements were used in the same sickle: both Type 1 pieces (Fig. 11.18: 1, and 3-5; Pl. 11.4: 2, and 4-6) and a Type 3 piece (Fig. 11.18: 2; Pl. 11.4: 3) were hafted in the same manner. Thirdly, as shown in the section drawing (Fig. 11.17), the dorsal surface of each element was exposed more than the ventral surface, much of which was covered with bitumen. These observations help to reconstruct the manner in which other isolated sickle elements were originally hafted to their handle.

Level 12 (Figs. 11.19 & 11.20)

The Level 12 assemblage amounts to 1806 pieces (Table 11.1), consisting of 64 cores (3.5 %), 1549 pieces of debitage (85.8 %), and 193 tools (10.7 %). Core technology is similar to that in earlier levels, but blade production seems to be slightly reduced in this level with only a few blade cores present. The presence of blade blanks in the debitage also diminishes slightly (8.8 %; 119/1349; Table 11.3). Most cores are of the flake type (Table 11.2), dominated by single-platform cores (Fig. 11.19: 2), although change-of-orientation cores (Fig. 11.19: 1 and 3) seem to increase in relative importance (Table 11.2).

The tool inventory is characterized by a range of types, such as sickle elements (Fig. 11.20: 6-10), denticulates (Fig. 11.19: 4, 5, and 7; Pls. 11.1: 17; 11.2: 1 and 3), notches (Fig. 11.19: 6; Pl. 11.2: 12), scrapers (Fig. 11.20: 1), borers (Fig. 11.20: 2 and 3; Pl. 11.3: 7 and 8) and burins (Fig. 11.20: 4 and 5; Pl. 11.3: 16). The common occurrence of sickle elements and the rare representation of burins are elements shared with the Level 13 assemblage, in strong contrast with the assemblages from Levels 17-14. The popularity of Types 2 (Fig. 11.20: 8 and 9) and 4 (Fig. 11.20: 10) characterizes the sickle element assemblage of Level 12, a feature also in common with Level 13 (Table 11.4).

Level 11 (Figs. 11.21 & 11.22)

The Level 11 flint assemblage comprises 2469 pieces (Table 11.1), 121 cores (4.9 %), 2157 pieces of debitage (87.4 %), and 191 retouched tools (7.7 %). The dominance of flake production is prominent both in core and debitage assemblages, with only a single blade core fragment (Table 11.2) and a small number of blades identified (8.0 %; 144/1797; Table 11.3). Single-platform (Fig. 11.21: 1 and 2) and change-of-orientation flake cores are almost equally represented, but multiple-platform cores are also common. Repeated use of the same cores is suggested in this level.

The common occurrence of change-of-orientation and multiple-platform cores in this level may be due partly to the discovery of an interesting feature in the level (Contexts AF3-3 and C10-2 in Square AF3; see Nishiaki *et al.* 2001) – a large mudbrick-walled building with rectangular rooms. A concentration of flake debris was discovered in an open space at the southwest of this building, consisting of 35 cores, 9 core-edge elements, 95 cortical flakes, 158 partially cortical flakes, 98 flakes, 16 partially cortical blades, 21 blades, 94 chips and fragments, and 9 retouched tools, totalling 535 pieces, almost exclusively in a honey brown flint, with some reddish honey brown pieces probably altered by thermal action. Most cores are either small and exhausted or change-of-orientation and multiple-platform types, which combined with the high proportion of debitage suggests that the concentration represents a knapping floor, or a floor where knapping waste had been discarded. The few retouched tools (7 denticulates and 2 sickle elements) may have been accidental intrusions.

The range of tool types in Level 11 is the same as in earlier levels. Representative types such as sickle elements (Fig. 11.22), denticulates (Fig. 11.21: 7 and 8; Pl. 11.1: 15 and 18) and notches (Fig. 11.21: 3 and 4; Pl. 11.2: 8 and 16) are illustrated. While sickle elements are the most common type, their relative frequency decreases slightly (Table 11.4) and the sickle element type also changes: Type 3 (Fig. 11.22: 7-9) becomes more common than Type 4 (Fig. 11.22: 10 and 11) from this level on (Table 11.4). Frequencies of simple retouched flakes and denticulates increase in this level. This relationship, and the fact that many sickle elements tend to be on flake blanks underscores the technological tendency already started in earlier levels. Another group of tools worth mentioning is thumbnail end-scrapers (Fig. 11.21: 5 and 6) made on short flakes or blades, (maximum length less than 1.5 cm) with unretouched butts and scraper retouch affecting the distal end. Very similar scrapers have been reported from the Late Ubaid site of Değirmentepe in the Upper Turkish Euphrates valley (Balkan-Atlı 1995).

Level 10 (Figs. 11.23-11.27)

The Level 10 assemblage consists of 2536 artifacts: 177 cores (7.0 %), 2160 pieces of debitage (85.2 %), and 199 retouched tools (7.8 %) (Table 11.1). The strong technological and typological resemblance between Levels 10 and 11 is not surprising given that these two levels are stratigraphically very closely situated (Nishiaki *et al.* 2001). Flake cores dominate core types (Figs. 11.23 to 11.25: 1-6), in particular single-platform (Fig. 11.23: 3 and 4) and change-of-orientation types (Figs. 11.23: 7; 11.24: 1-4; 11.25: 1, 3, and 5). A small number of atypical opposed-platform and multiple-platform cores (Fig. 11.25: 4 and 6) are also present and the few blade cores from this level are all comparatively small (Figs. 11.23: 5 and 6; 11.25: 2; Pl. 11.1: 11 and 12). The typical crested blades are probably by-products from an early stage of preparation of these blade cores (Pl. 11.5: 6).

As in other levels, sickle elements (Fig. 11.26: 2-5), denticulates (Fig. 11.25: 8; Pl. 11.1: 13 and 14), and retouched flakes are common tool types. Type 4 sickle elements become very rare (Table 11.4), notches, borers (Fig. 11.26: 1; Pl. 11.3: 9), scrapers and retouched blades are less common, and burins (Fig. 11.25: 9) and a splintered piece (Fig. 11.25: 7) are extremely rare. Two massive, limestone tools are worthy of note: one is a chopper with a round cutting edge on the longer side of thick flake (Fig. 11.26: 6; Pl. 11.5: 5), and the other is a hoe-shaped tool with an edge made by direct retouch at the distal end of a massive flake (Fig. 11.27; Pl. 11.5: 1), and narrowing at the proximal end but showing no evidence of hafting to any handle.

11.4.2 Late Northern Ubaid

Deposits of the Late Northern Ubaid were excavated in Levels 9 to 4 of Sector A only.

Level 9 (Fig. 11.28)

The assemblage consists of 1282 pieces (Table 11.1), 108 cores (8.4 %), 1051 pieces of debitage (82.0 %), and 123 tools (9.6 %). Core type composition is very similar to earlier levels (Table 11.5) with single-platform (Fig. 11.28: 2) and change-of-orientation flake cores being the most common. There are also a smaller number of multiple-platform flake (Fig. 11.28: 1) and blade cores. The ratio of blades in the debitage assemblage is 9.1 % (80/874; Table 11.6).

The tool assemblage differs somewhat from earlier levels (Table 11.7). Miscellaneous retouched flakes are the most common type forming about a third of the assemblage, followed by sickle elements which account for about 25 % (Fig. 11.28: 3-6), denticulates 20 % and notches 10 %. There are much smaller number of borers, burins, scrapers, retouched blades and so on. The relative frequency of these tool types seems almost stable throughout other levels of the Late Northern Ubaid levels (Table 11.7), perhaps typifying the tool inventory of this Ubaidian phase. Heavy duty tools such as bifaces and picks also occur characteristically in these levels. Level 9 also yielded a single biface (Fig. 11.28: 7; Pl. 11.5: 4), which resembles an Acheulian hand-axe but shows clear fresh flake scars.

Level 8 (Figs. 11.29 & 11.30)

There are 2133 flint artifacts from Level 8 (Table 11.1); 125 cores (5.9 %), 1844 pieces of debitage (86.4 %), and 164 tools (7.7 %). Flake cores, mostly single-platform and change-of-orientation types, dominate the core assemblage (Table 11.5). A few opposed-platform, blade and flake cores (Fig. 11.29: 1; Pl. 11.1: 10) are also present. Blades occur in the debitage assemblage in almost the same frequency as in Level 9 (9.0 %; 136/1511; Table 11.6).

Miscellaneous retouched flakes are the most popular tools in Level 8. Sickle elements are slightly more numerous than in Level 9, reaching nearly 30 % of the total (Table 11.7; Fig. 11.29: 5 and 6). With regard to sickle element type, the relative increase of Type 3 should be noted as, along with Type 2, it becomes the most common type (Table 11.7). Retouched blades, also more common here, include possible shape-defined sickle elements (Fig. 11.29: 4). Denticulates, notches, borers (Fig. 11.29: 2; Pl. 11.3: 4), a splintered piece (Fig. 11.29: 3), other flake tools and two heavy-duty tools are also present. One of the latter, a pick shown in Fig. 11.30: 1 (Pl. 11.5: 2) has a pointed tip created by trihedral flaking. The second is the chopper of Fig. 11.30: 2 made on hard sandstone.

Level 7 (Fig. 11.31)

The 1819 flint artifacts from Level 7 consist of 128 cores (7.0 %), 1553 pieces of debitage (85.4 %), and 138 retouched tools (7.6 %; Table 11.1). Of the cores only one piece has traces of blade production (Fig. 11.31: 1; Table 11.5). Furthermore, the relative frequency of blades in the debitage is also very low in this level (6.8 %; 91/1347; Table 11.6).

Retouched flakes (Fig. 11.31: 4 and 5) are the most common tool type followed by sickle elements (Fig. 11.31: 6-8) and denticulates (Fig. 11.31: 3). For the first time at Tell Kosak Shamali, Typle 3 becomes the dominant sickle element at the expense of Types 2 and 4 (Table 11.7). This pattern continues in later levels. One pick similar to that of Level 8 is present (Pl. 11.5: 3). Burins (Fig. 11.31: 2), scrapers and retouched blades are rare as in other Late Northern Ubaid levels.

Level 6 (Fig. 11.32)

There are 1602 flint artifacts in the Level 6 collection (Table 11.1); 71 cores (4.4 %), 1449 pieces of debitage (90.4 %), and 82 tools (5.1 %). The core assemblage, dominated by single-platform and change-of-orientation types, is comparable to that of earlier levels, but includes more multiple-platform cores (Table 11.5). With the exception of one prism blade core (Fig. 11.32: 1), all are flake cores, and flakes are abundant in the debitage assemblage whereas blades form only 7.3 % (79/1079; Table 11.6).

The predominance of miscellaneously retouched flakes (over 40%) in the tool assemblage is striking in this level (Table 11.7). These are followed, in order, by sickle elements (Fig. 11.32: 5, 7 and 8), denticulates and notches (Fig. 11.32: 4). There are a few borers (Fig. 11.32: 2 and 3) and retouched blades (Fig. 11.32: 6) as well.

Level 5 (Fig. 11.33)

The Level 5 assemblage consists of 1220 pieces (Table 11.1): 62 cores (5.1 %), 1080 pieces of debitage (88.5 %), and 78 tools (6.4 %). Apart from one single-platform blade core (Fig. 11.33: 1), all others are flake cores (Table 11.5), most either single-platform or change-of-orientation types. Opposed- and multiple-platform cores are extremely rare. Blades comprise 8.2 % of the debitage assemblage (74/906; Table 11.6).

Once again, retouched flakes (Fig. 11.33: 5) dominate the Level 5 assemblage, followed by sickle-elements (Fig. 11.33: 6-8), denticulates (Fig. 11.33: 2 and 4), notches (Fig. 11.33: 3), and a far smaller number of borers and burins. There is a conspicuous tendency to use flake blanks for tool manufacture. Among the sickle elements, Types 3 (Fig. 11.33: 6) and 2 (Fig. 11.33: 7 and 8) are very common, while other types are represented by a mere handful of pieces (Table 11.7). Type 4, which has consis-

Table 11.5 Cores from the Late Northern Ubaid levels of Tell Kosak Shamali.

	Sector A													
Type	9	%	8	%	7	%	6	%	5	%	4	%	Total	%
(Early stage)														
Chunk	4	3.7	4	3.2	3	2.3	1	1.4	1	1.6	5	6.9	18	3.2
Semi-flaked	14	13.0	14	11.2	16	12.5	6	8.5	19	30.6	7	9.7	76	13.4
(Blade cores)														
Single-platform	3	2.8	0	0.0	1	0.8	1	1.4	1	1.6	2	2.8	8	1.4
Flat	(0)		(0)		(0)		(0)		(0)		(1)		(1)	
Prism	(3)		(0)		(1)		(1)		(1)		(1)		(7)	
Opposed-platform	1	0.9	2	1.6	0	0.0	0	0.0	0	0.0	0	0.0	3	0.5
Multiple-platform	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Change-of-orientation	1	0.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Crossed	(0)		(0)		(0)		(0)		(0)		(0)		(0)	
Bifacial	(1)		(0)		(0)		(0)		(0)		(0)		(0)	
Globular	(0)		(0)		(0)		(0)		(0)		(0)		(0)	
(Flake cores)														
Single-platform	36	33.3	55	44.0	57	44.5	26	36.6	21	33.9	20	27.8	215	38.0
Flat	(20)		(28)		(23)		(10)		(12)		(9)		(102)	
Prism	(16)		(27)		(34)		(16)		(9)		(11)		(113)	
Opposed-platform	0	0.0	2	1.6	2	1.6	0	0.0	1	1.6	0	0.0	5	0.9
Multiple-platform	4	3.7	3	2.4	6	4.7	5	7.0	0	0.0	2	2.8	20	3.5
Change-of-orientation	30	27.8	35	28.0	37	28.9	22	31.0	17	27.4	29	40.3	170	30.0
Crossed	(11)		(18)		(13)		(11)		(7)		(6)		(66)	
Bifacial	(1)		(1)		(2)		(3)		(4)		(4)		(15)	
Globular	(18)		(16)		(22)		(8)		(6)		(19)		(89)	
(Final stage)														
Exhausted	12	11.1	8	6.4	6	4.7	9	12.7	2	3.2	6	8.3	43	7.6
Unidentified	3	2.8	2	1.6	0	0.0	1	1.4	0	0.0	1	1.4	7	1.2
Total	108	100.0	125	100.0	128	100.0	71	100.0	62	100.0	72	100.0	566	100.0

Table 11.6 Debitage from the Late Northern Ubaid levels of Tell Kosak Shamali.

Sector A	Level													
Type	9	%	8	%	7	%	6	%	5	%	4	%	Total	%
Core trimming pieces														
Crested pieces, Type 1	0	0.0	2	0.1	0	0.0	0	0.0	1	0.1	0	0.0	3	0.0
Crested pieces, Type 2	3	0.3	6	0.3	1	0.1	1	0.1	1	0.1	2	0.1	14	0.2
Plunging pieces	1	0.1	1	0.1	0	0.0	1	0.1	1	0.1	3	0.2	7	0.1
Core tablets	0	0.0	1	0.1	2	0.1	1	0.1	0	0.0	2	0.1	6	0.1
Core-edge pieces	16	1.5	20	1.1	13	0.8	18	1.2	13	1.2	27	1.7	107	1.2
Flakes and Blades														
Cortical flakes	147	14.0	279	15.1	234	15.1	216	14.9	167	15.5	245	15.4	1288	15.0
Partially cortical flakes	352	33.5	551	29.9	524	33.7	367	25.3	331	30.6	420	26.3	2545	29.7
Flakes	295	28.1	545	29.6	498	32.1	417	28.8	334	30.9	473	29.6	2562	29.9
Partially cortical blades	20	1.9	62	3.4	32	2.1	27	1.9	33	3.1	35	2.2	209	2.4
Blades	60	5.7	74	4.0	59	3.8	52	3.6	41	3.8	39	2.4	325	3.8
Chips and fragments	157	14.9	303	16.4	190	12.2	349	24.1	158	14.6	350	21.9	1507	17.6
Total	1051	100.0	1844	100.0	1553	100.0	1449	100.0	1080	100.0	1596	100.0	8573	100.0

tently been diminishing in popularity from Level 13, finally disappears in this level. This trend in tool composition is also observed in Level 4 and the later levels of Sector A as well (see below).

Level 4 (Fig. 11.34)

There are 72 cores (4.0 %), 1596 pieces of debitage (87.9 %), and 147 tools (8.1 %) in the Level 4 collection (a total of 1815 pieces; Table 11.1). Most cores are flake cores with change-of-orientation types more common than single-platform types (Table 11.5). The relatively higher frequency of exhausted cores may indicate the common reuse of cores in this level (Fig. 11.34: 2). The two blade cores recovered are of the prism type (Fig. 11.34: 1). The blade index for the debitage assemblage is 6.1 % (74/1212; Table 11.6).

Sickle elements (Fig. 11.34: 5-7) represent the most common tool type in Level 4, but poorly retouched flakes are also quite common (Table 11.7). Consequently the assemblage contains fewer denticulates and notches. Also present are a few retouched blades (Fig. 11.34: 4) and a single example of a splintered piece (Fig. 11.34: 3).

11.4.3 Terminal Northern Ubaid

Levels 3 to 1 of Sector A and Level 7 of Sector B belong to the Terminal Northern Ubaid. While the Sector A levels were all defined with solid architectural evidence, Level 7 of Sector B consisted of featureless layers, containing both Terminal and Late Northern Ubaid sherds (Koizumi and Sudo 2001). Therefore the lithic materials from the latter, which may also contain Late Northern Ubaid materials, should be considered with caution.

(1) Sector A

Level 3 (Figs. 11.35 & 11.36)

The paucity of materials from Levels 3-1 of Sector A reflect the limited exposure of these levels. The Level 3 collection comprises 318 pieces (Table 11.1): 17 cores (5.4 %), 265 pieces of debitage (83.3 %), and 36 tools (11.3 %). Although a variety of core types are represented ranging from semi-flaked (Fig. 11.35: 1) to exhausted cores, single-platform flake (Fig. 11.35: 2) and change-of-orientation cores (Fig. 11.35: 3) are

Table 11.7 Retouched tools from the Late Northern Ubaid levels of Tell Kosak Shamali.

	Sector A													
Type	9	%	8	%	7	%	6	%	5	%	4	%	**Total**	%
Sickle element	28	22.8	46	28.0	28	20.3	18	22.0	20	25.6	61	41.5	201	27.5
Type 1	(2)		(5)		(3)		(3)		(2)		(4)		(19)	
Type 2	(18)		(14)		(9)		(5)		(4)		(20)		(70)	
Type 3	(4)		(14)		(12)		(6)		(11)		(28)		(75)	
Type 4	(1)		(6)		(1)		(3)		(0)		(1)		(12)	
Type 5	(2)		(3)		(0)		(0)		(1)		(1)		(7)	
Others	(1)		(4)		(3)		(1)		(2)		(7)		(18)	
Borer	6	4.9	6	3.7	0	0.0	3	3.7	1	1.3	3	2.0	19	2.6
Type 1	(6)		(5)		(0)		(2)		(1)		(2)		(16)	
Type 2	(0)		(0)		(0)		(0)		(0)		(1)		(1)	
Type 3	(0)		(1)		(0)		(0)		(0)		(0)		(1)	
Type 4	(0)		(0)		(0)		(1)		(0)		(0)		(1)	
Type 5	(0)		(0)		(0)		(0)		(0)		(0)		(0)	
Type 6	(0)		(0)		(0)		(0)		(0)		(0)		(0)	

Type	Sector A 9	%	8	%	7	%	6	%	5	%	4	%	Total	%
Burin	5	4.1	4	2.4	3	2.2	1	1.2	0	0.0	3	2.0	16	2.2
Type 1	(2)		(3)		(1)		(0)		(0)		(2)		(8)	
Type 2	(0)		(0)		(0)		(0)		(0)		(0)		(0)	
Type 3	(0)		(0)		(0)		(0)		(0)		(0)		(0)	
Type 4	(2)		(1)		(0)		(1)		(0)		(0)		(4)	
Type 5	(1)		(0)		(1)		(0)		(0)		(1)		(3)	
Type 6	(0)		(0)		(0)		(0)		(0)		(0)		(0)	
Spall	(0)		(0)		(1)		(0)		(0)		(0)		(1)	
Splintered	0	0.0	1	0.6	1	0.7	0	0.0	0	0.0	1	0.7	3	0.4
Type 1	(0)		(0)		(0)		(0)		(0)		(1)		(1)	
Type 2	(0)		(1)		(1)		(0)		(0)		(0)		(2)	
Denticulate	26	21.1	17	10.4	28	20.3	15	18.3	16	20.5	14	9.5	116	15.8
Type 1	(14)		(8)		(11)		(8)		(7)		(6)		(54)	
Type 2	(6)		(3)		(4)		(2)		(3)		(2)		(20)	
Type 3	(5)		(4)		(8)		(2)		(3)		(3)		(25)	
Type 4	(1)		(2)		(5)		(3)		(3)		(3)		(17)	
Notch	11	8.9	21	12.8	18	13.0	8	9.8	11	14.1	15	10.2	84	11.5
Type 1	(3)		(7)		(5)		(5)		(3)		(8)		(31)	
Type 2	(2)		(3)		(3)		(0)		(1)		(5)		(14)	
Type 3	(5)		(5)		(7)		(1)		(3)		(1)		(22)	
Type 4	(0)		(2)		(3)		(1)		(3)		(1)		(10)	
Type 5	(1)		(4)		(0)		(1)		(1)		(0)		(7)	
Scraper	1	0.8	6	3.7	4	2.9	0	0.0	3	3.8	7	4.8	21	2.9
Type 1	(1)		(2)		(3)		(0)		(2)		(1)		(9)	
Type 2	(0)		(1)		(0)		(0)		(0)		(0)		(1)	
Type 3	(0)		(1)		(1)		(0)		(1)		(2)		(5)	
Type 4	(0)		(1)		(0)		(0)		(0)		(4)		(5)	
Type 5	(0)		(1)		(0)		(0)		(0)		(0)		(1)	
Type 6	(0)		(0)		(0)		(0)		(0)		(0)		(0)	
Ret. blade	6	4.9	10	6.1	6	4.3	3	3.7	1	1.3	3	2.0	29	4.0
Type 1	(3)		(4)		(6)		(3)		(1)		(2)		(19)	
Type 2	(1)		(4)		(0)		(0)		(0)		(1)		(6)	
Type 3	(1)		(1)		(0)		(0)		(0)		(0)		(2)	
Type 4	(0)		(0)		(0)		(0)		(0)		(0)		(0)	
Type 5	(1)		(1)		(0)		(0)		(0)		(0)		(2)	
Ret. flake	39	31.7	52	31.7	49	35.5	34	41.5	26	33.3	40	27.2	240	32.8
Type 1	(17)		(20)		(21)		(16)		(9)		(15)		(98)	
Type 2	(5)		(13)		(10)		(11)		(8)		(15)		(62)	
Type 3	(13)		(12)		(8)		(6)		(6)		(6)		(51)	
Type 4	(4)		(7)		(10)		(1)		(3)		(4)		(29)	
Biface	1	0.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1
Chopper	0	0.0	1	0.6	1	0.7	0	0.0	0	0.0	0	0.0	2	0.3
Pick	0	0.0	1	0.6	1	0.7	0	0.0	0	0.0	0	0.0	2	0.3
Type 1	(0)		(0)		(0)		(0)		(0)		(0)		(0)	
Type 2	(0)		(1)		(1)		(0)		(0)		(0)		(2)	
Rod	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Hoe	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	123	100.0	164	100.0	138	100.0	82	100.0	78	100.0	147	100.0	732	100.0

the most common types. While the debitage assemblage contains some blades (11.1 %; 24/217; Table 11.9), no blade cores have been recovered.

The tool assemblage consists mainly of simple retouched flakes, denticulates (Fig. 11.36: 3 and 4; Pls. 11.1: 16; 11.2: 2), and notches (Fig. 11.35: 4 and 5; 11.36: 1 and 2; Pl. 11.2: 7, 11, 13 and 17). The frequency of sickle elements (Fig. 3.36: 5 and 6) is exceptionally low in comparison with the assemblages from other levels, which is perhaps due to the small sample size for this level (Table 11.10).

Level 2 (Fig. 11.37)

The Level 2 collection totals 309 flint artifacts: 17 cores (5.5 %), 260 pieces of debitage (84.1 %), and 32 tools (10.4 %) (Table 11.1). Single-platform (Fig. 11.37: 1) and change-of-orientation flake cores dominate the core assemblage (Table 11.8). There is one multiple-platform flake core among the remaining cores (Fig. 11.37: 2). As in Level 3, no blade cores exist and the debitage blade index is 6.1 % only (13/214; Table 11.9).

Nearly half the tools are miscellaneous, simple retouched flakes (Table 11.10), followed by sickle elements (Fig. 11.37: 7) which form about a quarter of the tool assemblage. Although the sample is small, Type 2 sickle elements become slightly more prevalent. Other tools such as notches (Fig. 11.37: 3 and 4; Pl. 11.2: 9 and 15), denticulates (Fig. 11.37: 6; Pl. 11.2: 5) and scrapers (Fig. 11.37: 5; Pl. 11.3: 3) are present in comparatively low percentages.

Level 1 (Figs. 11.38 & 11.39)

This level produced 282 flint artifacts, of which 20 pieces (7.1 %) are cores, 240 (85.1 %) are debitage, and 22 (7.8 %) are tools (Table 11.1). Six of the 20 cores were excavated at the southeastern corner of Room 101, probably from a cache (Nishiaki *et al.* 2001). Their relatively large size reinforces this interpretation (Pl. 11.1: 1-6). These consist of four single-platform flake cores (Figs. 11.38: 1-3; 11.39: 2) and two change-of-orientation flake cores (Figs. 11.38: 4; 11.39: 1), reflecting the general core type inventory in this level (Table 11.8). There were no blade cores in the cache nor in other contexts, although a small number of blades have been identified in the debitage assemblage (6.3 %; 12/191; Table 11.9).

Sickle elements, among which Types 1 and 2 (Fig. 11.39: 4-6) are more common than Type 3, form more than a third of the retouched tools. Simple retouched flakes also comprise a large part of the inventory (Table 11.10). Other tool types include denticulates, notches and retouched blades (Fig. 11.39: 3).

(2) Sector B

Level 7 (Figs. 11.40-11.43)

Level 7 of Sector B consists of 999 artifacts (Table 11.1), 111 cores (11.1 %), 742 pieces of debitage (74.3 %), and 146 tools (14.6 %). Technologically, this level shares many similar features with Level 3 and the upper levels of Sector A, in particular, in the scarcity of blade cores (Table 11.8; Fig. 11.40: 4-6, and 8) and the predominance of change-of-orientation flake cores over single-platform ones (Fig. 11.40: 1-3). Given that the use of single-platform cores tends to produce either blades or elongated blanks, their relative paucity may relate to the very low frequency of blade blanks in these assemblages (3.1 %; 18/576; Table 11.9).

The tool assemblage is also similar to the upper levels of Sector A (Table 11.10): there are more retouched flakes and denticulates (Fig. 11.41: 1-3; Pl. 11.3: 13 and 14) than sickle elements (Fig. 11.43). Sickle element types are dominated by Types 1 (Fig. 11.43: 1-4) and 2 (Fig. 11.43: 6), with Type 3 specimens relatively rare (Fig. 11.43: 5, and 7-9). While this is in striking contrast to Level 4 and the earlier Sector A levels, it is a feature shared with Level 1 of Sector A. Other tool types such as borers (Fig. 11.41: 5, and 7-9), burins (Fig. 11.42: 1 and 2), scrapers (Fig. 11.41: 4; Pl. 11.3: 11), retouched blades (Fig. 11.41: 6 and 10; Pl. 11.3: 10), picks (Fig. 11.42: 3) and a rod (Fig. 11.42: 4; Pl. 11.3: 12), are rare. The frequency of each tool type is not inconsistent with that for other Terminal Northern Ubaid levels, but the picks, which occur in Levels 7 and 8 of Sector A among other levels, may be intrusive materials from the Late Northern Ubaid period.

Table 11.8 Cores from the Terminal Northern Ubaid levels of Tell Kosak Shamali.

	Sector A						Sector B			
Type	3	%	2	%	1	%	7	%	Total	%
(Early stage)										
Chunk	1	5.9	0	0.0	1	5.0	3	2.7	5	3.0
Semi-flaked	1	5.9	1	5.9	2	10.0	8	7.2	12	7.3
(Blade cores)										
Single-platform	0	0.0	0	0.0	0	0.0	2	1.8	2	1.2
Flat	(0)		(0)		(0)		(0)		(0)	
Prism	(0)		(0)		(0)		(2)		(2)	
Opposed-platform	0	0.0	0	0.0	0	0.0	1	0.9	1	0.6
Multiple-platform	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Change-of-orientation	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Crossed	(0)		(0)		(0)		(0)		(0)	
Bifacial	(0)		(0)		(0)		(0)		(0)	
Globular	(0)		(0)		(0)		(0)		(0)	
(Flake cores)										
Single-platform	7	41.2	6	35.3	9	45.0	37	33.3	59	35.8
Flat	(4)		(3)		(4)		(13)		(24)	
Prism	(3)		(3)		(5)		(24)		(35)	
Opposed-platform	2	11.8	0	0.0	0	0.0	1	0.9	3	1.8
Multiple-platform	1	5.9	1	5.9	0	0.0	4	3.6	6	3.6
Change-of-orientation	3	17.6	8	47.1	7	35.0	51	45.9	69	41.8
Crossed	(2)		(3)		(3)		(23)		(31)	
Bifacial	(0)		(2)		(0)		(3)		(5)	
Globular	(1)		(3)		(4)		(25)		(33)	
(Final stage)										
Exhausted	2	11.8	1	5.9	1	5.0	1	0.9	5	3.0
Unidentified	0	0.0	0	0.0	0	0.0	3	2.7	3	1.8
Total	17	100.0	17	100.0	20	100.0	111	100.0	165	100.0

Table 11.9 Debitage from the Terminal Northern Ubaid levels of Tell Kosak Shamali.

	Sector A						Sector B			
Type	3	%	2	%	1	%	7	%	Total	%
Core trimming pieces										
Crested pieces, Type 1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Crested pieces, Type 2	2	0.8	0	0.0	0	0.0	1	0.1	3	0.2
Plunging pieces	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Core tablets	0	0.0	0	0.0	1	0.4	1	0.1	2	0.1
Core-edge pieces	6	2.3	7	2.7	8	3.3	9	1.2	30	2.0
Flakes and Blades										
Cortical flakes	33	12.5	40	15.4	31	12.9	125	16.8	229	15.2
Partially cortical flakes	87	32.8	94	36.2	74	30.8	222	29.9	477	31.7
Flakes	73	27.5	67	25.8	74	30.8	211	28.4	425	28.2
Partially cortical blades	13	4.9	8	3.1	3	1.3	15	2.0	39	2.6
Blades	11	4.2	5	1.9	9	3.8	3	0.4	28	1.9
Chips and fragments	40	15.1	39	15.0	40	16.7	155	20.9	274	18.2
Total	265	100.0	260	100.0	240	100.0	742	100.0	1507	100.0

11.4.4 Post-Ubaid

Levels 6 and 5 of Sector B produced Post-Ubaid potters' workshops in which two well-preserved kilns were excavated together with a variety of pottery production tools (Koizumi and Sudo 2001). Accordingly, the lithic assemblages from these levels may be somewhat affected by functional biases. However, a large number of lithic artifacts were discovered from both levels and typologically show no obvious functional anomaly from those of other levels.

Level 6 (Fig. 11.44)

The 3905 flint artifacts from this level are divided into 150 cores (3.8 %), 3486 pieces of debitage (89.3 %), and 269 tools (6.9 %; Table 11.1). The basic blank production technology evident in the core and debitage differs little from that of the Terminal Northern Ubaid period. As in the Ubaid levels, cores are primarily single-platform (Fig. 11.44: 1) and change-of-orientation flake types (Table 11.11). Evidence of blade production is poor in both core and debitage assemblages and blade blanks constitute only 3.3 % (67/2018) of the latter (Table 11.12).

Typologically, the tools are also similar to those of the Terminal Northern Ubaid (Table 11.13). Simple retouched flakes and other flake tools, such as denticulates (Fig. 11.44: 2) and notches are quite popular. Sickle elements are also popular, comprising about one fifth of the tool assemblage (Fig. 11.44: 5-8). While Types 2 and 3 are nearly equally represented (Table 11.13), Type 6 pieces, i.e. sickle elements made on Canaanean blades, appear for the first time. Among the rare tools are a thick rod with a triangular section (Fig. 11.44: 3) and burins on flakes (Fig. 11.44: 4).

Level 5 (Figs. 11.45 & 11.46)

2027 flint artifacts were excavated from Level 5 of Sector B (Table 11.1): 114 cores (5.6 %), 1713 pieces of debitage (84.5 %), and 200 retouched tools (9.9 %). Their techno-typological features are virtually the same as in Level 6 of Sector B, which is not surprising given the close stratigraphic relationship between these two levels. While a few cores with traces of blade production exist (Fig. 11.45: 1), the vast majority of cores are either single-platform or change-of-orientation flake cores (Fig. 11.45: 3) (Table 11.11). Opposed-platform and multiple-platform flake cores (Fig. 11.45: 2) are very rare. The blade index in the debitage assemblage is

Table 11.10 Retouched tools from the Terminal Northern Ubaid levels of Tell Kosak Shamali.

	Sector A						Sector B			
Type	3	%	2	%	1	%	7	%	Total	%
Sickle element	2	5.6	9	28.1	8	36.4	33	22.6	52	22.0
Type 1	(0)		(1)		(2)		(12)		(15)	
Type 2	(0)		(3)		(3)		(10)		(16)	
Type 3	(2)		(4)		(2)		(6)		(14)	
Type 4	(0)		(0)		(1)		(1)		(2)	
Type 5	(0)		(1)		(0)		(4)		(5)	
Others	(0)		(0)		(0)		(0)		(0)	
Borer	.0	0.0	0	0.0	0	0.0	7	4.8	7	3.0
Type 1	(0)		(0)		(0)		(5)		(5)	
Type 2	(0)		(0)		(0)		(0)		(0)	
Type 3	(0)		(0)		(0)		(1)		(1)	
Type 4	(0)		(0)		(0)		(0)		(0)	
Type 5	(0)		(0)		(0)		(1)		(1)	
Type 6	(0)		(0)		(0)		(0)		(0)	

	Sector A						Sector B			
Type	3	%	2	%	1	%	7	%	Total	%
Burin	0	0.0	0	0.0	1	4.5	2	1.4	3	1.3
Type 1	(0)		(0)		(0)		(1)		(1)	
Type 2	(0)		(0)		(0)		(0)		(0)	
Type 3	(0)		(0)		(0)		(1)		(1)	
Type 4	(0)		(0)		(0)		(0)		(0)	
Type 5	(0)		(0)		(0)		(0)		(0)	
Type 6	(0)		(0)		(0)		(0)		(0)	
Spall	(0)		(0)		(1)		(0)		(1)	
Splintered	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Type 1	(0)		(0)		(0)		(0)		(0)	
Type 2	(0)		(0)		(0)		(0)		(0)	
Denticulate	10	27.8	2	6.3	4	18.2	36	24.7	52	22.0
Type 1	(7)		(0)		(3)		(22)		(32)	
Type 2	(2)		(0)		(1)		(5)		(8)	
Type 3	(0)		(2)		(0)		(4)		(6)	
Type 4	(1)		(0)		(0)		(5)		(6)	
Notch	8	22.2	5	15.6	1	4.5	10	6.8	24	10.2
Type 1	(2)		(4)		(0)		(3)		(9)	
Type 2	(2)		(0)		(0)		(3)		(5)	
Type 3	(1)		(1)		(1)		(1)		(4)	
Type 4	(2)		(0)		(0)		(1)		(3)	
Type 5	(1)		(0)		(0)		(2)		(3)	
Scraper	0	0.0	1	3.1	0	0.0	8	5.5	9	3.8
Type 1	(0)		(1)		(0)		(5)		(6)	
Type 2	(0)		(0)		(0)		(0)		(0)	
Type 3	(0)		(0)		(0)		(1)		(1)	
Type 4	(0)		(0)		(0)		(2)		(2)	
Type 5	(0)		(0)		(0)		(0)		(0)	
Type 6	(0)		(0)		(0)		(0)		(0)	
Ret. blade	2	5.6	0	0.0	2	9.1	13	8.9	17	7.2
Type 1	(2)		(0)		(0)		(9)		(11)	
Type 2	(0)		(0)		(1)		(1)		(2)	
Type 3	(0)		(0)		(1)		(0)		(1)	
Type 4	(0)		(0)		(0)		(0)		(0)	
Type 5	(0)		(0)		(0)		(3)		(3)	
Ret. flake	14	38.9	15	46.9	6	27.3	34	23.3	69	29.2
Type 1	(8)		(9)		(3)		(10)		(30)	
Type 2	(3)		(2)		(2)		(13)		(20)	
Type 3	(3)		(4)		(1)		(4)		(12)	
Type 4	(0)		(0)		(0)		(7)		(7)	
Biface	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Chopper	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Pick	0	0.0	0	0.0	0	0.0	2	1.4	2	0.8
Type 1	(0)		(0)		(0)		(2)		(2)	
Type 2	(0)		(0)		(0)		(0)		(0)	
Rod	0	0.0	0	0.0	0	0.0	1	0.7	1	0.4
Hoe	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	36	100.0	32	100.0	22	100.0	146	100.0	236	100.0

Table 11.11 Cores from the Post-Ubaid levels of Tell Kosak Shamali.

Type	Sector B 6	%	5	%	Total	%
(Early stage)						
Chunk	3	2.0	2	1.8	5	1.9
Semi-flaked	13	8.7	26	22.8	39	14.8
(Blade cores)						
Single-platform	5	3.3	2	1.8	7	2.7
Flat	(1)		(0)		1	
Prism	(4)		(2)		6	
Opposed-platform	0	0.0	0	0.0	0	0.0
Change-of-orientation	0	0.0	0	0.0	0	0.0
Crossed	(0)		(0)		(0)	
Bifacial	(0)		(0)		(0)	
Globular	(0)		(0)		(0)	
(Flake cores)						
Single-platform	58	38.7	38	33.3	96	36.4
Flat	(24)		(22)		(46)	
Prism	(34)		(16)		(50)	
Opposed-platform	2	1.3	2	1.8	4	1.5
Multiple-platform	10	6.7	4	3.5	14	5.3
Change-of-orientation	47	31	33	29	80	30
Crossed	(20)		(16)		(36)	
Bifacial	(6)		(0)		(6)	
Globular	(21)		(17)		(38)	
(Final stage)						
Exhausted	6	4.0	7	6.1	13	4.9
Unidentified	6	4.0	0	0.0	6	2.3
Total	150	100.0	114	100.0	264	100.0

Table 11.12 Debitage from the Post-Ubaid levels of Tell Kosak Shamali.

Type	Sector B 6	%	5	%	Total	%
Core trimming pieces						
Crested pieces, Type 1	1	0.0	0	0.0	1	0.0
Crested pieces, Type 2	0	0.0	1	0.1	1	0.0
Plunging pieces	0	0.0	0	0.0	0	0.0
Core tablets	3	0.1	2	0.1	5	0.1
Core-edge pieces	21	0.6	22	1.3	43	0.8
Flakes and Blades						
Cortical flakes	387	11.1	288	16.9	675	13.0
Partially cortical flakes	721	20.7	534	31.3	1255	24.2
Flakes	843	24.3	467	27.4	1310	25.3
Partially cortical blades	21	0.6	42	2.5	63	1.2
Blades	46	1.3	33	1.9	79	1.5
Chips and fragments	1432	41.2	315	18.5	1747	33.7
Total	3475	100.0	1704	100.0	5179	100.0

5.5 % (75/1364), and crested elements showing the use of developed blade technology are also extremely rare (Table 11.12).

The relative frequency of each tool type in Level 5 is very similar to that of Level 6 (Table 11.13). Simple retouched flakes form about one third of the tools, followed by sickle elements (Fig. 11.46: 6), denticulates (Fig. 11.45: 4 and 5), notches, retouched blades (Fig. 11.46: 1-4), scrapers (Fig. 11.45: 6), and borers (Fig. 11.46: 5). The frequency of Type 3 sickle elements drops significantly, an important trait noted in later levels too. Retouched blades are relatively common in Levels 6 and 5 of Sector B in comparison to the earlier Ubaid levels and include Canaanean blades made of cream gray, medium-grained flint (Fig. 11.46: 4). These blades have regular, parallel lateral edges, often with two parallel ridges on the dorsal surface and a transversal section which is typically trapezoidal. There are no complete Canaanean blades in the present collection, only segments, but judging from the width, (more than 2 cm), the original blade blanks would have been over 10 cm long in most cases. As there are no blade cores in the collection from which these blades could have been produced, the implication is that they were imports.

11.4.5 Uruk

The top four levels of Sector B are assigned to the Middle Uruk period on the basis of ceramic typology. Level 4 yielded no architectural remains, while Levels 3-1 produced evidence of mudbrick work. No pottery workshop features such as those of Levels 6 and 5 were excavated from these levels, and a change in the pattern of use of space is suggested between Levels 5 and 4 (Koizumi and Sudo 2001).

Level 4 (Figs. 11.47 & 11.48)

Although no architectural remains were discovered, a relatively large number of flint artifacts (2301 pieces) were recovered from Level 4 (Table 11.1), including 105 cores (4.6 %), 1959 pieces of debitage (85.1 %), and 237 retouched tools (10.3 %). Technologically the Uruk lithic assemblages are very similar to those of the Post-Ubaid. A strong emphasis on flake pro-

Table 11.13 Retouched tools from the Post-Ubaid levels of Tell Kosak Shamali.

	Sector B					
Type	6	%	5	%	Total	%
Sickle element	**53**	19.8	**36**	18.2	**89**	19.1
Type 1	(7)		(2)		(9)	
Type 2	(14)		(14)		(28)	
Type 3	(19)		(6)		(25)	
Type 4	(4)		(2)		(6)	
Type 5	(6)		(4)		(10)	
Type 6	(2)		(7)		(9)	
Others	(1)		(2)		(3)	
Borer	**8**	3.0	**9**	4.5	**17**	3.6
Type 1	(4)		(5)		(9)	
Type 2	(0)		(0)		(0)	
Type 3	(3)		(2)		(5)	
Type 4	(1)		(1)		(2)	
Type 5	(0)		(0)		(0)	
Type 6	(0)		(1)		(1)	
Burin	**5**	1.9	**1**	0.5	**6**	1.3
Type 1	(2)		(0)		(2)	
Type 2	(2)		(0)		(2)	
Type 3	(0)		(1)		(1)	
Type 4	(0)		(0)		(0)	
Type 5	(1)		(0)		(1)	
Type 6	(0)		(0)		(0)	
Spall	(0)		(0)		(0)	
Splintered	**0**	0.0	**0**	0.0	**0**	0.0
Type 1	(0)		(0)		(0)	
Type 2	(0)		(0)		(0)	
Denticulate	**60**	22.4	**33**	16.7	**93**	20.0
Type 1	(26)		(18)		(44)	
Type 2	(13)		(2)		(15)	
Type 3	(14)		(9)		(23)	
Type 4	(7)		(4)		(11)	
Notch	**35**	13.1	**20**	10.1	**55**	11.8
Type 1	(13)		(8)		(21)	
Type 2	(5)		(2)		(7)	
Type 3	(7)		(7)		(14)	
Type 4	(2)		(0)		(2)	
Type 5	(8)		(3)		(11)	
Scraper	**5**	1.9	**12**	6.1	**17**	3.6
Type 1	(2)		(5)		(7)	
Type 2	(1)		(0)		(1)	
Type 3	(1)		(2)		(3)	
Type 4	(1)		(4)		(5)	
Type 5	(0)		(1)		(1)	
Type 6	(0)		(0)		(0)	
Ret. blade	**32**	11.9	**17**	8.6	**49**	10.5
Type 1	(19)		(12)		(31)	
Type 2	(4)		(1)		(5)	
Type 3	(1)		(0)		(1)	
Type 4	(0)		(0)		(0)	
Type 5	(8)		(4)		(12)	
Ret. flake	**68**	25.4	**70**	35.4	**138**	29.6
Type 1	(21)		(29)		(50)	
Type 2	(18)		(17)		(35)	
Type 3	(12)		(21)		(33)	
Type 4	(17)		(3)		(20)	
Biface	**0**	0.0	**0**	0.0	**0**	0.0
Chopper	**0**	0.0	**0**	0.0	**0**	0.0
Pick	**0**		**0**	0.0 0.0	**0**	0.0
Type 1	(0)		(0)		(0)	
Type 2	(0)		(0)		(0)	
Rod	2	0.7	**0**	0.0	2	0.4
Hoe	**0**	0.0	**0**	0.0	**0**	0.0
Total	**268**	100.0	**198**	100.0	**466**	100.0

duction from either single-platform or change-of-orientation cores (Fig. 11.47: 1) through direct percussion is maintained. Few blade cores are represented (Fig. 11.47: 3; Table 11.14), and the percentage of blade blanks is also low (4.3 %; 70/1616; Table 11.15).

However, some changes are noted in tool typology (Table 11.16), the most conspicuous relating to sickle elements. The decreasing trend is accelerated, so that they form only about 15 % or less in all the Uruk levels. Furthermore, Types 2 and 1 (Fig. 11.48: 4-6) are more abundant, and Type 6, Canaanean elements, are consistently represented and include pieces with denticulated edges (Fig. 11.48: 5). Comparable wide blades without visible gloss are also found among the retouched blades (Fig. 11.48: 3). As sickle elements decrease, so simple retouched flakes evidently increase (Table 11.16). While other tools such as denticulates (Fig. 11.47: 6), notches (Figs. 11.47: 7; 11.48: 1), scrapers (Fig. 11.48: 2) and borers (Fig. 11.47: 2, 4 and 5; Pl. 11.3: 6) are present in moderate percentages, they also appear to decrease in popularity. Among the borers, two Type 6 specimens similar to picks appear for the first time.

Level 3 (Fig. 11.49)

The Level 3 assemblage (796 pieces) is composed of 36 cores (4.5 %), 650 pieces of debitage (81.7 %), and 110 tools (13.8 %; Table 11.1). Single-platform and change-of-orientation flake cores are common as in other levels, but multiple-platform cores are also present in a certain

Table 11.14 Cores from the Uruk levels of Tell Kosak Shamali.

Type	Sector B 4	%	3	%	2	%	1	%	Total	%
(Early stage)										
Chunk	8	7.6	0	0.0	0	0.0	2	12.5	10	6.0
Semi-flaked	12	11.4	5	13.9	1	9.1	3	18.8	21	12.5
(Blade cores)										
Single-platform	3	2.9	1	2.8	0	0.0	0	0.0	4	2.4
Flat	(0)		(1)		(0)		(0)		(1)	
Prism	(3)		(0)		(0)		(0)		(3)	
Opposed-platform	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Multiple-platform	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Change-of-orientation	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Crossed	(0)		(0)		(0)		(0)		(0)	
Bifacial	(0)		(0)		(0)		(0)		(0)	
Globular	(0)		(0)		(0)		(0)		(0)	
(Flake cores)										
Single-platform	34	32.4	19	52.8	7	63.6	5	31.3	65	38.7
Flat	(26)		(12)		(4)		(3)		(45)	
Prism	(8)		(7)		(3)		(2)		(20)	
Opposed-platform	2	1.9	0	0.0	0	0.0	0	0.0	2	1.2
Multiple-platform	9	8.6	6	16.7	1	9.1	1	6.3	17	10.1
Change-of-orientation	28	26.7	4	11.1	2	18.2	3	18.8	37	22.0
Crossed	(15)		(1)		(1)		(2)		(19)	
Bifacial	(1)		(0)		(0)		(0)		(0)	
Globular	(12)		(3)		(1)		(1)		(17)	
(Final stage)										
Exhausted	8	7.6	1	2.8	0	0.0	1	6.3	10	6.0
Unidentified	1	1.0	0	0.0	0	0.0	1	6.3	2	1.2
Total	105	100.0	36	100.0	11	100.0	16	100.0	168	100.0

Table 11.15 Debitage from the Uruk levels of Tell Kosak Shamali.

Type	Sector B 4	%	3	%	2	%	1	%	Total	%
Core trimming pieces										
Crested pieces, Type 1	1	0.1	0	0.0	0	0.0	0	0.0	1	0.0
Crested pieces, Type 2	2	0.1	1	0.2	0	0.0	0	0.0	3	0.1
Plunging pieces	3	0.2	1	0.2	0	0.0	0	0.0	4	0.1
Core tablets	1	0.1	0	0.0	0	0.0	0	0.0	1	0.0
Core-edge pieces	27	1.4	22	3.4	5	1.8	20	5.0	74	2.3
Flakes and Blades										
Cortical flakes	333	17.1	123	19.0	58	21.0	62	15.4	576	17.6
Partially cortical flakes	663	34.1	241	37.1	90	32.6	141	35.1	1135	34.7
Flakes	550	28.3	176	27.1	84	30.4	113	28.1	923	28.2
Partially cortical blades	20	1.0	14	2.2	8	2.9	14	3.5	56	1.7
Blades	50	2.6	14	2.2	14	5.1	9	2.2	87	2.7
Chips and fragments	296	15.2	57	8.8	17	6.2	43	10.7	413	12.6
Total	1946	100.0	649	100.0	276	100.0	402	100.0	3273	100.0

percentage (Table 11.14). Cores-on-flakes, with the main flaking surface on the dorsal surface of the blank, are conspicuous among the single-platform core group (Fig. 11.49: 1 and 2). There is only one fragment of a single-platform blade core, and the blade index is very low (4.9 %; 28/568; Table 11.15).

Nearly half the tools are miscellaneous simple retouched flakes, and only about 15 % are sickle elements, including Canaanean Type 6 pieces (Fig. 11.49: 6; Table 11.16). Type 3 sickle elements, characteristic in the Ubaid, are rare. Denticulates, notches, scrapers (Fig. 11.49: 3 and 4), and burins (Fig. 11.49: 5) are also present, but far fewer in numbers than previously. Most scrapers are Type 4 - end-scrapers, as in Level 4.

Level 2 (Fig. 11.50)

The Level 2 assemblage consists of 328 pieces including 11 cores (3.4 %), 276 pieces of debitage (84.2 %), and 41 retouched tools (12.5 %) (Table 11.1). The technological features are basically the same as in the earlier Uruk assemblages. Single-platform flake cores dominate, but less common are change-of-orientation and multiple-platform types (Fig. 11.50: 1) (Table 11.14). No blade cores exist, and blade themselves are rare (8.7 %; 22/254; Table 11.15).

The tool type composition is practically the same as in Level 3 (Table 11.16), primarily simple retouched flakes, and of lesser importance are flake tools such as sickle elements (Fig. 11.50: 6), notches (Fig. 11.50: 4 and 5), denticulates, a borer, and scrapers (Fig. 11.50: 2). Canaanean pieces are represented among the retouched blades and sickle elements (Fig. 11.50: 6 and 7; Pl. 11.3: 18). The borer is a Type 6 piece, a characteristic of the Uruk lithics at Tell Kosak Shamali (Fig. 11.50: 3).

Level 1 (Fig. 11.51)

The Level 1 collection consists of 464 flint artifacts (Table 11.1): 16 cores (3.4 %), 402 pieces of

Table 11.16 Retouched tools from the Uruk levels of Tell Kosak Shamali.

	Sector B									
Type	4	%	3	%	2	%	1	%	Total	%
Sickle element	27	11.4	17	15.5	6	14.6	3	6.5	53	12.2
Type 1	(6)		(4)		(1)		(1)		(11)	
Type 2	(8)		(6)		(1)		(1)		(16)	
Type 3	(6)		(2)		(2)		(0)		(10)	
Type 4	(1)		(2)		(0)		(0)		(3)	
Type 5	(0)		(1)		(0)		(0)		(1)	
Type 6	(5)		(1)		(2)		(0)		(8)	
Others	(1)		(1)		(0)		(1)		(0)	
Borer	18	7.6	2	1.8	2	4.9	4	8.7	26	6.0
Type 1	(11)		(1)		(1)		(2)		(15)	
Type 2	(3)		(0)		(0)		(0)		(3)	
Type 3	(1)		(1)		(0)		(1)		(3)	
Type 4	(1)		(0)		(0)		(0)		(1)	
Type 5	(0)		(0)		(0)		(0)		(0)	
Type 6	(2)		(0)		(1)		(1)		(4)	

Type	Sector B 4	%	3	%	2	%	1	%	Total	%
Burin	2	0.8	1	0.9	1	2.4	1	2.2	5	1.2
Type 1	(1)		(1)		(1)		(1)		(4)	
Type 2	(1)		(0)		(0)		(0)		(0)	
Type 3	(0)		(0)		(0)		(0)		(0)	
Type 4	(0)		(0)		(0)		(0)		(0)	
Type 5	(0)		(0)		(0)		(0)		(0)	
Type 6	(0)		(0)		(0)		(0)		(0)	
Spall	(0)		(0)		(0)		(0)		(0)	
Splintered	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Type 1	(0)		(0)		(0)		(0)		(0)	
Type 2	(0)		(0)		(0)		(0)		(0)	
Denticulate	42	17.8	12	10.9	2	4.9	5	10.9	61	14.1
Type 1	(22)		(10)		(1)		(1)		(34)	
Type 2	(8)		(0)		(0)		(0)		(8)	
Type 3	(10)		(1)		(1)		(2)		(14)	
Type 4	(2)		(1)		(0)		(2)		(5)	
Notch	38	16.1	9	8.2	4	9.8	2	4.3	53	12.2
Type 1	(10)		(8)		(1)		(0)		(19)	
Type 2	(8)		(0)		(1)		(0)		(9)	
Type 3	(12)		(1)		(2)		(1)		(16)	
Type 4	(4)		(0)		(0)		(1)		(5)	
Type 5	(4)		(0)		(0)		(0)		(4)	
Scraper	13	5.5	6	5.5	3	7.3	1	2.2	23	5.3
Type 1	(4)		(1)		(0)		(0)		(5)	
Type 2	(1)		(0)		(0)		(0)		(0)	
Type 3	(2)		(1)		(2)		(1)		(6)	
Type 4	(6)		(4)		(1)		(0)		(11)	
Type 5	(0)		(0)		(0)		(0)		(0)	
Type 6	(0)		(0)		(0)		(0)		(0)	
Ret. blade	11	4.7	10	9.1	4	9.8	1	2.2	26	6.0
Type 1	(7)		(7)		(4)		(1)		(19)	
Type 2	(0)		(1)		(0)		(0)		(1)	
Type 3	(0)		(0)		(0)		(0)		(0)	
Type 4	(2)		(0)		(0)		(0)		(0)	
Type 5	(2)		(2)		(0)		(0)		(4)	
Ret. flake	85	36.0	53	48.2	19	46.3	29	63.0	186	43.0
Type 1	(32)		(20)		(7)		(10)		(69)	
Type 2	(20)		(10)		(2)		(6)		(38)	
Type 3	(21)		(9)		(7)		(7)		(44)	
Type 4	(12)		(14)		(3)		(6)		(35)	
Biface	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Chopper	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Pick	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Type 1	(0)		(0)		(0)		(0)		(0)	
Type 2	(0)		(0)		(0)		(0)		(0)	
Rod	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Hoe	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	236	100.0	110	100.0	41	100.0	46	100.0	433	100.0

debitage (86.6 %), and 46 tools (9.9 %). Single-platform and change-of-orientation flake cores dominate the core assemblage (Table 11.14). Cores-on-flakes are common among the single-platform cores (Fig. 11.51: 1 and 2). While there are no blade cores, blades form 6.8% of the debitage (23/339; Table 11.15).

For the first time in the long sequence at Tell Kosak Shamali, simple retouched flakes form more than half the tool category in Level 1 (Fig. 11.51: 7; Table 11.16), with all other tools being very rare (Fig. 11.51: 3-5), and even sickle elements constituting less than 10 % of the assemblage (Fig. 11.51: 6; Pl. 11.3: 19). Only three sickle elements are present in this level, one of which is Canaanean.

11.5 Obsidian artifacts (Figs. 11.52 & 11.53)

133 obsidian artifacts were excavated from Sector A and 26 from Sector B (Table 11.1). They constitute a very small portion of the total flaked stone artifacts from Tell Kosak Shamali (0.40%; 133/32894 pieces). Nevertheless, they are consistently present in nearly all levels, with a general trend towards chronological change. Levels with more than 1 % of obsidian artifacts are all in the earliest part of the Ubaid sequence. Particularly well represented are those in Levels 16-14, and perhaps in Levels 13 and 12 of Sector A. From Level 11 onwards they become increasingly rarer, accounting for one third of a percent at most in the top levels of Sector B.

Table 11.17 also shows a general breakdown of all obsidian artifacts. It shows the obsidian collection of Tell Kosak Shamali to represent two distinct groups, one for the Early and Late Northern Ubaid levels (Levels 17-4 of Sector A), and the other for the Terminal Northern Ubaid to Uruk levels (Levels 3-1 of Sector A and Levels 6-1 of Sector B).

The Early and Late Northern Ubaid material is characterized by 1) very few cores and flakes, 2) numerous unretouched blades, and 3) a moderate number of retouched tools. There are only two cores, both highly exhausted reflecting the precious nature of obsidian for the Ubaid community (Fig. 11.52: 1 and 7; Pl. 11.5: 15). The well-preserved piece illustrated in Fig. 11.52: 1, (2.5 cm long), indicates the use of pressure flaking for blade production from a single-platform core, an observation also evident on the products. Parallel-sided, regular blades with ridges running uni-directionally, are by far the most common artifacts among the debitage (Fig. 11.52: 2, 3, 6, and 10-15; Pl. 11.5: 13). The dorsal surface of the proximal end shows traces of deliberate abrasion, a procedure often taken as indicative of pressure flaking (Fig. 11.52: 6 and 15; Pl. 11.5: 9). Blades tend towards the microlithic, with widths rarely exceeding 1.5 cm. Segments predominate with complete blades being extremely rare. Given the rarity of cores and core preparation flakes, it is likely that obsidian was imported in the form of finished tools or unretouched blades during the Ubaid period. More than half the tools are simple retouched blades with either continuous (Type 1) or intermittent side trimming (Type 2), although the "retouch" could also have been caused through use. Other tools include truncated blades (Fig. 11.52: 9; Pl. 11.5: 12), notches, splintered pieces (Fig. 11.52: 4 and 8), a denticulate and tool fragments of unknown shape. Two of the blade tools show a clearly retouched back and heavy damage on the other side (Fig. 11.52: 5; Pl. 11.5: 10). Their morphological resemblance to Type 3 flint sickle elements is so striking that, although without visible gloss, they can be termed shape-defined sickle elements.

A new manner of obsidian use appeared in the Terminal Northern Ubaid (Table 11.17): obsidian materials of the Terminal Northern Ubaid to Uruk levels include 1) a larger number of cores, 2) many flakes, and 2) extremely few retouched pieces. The presence of many cores and flakes indicates that, in contrast to the earlier Ubaid periods, obsidian was introduced into the site in a non-prepared form. Nevertheless, the intensive reduction of cores is also noticeable in these periods. Cores are all so highly exhausted that their final stage show no defined shape (Fig. 11.53: 7). At least two techniques for core reduction are observable: flakes (Fig. 11.53: 3, 4, 6, and 9; Pl. 11.5: 8) and core preparation flakes (Fig. 11.53: 2) show traces of direct percussion with hard hammer, while

Table 11.17 Chalcolithic obsidian artifacts from Tell Kosak Shamali.

Sector A	Level 17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	Later pits	Mixed	Total
Cores																				
Exhausted	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**2**
Debitage																				
Core-edge pieces	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	**3**
Cortical flakes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Partially cortical flakes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Flakes	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	**1**
Partially cortical blades	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Blades	0	4	3	13	21	7	10	7	4	4	6	0	2	3	1	0	0	0	0	**85**
Chips and fragments	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	**1**
Tools																				
Ret. blades, Type 1	0	0	1	2	4	2	3	2	0	1	1	1	0	3	0	0	0	0	0	**20**
Ret. blades, Type 2	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	**4**
Sickle elements ?	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	**2**
Truncated blades	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	**3**
Notches, Type 1	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	**3**
Notches, Type 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Denticulates	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**
Splintered pieces, Type 1	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	**4**
Splintered pieces, Type 2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**1**
Fragments	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	**3**
Total	**1**	**4**	**4**	**17**	**25**	**15**	**17**	**12**	**5**	**9**	**11**	**1**	**3**	**7**	**1**	**1**	**0**	**0**	**0**	**133**

Sector B	Level 7	6	5	4	3	2	1	Later pits	Mixed	Total
Cores										
Exhausted	0	0	1	2	0	0	0	0	0	**3**
Debitage										
Core-edge pieces	1	1	0	0	0	0	0	0	0	**2**
Cortical flakes	0	0	0	0	0	0	0	0	0	**0**
Partially cortical flakes	0	0	0	0	0	0	0	0	0	**0**
Flakes	1	5	2	1	0	1	1	0	0	**11**
Partially cortical blades	0	0	0	0	0	0	0	0	0	**0**
Blades	2	1	0	4	1	0	0	0	0	**8**
Chips and fragments	0	0	0	0	0	0	0	0	0	**0**
Tools										
Ret. blades, Type 1	0	0	1	0	0	0	0	0	0	**1**
Ret. blades, Type 2	0	0	0	0	0	0	0	0	0	**0**
Sickle elements ?	0	0	0	0	0	0	0	0	0	**0**
Truncated blades	0	1	0	0	0	0	0	0	0	**1**
Notches, Type 1	0	0	0	0	0	0	0	0	0	**0**
Notches, Type 2	0	0	0	0	0	0	0	0	0	**0**
Denticulates	0	0	0	0	0	0	0	0	0	**0**
Splintered pieces, Type 1	0	0	0	0	0	0	0	0	0	**0**
Splintered pieces, Type 2	0	0	0	0	0	0	0	0	0	**0**
Fragments	0	0	0	0	0	0	0	0	0	**0**
Total	4	8	4	7	1	1	1	**0**	**0**	26

blades have pressure flaking traits (Fig. 11.53: 1, 5 and 8). One core also shows traces of direct percussion (Fig. 11.53: 7) employed in the final stage, perhaps to extract flakes from the cores on which blade production was no longer possible. Flakes and blades were rarely retouched, and their use or function is unknown at present. As in the earlier Ubaid periods all obsidian pieces from the Terminal Northern Ubaid, Post-Ubaid and Uruk levels are microlithic, except one large flake from Level 5 of Sector B (Fig. 11.53: 9). This piece was discovered together with a complete bowl in a narrow space between the walls of Rooms 503 and 504 in the potters' workshop (Koizumi and Sudo 2001: 123), where it may have been stored for future use. Because of its large size even cores could have been produced from this flake.

11.6 Chronological developments of the lithic industries

The Chalcolithic lithic industries of Tell Kosak Shamali represent a continuous development from the Early Northern Ubaid to Middle Uruk periods. However, the above analysis shows that the industries can be divided into several chronological phases, each characterized by a specific set of techno-typological features and patterns of raw material use.

Phase 1 (Levels 17-14 of Sector A)

The lithic industry from the earliest levels of the Early Northern Ubaid (Phase 1 -Levels 17-14 of Sector A) is characterized technologically by at least three core reduction methods:

1) Method 1 is the most specialized using prismatic cores. It began with the manufacture of a prepared core blank, typically boat-shaped in form (e.g. Fig. 11.12). A large platform was then produced along the longitudinal axis of the prepared core blank, and a series of blades was detached from one end. The technique for blade detachment was probably direct percussion. While a punch may also have been used, there was no reliable trace suggesting the use of pressure flaking. Crested elements occasionally found in the collection are perhaps by-products from this method.

2) Method 2 also represents blade technology, but resemble more the flake production method described below. It used minimally prepared cores, usually made on split pebbles or thick flakes. The platform was made by a few simple blows at one end of the core, and blanks taken from the platform by uni-directional flaking. Both blades and flakes must have been produced in a single series of core reduction, and cores with traces of blade removals at the final stage were identified as representing this method. This technique was probably achieved by hard hammer flaking.

3) Method 3 shares the basic technological characteristics of Method 2, but is distinguished by the flake-shaped scars on the main flaking surface. Blank production began with direct percussion from a single-platform at one end, but the platform was often rotated or moved in the course of core reduction so that in their final stages, many cores had more than one platform. Cores resulting from this method can therefore be classified into several types according to the number and location of striking platforms (see above).

The core reduction technology of Phase 1 undoubtedly focuses on Method 3, with emphasis on flake production. However, Methods 1 and 2 were also employed more frequently than in most of the later levels, as evidenced by a higher proportion of blade cores and prismatic blades (Figs. 11.1 and 11.2). Precise discrimination between these two methods is very difficult in practise, since many cores underwent such repeated reduction that traits of core preparation in the earlier stage have been lost, and morphological features of the products have overlapped. Nevertheless, a few cores show definite traces of the use of Method 1, a feature rarely observed in the later phases.

Typologically, the Phase 1 lithics are characterized by the rarity of sickle elements (Fig. 11.3: 8). While very common in later levels, sickle elements constitute less than 20 % of the tool assemblage of this phase. Furthermore, they were more often manufactured on elongated blades than seen in later levels (Fig. 11.4), and the most characteristic type is the rectangular element or Type 1 (Fig. 11.5: 1). A variety of burins, in higher proportions (nearly 15%) also characterize this phase (Fig. 11.3: 2). While Types 1 to 3 burins are present in other phases, Types 4 to 6, and particularly Type 6 (composite burins) are only recorded in this phase. With regard to raw material use, this phase includes more obsidian artifacts (2.2 %), a percentage which, although low, is significantly higher than in later periods (Fig. 11.6). The obsidian was imported mainly as blades or finished tools (Fig. 11.7).

Phase 2 (Levels 13-12 of Sector A)

This phase shares the same technological features as Phase 1. Blade cores, as well as blade blanks, suggesting the use of Methods 1 and 2 are more common than in the other phases (Figs. 11.1 and 11.2). A more evident change is observed in the tool inventory. Sickle elements dramatically increase in this phase (Fig. 11.3: 8), particularly in Level 13, comprising over a half of all retouched tools. They are characteristically one-corner pointed types (Types 2 and 4 sickle elements) made on elongated blanks (Figs. 11.4 and 11.5). The proportion of burins drops sharply to 1-2% (Fig. 11.3: 2) and the number of obsidian artifacts decreases significantly (Fig. 11.6), two features which also characterize Phase 3. In short, the lithic industry of Phase 2 resembles Phase 1 in technological terms, but Phase 3 more in typological aspects.

Phase 3 (Levels 11-9 of Sector A)

Blade cores and debitage become rare in this phase (Figs. 11.1 and 11.2). Most blanks are flakes produced by Method 3. Sickle elements make up an important portion of the retouched tool category, as in the earlier phase (Fig. 11.3: 8), but display typological changes. While Type 2 continues its predominance, Type 4 pieces clearly decrease as Type 3 (crescent-shaped pieces) become the second most common type (Fig. 11.5). Type 1 (rectangular-shaped pieces) also remains less important than in Phase 1. Sickle element blanks changed too, with the use of blade blanks sharply decreasing (Fig. 11.4). Other tool types such as burins and retouched blades continue to be rare, but miscellaneously shaped retouched flakes increase from this phase onward (Fig. 11.3: 7). The use of obsidian is very rare (Fig. 11.6).

Phase 4 (Levels 8-4 of Sector A)

This phase obviously represents a continuation from Phase 3 sharing most of its technological and typological traits (Figs. 11.1-11.4). However, a striking change is detected in sickle element types with Types 2 and 4 becoming increasingly rare and Type 3 (crescent-shaped) the most common (Fig. 11.5: 3). Borers with multiple points (Type 2) appear in this phase, ad-hoc retouched flakes are more common (Fig. 11.3: 7). Also worthy of mention is the occurrence of heavy duty tools such as picks and bifaces. The import of obsidian is similar to that in the earlier phases as demonstrated by Figs. 11.6 and 11.7.

Phase 5 (Levels 3-1 of Sector A and Level 7 of Sector B)

Technologically, there is no clear separation between Phases 5 and 4 (Fig. 11.1) in that the dominant core reduction technology is one of flake production using Method 3. Typologically, a gradual decrease of sickle elements is evident from this phase onward (Fig. 11.3: 8). A change in sickle element types also occurs (Fig. 11.5), which sees the rise in popularity of Type 1, the decrease of Type 3 (abundant in Phase 3) and the virtual absence of Type 4. Another important change is detected in the exploitation of obsidian; obsidian artifacts now include a certain number of flakes, rare in earlier phases (Fig. 11.7). The pattern of import or use of this exotic raw material may have changed in this phase (see below).

Phase 6 (Levels 6-5 of Sector B)

While most of the techno-typological features are the same as in Phase 5, a new element is added - a new method for blade production, i.e. Method 4 for Canaanean blades. Since only a few specimens retain the bulb of percussion or even the platform, it is difficult to reconstruct the technology in detail, but it would seem to resemble that reconstructed at other Late Chalcolithic and Early Bronze Age sites. Experi-

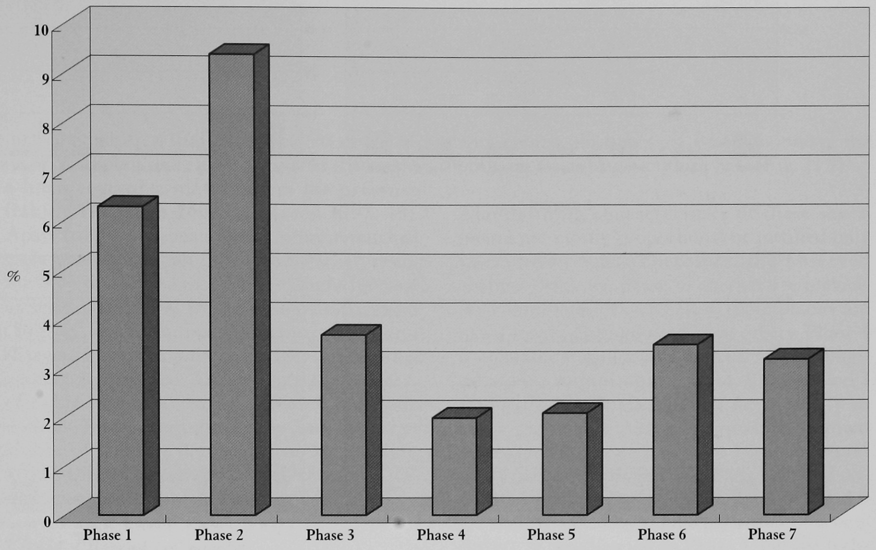


Fig. 11.1 Proportions of blade cores by phases *(Data from the tables in this chapter).*

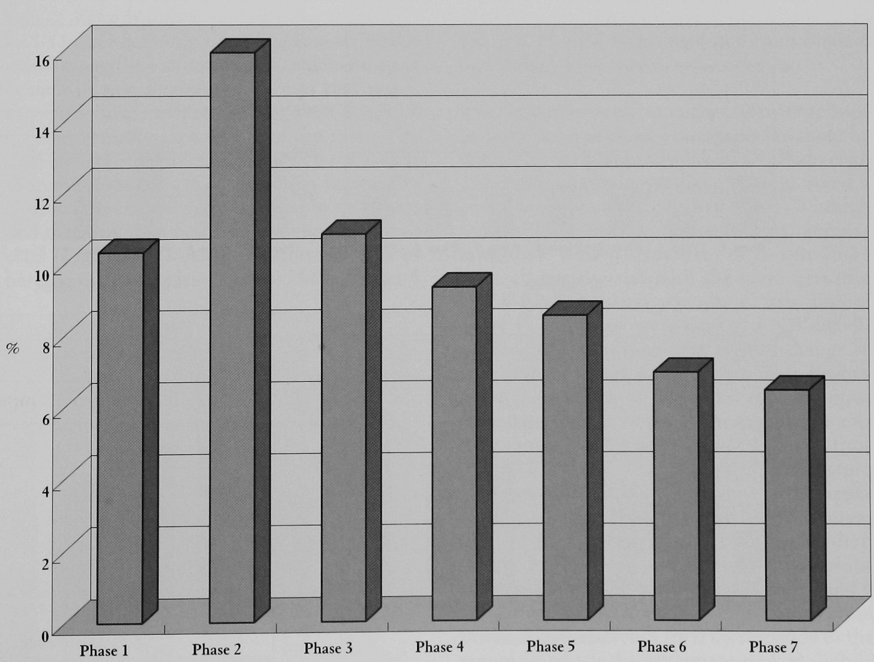


Fig. 11.2 Proportions of blades and tools made on blade blanks by phases *(Data from the tables in this chapter).*

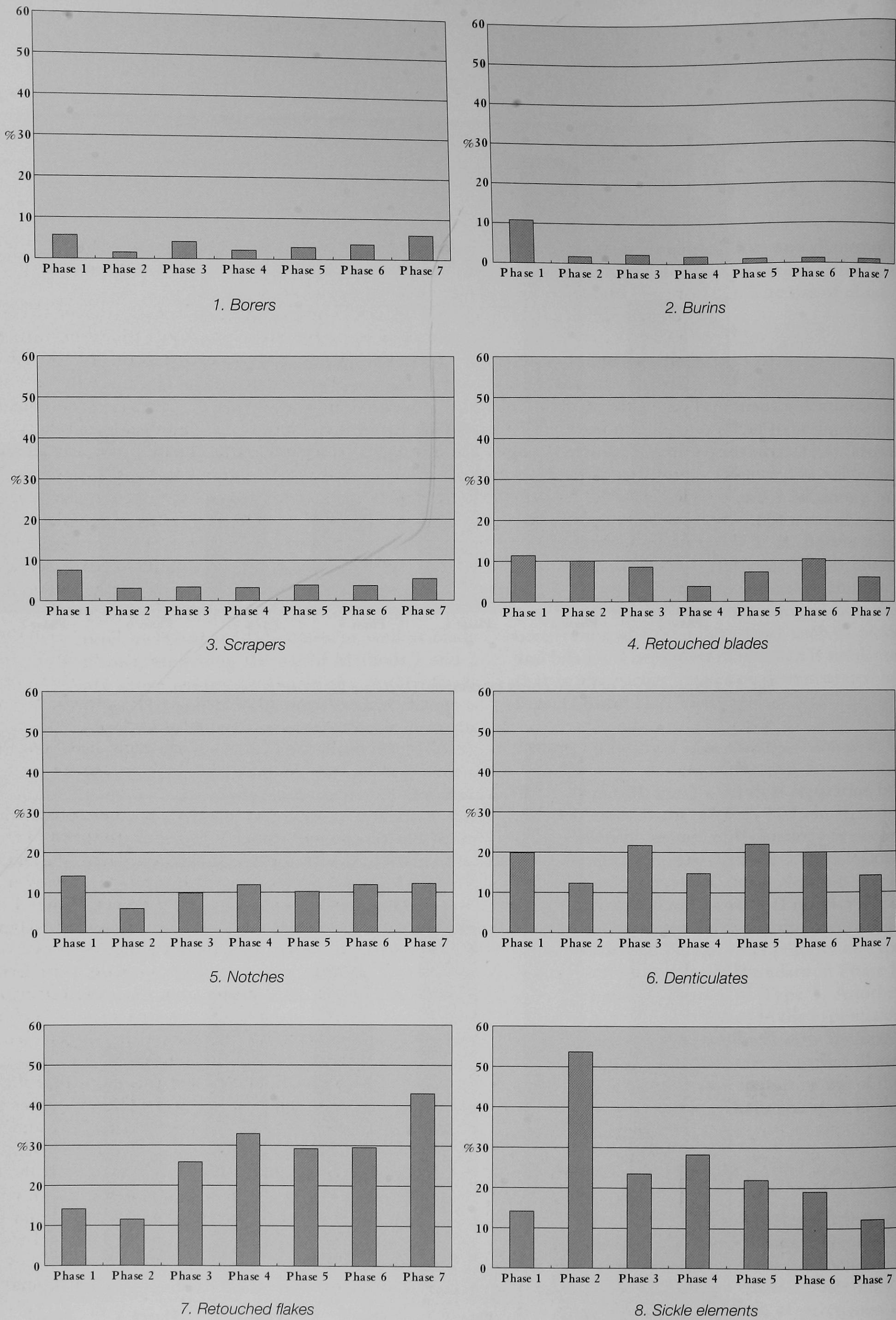


Fig. 11.3 Proportions of major retouched tools by phases *(Data from the tables in this chapter).*

mental replication studies and the few discoveries of knapping tools have suggested the use of a horn core or a metal object for pressure flaking (Pelegrin 2002; cf. Rosen 1997: 48). Apart from Canaanean blades, other retouched tools generally do not differ from earlier levels, the only possible change being a slight increase of retouched blades in the Post-Ubaid periods (Fig. 11.3: 4). Blades with continuous and discontinuous retouched edges are almost equally represented. Considering the decrease of sickle elements, these blade tools, although without visible silica gloss, may have served as sickle elements. As in Phase 5, obsidian artifacts include many flakes and cores, but few retouched pieces and blades (Fig. 11.7).

Phase 7 (Levels 4-1 of Sector B)

Basically, this phase shares the same technological features as Phase 6. The common production of flake blanks is one of these (Figs. 11.1 and 11.2), while imported Canaanean blades exist among the tool category. A notable change is seen in the decrease of formal tool types, especially sickle elements (Fig. 11.3: 8) which account for only about 10 % of the tools. The decreasing manufacture of Type 3 sickle elements continues (Fig. 11.5). An increase in ad-hoc retouched flakes is evident in this phase and they now represent the most common tool class (Fig. 11.3: 7). Also common is a type of borer similar to a pick (Type 6). As in Phases 5 and 6 cores and flakes are common among the obsidian assemblages of this phase (Fig. 11.7).

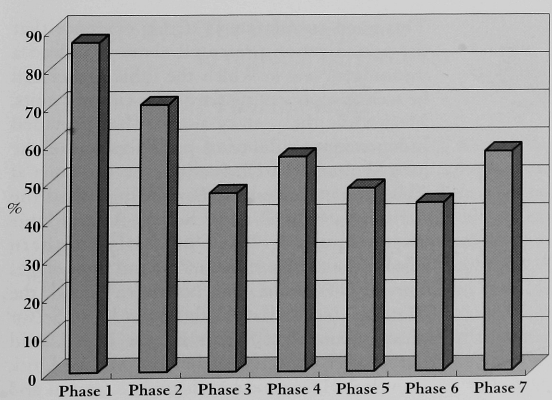
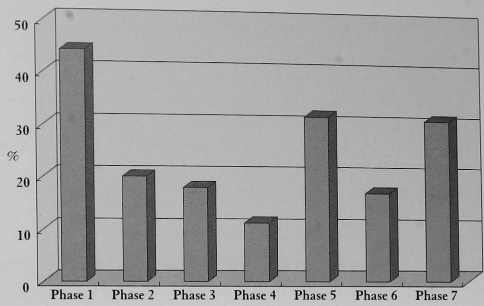


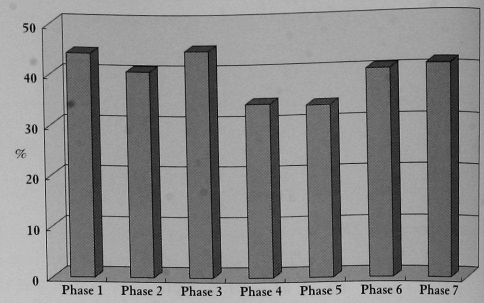
Fig. 11.4 Proportions of sickle elements on blade blanks by phases.

The defining characteristics of these seven phases are mostly proportional or justified only in relative terms. Therefore, the observed changes from one phase to another are inevitably continuous. Nevertheless, some phases are more clearly distinguished from others. Phase 1 is separable from Phase 2 in nearly all typological aspects and raw material use. Phases 2 and 3 also differ from each other, particularly in blank production methods and sickle element typology. However, Phases 3 to 4 seem to represent a process of continuous change divided only on sickle element typology. Phases 4 and 5 are distinguished by the introduction of a new pattern of obsidian use in Phase 5, but the techno-typological aspects of their flintwork are mostly continuous. The relationship between Phases 5 and 6 is also comparable, but with a new element, the Canaanean blade, added to Phase 6. Phase 7 is distinguished from Phase 6 by a change in flint tool frequencies.

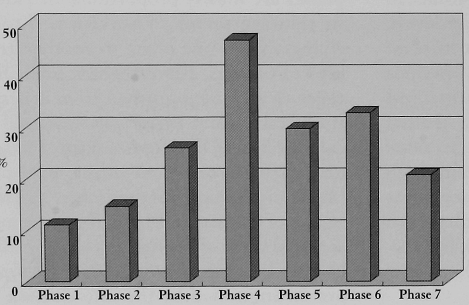
It is very interesting that these phases defined by lithic analysis closely correspond to those by defined by architectural analysis (Nishiaki *et al.* 2001). For example, we have already noted a break in architecture between Phases 1 and 2, i.e. Levels 14 and 13 of Sector A: rectangular mudbrick-walled structures of Levels 16-14 were all constructed with the main axis in a WSW-ENE direction, whereas all structures of Level 13 and above were built in a NW-SE direction. This is perhaps the biggest change in the architectural remains of Tell Kosak Shamali, and it is at this point that the most important change in the lithic sequence is evident. Similarly, between Levels 12 and 11, or Phases 2 and 3 a small change of architecture has been identified: the structures of the upper levels were built slightly to the north, whereas the lower ones overlapped with each other. Levels 9 and 8 are also separated by minor changes in building plan, when Phases 3 and 4 are defined by lithic analysis. The change from Phases 4 to 5 (Levels 4 to 3) corresponds to the period in which the settlement moved slightly towards the eastern part of the mound. The period of Phase 6 (Levels 6 and 5 of Sector B) is characterized by installation of the developed



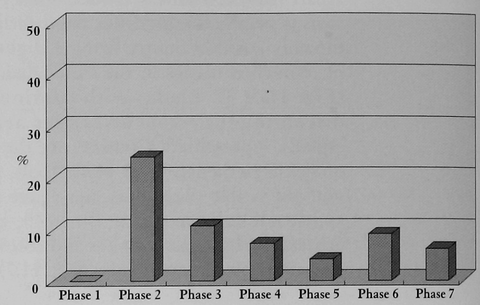
1. Type 1



2. Type 2



3. Type 3



4. Type 4

Fig. 11.5 Proportions of sickle element types by phases *(Data from the tables in this chapter).*

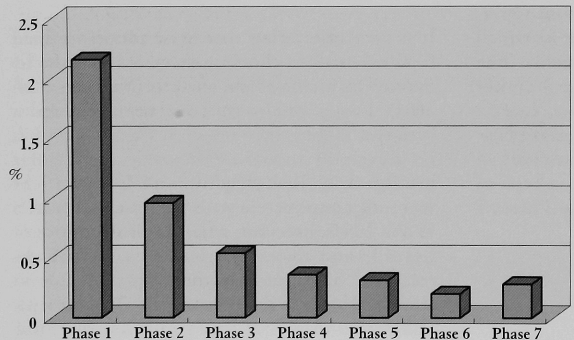


Fig. 11.6 Proportions of obsidian artifacts by phases *(Data from the tables in this chapter).*

potters' workshop on which new settlements of Phase 7 (Levels 4-1) were constructed with a layer containing no construction (Level 4). The architectural analysis suggests another small break between Levels 6 and 5 of Sector A, although there is no conclusive evidence to verify this from the techno-typological aspects of the lithic assemblages.

This good correlation is strong evidence that the periodization presented above is indeed a meaningful one in which the lithic phases can be seen as representing particular cultural units. Meanwhile the pottery analysis has provided independent evidence of periodization of the long sequence of Chalcolithic occupations at Tell Kosak Shamali. It has distinguished the earlier (Levels 17-13 of Sector A) and later stages (Levels 12-10) of the Early Northern Ubaid, the earlier (Levels 9-7) and later stages (Levels 6-4) of the Late Northern Ubaid, the Terminal Northern Ubaid (Levels 3-1 of Sector A and Level 7 of Sector B), the Post-Ubaid (Levels 6-5 of Sector B) and the Middle Uruk (Levels 4-1) (Nishiaki *et al.* 2001; Koizumi and Sudo 2001). Most of these ceramic time-units match the phases defined by the lithic and ar-

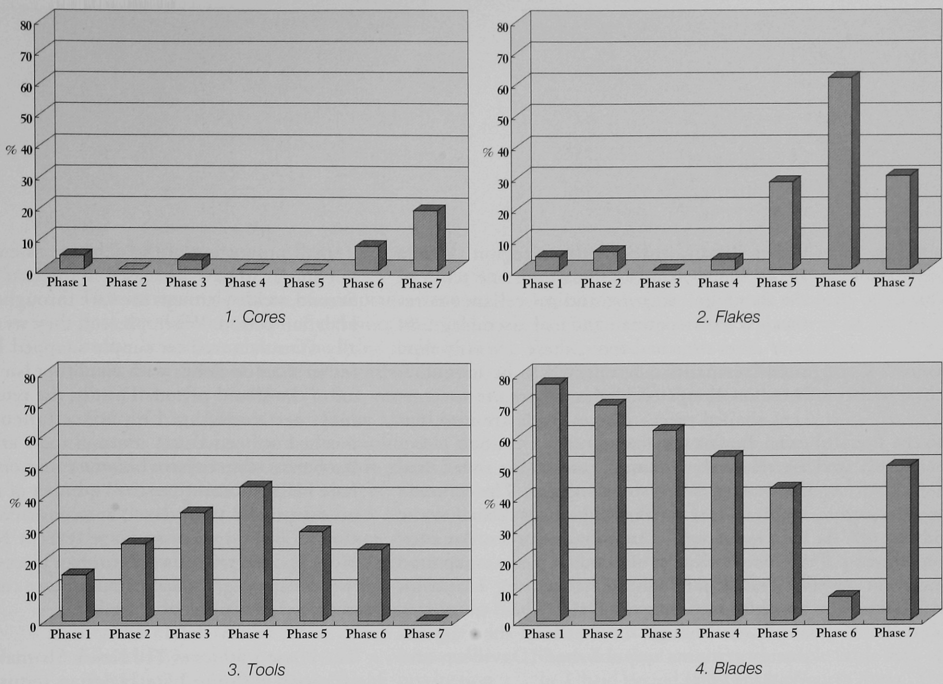


Fig. 11.7 Proportions of major obsidian categories by phases *(Data from the tables in this chapter).*

chitectural studies, except for the definition of the later stage of the Early Northern Ubaid. Although the implication of this discrepancy requires attention, we leave a detailed interpretation for future discussion, as the ceramic data have not yet been fully published. Meanwhile, below we shall attempt to set the lithic evidence into regional chrono-spatial contexts.

11.7 The lithic sequence in regional perspectives

11.7.1 Flint industries

The Chalcolithic sequence of Tell Kosak Shamali starts with Phase 1. The stratigraphic position, the ceramic assemblages and the obtained radiocarbon dates (Nishiaki 2001c) all indicate that Phase 1 levels represent the earliest phase of Ubaid expansion to the Upper Euphrates. As the ceramics in these levels contained both Halaf and Ubaid sherds, they could belong to the Halaf-Ubaid transitional period or a contact period of the local Halafian society with the Ubaidian tradition (Nishiaki *et al.* 1999). Additionally the architectural remains of this phase also include a Halaf-related element, a tholoi-like structure (Nishiaki *et al.* 2001: 90). Therefore a careful examination of the lithic data could clarify the manner in which the Ubaid tradition penetrated the local society in the domain of daily commodities such as lithic implements.

Interestingly enough, the Phase 1 lithics appears to resemble the late Halafian industry rather than Ubaid industries from the later levels of Tell Kosak Shamali. The similarities are enhanced when the literature on Halafian lithics from North Syria is surveyed. The best data come from the Early Halaf Levels 3-1 of Tell Sabi Abyad, in the Balikh valley. The flint artifacts are mostly manufactured on flake blanks with blades accounting for less than 10 % (Copeland 1989, 1996). Flake scrapers, denticulates, notches and retouched flakes are common tools. Sickle elements, which at about 12 % are relatively rare, include a few crescent-shaped pieces (our Type 3), but most belong to the elongated blade type (our Type 1). Burins are even rarer (only a few percent), and a small number of flint and obsidian arrowheads are present. The assemblages contain about 20 % obsidian pieces. A similar assemblage is reported from the Middle Halaf contexts at Tell

Omm Quseir, in the Khabur region (Maeda 1998). Blades comprise less than one tenth of the debitage category, and miscellaneous retouched tools dominate the tool assemblage. Of over 200 retouched tools, there are only nine sickle elements, all reported to be manufactured on elongated blades. There are no crescent-shaped pieces. Arrowheads are rare, but exist. Burins are uncommon. Obsidian pieces are relatively common, comprising more than 30 % of all flaked stone artifacts. The common occurrence of obsidian is perhaps related to site location close to Anatolian sources. An even higher percentage of obsidian pieces is reported at Tell Aqab, which has a long Halafian sequence including the Halaf-Ubaid transitional phase, although the details of the lithic industry remains unpublished (Davidson and Watkins 1981).

With reference to the Late Halaf industry from the Upper Euphrates near Tell Kosak Shamali, a detailed description is available of the lithics from Shams ed-Din Tannira, a site about 30 km south of Tell Kosak Shamali. The debitage assemblage consists of about 30 % blades and the tool assemblage of over 15 % burins (Azoury and Bergman 1980). Sickle elements, mostly of the elongated blade type, are uncommon, forming only 5 % of the tools at most. Transversal arrowheads are also present. Obsidian artifacts occupy about 10 % of the lithic materials. Other Late Halafian material comes from Kazane Höyük, north of Balikh, Turkey (Bernbeck *et al.* 1999). The lithic assemblage has features which are clearly comparable to those of Shams ed-Din Tannira. Blades comprise about 15 % of the debitage, formal retouched tools consist of burins, notches, borers and scrapers, but there are no arrowheads. While notches are the most numerous type, burins are also common, accounting for more than 20 % of the formal tools. Importantly, no sickle elements were recovered. Obsidian pieces, forming 3 % of the total flaked stone artifacts, are represented mainly by unretouched blades.

These assemblages from different regional and temporal contexts, and from sites of different settlement types, show a great deal of variability. Nevertheless, a couple of general trends can be pointed out. First, blades generally constitute a small proportion of the debitage assemblage, but appear to have increased in the Late Halaf. Second, sickle elements are rare throughout the Halafian period. When present, they were usually manufactured on simple snapped blades, rather than on flakes with an abrupt back typical of the Ubaid period. Thirdly, the retouched tools are dominated by miscellaneous retouched/utilized flakes. Formal tools are rare, but burins seem to have become common in the Late Halaf. Fourthly, a small number of arrowheads, usually transversal, are consistently included in the tool assemblage (except Kazane Höyük). Lastly, the use of obsidian pieces clearly shows a geographical pattern, more common in the east closer to the sources.

The Phase 1 lithics of Tell Kosak Shamali show affinities with the Late Halafian industry on the Euphrates. Indeed, they are practically indistinguishable from those of Kazane Höyük and Shams ed-Din Tannira, which is not surprising considering their temporal and regional proximity. Frequencies of specific tool types, particularly burins, and sickle element morphology are very similar between the sites, as is the use of obsidian. Differences lie in the number of blades and arrowheads: the slightly less common occurrence of blade blanks and the absence of arrowheads in the Phase 1 lithics at Tell Kosak Shamali, indicate links with the Ubaid industry.

The Halaf-Ubaid transition in North Syria has been noted at several sites in North Syria, including Tell Chagar Bazar (Mallowan 1936, 1947), Tell Brak (Mallowan 1947), Tell Aqab (Davidson and Watkins 1981) and Tell Ziyada (Hole 2000). Evidence of Ubaid elements increasingly incorporated within the Halafian material culture in the transitional levels of these sites is reported (Hole 2000: 21-22). The survival of Halafian elements in the Phase 1 lithics poses an interesting question in particular as the associated pottery has been described as "definitely Ubaid ware" (Nishiaki *et al.* 1999: 31). The Phase 1 lithics of Tell Kosak Shamali imply that the Ubaid tradition did not arrive in the Upper Euphrates as a fully established form of the Ubaid entity. Instead, people apparently accepted new material culture by stages, ceramic style first followed by the lithic style.

This intriguing pattern of acceptance may reflect the different roles of ceramics and lithics in the symbolic sphere. The lithic implements must have been of far lesser symbolic importance than the ceramics. In fact, most features described as characteristic of the Ubaid lithics concern attributes that are so minute that they would have been invisible at first glance, even by the prehistoric people. The fine decoration and the distinct forms of Ubaid ceramics, on the other hand, would have been more easily recognizable by others, hence promoting a more rapid adoption of new styles. When considering the lithics of Phase 2, that phase bridging the Halaf-related Phase 1 and the typical Ubaid Phase 3, we can detect a comparable phenomenon. In this Phase, blank production technology remained almost the same as in Phase 1, but new Ubaid-type tool assemblages, characterized by a distinct form of sickle elements, were introduced. This changing pattern indicates the same pattern of acceptance, i.e. a visible element (tool types) first and a less visible one (blank production technology) later.

An alternative explanation is also be considered. Survival of Halafian elements in the lithic industries could reflect a continuance of the old economy in the earliest phase of the Northern Ubaid. One of the most important Halafian traits in the Phase 1 lithics is the rarity of sickle elements, which display a dramatic increase from Phase 2 onwards. As sickle elements are considered to monitor the relative importance of farming, their lower frequency in the Phase 1 levels may indicate a reliance on other economic strategies, for example, herding and/or hunting. Zooarchaeological studies of the faunal assemblages at Shams ed-Din Tannira (Uerpmann 1980) and Umm Qseir (Zeder 1994), sites with lithic assemblages fairly comparable with our Phase 1 lithics, show a predominance of wild animals such as gazelles and equids. The excavators suggest that the economy of these two small settlements, located in the marginal zone of rainfed farming, placed emphasis on hunting as well as on herding. The inhabitants at Tell Kosak Shamali, in a similar geographical setting, may have relied on similar subsistence strategies in the earliest phase of the Northern Ubaid, using a similar set of lithic tools. Unfortunately, the results of zooarchaeological analysis at Tell Kosak Shamali, are insufficient to support this hypothesis at the moment, as the samples from the earliest levels so far analyzed, are too small to suggest a distinct pattern of animal exploitation (Gourichon p.c.).

From Phase 3 onward, we have different sets of lithic evidence which no longer bear clear Halafian elements. We have to look at Ubaid sites in rather remote regions for a comparison of the lithic data. The closest, Tell al-'Abr on the Upper Euphrates (Yamazaki 1999), provides no description of the lithic assemblages, nor does Tell Hammam et-Turkman in the Balikh valley (van Loon 1988). In fact, Tell Kosak Shamali is the first site with ample lithic data of the Ubaid period in this part of north Syria.

In the Turkish Euphrates valley, to the north of Tell Kosak Shamali, some descriptions are available from the 1970s excavations in the Atatürk dam lake area. The Late Northern Ubaid levels at Değirmentepe yielded over 20,000 flaked stone artifacts (Balkan-Atlı 1995). Technologically, the assemblages resemble those of Phases 3 - 5 of Tell Kosak Shamali, characterized by dominant flake production from single-platform cores, and a low blade index of less than 2 %. However, the tool assemblages at Değirmentepe are very distinct, having an unusually high number of perforators, over 90 % of the tool inventory. This anomaly, as well as the function(s) of the perforators, have not been adequately explained, but the same reportedly occurs at İkizhöyük and Tülintepe, also in southeast Turkey. Apart from this, the range of tool types itself shares similarities with the Phase 3 and later phases of Tell Kosak Shamali. Thumbnail end-scrapers, common at Değirmentepe, became common at Tell Kosak Shamali in Phase 3. Flake perforators with multiple points (our Type 2), also characteristic of the Değirmentepe industry, appear in Phases 4 and 5 of Tell Kosak Shamali. Furthermore, crescent and the one-corner pointed sickle elements types popular at Değirmentepe are most abundant in Phases 3 and 4 of Tell Kosak Shamali.

No such detailed lithic descriptions have been available to date for other Ubaid sites in southeast Turkey and north Syria. However, at Telul eth-Thalathat II, northern Iraq, useful data on the chronological developments of Ubaid lithics are present (Nishiaki 2001d, in press). Examination of morphological and traceological features of sickle elements from fourteen architectural levels of Thalathat II suggest that at least two hafting systems, using different types of sickle elements, were commonly used in the Ubaid and Late Chalcolithic periods. In the "oblique system", crescent or one-corner pointed sickle elements were inserted obliquely in to a handle, while in the "parallel system" elements were hafted parallel to the handle. These two systems follow different chronological patterns at Thalathat II: the parallel system was more popular in the late stage of the Early Northern Ubaid (Level XIV), but was replaced by the oblique system in the Late Northern Ubaid (Level XIII), which was subsequently gradually replaced once more by the parallel system in later periods.

The new data from Tell Kosak Shamali confirms the above picture (Fig. 11.5). In the earliest stages of the Northern Early Ubaid (Phases 1 and 2), elongated sickle elements (Type 1) probably used for the parallel system were popular. They were gradually replaced by crescent-shaped ones (Type 3) for the oblique system, which became most popular in the Late Northern Ubaid (Phase 4), after which they gave way to rectangular elements for the parallel system (Type 1) in the Terminal Northern Ubaid and later periods (Phases 5-7). The cyclical change of sickle element manufacturing is demonstrated as occurring not only in northern Iraq, but also on the Upper Euphrates. The Ubaid inhabitants at Tell Kosak Shamali obviously maintained close ties with northern Iraq, over 400 km away from the Upper Euphrates, at least in sickle manufacturing traditions.

The oblique hafting system using crescent-shaped sickle elements perhaps characterizes the earlier phase of the Late Northern Ubaid entity. Its replacement by the parallel system with rectangular elements took place gradually in the later phase. Whether or not this change was a phenomenon that pervaded the regions of Ubaid culture is as yet unclear. In fact, the available literature seems to suggest that the change occurred earlier in the east than in the west (Nishiaki 2001d). According to Bulgarrelli (1984), the sickle elements from the Halaf-Ubaid site of Tell Hassan, in the Hamrin region, show a time-vectored change: those from Halaf and Halaf-Ubaid transitional levels had both oblique and parallel gloss, but those from the Ubaid ones had parallel gloss only. This change is comparable to that observed at Thalathat II and Tell Kosak Shamali, but the replacement of the oblique system by the parallel one was apparently made in the Early Ubaid period in the Hamrin region. Likewise the published sickle elements from Tell Madhhur also suggest the popular use of the parallel system in the earlier phases of the Ubaid period (Miller and Miller 1984). These geographical patterns observed in sickle element technology may reflect a continuous wave of cultural "influence" from the east to west. The wave not only caused Ubaidization in the west, but also introduced new methods of lithic manufacture in later periods.

As the lithic assemblages of the Post-Ubaid levels (Phase 6) differ little from those of the Terminal Northern Ubaid (Phase 5), the Post-Ubaid industry is considered to be an indigenous evolution from the local Ubaid. New elements are limited practically solely to Canaanean blades. Their very rare occurrence (two in Level 6 and five in Level 5 of Sector B), the complete absence of Canaanean cores and the use of exotic flint all indicate Canaanean blades were imports at Tell Kosak Shamali. When and where this particular blade production technology was invented is unclear, but the stratigraphic evidence from Hacınebi (Edens 1999), southeast Anatolia, shows that it was already established in its Phase A, at least part of which was contemporaneous with the Post-Ubaid of Tell Kosak Shamali. The Canaanean blades from the Post-Ubaid levels at Tell Kosak Shamali perhaps represent one of the earliest examples of this particular series of blade implements.

Lithics from the overlying Uruk levels (Phase 7) share many features with those of the Post-Ubaid. The differences are mostly proportional, rather than relating to the replacement or addition of particular tool types. The Uruk materials also consisted of two distinct local and non-local industries. The former, and far more common, was the domestic industry exploiting local flint to produce a range of flake tools such as scrapers, borers and denticulates. Prismatic blades and blade tools were also produced but in a much smaller numbers. The tendency towards manufacturing more non-standardized tools accelerated in this period; in fact, retouched flakes often referred to as ad-hoc or junk tools are now the representative tool "type". Consequently, blade elements in the lithic assemblages sharply dropped in this phase. The possibility that the "retouched flakes" from Tell Kosak Shamali could also include accidentally edge-damaged pieces can not be ruled out (cf. Miller 1984), but there is no reason to believe that environmental retouch occurred more frequently in the Uruk period. Given that all the lithics from Tell Kosak Shamali were classified by the same analyst, with a consistent standard of classification, the more common manufacture of miscellaneous expedient tools in the Uruk is indicative of the real picture. There is little doubt that the trend reflects the greater availability of substitute materials, i.e. metals in this period.

The second industry sees the production of large regular, Canaanean blades. Rare in Phase 6, accounting for less than 10 % of all blades, they are consistently present in all Phase 7 levels in the form of glossed and non-glossed blades. There are no Canaanean cores or knapping debris indicating that the blades were not produced within the excavated area at least. Related evidence, such as production on exotic raw materials, also suggests imports. The non-local industry of Phase 7, or the Middle Uruk, appears to be limited strictly to the use of Canaanean blades. Tabular scrapers, often discovered in association with the Uruk contexts in this region, are absent in the Tell Kosak Shamali collection. Their absence is further evidence of the strong domestic character of the excavated assemblages.

The Phase 7 levels of Tell Kosak Shamali are considered comparable to the Middle Uruk, and partly to the Late Uruk in upper levels, of southern Mesopotamia (Nishiaki *et al.* 1999: 35). During this period, colonies of south Mesopotamian origin were founded at several settlements such as Sheikh Hassan (Boese 1995), Jebel Aruda (Hanbury-Tenison 1982), Habuba Kabira (Strommenger 1980), and Jerablus Tahtani (Peltenburg 1999) on the Upper Euphrates. Tell Kosak Shamali, located in the same valley in a remarkably strategic geographical setting that serves as a crossing point of the Euphrates (Oguchi 2001), might also have been occupied by such foreign communities. However, the lithic evidence itself does not provide sufficient information to determine the origin of the inhabitants. In fact, the characteristic traits of this late prehistoric period, summarized above, are so general that no distinct set of features has emerged that separate indigenous from foreign communities.

However, ceramic analysis at Hacınebi in the northern Turkish Euphrates valley has provided some clues to this matter. Two distinct residential areas, believed to represent the local inhabitants and the Uruk immigrants respectively, were identified in the later phase (Phase B2) of this Early-Middle Uruk settlement, so allowing a comparative analyses of the lithic assemblages (Edens 1999). The assemblages ascribed to the local inhabitants contain more blades, about 10-25 %, most of which are Canaanean. On the other hand, the Uruk assemblages have fewer blades, 10-12 % at most, of which Canaanean blades constitute only about half of the blade assemblages. Edens suggests that Canaanean blades were produced by local knappers, and were traded to the Uruk immigrants. In addition, the manner of blade use for sickle elements also differs between the communities. Sickle elements with traces of gloss and/or bitumen were present in both groups, but more denticulated pieces, reminiscent of the sickle elements of South Mesopotamia, were characteristically present in the Uruk assemblages. Furthermore, while gloss on local blades is preferentially restricted to the left of the blade, it is found indifferently on both the right and left of Uruk blades.

The Phase 7 lithic assemblages of Tell Kosak Shamali resemble more those of the Uruk immigrant industry at Hacınebi. Firstly, there is no trace of Canaanean blade production at Tell

Kosak Shamali. Secondly, the use of Canaanean blades is rather limited, suggesting their precious nature as a trade material. Thirdly, gloss on sickle elements from Phase 7 occurs indifferently on right and left positions (Table. 11.18). Fourthly, Canaanean blades include pieces with fine denticulation (e.g. Fig. 11.50: 6). Finally, blade production itself was unpopular at Tell Kosak Shamali. These features, all shared with the Hacınebi colony industry, may indicate that the Phase 7 lithics were derived from Uruk immigrants. However, shortcomings are inevitable when such a limited range of comparisons are used; in fact most comparisons relate to a single artifact class, i.e. Canaanean blades. Irrespective of local or foreign origin, a very small community as that of Tell Kosak Shamali might not have accommodated lithic specialists, without whose considerable skills Canaanean blade production could not have been effectively performed (Pelegrin and Otte 1992). Indeed, the presumably local community of the Post-Ubaid did not produce but rather imported Canaanean blades from other communities, perhaps in the north. A similar scenario might have occurred in the Uruk period. As such, the above interpretation should be tested when more data on changes of domestic industries and other artifact categories, notably pottery, become available. Whatever the case, the dual-structure clearly defined by local and non-local components is the important feature of the Uruk flint industry. It emerged in the Post-Ubaid period and became established during the Uruk period. A greater emphasis was placed on flake production in the domestic industry and on specialist blade production in the imported industry, reflecting the more complex nature of the socio-economic environments in this period.

11.7.2 Obsidian industries

Table 11.19 summarizes the relative frequency of obsidian pieces at Halaf to Uruk sites in the Euphrates and Balikh valleys. Sites beyond the Taurus such as Değirmentepe (Balkan-Atlı 1995) and Arslantepe (Caneva 1993) are shown separately so as to avoid anomalies caused by their close locations to obsidian sources in southeast Anatolia. The table clearly shows that obsidian became rare in these valleys during this time period. Obsidian was relatively common in the Early Halaf, but rapidly decreased in the Late Halaf. The new data from Tell Kosak Shamali cover the later periods, attests that this declining trend continued into the Ubaid and Uruk periods.

The common use of obsidian at Halafian settlements is a phenomenon perhaps to be understood in relation to the extensive circulation of ceramics in this period. Geochemical analyses of ceramic paste, though the method of which may not have been so sophisticated (Galbraith and Roaf 2001), generally suggest the distribution of fine Halafian vessels produced at a limited number of sites over a wide region (Davidson and McKerrell 1976). Obsidian also seems to have been distributed within a similar exchange network, embedded in the economic system peculiar to Halafian society. Sites with plenty of obsidian, up to 80 % of the lithic assemblages, appeared even in the consumption area, such as at Tell Aqab on the upper Khabur, probably as redistribution centers of obsidian (Cauvin and Chataigner 1998: 345).

The obvious and rapid decline of obsidian use in the Ubaid period is likely to reflect a change in economic systems between these two periods. The Ubaid communities at Tell Kosak Shamali apparently enjoyed economic autonomy, or at least their trade effort was more directed to goods other than obsidian. The Tell Kosak Shamali evidence indicates that use of obsidian during the earliest Ubaid (Phase 1) did not differ much from the Late Halafian, and replacement by Ubaid type procurement was completed only in the later part of the Early Ubaid (Phase 3), preceded by a transitional stage (Phase 2). In fact, this pattern of change is quite similar to that noted for the flint industry, suggesting that the introduction of the Ubaid-type lithic tradition occurred almost simultaneously for both flint and obsidian industries.

A survey of the literature suggests that the above change may represent a local phenomenon, characteristic in regions relatively far from source areas. In fact obsidian continued as a common lithic raw material at

Table 11.18 Analysis of the sickle elements from Uruk levels of Tell Kosak Shamali.

(1) Sickle elements from the Uruk levels (Sector B)

	Blades		Flakes	Unknown	Total
	Canaanean	Prismatic		fragments	
Level 1	0	1	1	1	3
Level 2	2	2	2	0	6
Level 3	1	13	2	1	17
Level 4	5	14	7	1	27
Total	8	30	12	3	53
%	15.1	56.6	22.6	5.7	100.0

(2) Position of the gloss on sickle elements from the Uruk levels (Sector B)

	Blades			Flakes			Total
	Right	Left	Invisible	Right	Left	Invisible	
Level 1	1	0	0	0	0	1	2
Level 2	0	1	3	1	0	1	6
Level 3	2	3	9	1	0	1	16
Level 4	5	5	9	0	1	6	26
Total	8	9	21	2	1	9	50
%	16.0	18.0	42.0	4.0	2.0	18.0	100.0

Table 11.19 Obsidian use at Chalcolithic settlements on the Upper Euphrates and the Balikh.

Period	Site	Phase/Square	Obsidian	Ob + Flint	Ob (%)	References
Anatolian plateau						
Middle-Late Uruk	Hassek Höyük		26	2992	0.87	Otte and Behm-Blancke 1990
Middle Uruk	Arslantepe	VII			< 10	Caneva 1993
Late Ubaid	Değirmentepe	6	35	924	3.79	Balkan-Atlı 1995
Late Ubaid	Değirmentepe	7	482	18021	2.67	Balkan-Atlı 1995
Late Ubaid	Değirmentepe	8	95	4069	2.33	Balkan-Atlı 1995
Late Ubaid	Değirmentepe	9	14	175	8.00	Balkan-Atlı 1995
Late Ubaid	Değirmentepe	10	5	110	4.55	Balkan-Atlı 1995
Lower plain						
Late Uruk	Jebel Aruda		9	408	2.21	Hanbury -Tenison 1982
Middle-Late Uruk	Kosak Shamali	Phase 7	11	3900	0.28	Present study
Early-Middle Uruk	Hacınebi				< 1.0	Edens 1999
Post-Ubaid	Kosak Shamali	Phase 6	12	5944	0.20	Present study
Terminal Ubaid	Kosak Shamali	Phase 5	6	1914	0.31	Present study
Late Ubaid	Kosak Shamali	Phase 4	31	8620	0.36	Present study
Early Ubaid (late)	Kosak Shamali	Phase 3	34	6321	0.54	Present study
Early Ubaid (early)	Kosak Shamali	Phase 2	40	4159	0.96	Present study
Halaf-Ubaid Trans.	Kosak Shamali	Phase 1	26	1202	2.16	Present study
Late Halaf	Kazane Höyük	D16	14	514	2.72	Bernbeck *et al.* 1999
Late Halaf	Kazane Höyük	D17	19	741	2.56	Bernbeck *et al.* 1999
Middle-Late Halaf	Shams ed-Din		473	4207	11.24	Azoury and Bergman 1980
Early Halaf	Sabi Abyad	1-3A	26	102	25.49	Copeland 1996
Early Halaf	Sabi Abyad	3B	128	583	21.96	Copeland 1996
Early Halaf	Sabi Abyad	3C	13	62	20.97	Copeland 1996

sites on the upper Tigris, upper Khabur, and northern Iraqi Mesopotamia (Cauvin and Chataigner 1998). In contrast, in the regions south of these areas, the period between the Halaf and Ubaid saw a decline in obsidian as evidenced at Tell Kosak Shamali. For instance, about 30 % obsidian was recovered from the Halafian levels of Tell Hassan, in the Hamrin region, falling to 12 % in the transitional Halaf-Ubaid levels, with a further fall to 6 % in the Ubaid levels (Cauvin and Chataigner 1998: 347). The obsidian circulation zone from the eastern sources appears to have been reduced in the Ubaid period.

Table 11.19 suggests that patterns of obsidian use changed little between the Ubaid and Uruk periods on the upper Euphrates. Furthermore, during the Uruk obsidian pieces are reported only sparsely. As with those regions distant from obsidian sources discussed above, a similar trend is indicated in the marginal zone, while a different pattern is evident in the zone closer to source areas. Despite the limitations of the available literature, analysis of the northern Iraqi Telul eth-Thalathat II collection offers a further good example for the latter pattern. Here, the Ubaid levels (Levels XIV-VIIb) consistently contain about 20 % obsidian pieces, a percentage which increased to over 30 % in subsequent levels assigned to the Late Chalcolithic (Levels VIIa-I), a period chronologically comparable to the Uruk. Where obsidian import was concerned, the northern Iraqi communities increased their ties with the north during the Uruk period, but this did not occur in the Syrian Euphrates valley. These different patterns are certainly intriguing when considering the cultural contrast between these regions. Needless to say, the settlement of Tepe Gawra (Tobler 1950) and the Late Chalcolithic levels of Thalathat II show few elements derived from southern Mesopotamia Uruk, wheras at Tell Kosak Shamali there are many. The two contemporaneous communities perhaps belonged to different cultural groups which may well have maintained different social relations with other regions. The obsidian data, therefore, should be taken as evidence suggesting the increasing complexity of cultural patterns in this period.

The change of obsidian use in the Ubaid to Uruk sequence at Tell Kosak Shamali is also qualitative. As already documented in previous sections, a major change occurred in the Terminal Northern Ubaid (Phase 5). During this period, an increase in flakes and cores is apparent in obsidian assemblages which, in earlier periods, had been dominated by blades and finished tools. The manufacture of flakes from obsidian may characterize the Terminal Northern Ubaid to the Uruk periods on the Syrian Upper Euphrates, as the same is reported at the Late Uruk settlement of Jebel Aruda, where about one-third of obsidian pieces are flakes (Hanbury-Tenison 1982). Once again, the unpublished data on the Thalathat II material from Iraq may help us evaluate this pattern in a wider context. My analysis shows that no such change occurred at Thalathat II, where obsidian assemblages from both Ubaid (Levels VIIb-XIV) and Late Chalcolithic levels (I-VIIa) consist of numerous blades and finished tools (up to 70 to 90 %). In other words, these two sites have similar obsidian assemblages in Ubaid levels, but not in later, Uruk/Late Chalcolithic levels. This pattern is comparable to that noted for the relative frequencies of obsidian underscoring the different use of obsidian in the Uruk/Late Chalcolithic periods between these two regions of northern Mesopotamia.

The chronological change of obsidian consumption at Tell Kosak Shamali could be explained in at least two ways. One explanation posits a possible change in the obsidian procurement system at the end of the Ubaid period. During the earlier Ubaid, obsidian seems to have been imported to the site primarily as finished products, whereas from the Terminal Northern Ubaid and later it is imported mostly as cores, raw material and large flakes. The former had been a popular pattern of obsidian import in North Syria since the Neolithic (Nishiaki 1993), and continued into the Halafian (Copeland 1996; Bernbeck *et al.* 1999). Its possible abandonment in Euphrates valley during the Terminal Northern Ubaid could imply a significant change of social relations among regional communities. However, the change could also be interpreted in terms of settlement function.

Settlements with different functions might well have employed different import systems even during the same period; for example, during the Halafian period obsidian was imported as unflaked cobbles at Tell Aqab, but as finished products at Tell Umm Qseir, both on the upper Khabur. Cauvin and Chatigner (1998: 345) suggest this contrast reflects a difference in settlement types between these two sites; an agricultural village vs. a pastoralist camp. A change of settlement types is detected in the Tell Kosak Shamali sequence, but it is between the Post-Ubaid and Middle Uruk periods (Koizumi and Sudo 2001), and not between the Late and the Terminal Northern Ubaid when the change in obsidian use occurred. Therefore, if the obsidian import system changed at Tell Kosak Shamali during the Terminal Northern Ubaid, the cause(s) should be sought in social changes on a regional scale.

The second possible explanation is that the change reflects a change in obsidian technology within the settlement rather than a change in obsidian import. On close examination, we note that the Early and Late Northern Ubaid obsidian assemblages did, in fact, contain some cores (Table 11.17). Therefore, even during the earlier phases the import of finished products was not the exclusive means of obsidian procurement, and a certain number of blades were produced on site. It follows that the high frequency of blades and blade tools could simply reflect a strong emphasis on blade production, while the increase of obsidian flakes in the Terminal Northern Ubaid could, in turn, suggest the more common production of flakes. If this were the case, obsidian technology followed the same avenue of technological change defined in flint technology. The flint assemblages also showed a gradual decrease in blade production throughout the Ubaid, with the local production of blades finally nearly abandoned during the Uruk period. In the earlier Ubaid, pressure flaking techniques were applied to obsidian cores, quite likely to ensure their productivity in relation to the precious nature of the raw material. The rapid increase of flakes resulting from direct percussion, at the expense of pressure flaked blades in the Terminal Northern Ubaid may indicate the disappearance of knappers with a specialized knowledge of obsidian blade debitage at the settlement.

It is still uncertain if either of the above interpretations, or any other, adequately explains the observed change in obsidian composition at Tell Kosak Shamali. Obviously, a final conclusion must await the publication of related sites in the same valley. Whatever the case, the observed changes of obsidian use at Tell Kosak Shamali should contribute to a better understanding of the various aspects relating to social relations among North Syrian Chalcolithic communities.

11.8 Conclusion

This chapter examined the chronological developments of the lithic industries from the Chalcolithic levels of Tell Kosak Shamali. The analysis revealed a number of important changes in both flint and obsidian industries in the long Chalcolithic sequence which was divided into seven distinct phases. These changes are probably related to both indigenous evolution and contacts with other traditions. The most notable change relating to indigenous evolution is the continuous decrease of blade production and formalized tools throughout the period. A second point of note is the trend towards the emergence of a dual structure evident in the later flint industries: the domestic production of amorphous flake tools and import of blades as specialist products. The continuous change in the manufacturing technology of sickle elements and in the manner of obsidian use can also be listed as examples of local evolution. However, it should be noted that, in fact, all these aspects are shared with other communities in the same valley and in more remote regions including northern Mesopotamia. The consequent implication is that, although exotic materials were rarely used for lithic tools, the inhabitants of Tell Kosak Shamali were never isolated from the progressive trends among Chalcolithic communities on a regional scale.

Evidence of the major contacts is created by introductions of Ubaid and Uruk cultural entities, both originating in southern Mesopotamia. The results of lithic analysis show that they affected lithic traditions rather independently of ceramic ones. Ubaid-type lithic production penetrated local Halafian style later than that of pottery. In other words, during the earliest Ubaid pottery phase, Halafian lithic manufacturing techniques were still followed. In contrast, the Uruk-type lithic tradition had already appeared in the Post-Ubaid, although Ubaid-style pottery continued. These different patterns of acceptance of foreign traditions in different domains of material culture certainly pose important questions on how local communities became acculturated as a result of waves of intrusion of more powerfully equipped societies from the south. This mechanism deserves further study as it no doubt reflects the differentiated symbolic nature of artifacts as well as the complex structure of the material culture in a particular society.

The Chalcolithic levels of Tell Kosak Shamali cover a long period of over a millennium, during which the local society in north Syria experienced a significant degree of cultural change. Lithic industries of this period reflect such changes, but previous studies have rather neglected them in favor of other artifact remains, notably pottery. It is hoped that this paper will supplement, or even revise our current view to Chalcolithic cultural patterns on the Upper Euphrates.

Acknowledgements

I would like to thank Professor Shigeo Aoki, National Research Institute for Cultural Properties, Tokyo, and Mr. Shinya Watanabe, Graduate School of Arts and Sciences, College of Arts and Sciences, the University of Tokyo, who helped in reconstructing the flint-embedded sickle of Fig. 11.17 and Pl. 11.4. Without their expertise, proper study of this highly fragile object would never have been possible.

References

Anderson, P.C. and M.-L. Inizan (1994) Utilisation du tribulum au début du III[e] millénaire: des lames "Cananéennes" lustrées à Kutan (Ninive V) dans la région de Mossoul, Iraq. *Paléorient* 20(2): 85-103.

Azoury, I. and C. Bergman (1980) The Halafian lithic assemblage of Shams ed-Din Tannira. *Berytus* 28: 127-143.

Balkan-Atlı, N. (1995) A preliminary report of the chipped stone industry of Değirmentepe, an Ubaid settlement in Eastern Anatolia. In: *Readings in Prehistory - Studies Presented to Halet Çambel*, edited by the Section of Prehistory, the Istanbul University, pp. 127-148. Istanbul: Istanbul University.

Bernbeck, R., S. Pollock and C. Coursey (1999) The Halaf settlement at Kazane Höyük: Preliminary report on the 1996 and 1997 seasons. *Akkadica* 25: 109-147.

Boese, J. (1995) *Ausgrabungen in Tell Sheikh Hassan I: Vorläufige Berichte über die Grabungskampagnen 1984-1990 und 1992-1994*. Saarbrücken: Saarbrücken Druckerei und Verlag.

Bulgarelli, M.G. (1984) Tell Hassan: The lithic industry. *Sumer* 40: 290-292.

Caneva, I. (1993) From Chalcolithic to Early Bronze Age III at Arslantepe: A lithic perspective. In: *Between the Rivers and Over the Mountains,* edited by M. Frangipane, pp. 319-339. Roma: Università La Sapienza.

Cauvin, M.-C. and C. Chataigner (1998) Distribution de l'obsidienne dans les sites archéologiques du Proche et Moyen Orient. In: *L'Obsidienne du Proche et Moyen Orient - Du volcan à l'outil,* edited by M.-C. Cauvin, A. Gourgaud, B. Gratuze, N. Arnaud, G. Poupeau, J.-L. Poidevin et C. Chataigner, pp. 325-350. BAR International Series 738. Oxford: Archaeopress.

Copeland, L. (1989) The flint and obsidian artifacts of Tell Sabi Abyad. In: *Excavations at Tell Sabi Abyad,* edited by P.M.M.G. Akkermans, pp. 237-270. BAR International Series 468. Oxford: Archeopress.

Copeland, L. (1996) The flint and obsidian industries. In: *Tell Sabi Abyad: The Late Neolithic Settlement,* edited by P.M.M.G. Akkermans, pp. 285-338. Istanbul: Nederlands Historisch-Archaeologisch Instituut te Istanbul.

Davidson, T.E. and H. McKerrell (1976) Pottery analysis and Halaf period trade in the Khabur headwaters region. *Iraq* 38: 45-56.

Davidson, T.E. and T. Watkins (1981) Two seasons of excavations at Tell Aqab in the Jezireh, Northeastern Syria. *Iraq* 43: 1-18.

Edens, C. (1999) The chipped stone industry at Hacınebi: technological styles and special identity. *Paléorient* 25(1): 23-33.

Galbraith, J. and M. Roaf (2001) *Does the neutron activation analysis of Halaf pottery provide evidence of trade? A re-examination of Davidson and McKerrell's investigation of Halaf pottery from the Khabur basin in eastern Syria.* Department of Statistics Research Report. London: London School of Economics and Political Science.

Hole, F. (2000) The prehistory of the Khabur. *Subartu* VII: 17-27.

Hanbury-Tenison, J. (1982) The 1982 flaked stone assemblage at Jebel Aruda, Syria. *Akkadica* 33: 27-39.

Inizan, M.-L., M. Reduron-Ballinger, H. Roche and J. Tixier (1999) *Technology of Knapped Stone.* Nanterre: CREP.

Iwasaki, T., H. Nishino and A. Tsuneki (1995) The prehistory of the Rouj basin, Northwest Syria. *Anatolica* 21: 143-187.

Koizumi, T. and H. Sudo (2001) The stratigraphy and architectures of Sector B of Tell Kosak Shamali. In: *Y. Nishiaki and T. Matsutani* eds., pp. 115-152.

van Loon, M. (ed.) (1988) *Hammam et-Turkman I.* Istanbul: Nederlands Historisch-Archeologisch Instituut te Istanbul.

Maeda, O. (1998) Chipped and ground stone artifacts. In: *Excavations at Tell Umm Qseir in Middle Khabur Valley, North Syria,* edited by A. Tsuneki and Y. Miyake, pp. 86-107. Tsukuba: Tsukuba University.

Mallowan, M. (1936) The excavations at Tall Chagar Bazar, and an archaeological survey of the Habur region, 1934-35. *Iraq* 3: 1-86.

Mallowan, M. (1947) Excavations at Brak and Chagar Bazar. *Iraq* 9: 1-266.

Miller, R. (1984) Flaked stone technology from Tell Rubeidheh, Iraq. In: *Tell Rubeideh: An Early Uruk Village in the Jebel Hamrin,* edited by R.G. Killick, pp. 77-145. Warminsyer: Aris and Phillips Ltd.

Miller, R. and J.R. Miller (1984) The flaked stone industries at Tell Madhhur. *Sumer* 43: 164-167.

Nishiaki, Y. (1991) Chipped stone artifacts. In: *Tell Kashkashok, the Excavations at Tell No. II,* edited by T. Matsutani, pp. 40-58. Tokyo: University of Tokyo Press.

Nishiaki, Y. (1993) Anatolian obsidian and the Neolithic obsidian industries of North Syria: a preliminary review. In: *Essays on Anatolian Archaeology,* edited by H.I.H. Prince Takahito Mikasa, pp.140-160. Wiesbaden: Harrassowitz Verlag.

Nishiaki, Y. (1997) Neolithic sickle elements from the Balikh valley, North Syria. *Al-Rafidan* 18: 59-67.

Nishiaki, Y. (2000) *Lithic Technology of Neolithic Syria.* BAR International Series 840. Oxford: Archaeopress.

Nishiaki, Y. (2001a) The Palaeolithic flint artifacts from Tell Kosak Shamali. In: *Y. Nishiaki and T. Matsutani* eds., pp. 165-178.

Nishiaki, Y. (2001b) The Neolithic flaked stone artifacts from Tell Kosak Shamali. In: *Y. Nishiaki and T. Matsutani* eds., pp. 213-223.

Nishiaki, Y. (2001c) Radiocarbon dates and the

absolute chronology of Tell Kosak Shamali. In: *Y. Nishiaki and T. Matsutani* eds., pp. 153-157.
Nishiaki, Y. (2001d) Hafting systems of sickle elements from the Chalcolithic levels of Telul eth-Thalathat II, Iraq. In: *Beyond Tools - Redefining the PPN Lithic Assemblages of the Levant,* edited by I. Caneva, C. Lemorini, D. Zampetti and P. Biagi, pp. 55-72. Berlin: ex oriente.
Nishiaki, Y. (in press) Sickle manufacturing technologies at two Chalcolithic sites in North Mesopotamia: Tell Kosak Shamali (Syria) and Telul eth-Thalathat II (Iraq). In: *Festschrift for Lorraine Copeland,* edited by O. Aurenche and M. Le Mière. Lyon: Maison de l'Orient Méditerranéen.
Nishiaki, Y., T. Koizumi, M. Le Mière and T. Oguchi (1999) Prehistoric occupations at Tell Kosak Shamali, the upper Euphrates, Syria. *Akkadica* 113: 13-67.
Nishiaki, Y., M. Tao, S. Kadowaki, M. Abe and H. Tano (2001) Excavations in Sector A of Tell Kosak Shamali: The stratigraphy and architectures. In: *Y. Nishiaki and T. Matsutani* eds., pp. 49-113.
Nishiaki, Y. and T. Matsutani (eds.) (2001) *Tell Kosak Shamali: Archaeological Investigations on the Upper Euphrates, Syria, Vol. 1 - Excavations and the Earlier Prehistoric Remains.* UMUT Monograph 1. Tokyo: The University Museum, the University of Tokyo / Oxford: Oxbow Books.
Oguchi, T. (2001) Geomorphological and environmental settings of Tell Kosak Shamali, Syria. In: *Y. Nishiaki and T. Matsutani* eds., pp. 19-38.
Otte, M. and M.R. Behm-Blancke (1990) Die Rekonstruktion technischer Verfahrensweisen. In: *Hassek Höyük: Naturwissenschafflicle untersuchungen und lithische industrie,* edited by M.R. Behm-Blancke, pp. 165-176. Tübingen: E. Wasmuth.
Pelegrin, J. (2002) Principes de la reconnaissance des méthodes et techniques de taille. In: *Tell 'Atij, Tell Gudeda - Industrie Lithique*, by J. Chabot, pp. 215-226. CELAT 13. Québec: Université Laval.
Pelegrin, J. and M. Otte (1992) Einige Bemerkungen zur Präparations- und Ausbeuttechnik der Kernsteine aus Raum 29. In: *Hassek Höyük: Naturwissenschaftliche Untersuchungen und lithische Industrie,* edited by M.R. Behm-Blancke, pp. 219-224. Tübingen: E. Wasmuth.
Peltenburg, E. (1999) Tell Jerablus Tahtani 1992-1996: A summary. In: *Archaeology of the Upper Syrian Euphrates, the Tishreen Dam Area,* edited by G. del Omo Lete and J.-L. Montero Fenollós, pp. 97-105. Barcelona: Universitat de Barcelona.
Rosen, S. (1997) *Lithics After the Stone Age.* London: Altamira Press.
Strommenger, E. (1980) *Habuba Kabira: Eine Stadt vor 5000 Jahren.* Mainz and Rhein: Verlag Philipp von Zabern.
Tobler, A. J. (1950) *Excavations at Tepe Gawra (Vol. 2).* Philadelphia: The University of Pennsylvania Press.
Uerpman, H.-P. (1980) Faunal remains from Shams ed-Din Tannira, a Halafian site in Northern Syria. *Berytus* 28: 3-52.
Yamazaki, Y. (1999) Excavations at Tell al-'Abr. In: *Archaeology of the Upper Syrian Euphrates, the Tishreen Dam Area,* edited by G. del Omo Lete and J.-L. Montero Fenollós, pp. 83-96. Barcelona: Universitat de Barcelona.
Zeder, M. (1994) After the revolution: Post-Neolithic subsistence in Northern Mesopotamia. *American Anthropologist* 96(1): 97-126.

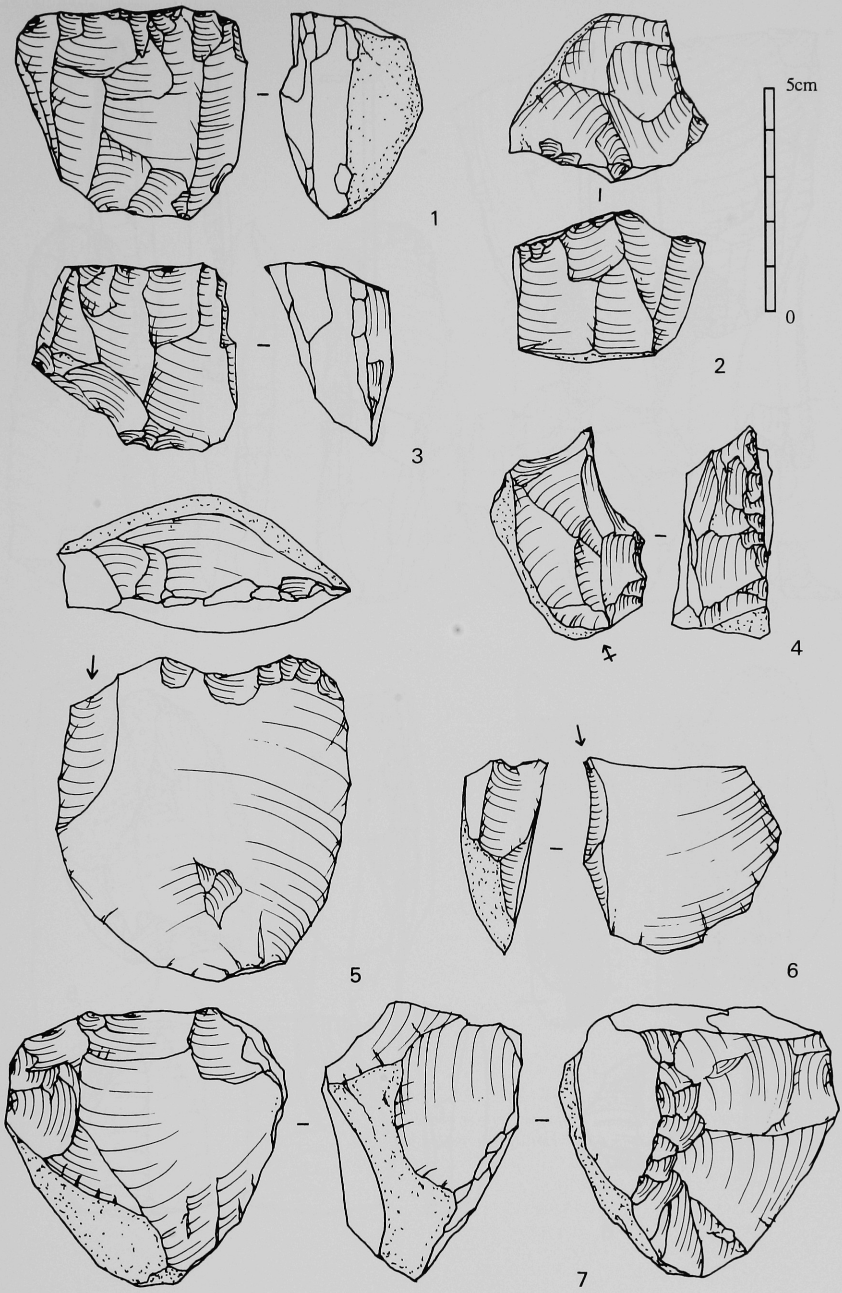


Fig. 11.8 Chalcolithic flint artifacts from Levels 17 and 16 of Sector A.
1. Single-platform flake core, flat type (94KSL-A14-1; Fill; Level 17).
2. Change-of-orientation flake core, globular type (95KSL-AF3-22; Fill; Level 17).
3. Single-platform flake core, flat type (94KSL-A13-1; Fill; Level 17).
4. Borer, Type 1 (95KSL-AF3-22; Fill; Level 17).
5. Burin, Type 4 (95KSL-AF6-10; Fill; Level 16).
6. Burin, Type 1 (95KSL-AF6-10; Fill; Level 16).
7. Change-of-orientation flake core, globular type (94KSL-D10-5; Fill; Level 16).

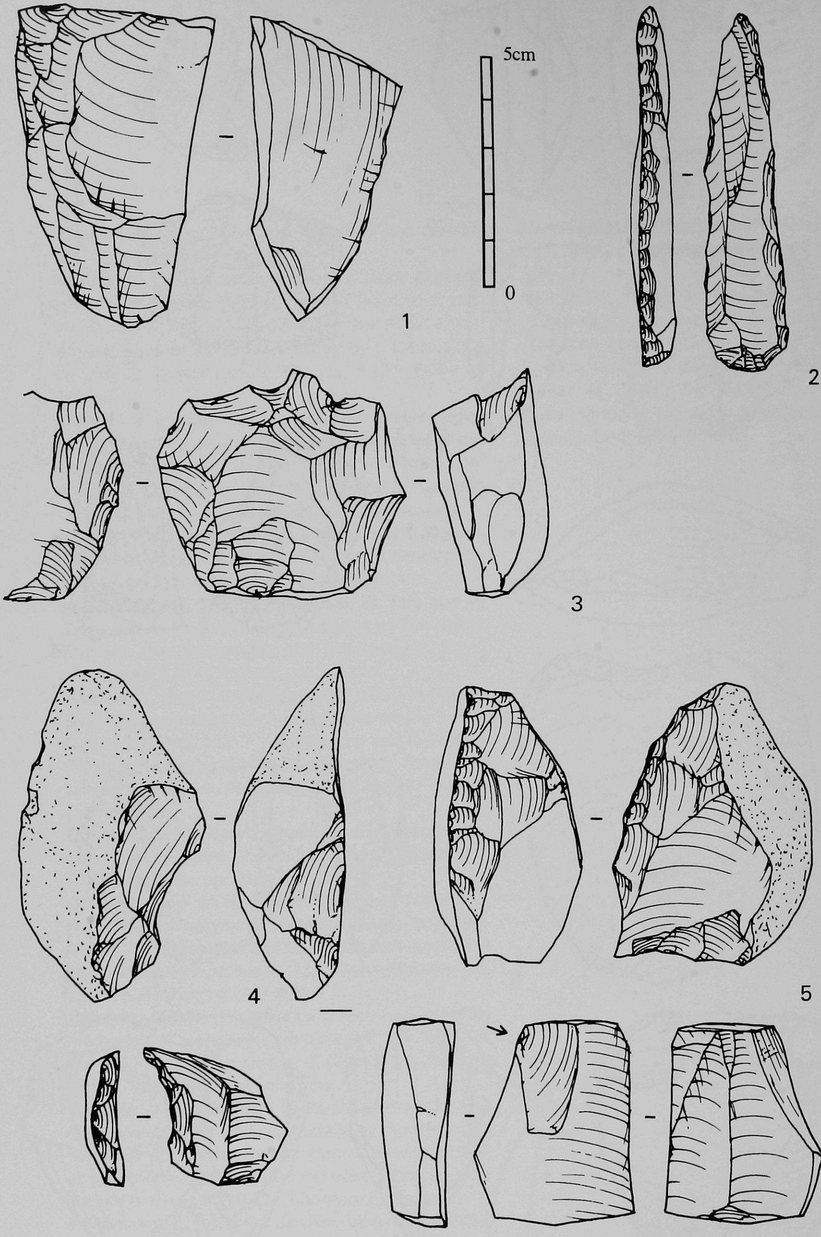


Fig. 11.9 Chalcolithic flint artifacts from Level 15 of Sector A.

1. Single-platform blade core, flat type (95KSL-AF6-8; 1504).
2. Borer, Type 4 (95KSL-AF5-22; Fill).
3. Denticulate, Type 2 (95KSL-AG5-7; Fill).
4. Notch, Type 1 (95KSL-AG5-7; Fill).
5. Scraper, Type 1 (95KSL-AF5-22; Fill).
6. Notch, Type 1 (95KSL-AF5-20; Fill).
7. Burin, Type 4 (94KSL-C11-4; Fill).

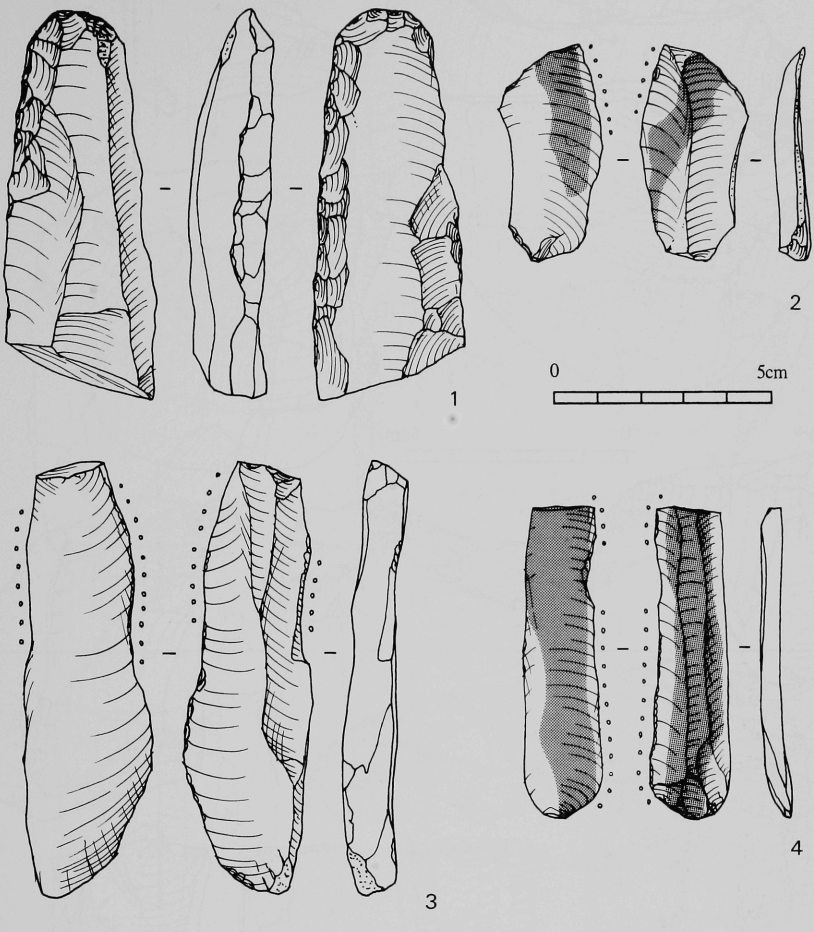


Fig. 11.10 Chalcolithic flint artifacts from Level 15 of Sector A.
1. Rod (95KSL-AF6-8; 1504).
2. Sickle element, Type 2 (95KSL-AF5-20; 1501).
3. Sickle element, Type 1 (95KSL-AG5-7; Fill).
4. Sickle element, Type 1 (95KSL-AG5-7; Fill).

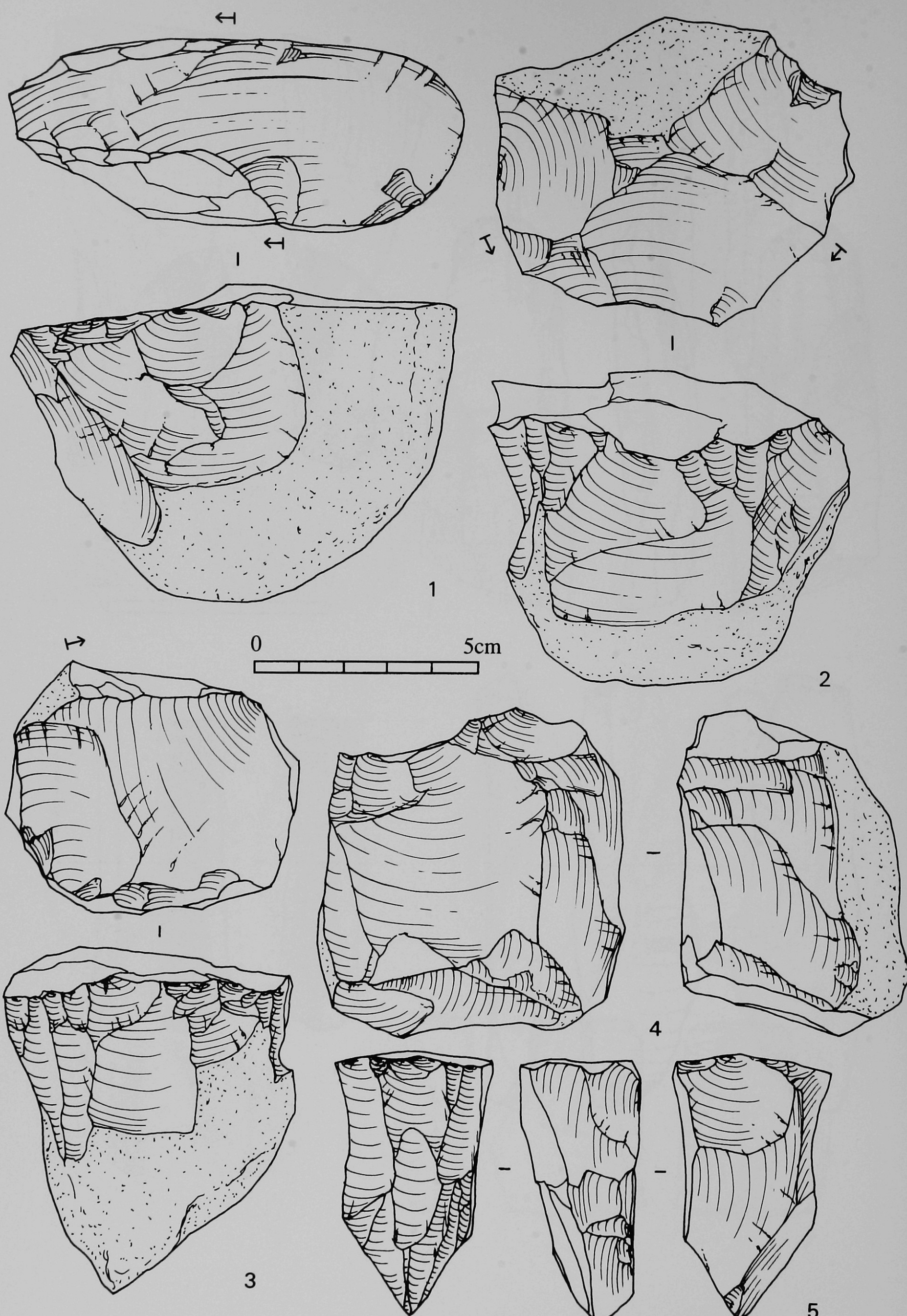


Fig. 11.11 Chalcolithic flint artifacts from Level 14 of Sector A.
1. Single-platform flake core, prism type (97KSL-AD5-120-3; 1402).
2. Single-platform flake core, prism type (97KSL-AE5-55-6; Fill).
3. Single-platform flake core, prism type (97KSL-AE5-5; 1401).
4. Change-of-orientation flake core, crossed type (97KSL-AE5-55-21; 1102).
5. Single-platform blade core, prism type (97KSL-AD4-54; 1402).

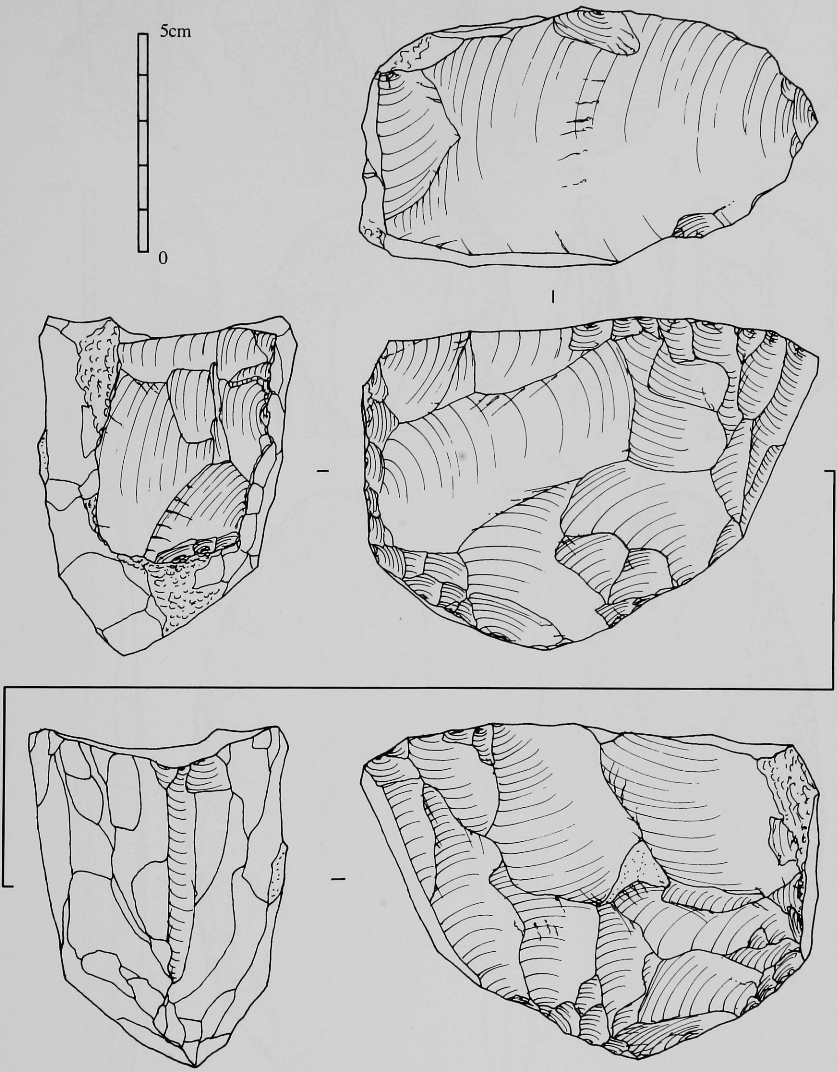


Fig. 11.12 Chalcolithic flint artifact from Level 14 of Sector A.
Single-platform blade core, prism type (95KSL-AE5-53-24; 1406). The core blank was a biface.

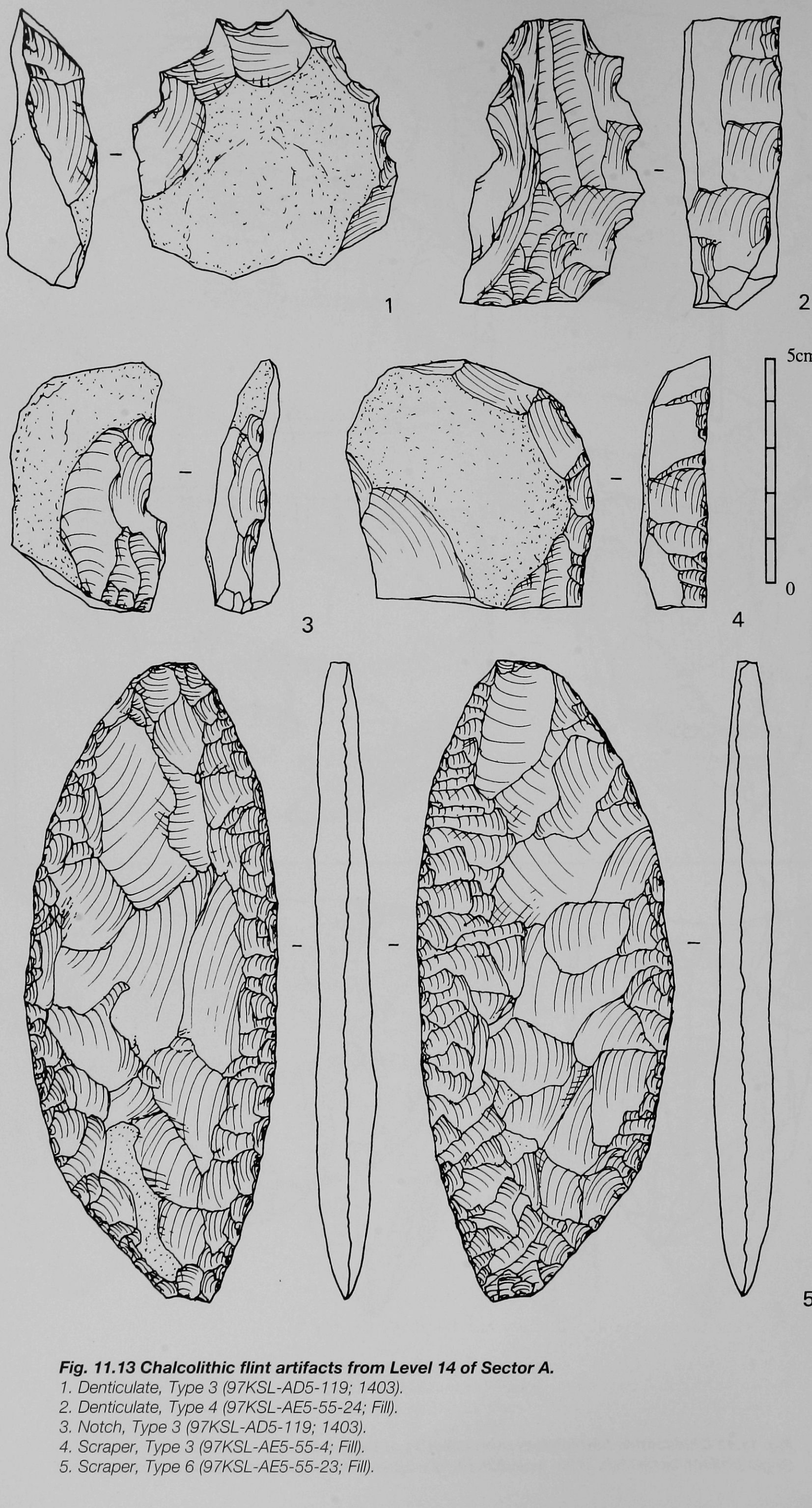


Fig. 11.13 Chalcolithic flint artifacts from Level 14 of Sector A.
1. Denticulate, Type 3 (97KSL-AD5-119; 1403).
2. Denticulate, Type 4 (97KSL-AE5-55-24; Fill).
3. Notch, Type 3 (97KSL-AD5-119; 1403).
4. Scraper, Type 3 (97KSL-AE5-55-4; Fill).
5. Scraper, Type 6 (97KSL-AE5-55-23; Fill).

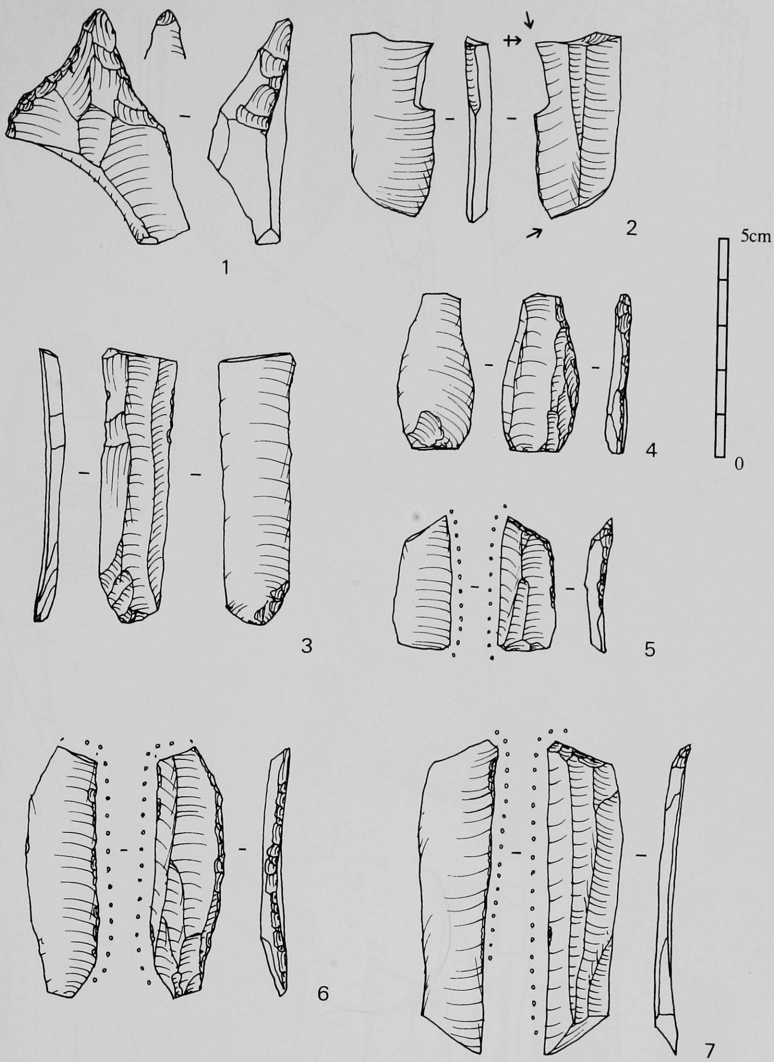


Fig. 11.14 Chalcolithic flint artifacts from Level 14 of Sector A.
1. Borer, Type 1 (97KSL-AD4-59; 1401).
2. Burin, Type 6 (97KSL-AE5-54; 1407).
3. Sickle element, Type 1, shape-defined (97KSL-AF4-13; 1408).
4. Retouched blade, Type 1 (97KSL-AE5-52; Fill).
5. Sickle element, Type 3 (97KSL-AE5-52; Fill).
6. Sickle element, Type 2 (97KSL-AE5-53; 1406).
7. Sickle element, Type 2 (97KSL-AD4-55; 1404).

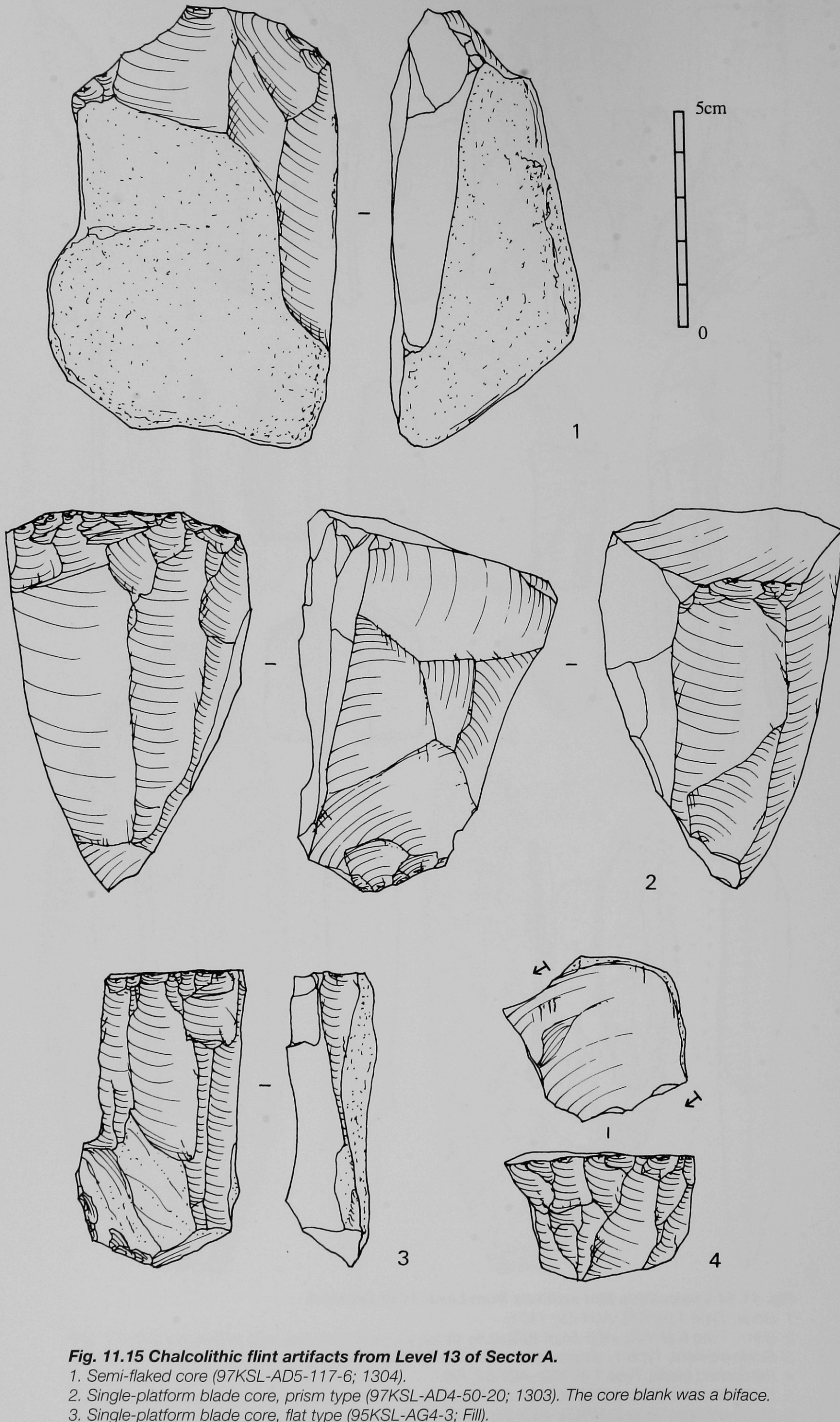


Fig. 11.15 Chalcolithic flint artifacts from Level 13 of Sector A.

1. Semi-flaked core (97KSL-AD5-117-6; 1304).

2. Single-platform blade core, prism type (97KSL-AD4-50-20; 1303). The core blank was a biface.

3. Single-platform blade core, flat type (95KSL-AG4-3; Fill).

4. Single-platform flake core, prism type (94KSL-A12-1; 1310).

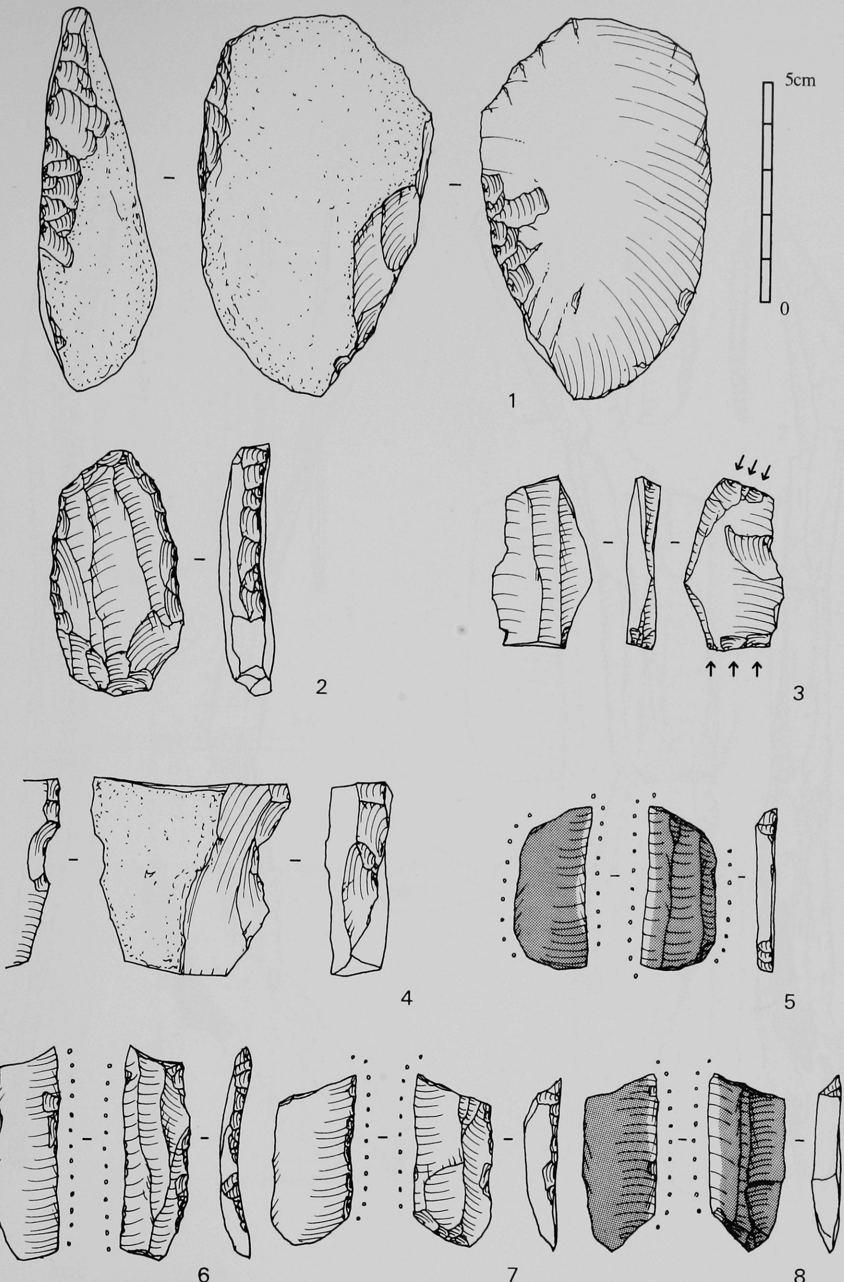


Fig. 11.16 Chalcolithic flint artifacts from Level 13 of Sector A.

1. Scraper, Type 1 (97KSL-AD5-116-1; 1301).
2. Scraper, Type 2 (95KSL-AG5-3; 1310).
3. Splintered piece, Type 2 (97KSL-AD5-114; 1302).
4. Notch, Type 1 (97KSL-AD5-117; 1304).
5. Sickle element, Type 3 (95KSL-AG5-5; Fill).
6. Sickle element, Type 2 (95KSL-AG5-5; Fill).
7. Sickle element, Type 4 (95KSL-AG5-5; Fill).
8. Sickle element, Type 4 (95KSL-AG5-5; Fill).

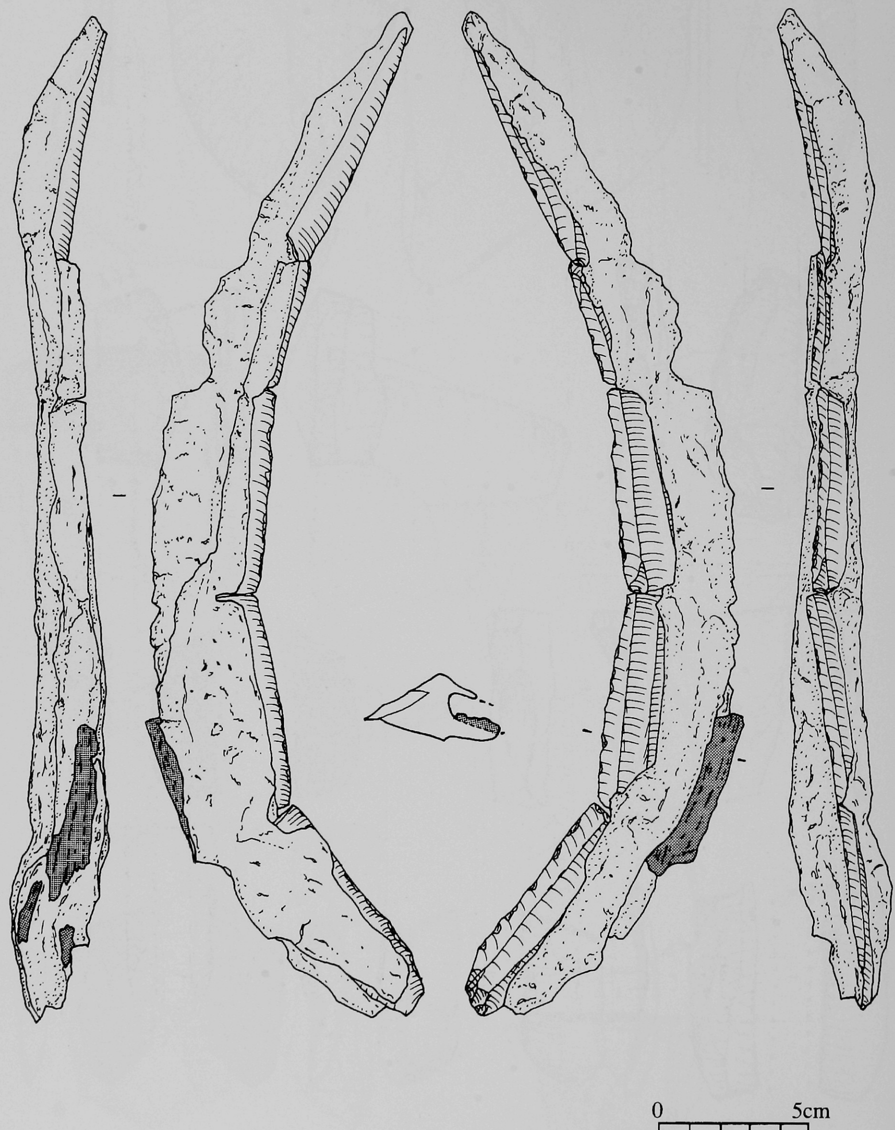


Fig. 11.17 The flint-bedded sickle from Level 13 of Sector A.
Sickle elements are hafted to a bone handle (hatched area) with bitumen (97KSL-AD5-116-1; 1301).

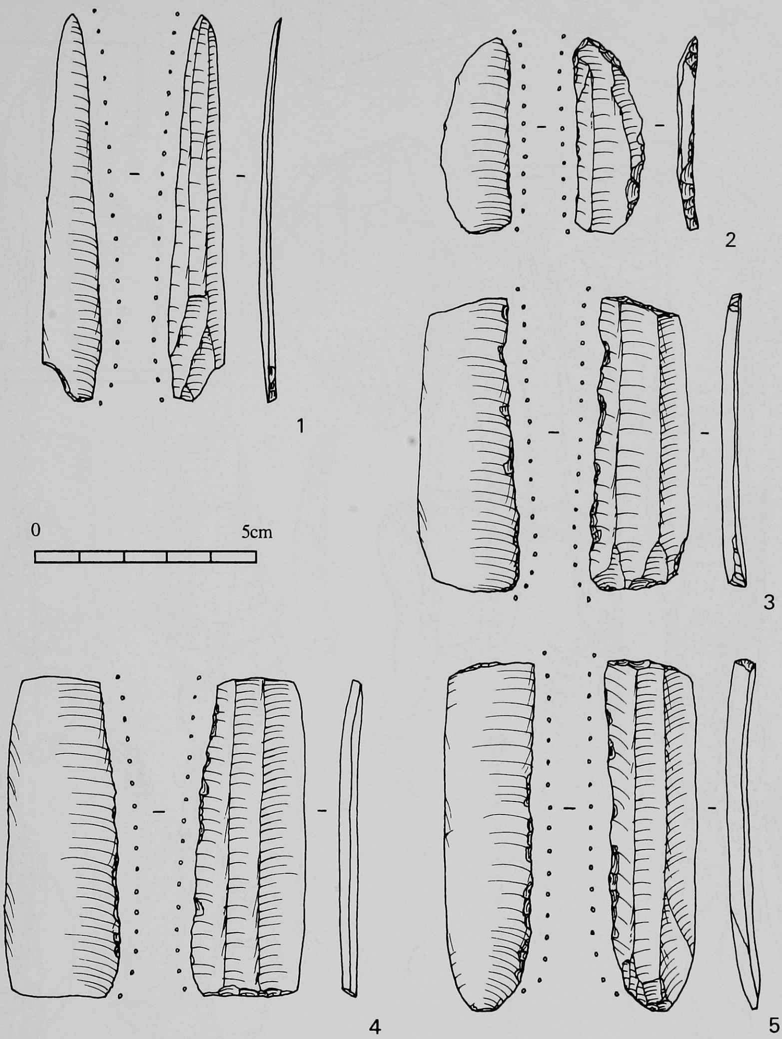


Fig. 11.18 Chalcolithic flint artifacts from Level 13 of Sector A.
1-5: Sickle elements hafted to the sickle illustrated in Fig. 11.17. The numbers indicate the order of arrangement (1 from top).

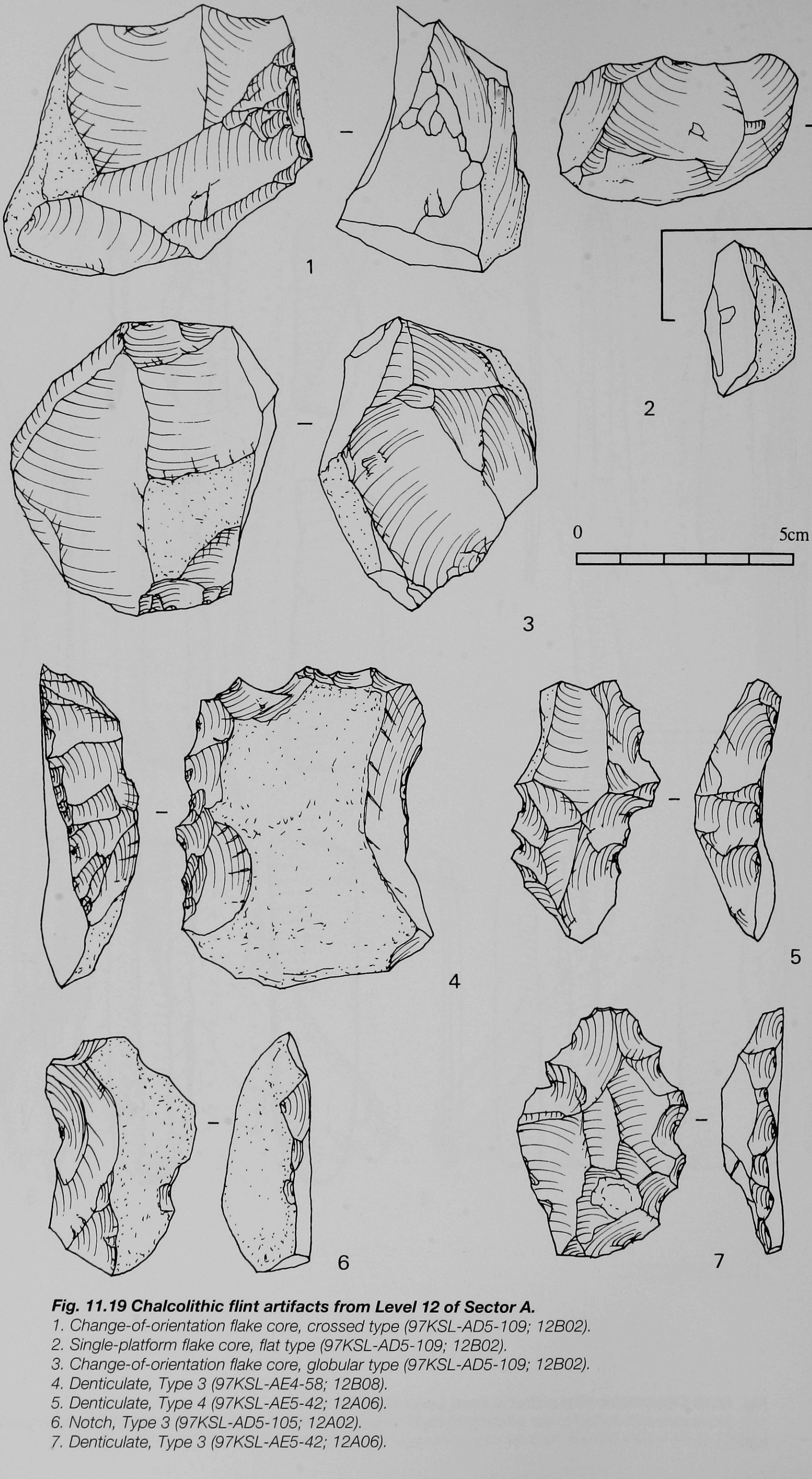


Fig. 11.19 Chalcolithic flint artifacts from Level 12 of Sector A.
1. Change-of-orientation flake core, crossed type (97KSL-AD5-109; 12B02).
2. Single-platform flake core, flat type (97KSL-AD5-109; 12B02).
3. Change-of-orientation flake core, globular type (97KSL-AD5-109; 12B02).
4. Denticulate, Type 3 (97KSL-AE4-58; 12B08).
5. Denticulate, Type 4 (97KSL-AE5-42; 12A06).
6. Notch, Type 3 (97KSL-AD5-105; 12A02).
7. Denticulate, Type 3 (97KSL-AE5-42; 12A06).

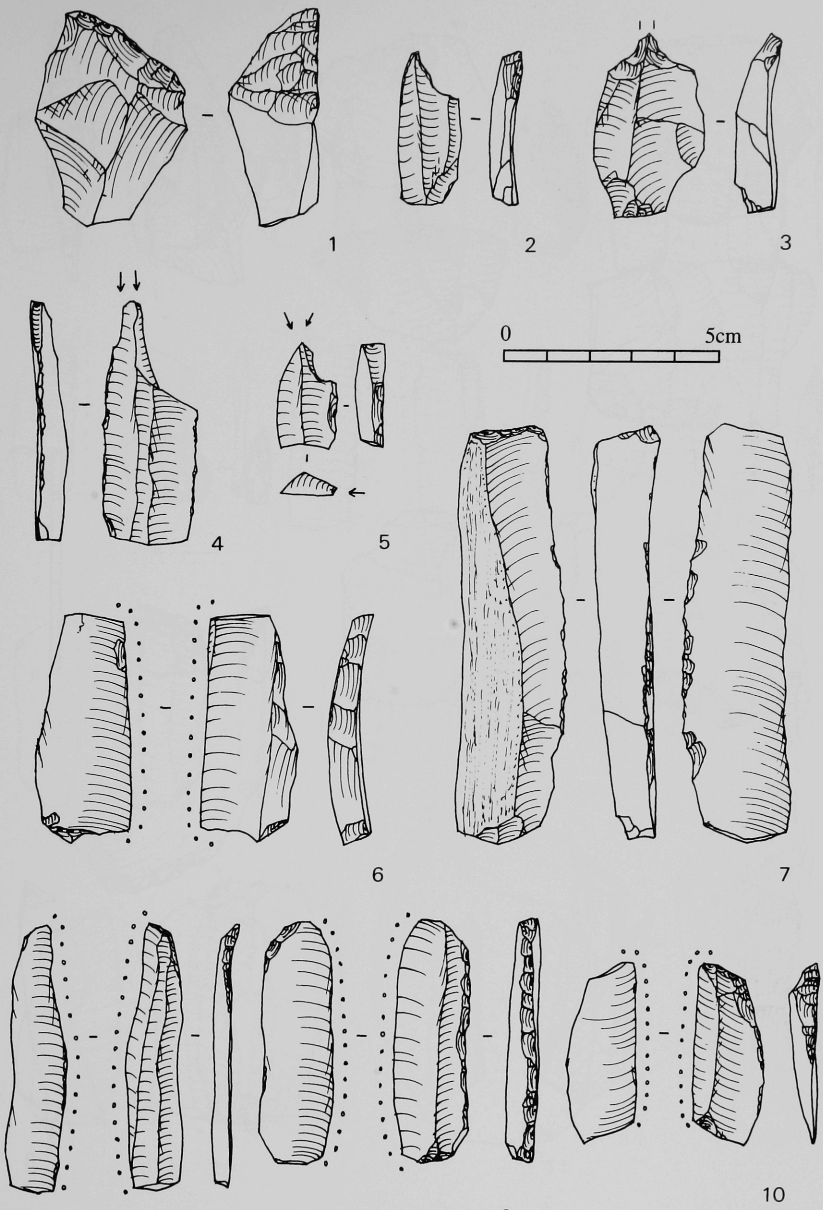


Fig. 11.20 Chalcolithic flint artifacts from Level 12 of Sector A.
1. Scraper, Type 4 (97KSL-AE5-42; 12A06).
2. Borer, Type 3 (97KSL-AD5-105; 12A02).
3. Borer, Type 1 (97KSL-AD5-105; 12A02).
4. Burin, Type 1 (97KSL-AD5-110; Fill).
5. Burin, Type 6 (95KSL-AF5-6; Fill).
6. Sickle element, Type 1 (97KSL-AD5-105; 12A02).
7. Sickle element, Type 1, Shape-defined (97KSL-AE5-42; 12A06).
8. Sickle element, Type 2 (97KSL-AE5-42; 12A06).
9. Sickle element, Type 2 (97KSL-AE5-47; 12A06).
10. Sickle element, Type 4 (97KSL-AD4-40; 12A01/12A04).

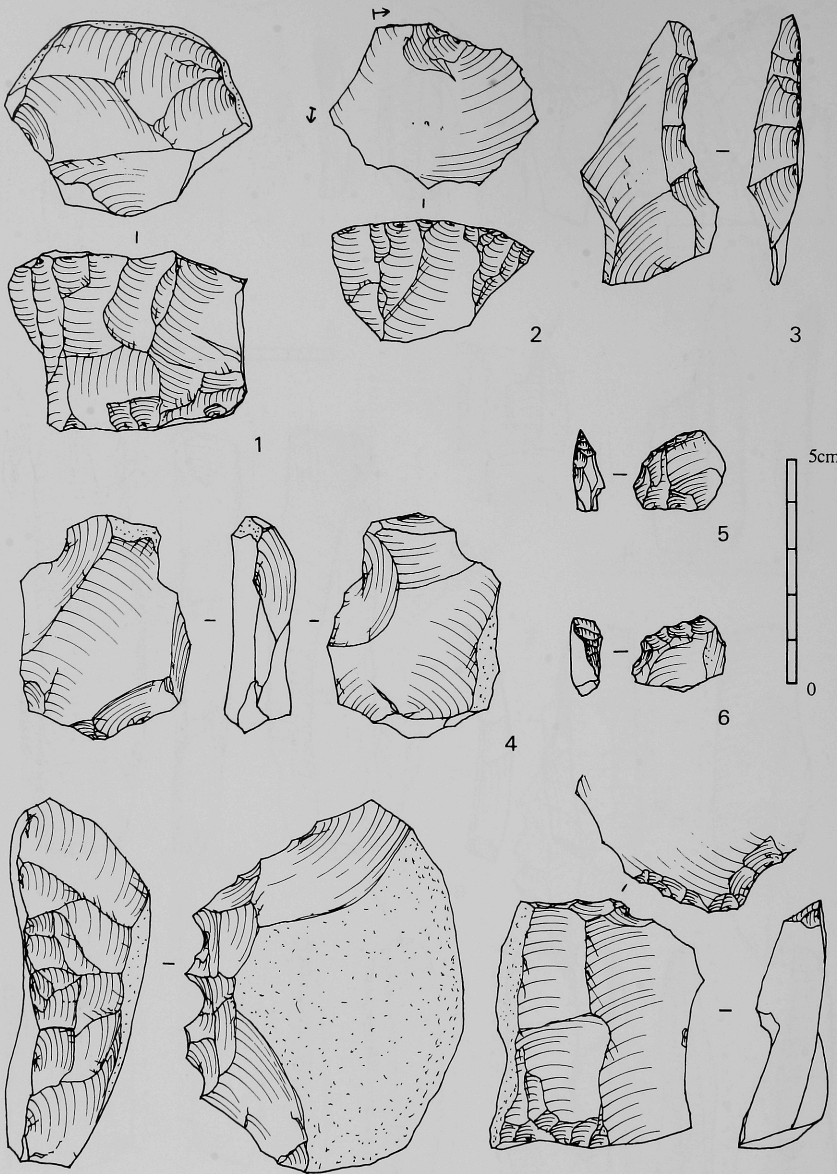


Fig. 11.21 Chalcolithic flint artifacts from Level 11 of Sector A.

1. Single-platform flake core, prism type (97KSL-AE5-34; 1105).
2. Single-platform flake core, prism type (97KSL-AE5-41; 1102/1105).
3. Notch, Type 1 (97KSL-AE4-31; 1101).
4. Notch, Type 4 (97KSL-AE6-36; 1103).
5. Scraper, Type 5 (95KSL-AF3-4; Fill).
6. Scraper, Type 5 (95KSL-AF3-4; Fill).
7. Denticulate, Type 1 (97KSL-AE6-26; 1122).
8. Denticulate, Type 2 (97KSL-AE5-41; 1102/1105).

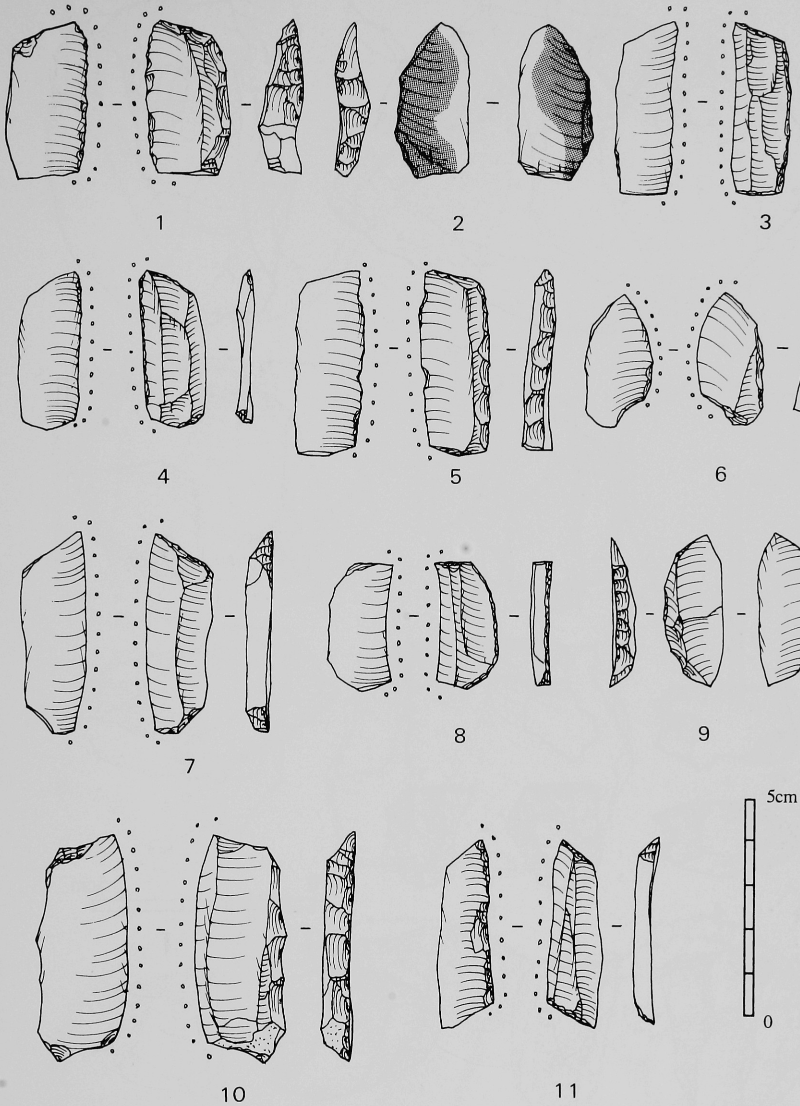


Fig. 11.22 Chalcolithic flint artifacts from Level 11 of Sector A.
1. Sickle element, Type 2 (97KSL-AE5-41; 1102/1105).
2. Sickle element, Type 2 (95KSL-AF3-7; Fill).
3. Sickle element, Type 2 (97KSL-AE6-22; Fill).
4. Sickle element, Type 2 (97KSL-AE5-41; 1102/1105).
5. Sickle element, Type 2 (97KSL-AE5-31; 1101).
6. Sickle element, Type 4 (97KSL-AE5-34; 1105).
7. Sickle element, Type 3 (97KSL-AE5-41; 1102/1105).
8. Sickle element, Type 3 (97KSL-AE6-36; 1103).
9. Sickle element, Type 3 (97KSL-AE4-31; 1101).
10. Sickle element, Type 4 (97KSL-AF5-4; 1111).
11. Sickle element, Type 4 (97KSL-AE4-47; 1109).

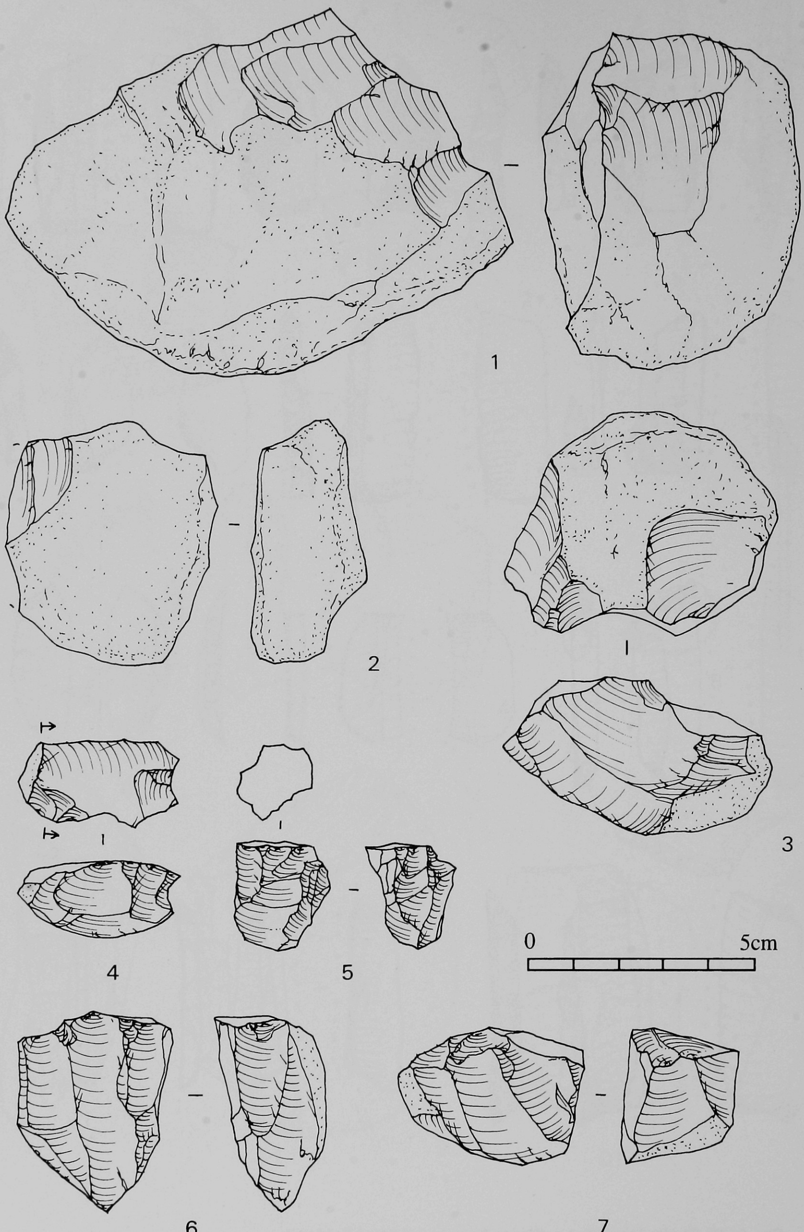


Fig. 11.23 Chalcolithic flint artifacts from Level 10 of Sector A.

1. Semi-flaked core (96KSL-AE4-12-5; 10A01).
2. Semi-flaked core (96KSL-AE4-12-2; 10A01).
3. Single-platform flake core, flat type (97KSL-AE5-20-3; 10A02).
4. Single-platform flake core, prism type (96KSL-AE4-16-57; 10A08).
5. Single-platform blade core, prism type (96KSL-AD6-35; Fill).
6. Single-platform blade core, flat type (96KSL-AD6-34; 10A02).
7. Change-of-orientation flake core, globular type (97KSL-AE5-22-42; 10A05).

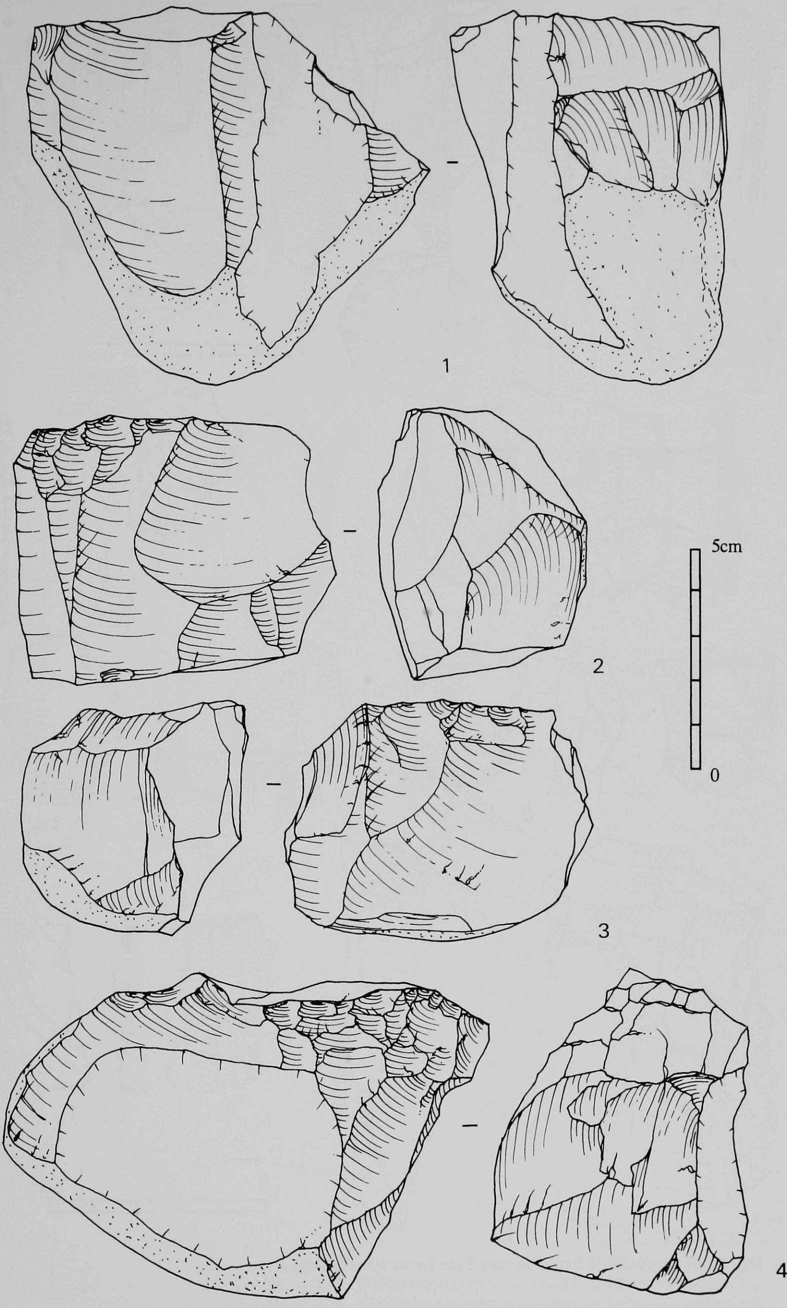


Fig. 11.24 Chalcolithic flint artifacts from Level 10 of Sector A.
1. Change-of-orientation flake core, crossed type (96KSL-AD4-12-1; 10A01).
2. Change-of-orientation flake core, crossed type (96KSL-AE4-14-30; 10A01).
3. Change-of-orientation flake core, crossed type (96KSL-AE4-14-11; 10A01).
4. Change-of-orientation flake core, globular type (96KSL-AE4-12-3; 10A01).

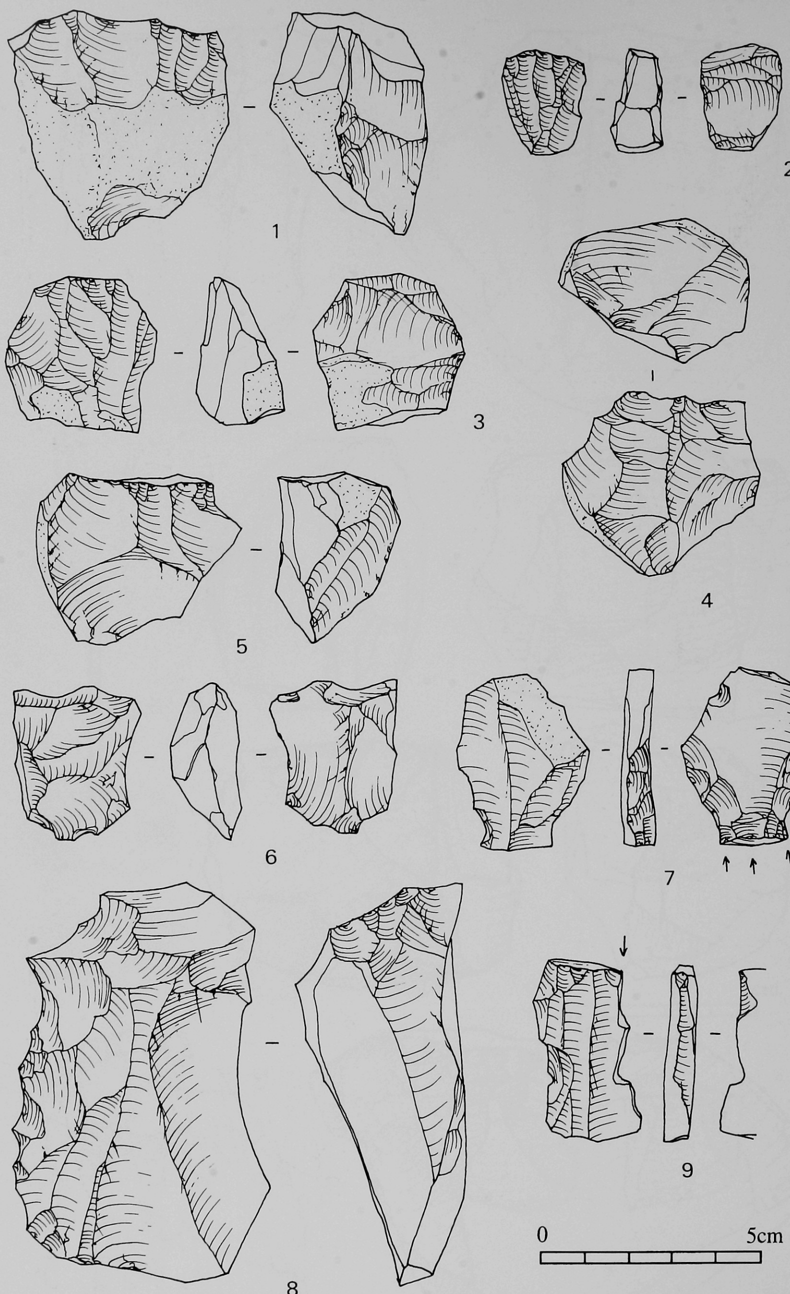


Fig. 11.25 Chalcolithic flint artifacts from Level 10 of Sector A.

1. Change-of-orientation flake core, crossed type (96KSL-AE4-14-25; 10A01).
2. Change-of-orientation blade core, bifacial type (96KSL-AD6-34; 10A02).
3. Change-of-orientation flake core, bifacial type (96KSL-AE4-14-20; 10A01).
4. Multiple-platform flake core, unifacial type (97KSL-AE5-20-2; 10A02).
5. Change-of-orientation flake core, bifacial type (97KSL-AE5-20-5; 10A02).
6. Multiple-platform flake core, unifacial type (96KSL-AE4-16-63; 10A08).
7. Splintered piece, Type 1 (96KSL-AE3-20; 10B11).
8. Denticulate, Type 1 (96KSL-AE4-14-56; 10A01).
9. Burin, Type 1 (96KSL-AE3-17; Fill).

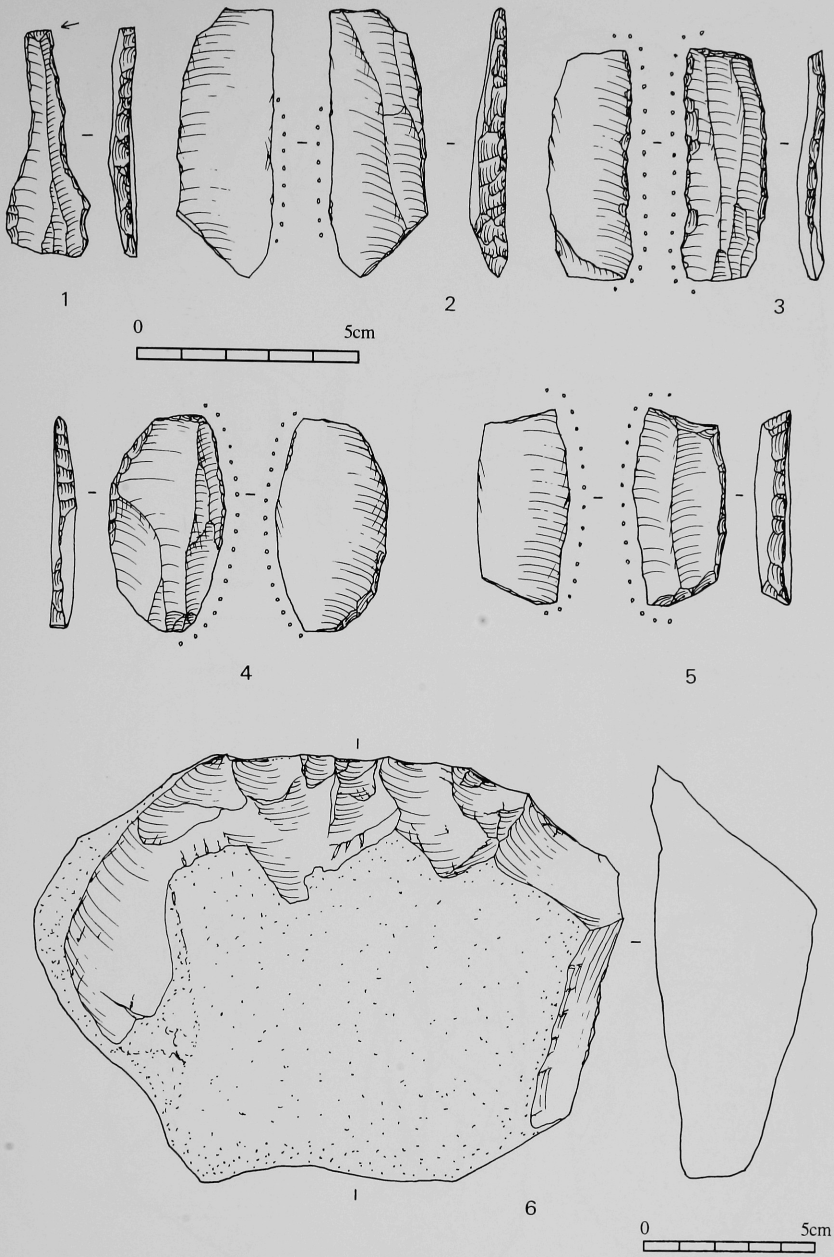


Fig. 11.26 Chalcolithic flint artifacts from Level 10 of Sector A.
1. Borer, Type 4 (95KSL-AF4-1; Fill).
2. Sickle element, Type 3 (96KSL-AD6-34; 10A02).
3. Sickle element, Type 3 (96KSL-AE3-17; Fill).
4. Sickle element, Type 3 (96KSL-AF6-13; Fill).
5. Sickle element, Type 3 (96KSL-AE3-17; Fill).
6. Chopper (96KSL-AE4-14-14; 10A01).

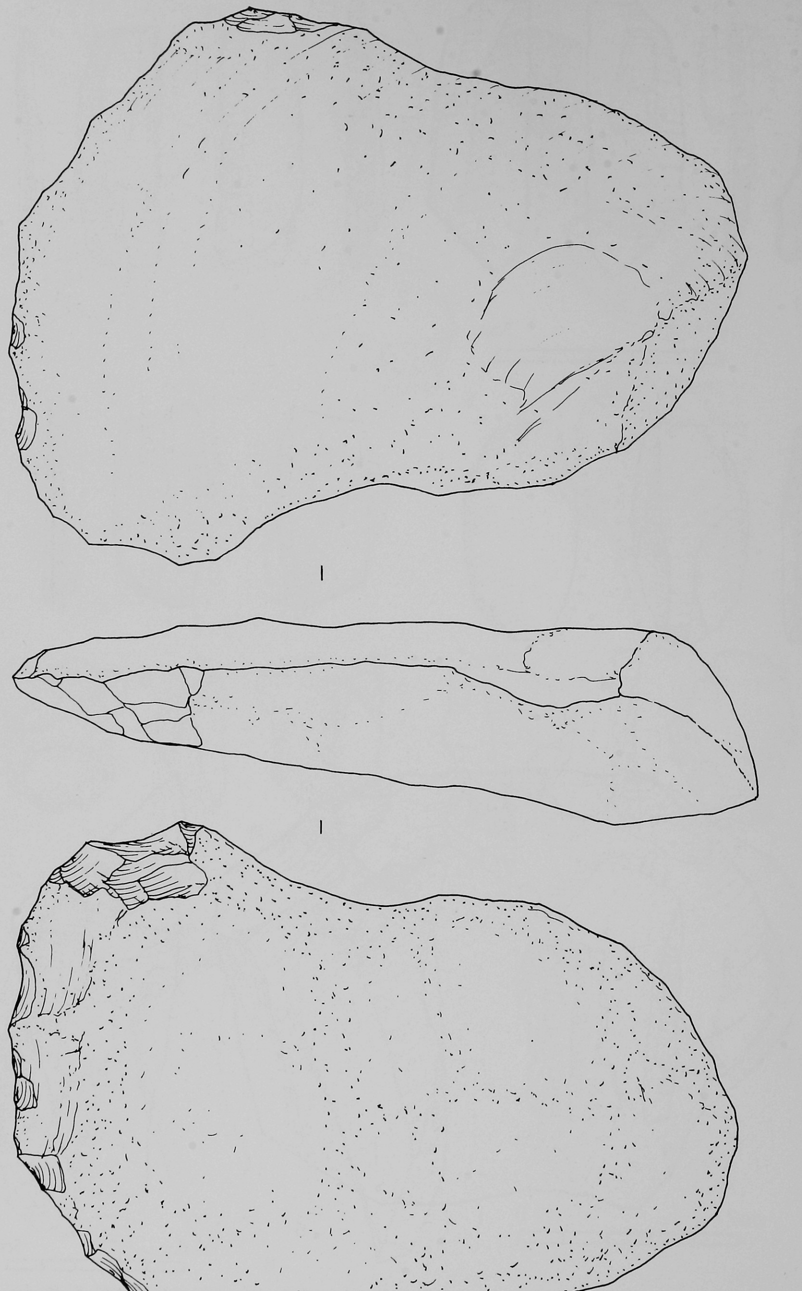


Fig. 11.27 Chalcolithic flint artifact from Level 10 of Sector A.
Hoe-shaped specimen (95KSL-AE4-14-60; 10A01).

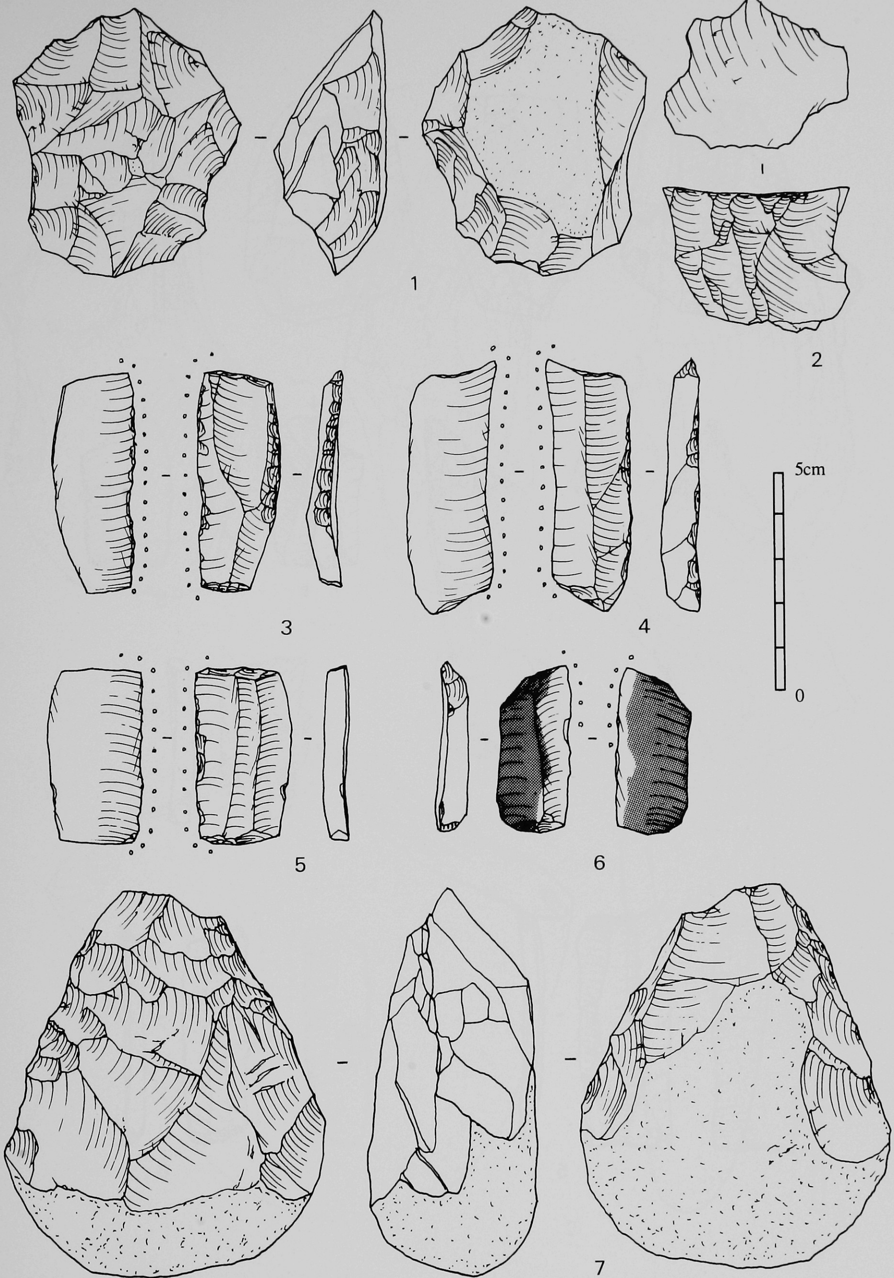


***Fig. 11.28* Chalcolithic flint artifacts from Level 9 of Sector A.**

1. Multiple-platform flake core, unifacial type (96KSL-AD4-34; Fill).
2. Single-platform flake core, prism type (96KSL-AD4-34; Fill).
3. Sickle element, Type 1 (97KSL-AE5-422; Fill).
4. Sickle element, Type 2 (96KSL-AD6-31; Fill).
5. Sickle element, Type 1 (96KSL-AE3-12; Fill).
6. Sickle element, Type 4 (96KSL-AD6-31; Fill).
7. Biface (96KSL-AD4-34; Fill).

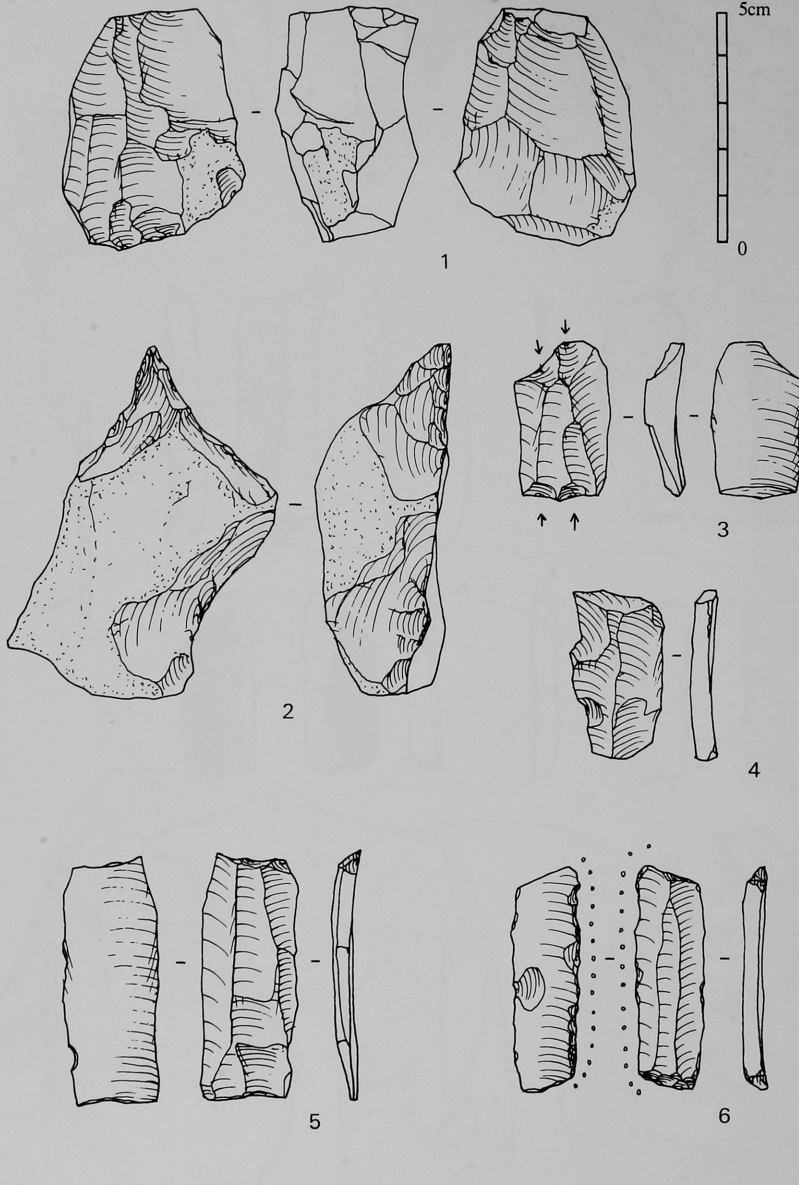


Fig. 11.29 Chalcolithic flint artifacts from Level 8 of Sector A.

1. Opposed-platform flake core, bifacial type (96KSL-AD4-24; 803).
2. Borer, Type 1 (96KSL-AE6-3; Fill).
3. Splintered piece, Type 2 (96KSL-AD4-35; 817).
4. Retouched blade, Type 1 (96KSL-AE5-14; 818).
5. Sickle element, Type 2 (96KSL-AD6-26; Fill).
6. Sickle element, Type 4 (96KSL-AD6-26; Fill).

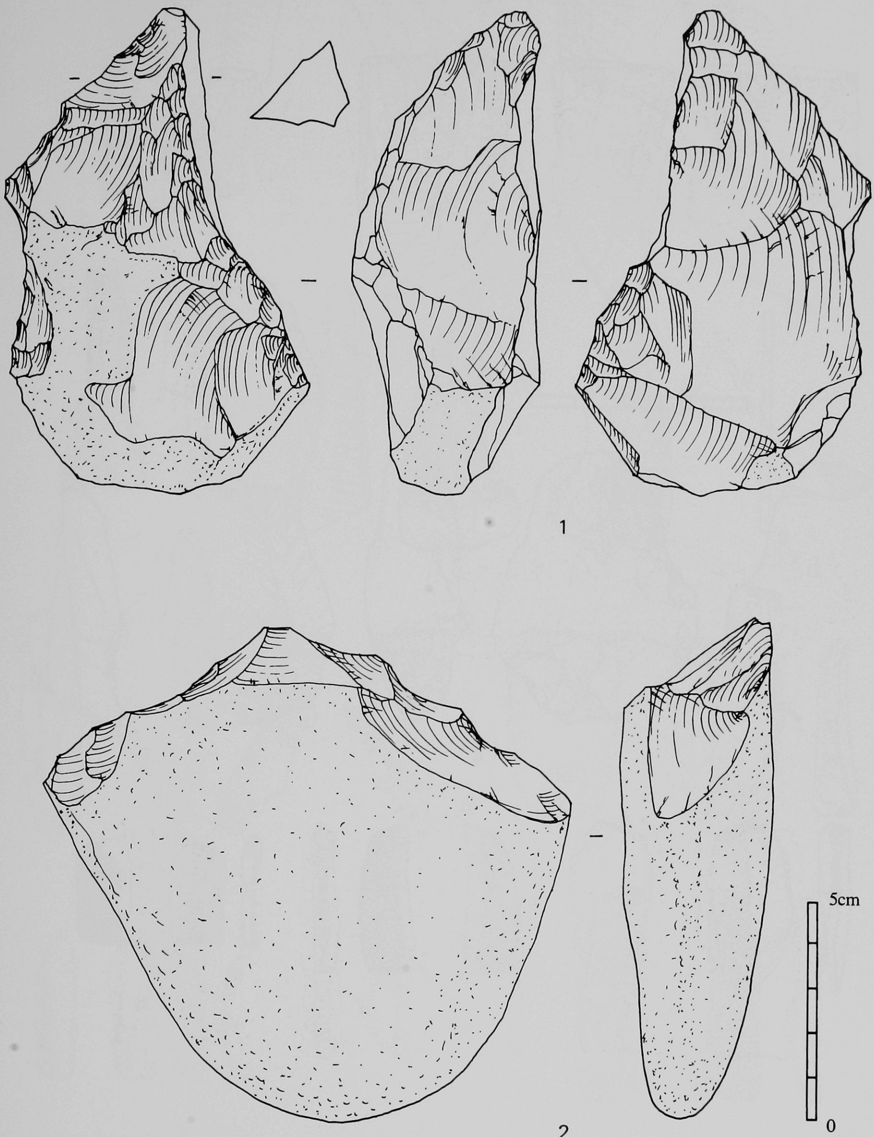


Fig. 11.30 Chalcolithic flint artifacts from Level 8 of Sector A.
1. Pick, Type 2 (96KSL-AE6-5; 823).
2. Chopper (96KSL-AD4-24; 803).

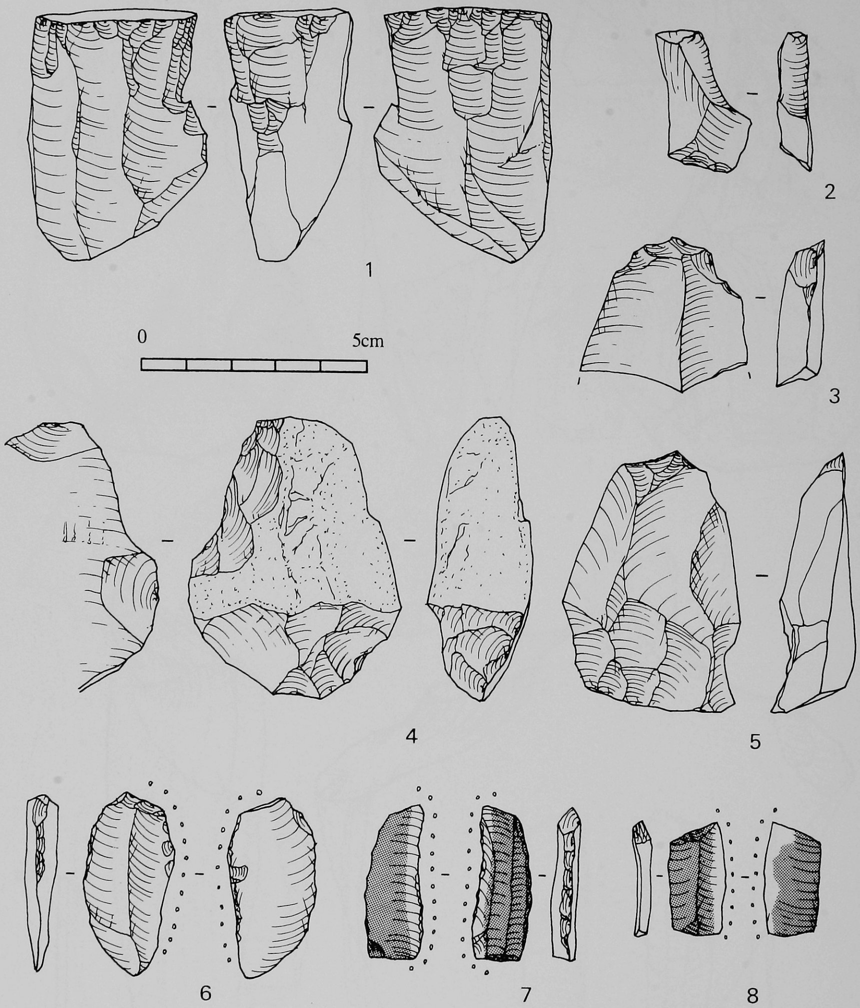


Fig. 11.31 Chalcolithic flint artifacts from Level 7 of Sector A.

1. Single-platform blade core, prism type (95KSL-AE5-4; 710).
2. Burin spall (96KSL-AD5-73; 703).
3. Denticulate, Type 2 (95KSL-AE5-1; Fill).
4. Retouched flake, Type 2 (95KSL-AE5-2; 706/707).
5. Retouched flake, Type 2 (95KSL-AE5-2; 706/707).
6. Sickle element, Type 4 (94KSL-A7-4; 719).
7. Sickle element, Type 2 (95KSL-AE5-6; 709).
8. Sickle element, Type 2 (95KSL-AE5-6; 709).

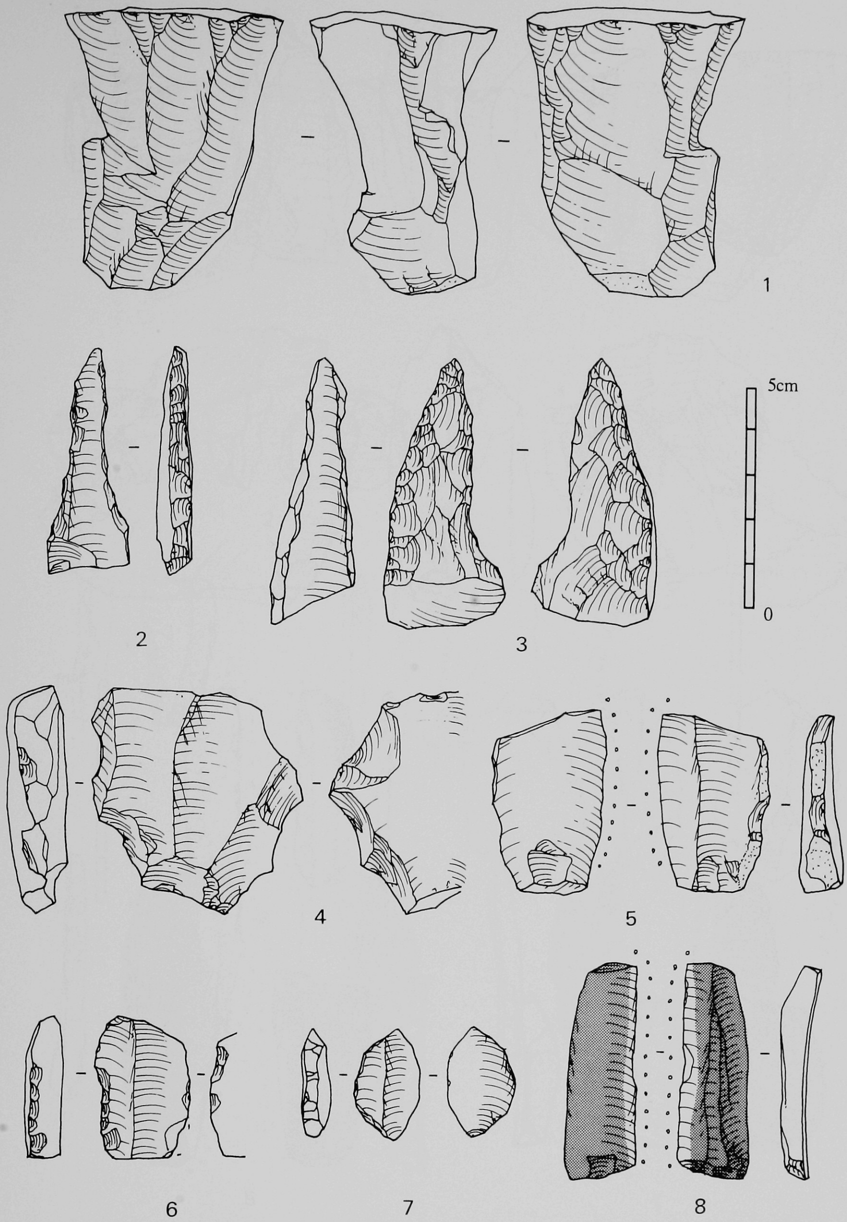


Fig. 11.32 Chalcolithic flint artifacts from Level 6 of Sector A.

1. Single-platform blade core, prism type (95KSL-AD5-66; Fill).
2. Borer, Type 4 (95KSL-AD5-61; Fill).
3. Borer, Type 6 (95KSl-AD5-63; 602).
4. Notch, Type 5 (95KSL-AD6-66; Fill).
5. Sickle element, Type 2 (95KSL-AD5-66; Fill).
6. Retouched blade, Type 1 (95KSL-AD5-66; Fill).
7. Sickle element, Type 3 (95KSL-AD5-67; 604).
8. Sickle element, Type 1 (95KSL-AD5-62; 604).

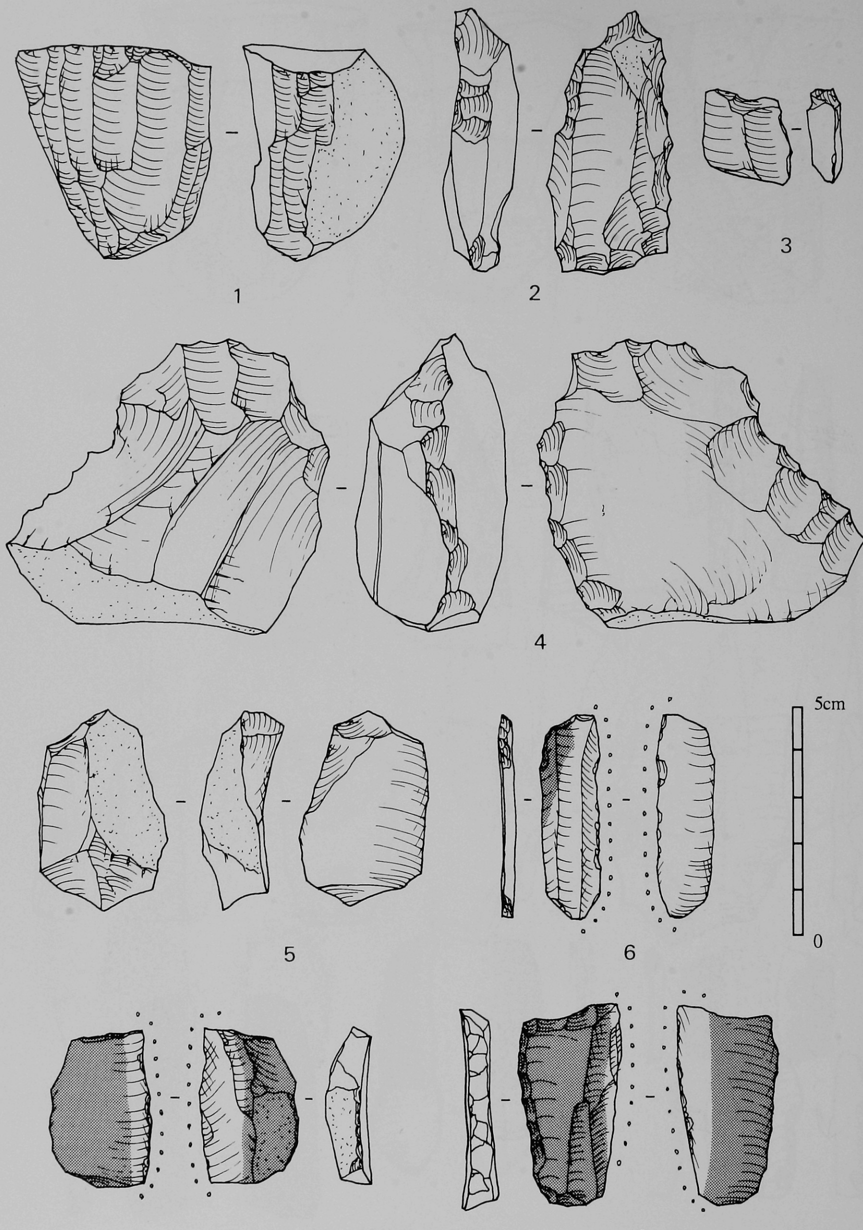


Fig. 11.33 Chalcolithic flint artifacts from Level 5 of Sector A.

1. Single-platform blade core, prism type (95KSL-AD5-53; 501).
2. Denticulate, Type 4 (95KSL-AD5-57; 502).
3. Notch, Type 4 (95KSL-AD5-57; 502).
4. Denticulate, Type 2 (96KSL-AE5-5; 505).
5. Retouched flake, Type 2 (95KSL-AD5-53; 501).
6. Sickle element, Type 3 (95KSL-AD5-48; 502).
7. Sickle element, Type 2 (95KSL-AD5-59; 503).
8. Sickle element, Type 2 (95KSL-AD5-53; 501).

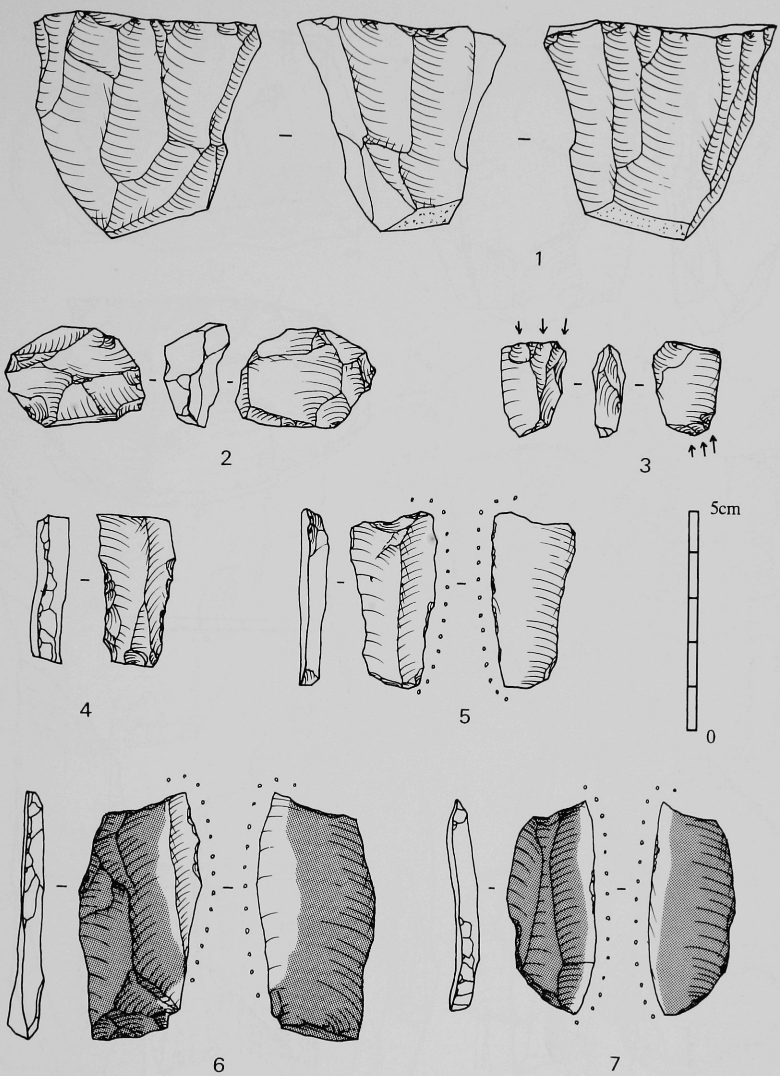


Fig. 11.34 Chalcolithic flint artifacts from Level 4 of Sector A.
1. Single-platform blade core, prism type (95KSL-AD5-18; 402).
2. Exhausted core (95KSL-AD5-28; 403).
3. Splintered piece, Type 2 (95KSL-AD5-12; 402).
4. Retouched blade, Type 2 (95KSL-AD5-26; 410).
5. Sickle element, Type 1 (95KSL-AD5-69; 406).
6. Sickle element, Type 2 (95KSL-AD5-55; 402).
7. Sickle element, Type 3 (95KSL-AD5-47; 401).

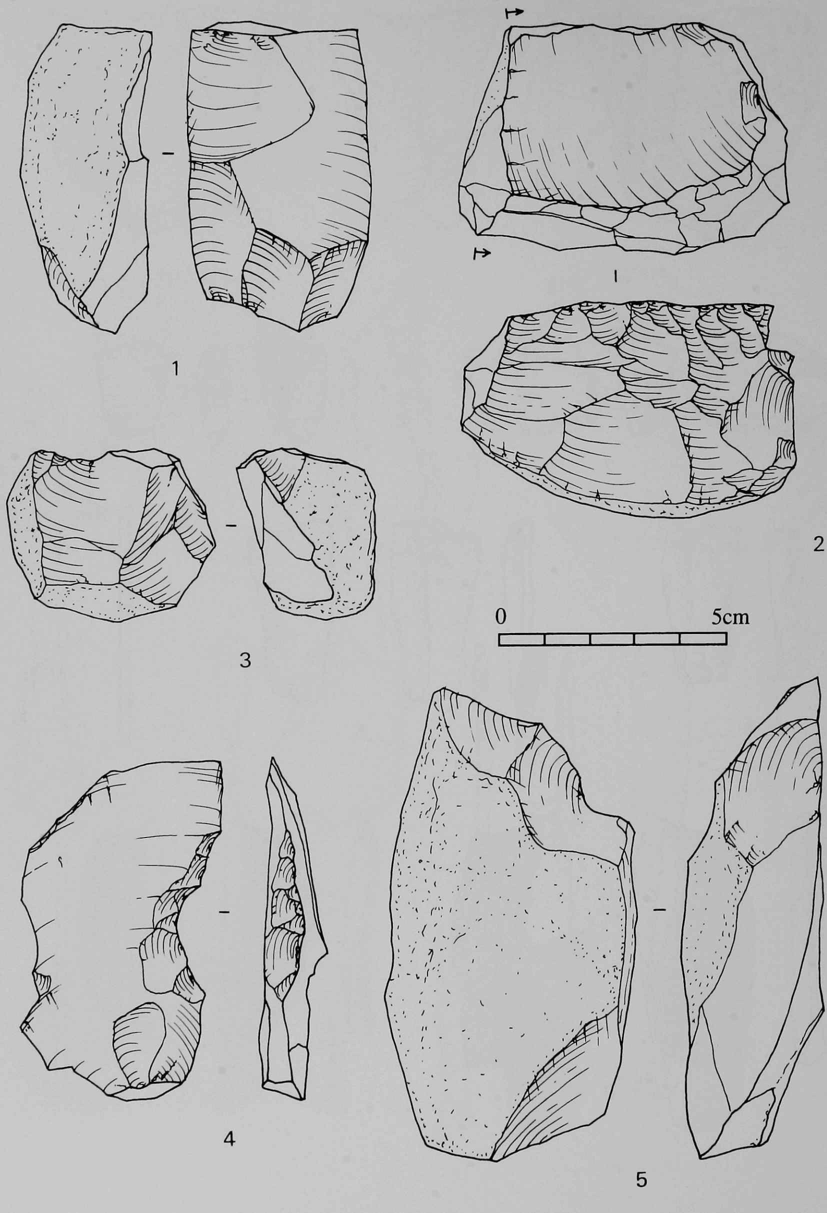


Fig. 11.35 Chalcolithic flint artifacts from Level 3 of Sector A.

1. Semi-flaked core (96KSL-AD6-9; 301).
2. Single-platform flake core, prism type (96KSL-AD6-8; 301).
3. Change-of-orientation flake core, crossed type (96KSL-AD6-7; 301).
4. Notch, Type 1 (96KSL-AD6-7; Fill).
5. Notch, Type 4 (96KSL-AD6-8; 301).

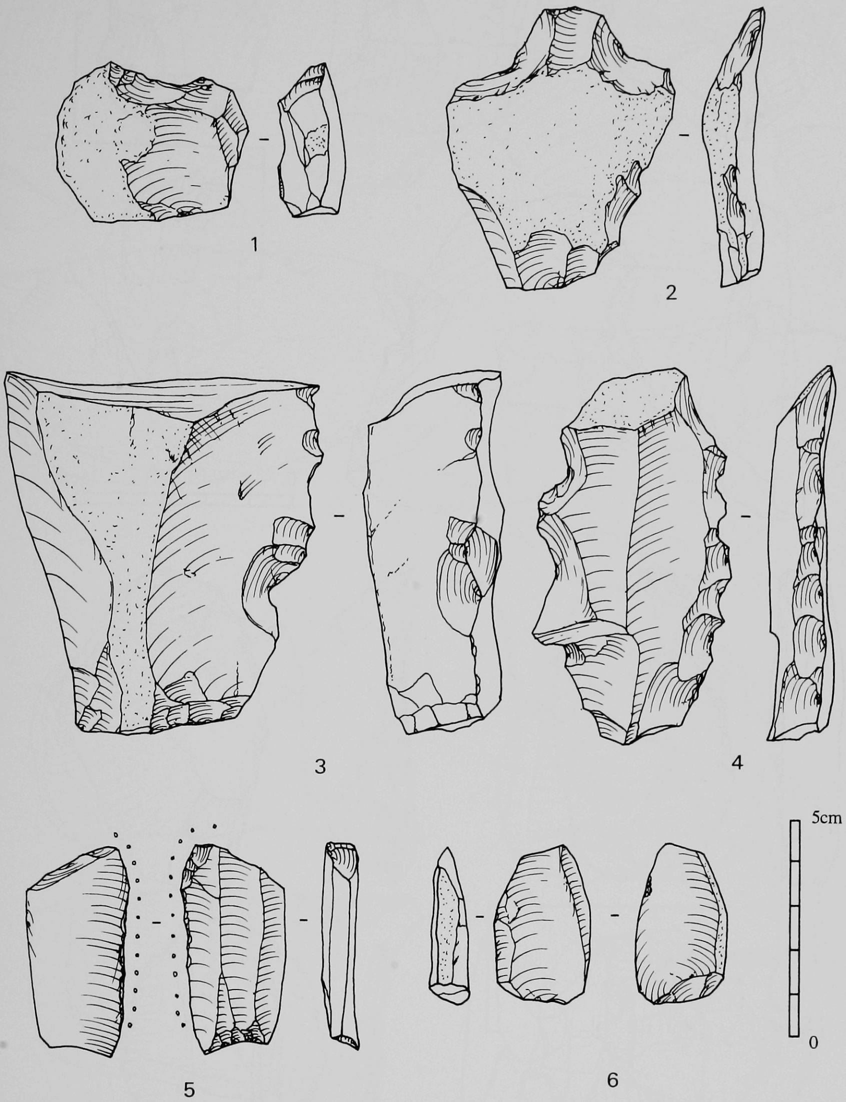


Fig. 11.36 Chalcolithic flint artifacts from Level 3 of Sector A.
1. Notch, Type 2 (96KSL-AD6-9; 301).
2. Notch, Type 5 (96KSL-AD6-8; 301).
3. Denticulate, Type 1 (96KSL-AD6-8; 301).
4. Denticulate, Type 4 (96KSL-AD6-8; 301).
5. Sickle element, Type 3 (96KSL-AD6-8; 301).
6. Sickle element, Type 3 (96KSL-AD6-8; 301).

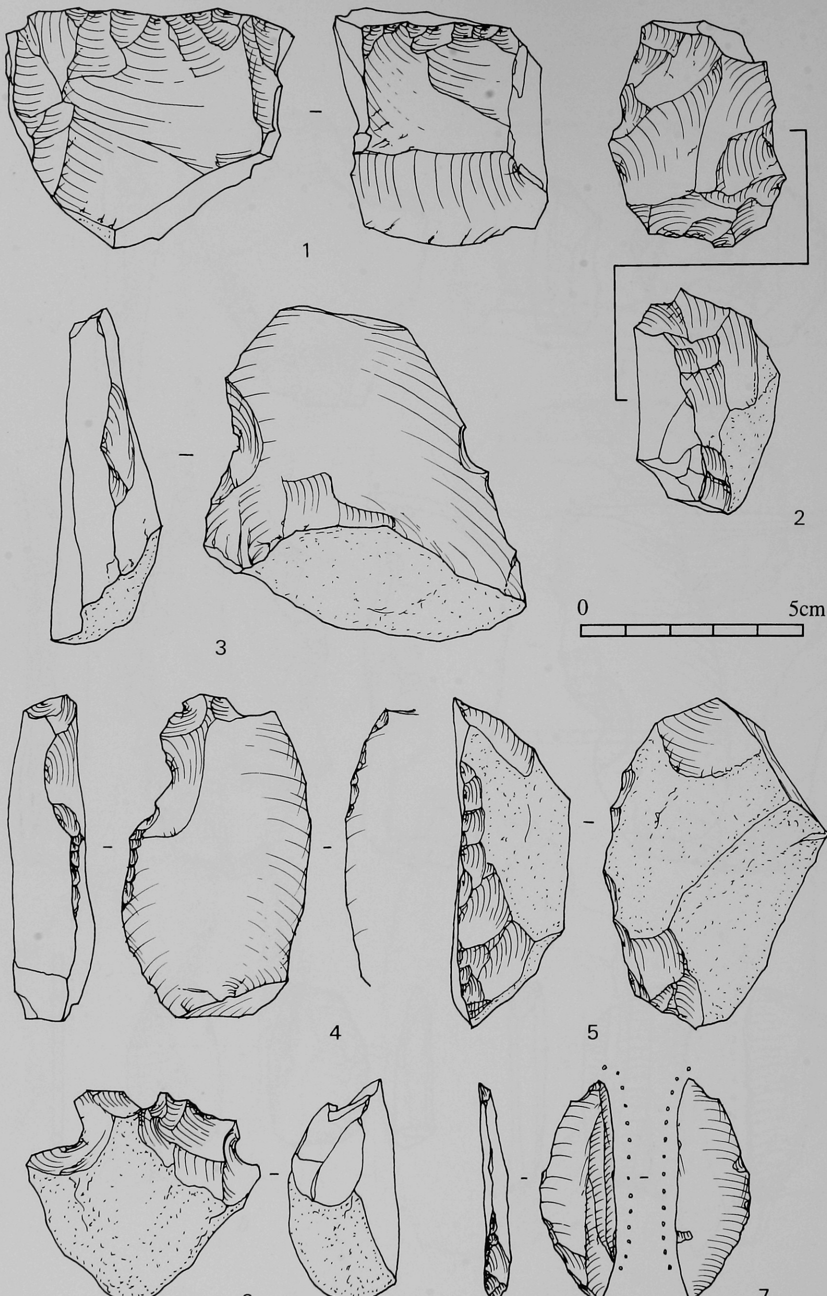


Fig. 11.37 Chalcolithic flint artifacts from Level 2 of Sector A.

1. Single-platform flake core, prism type (95KSL-AD6-6; 201).
2. Multiple-platform flake core, unifacial type (95KSL-AD6-6; 201).
3. Notch, Type 3 (95KSL-AD6-4; Fill).
4. Notch, Type 1 (95KSL-AD6-4; Fill).
5. Scraper, Type 1 (95KSL-AD6-4; Fill).
6. Denticulate, Type 3 (95KSL-AD6-6; 201).
7. Sickle element, Type 3 (95KSL-AD6-3; Fill).

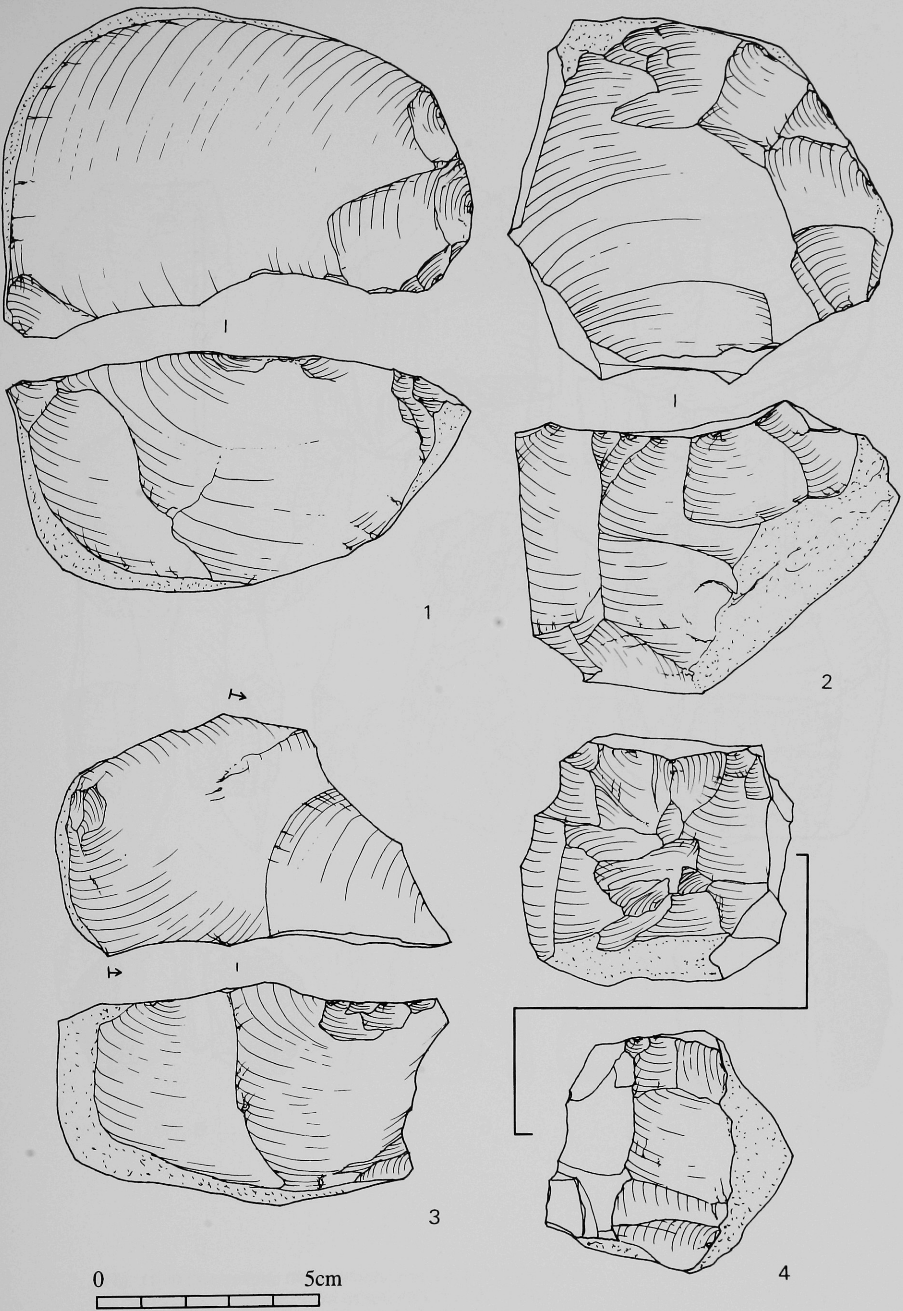


Fig. 11.38 Chalcolithic flint artifacts from Level 1 of Sector A.
1. Single-platform flake core, flat type (95KSL-AD4-3; 101).
2. Single-platform flake core, prism type (95KSL-AD4-3; 101).
3. Single-platform flake core, prism type (95KSL-AD4-3; 101).
4. Change-of-orientation flake core, globular type (95KSL-AD4-3; 101).

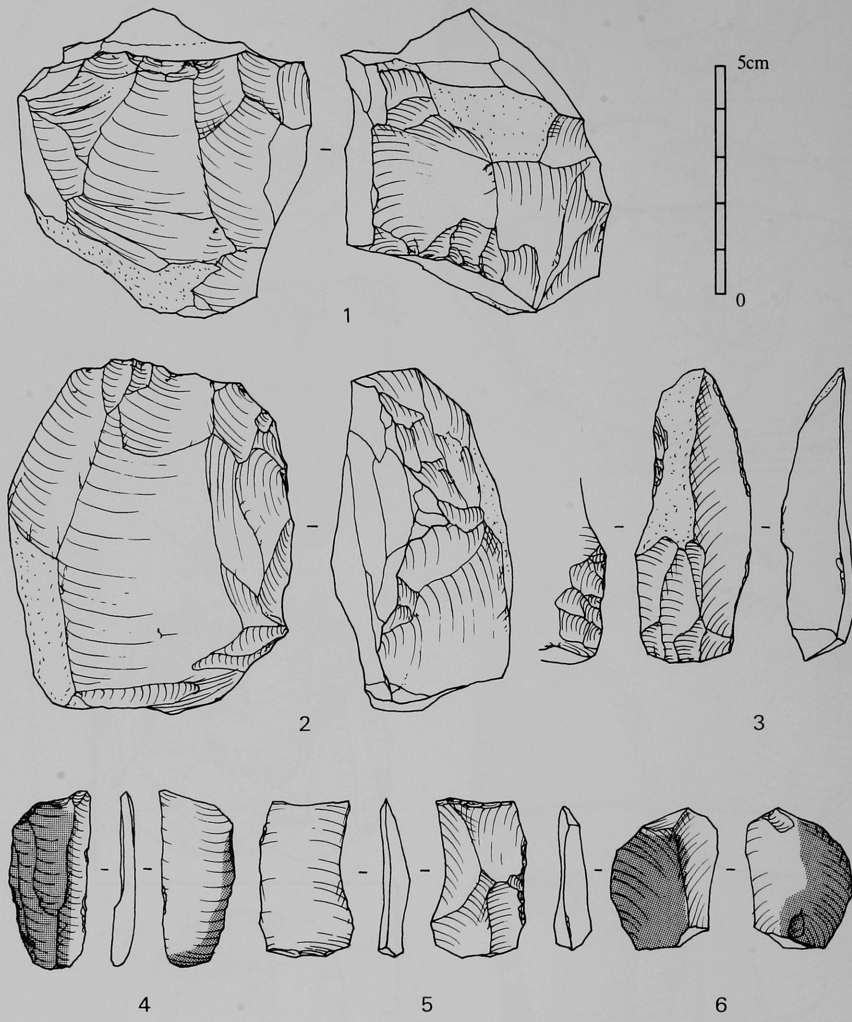


Fig. 11.39 Chalcolithic flint artifacts from Level 1 of Sector A.
1. Change-of-orientation flake core, globular type (95KSL-AD4-3; 101).
2. Single-platform flake core, flat type (95KSL-AD4-3; 101).
3. Retouched blade, Type 3 (94KSL-A6-2; Fill).
4. Sickle element, Type 2 (94KSL-A6-1; Fill).
5. Sickle element, Type 2 (94KSL-A6-1; Fill).
6. Sickle element, Type 2 (95KSL-AD5-8; 103).

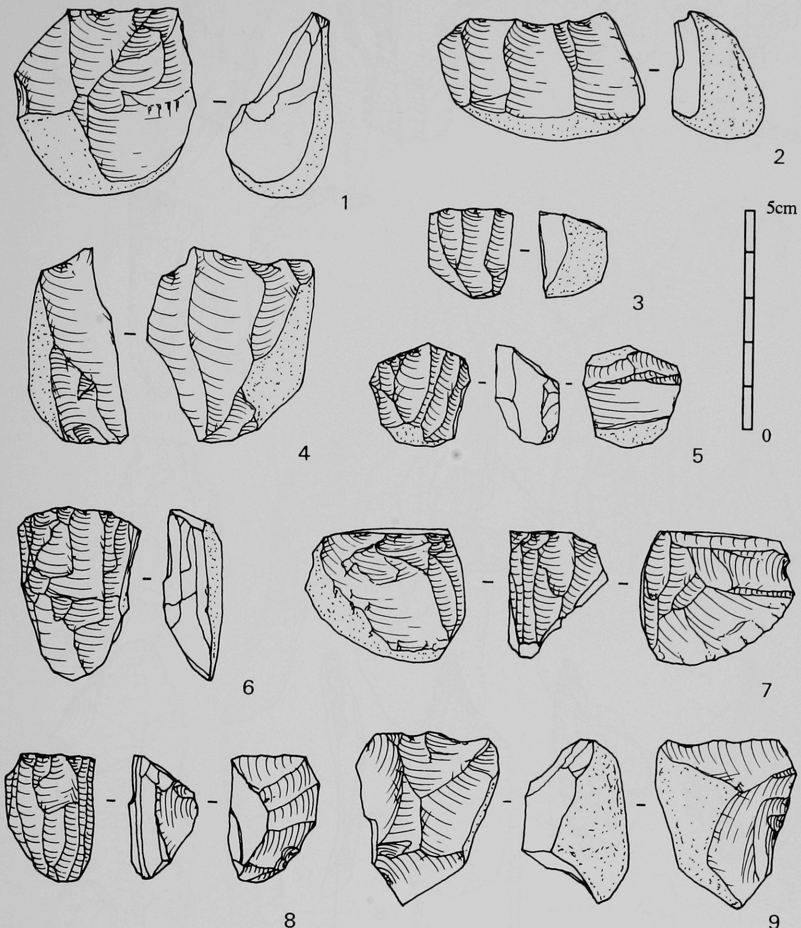


Fig. 11.40 Chalcolithic flint artifacts from Level 7 of Sector B.

1. *Single-platform flake core, flat type (97KSL-BE7-39; B702).*
2. *Single-platform flake core, flat type (97KSL-BE7-40; B701).*
3. *Single-platform flake core, flat type (97KSL-BE6-21; Fill).*
4. *Opposed-platform blade core, flat type (97KSL-BE6-21; Fill).*
5. *Single-platform blade core, flat type (97KSL-BE6-24; B701).*
6. *Single-platform blade core, flat type (97KSL-BE7-39; B702).*
7. *Single-platform flake core, prism type (97KSL-BE6-21; Fill).*
8. *Single-platform blade core, prism type (97KSL-BE7-38; B701).*
9. *Multiple-platform core, unifacial type (97KSL-BE7-40; B701).*

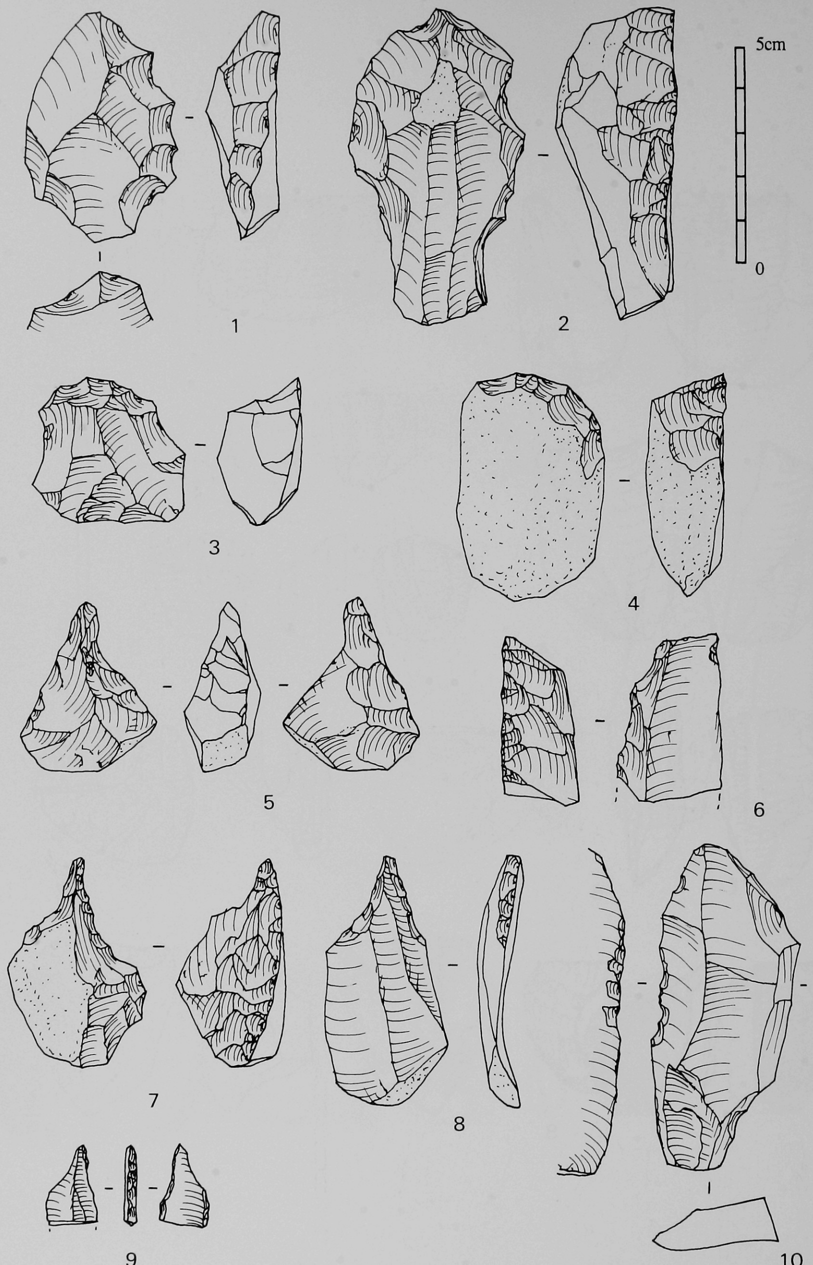


Fig. 11.41 Chalcolithic flint artifacts from Level 7 of Sector B.

1. Denticulate, Type 1 (97KSL-BE7-38; B701).
2. Denticulate, Type 4 (97KSL-BE6-21; Fill).
3. Denticulate, Type 3 (97KSL-BE7-39; B702).
4. Scraper, Type 4 (97KSL-BE6-21; Fill).
5. Borer, Type 1 (97KSL-BE7-39; B702).
6. Retouched blade, Type 4 (97KSL-BE6-21; Fill).
7. Borer, Type 1 (97KSL-BE6-23; Fill).
8. Borer, Type 3 (97KSL-BE6-23; Fill).
9. Borer, Type 5 (97KSL-BE6-21; Fill).
10. Retouched blade, Type 2 (97KSL-BE5-13; B704).

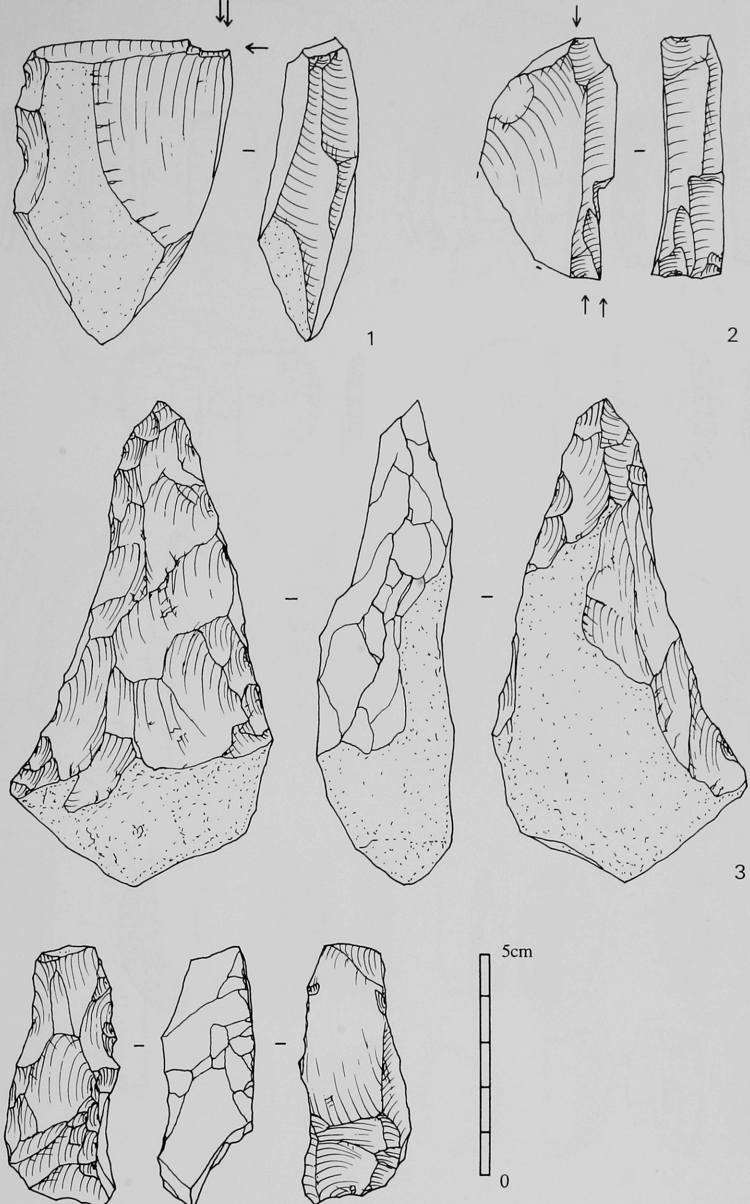


Fig. 11.42 Chalcolithic flint artifacts from Level 7 of Sector B.
1. Burin, Type 3 (97KSL-BE6-27; B704).
2. Burin, Type 1 (97KSL-BE6-27; B704).
3. Pick, Type 1 (97KSL-BE6-27; B704).
4. Rod (97KSL-BE6-27; B704).

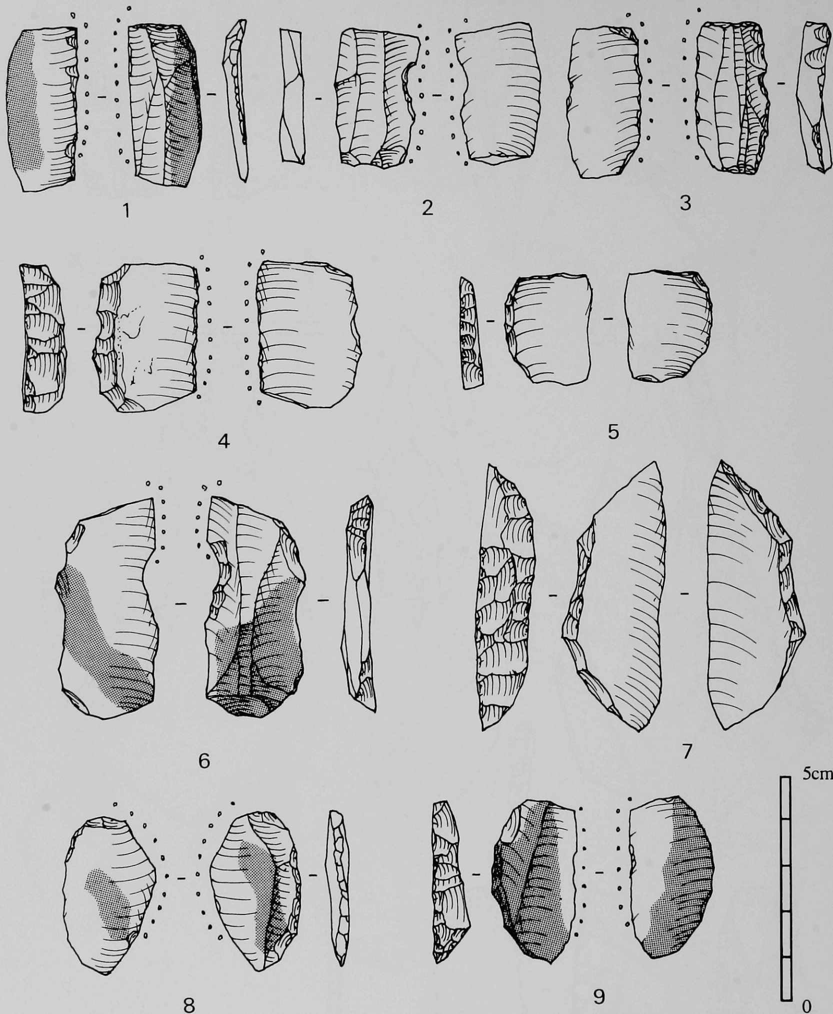


Fig. 11.43 Chalcolithic flint artifacts from Level 7 of Sector B.

1. Sickle element, Type 1 (97KSL-BE7-38; B701).
2. Sickle element, Type 1 (97KSL-BE6-23; Fill).
3. Sickle element, Type 1 (97KSL-BE7-38; B701).
4. Sickle element, Type 1 (97KSL-BE6-21; Fill).
5. Sickle element, Type 3, shape-defined (97KSL-BE7-40; B701).
6. Sickle element, Type 2 (97KSL-BE7-39; B702).
7. Sickle element, Type 3 (97KSL-BE7-38; B701).
8. Sickle element, Type 3 (97KSL-BE6-21; Fill).
9. Sickle element, Type 3 (97KSL-BE6-27; B704).

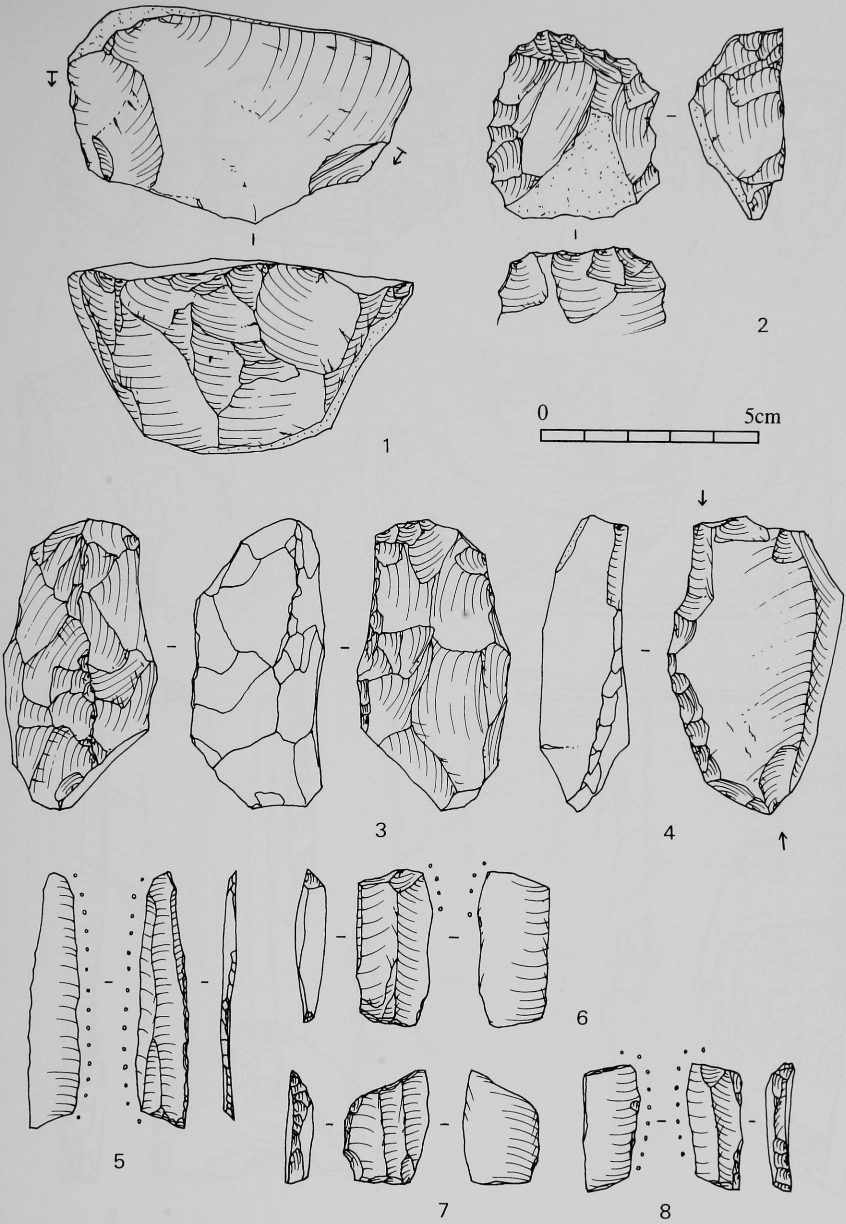


Fig. 11.44 Chalcolithic flint artifacts from Level 6 of Sector B.
1. Single-platform flake core, prism type (96KSL-BD7-51; B608).
2. Denticulate, Type 3 (96KSL-BD7-51; B608).
3. Rod (97KSL-BE7-34; B609).
4. Burin, Type 2 (97KSL-BE7-27; B610).
5. Sickle element, Type 5 (97KSL-BE5-3; Fill).
6. Sickle element, Type 2 (96KSL-BD7-52; B607).
7. Sickle element, Type 2 (96KSL-BD7-52; B607).
8. Sickle element, Type 5 (96KSL-BD7-52; B607).

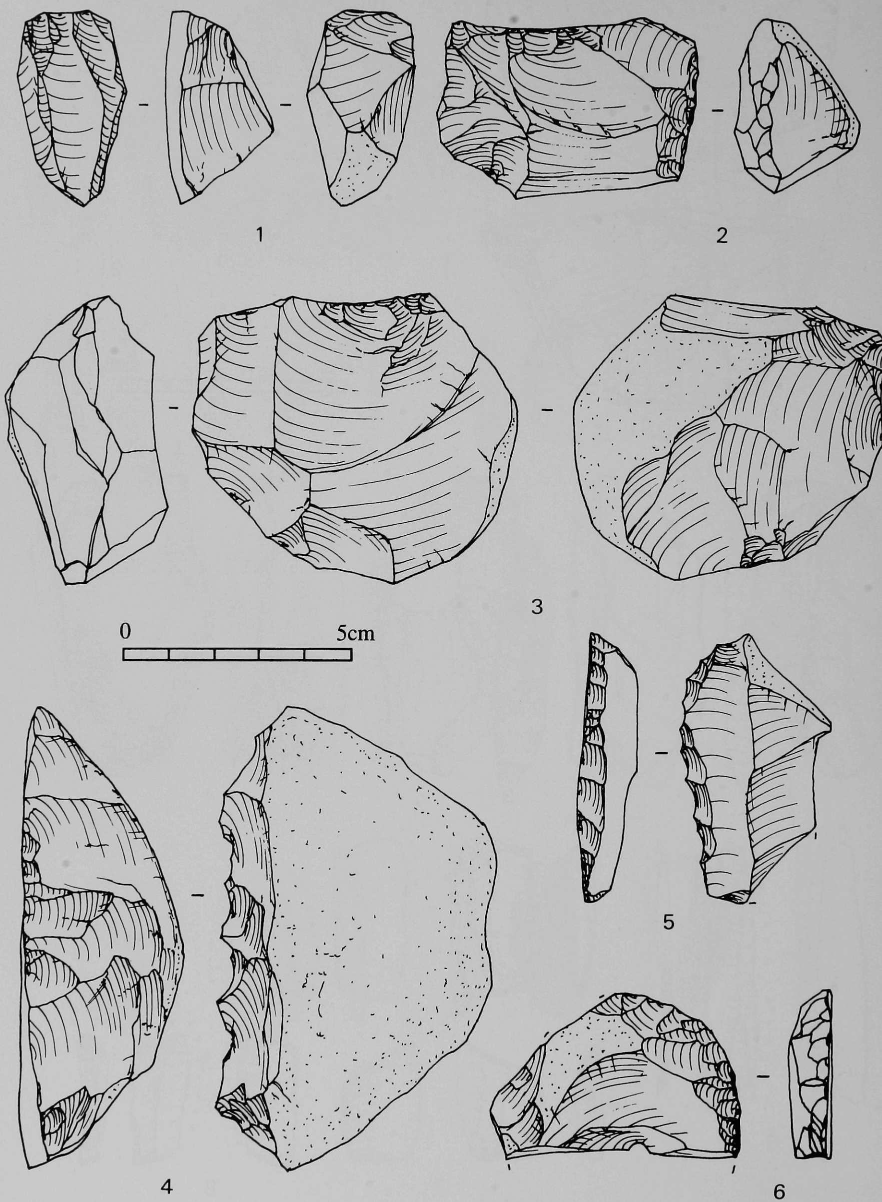


Fig. 11.45 Chalcolithic flint artifacts from Level 5 of Sector B.

1. Single-platform blade core, prism type (97KSL-BD6-29; B502).
2. Multiple-platform flake core, unifacial type (96KSL-BD7-47; B504).
3. Change-of-orientation flake core, bifacial type (96KSL-BD7-48; B504).
4. Denticulate, Type 1 (97KSL-BD6-29; B502).
5. Denticulate, Type 1 (96KSL-BD7-48; B504).
6. Scraper, Type 6 (96KSL-BE7-24; B505).

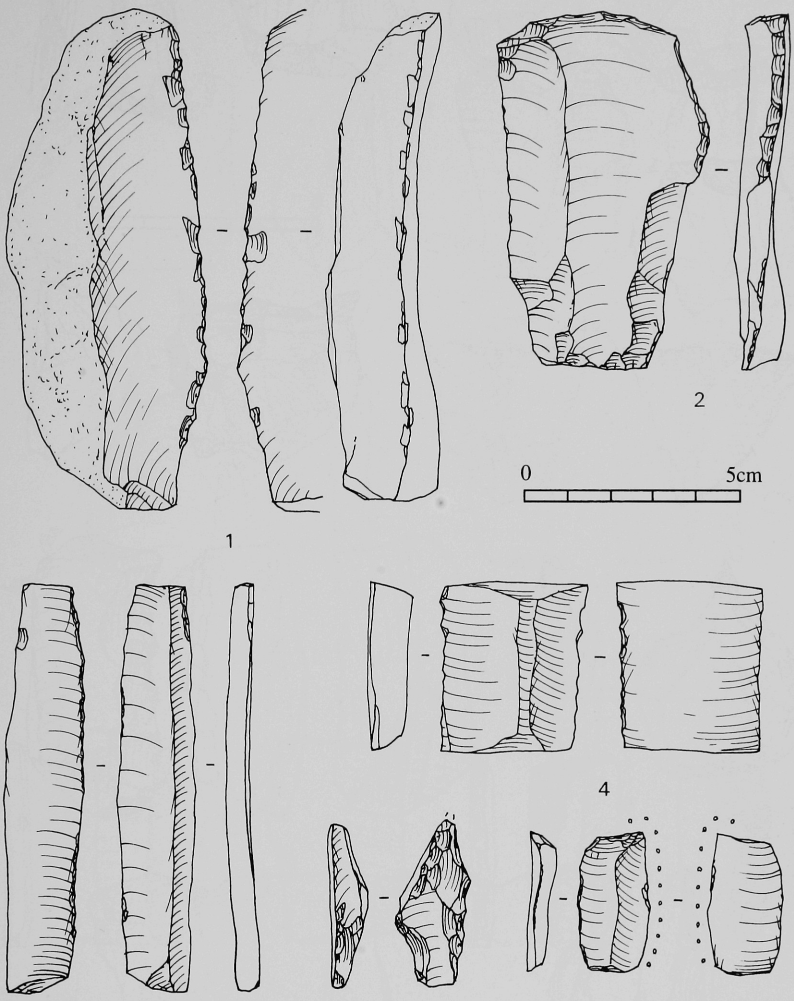


Fig. 11.46 Chalcolithic flint artifacts from Level 5 of Sector B.

1. Retouched blade, Type 1 (97KSL-BD6-19; Fill).
2. Retouched blade, Type 4 (97KSL-BD6-19; Fill).
3. Retouched blade, Type 1 (96KSL-BD7-48; B504).
4. Retouched blade, Type 6 (96KSL-BE7-24; B505).
5. Borer, Type 4 (96KSL-BD7-47; B504).
6. Sickle element, Type 2 (96KSL-BD7-47; B504).

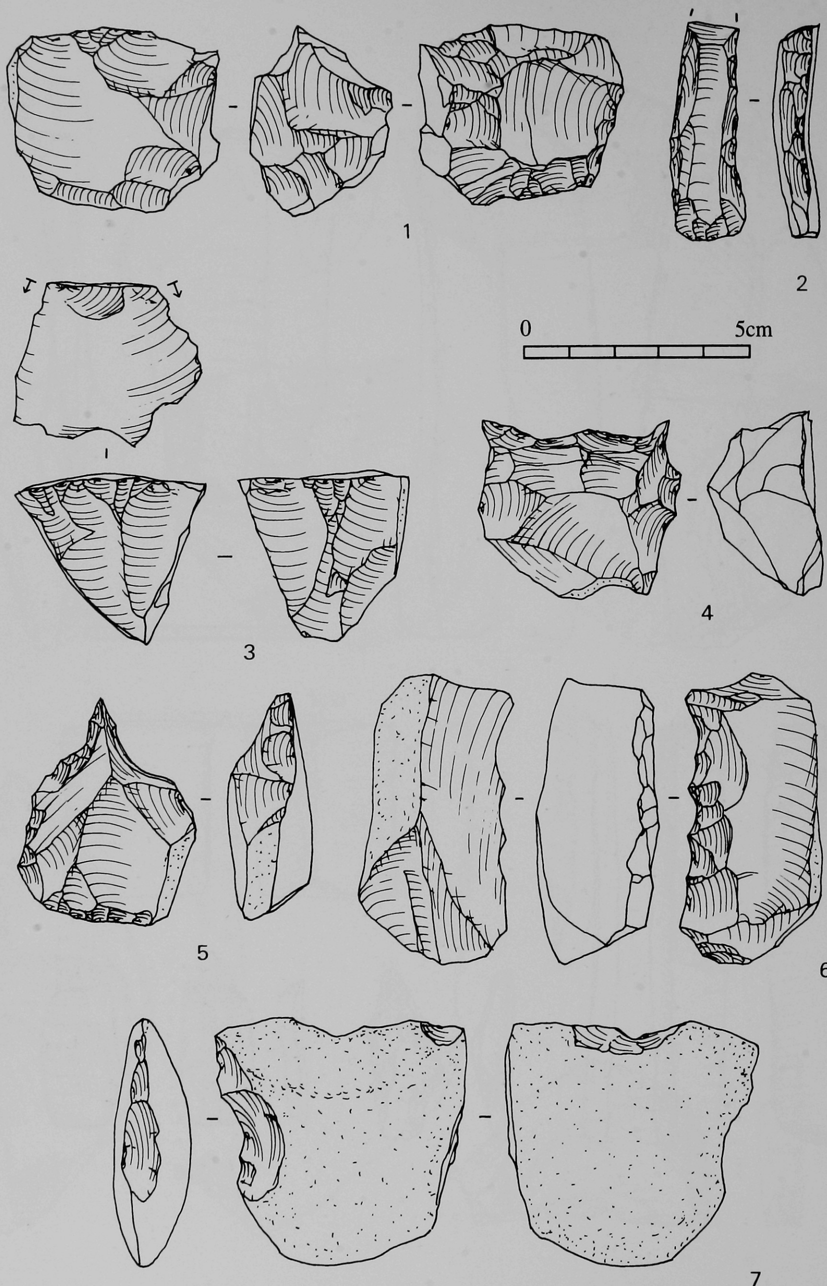


Fig. 11.47 Chalcolithic flint artifacts from Level 4 of Sector B.
1. Change-of-orientation flake core, globular type (96KSL-BD7-45; Fill).
2. Borer, Type 4 (96KSL-BD7-41; Fill).
3. Single-platform blade core, prism type (95KSL-BE6-2; Fill).
4. Borer, Type 2 (96KSL-BD7-45; Fill).
5. Borer, Type 1 (96KSL-BD7-45; Fill).
6. Denticulate, Type 1 (96KSL-BD7-42; Fill).
7. Notch, Type 2 (96KSL-BD7-42; Fill).

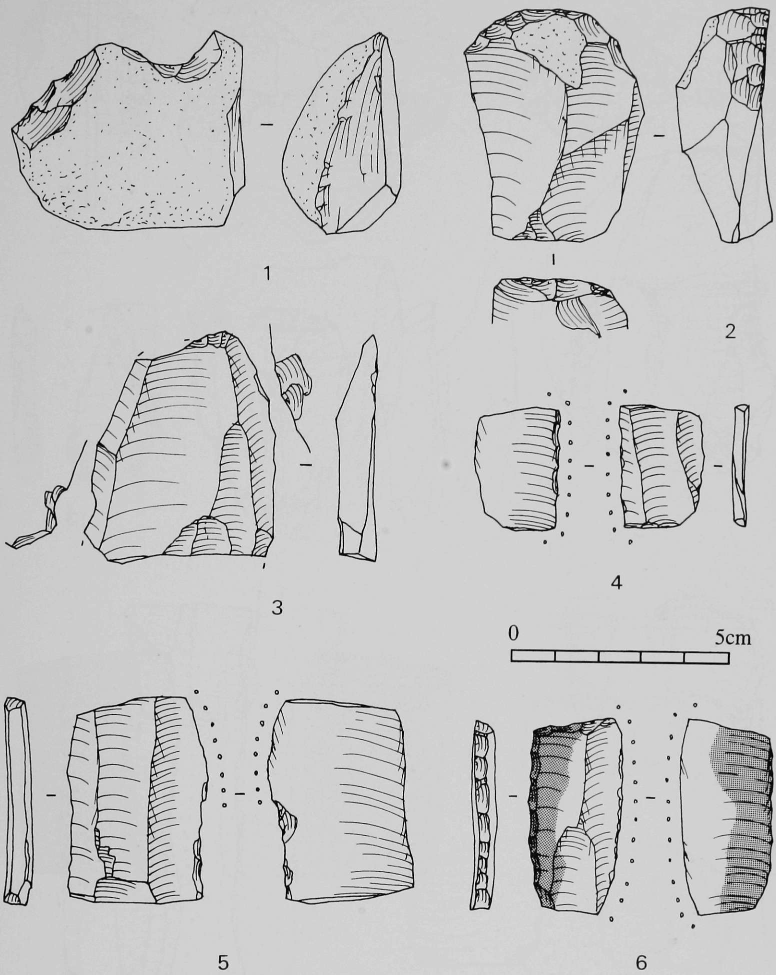


Fig. 11.48 Chalcolithic flint artifacts from Level 4 of Sector B.
1. Notch, Type 1 (96KSL-BD7-39; Fill).
2. Scraper, Type 4 (96KSL-BD7-39; Fill).
3. Retouched blade, Type 6, Canaanean (95KSL-BD6-17; Fill).
4. Sickle element, Type 1 (96KSL-BD6-18; Fill).
5. Sickle element, Type 1 (96KSL-BD7-45; Fill).
6. Sickle element, Type 1 (96KSL-BD7-44; Fill).

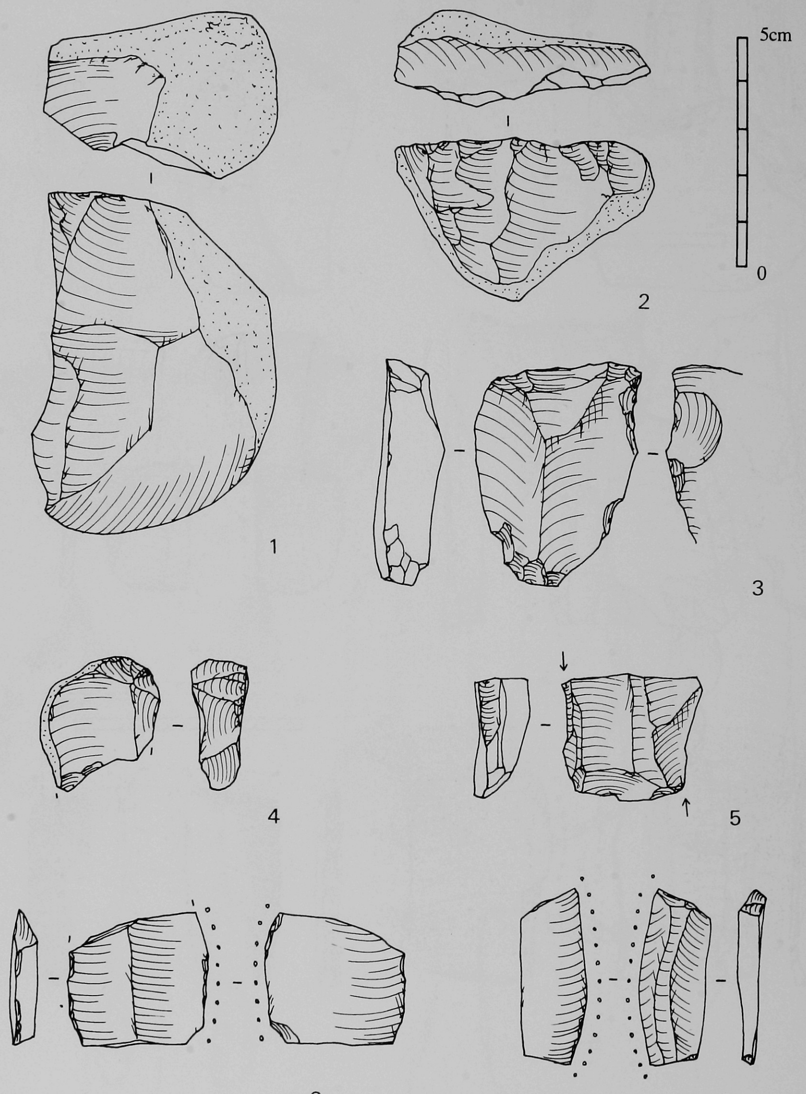


Fig. 11.49 Chalcolithic flint artifacts from Level 3 of Sector B.

1. Single-platform flake core, flat type (95KSL-BD7-19; B303).
2. Single-platform flake core, flat type (95KSL-BD7-12; Fill).
3. Scraper, Type 4 (95KSL-BD7-12; Fill).
4. Scraper, Type 4 (95KSL-BD7-20; B303).
5. Burin, Type 1 (95KSL-BD7-14; Fill).
6. Sickle element, Type 1, Canaanean (95KSL-BD7-20; B303).
7. Sickle element, Type 2 (95KSL-BD7-20; B303).

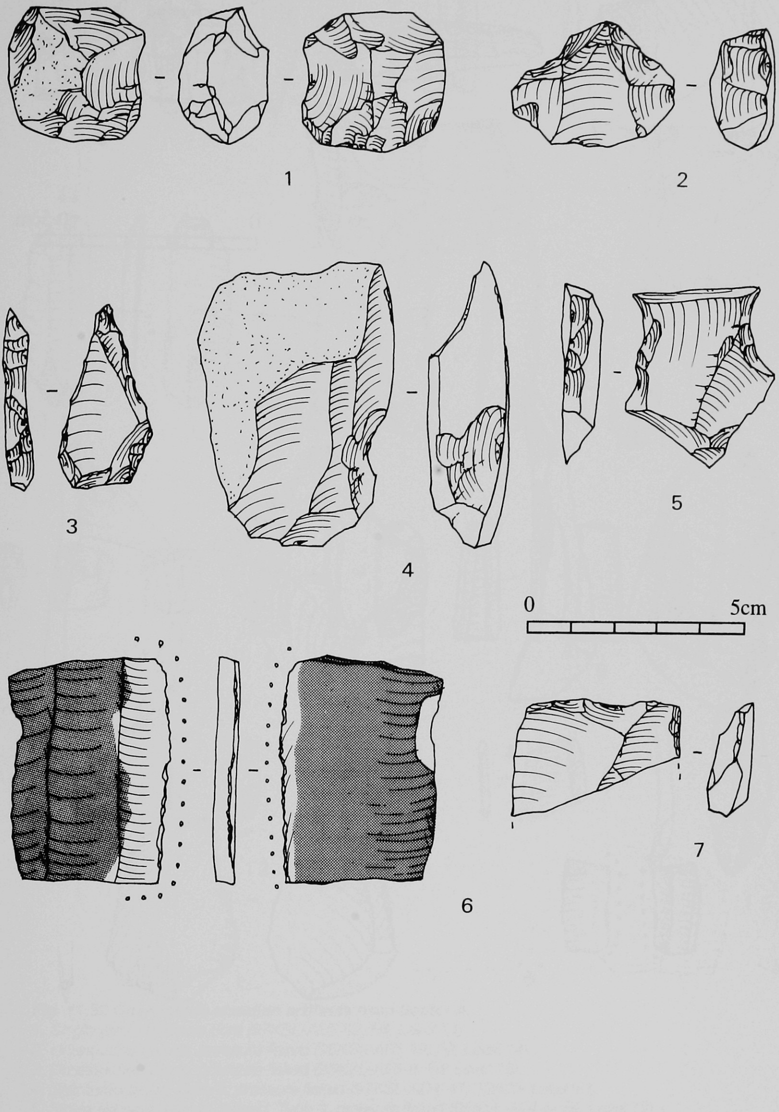


Fig. 11.50 Chalcolithic flint artifacts from Level 2 of Sector B.
1. Multiple-platform flake core, unifacial type (95KSL-BD7-11; B201).
2. Scraper, Type 4 (95KSL-BD7-11; B201).
3. Borer, Type 6 (95KSL-BD7-11; B201).
4. Notch, Type 3 (95KSL-BD7-11; B201).
5. Notch, Type 5 (95KSL-BD7-11; B201).
6. Sickle element, Type 6, Canaanean (95KSL-BD6-8; B201).
7. Sickle element, Type 6, Canaanean (95KSL-BD6-10; Fill).

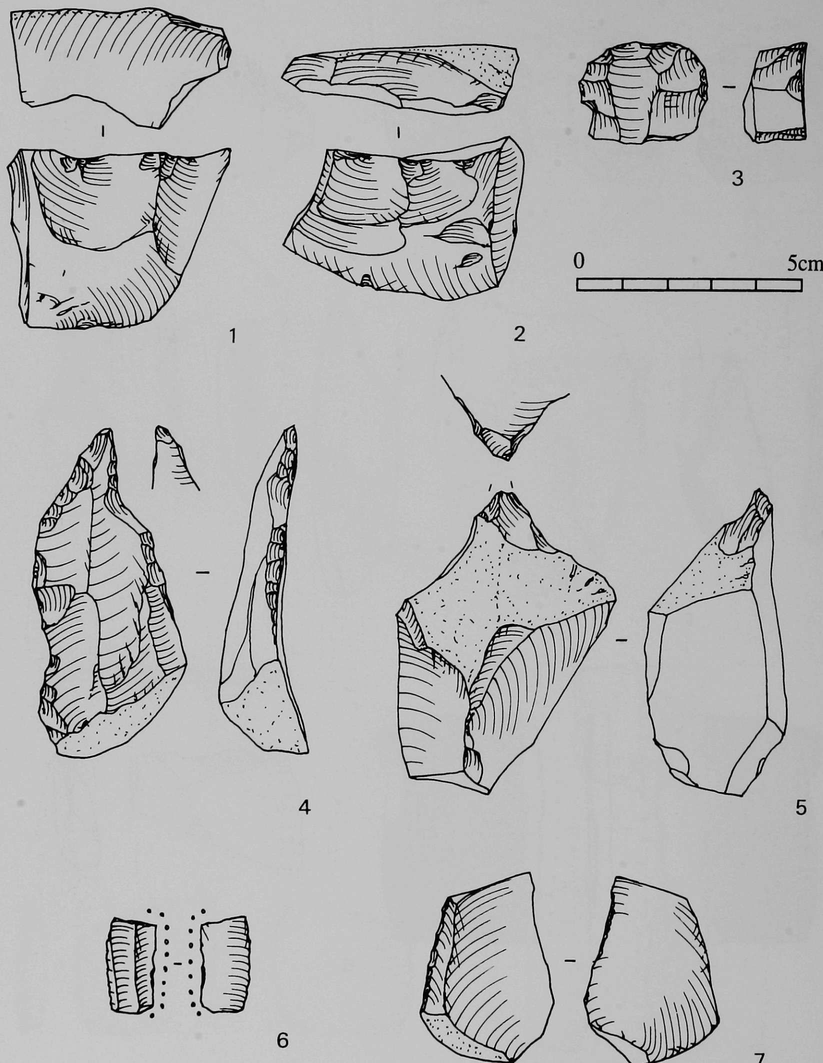


Fig. 11.51 Chalcolithic flint artifacts from Level 1 of Sector B.
1. Single-platform flake core, flat type (95KSL-BD7-4; B101).
2. Single-platform flake core, flat type (95KSL-BD7-8; B103).
3. Scraper, Type 4 (95KSL-BD7-8; B103).
4. Borer, Type 3 (95KSL-BD7-4; B101).
5. Borer, Type 1 (95KSL-BD7-5; Fill).
6. Sickle element, Type 1 (95KSL-BD6-6; B103).
7. Retouched flake, Type 1 (95KSL-BD6-6; B103).

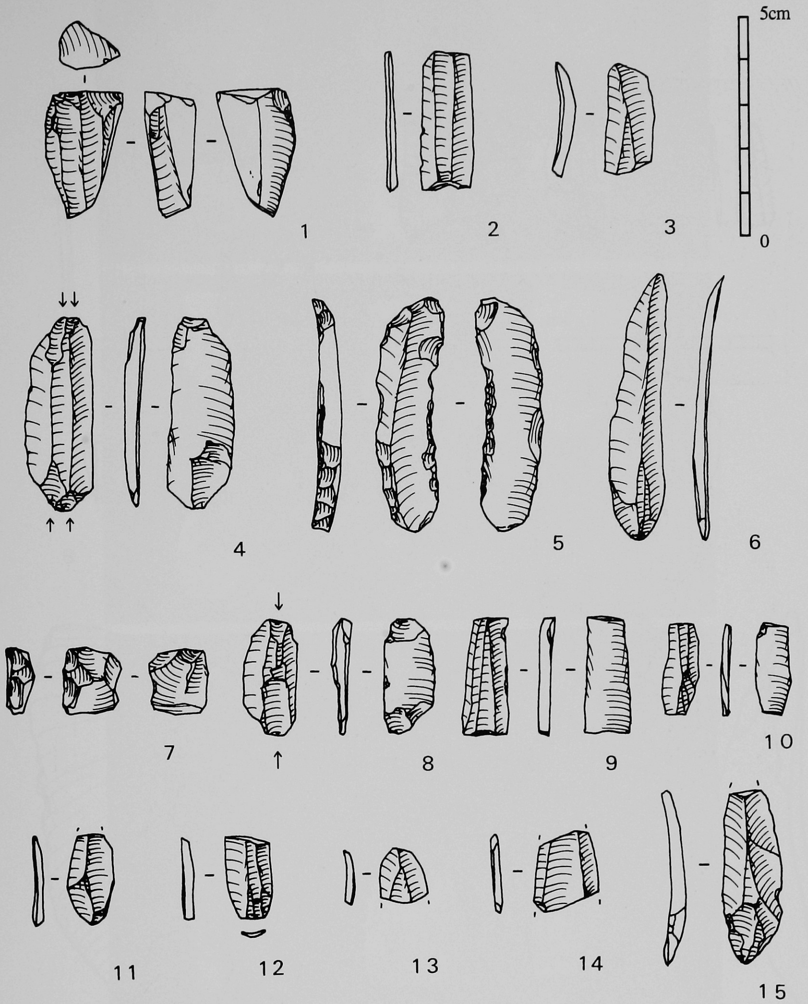


Fig. 11.52 Chalcolithic obsidian artifacts from Sector A.
1. Single-platform blade core (97KSL-AE5-52; Fill; Level 14).
2. Unretouched blade, pressure flaked (95KSL-AF5-19; Fill; Level 14).
3. Unretouched blade, pressure flaked (95KSL-AF5-8; Fill; Level 13).
4. Splintered piece, Type 2, pressure flaked (97KSL-AD4-47; 12A05; Level 12).
5. Sickle element, shape-defined, Type 3, pressure flaked (95KSL-AF4-6; Fill; Level 12).
6. Unretouched blade, pressure flaked (97KSL-AE4-25; 1101; Level 11).
7. Exhausted core (95KSL-AF3-7; Fill; Level 11).
8. Splintered piece, Type 2, pressure flaked (97KSL-AD4-38; 10B10; Level 10).
9. Truncated blade, pressure flaked (97KSL-AE5-18; 10A05; Level 10).
10. Unretouched blade, pressure flaked (96KSL-AE4-16; 10A08; Level 10).
11. Unretouched blade, pressure flaked (96KSL-AE4-10; 10A08; Level 10).
12. Unretouched blade, pressure flaked (97KSL-AE5-25; 10B13; Level 10).
13. Unretouched blade, pressure flaked (96KSL-AD4-28-28; 803; Level 8).
14. Unretouched blade, pressure flaked (95KSL-AD5-59; 503; Level 5).
15. Unretouched blade, pressure flaked (95KSL-AD5-39; 402; Level 4).

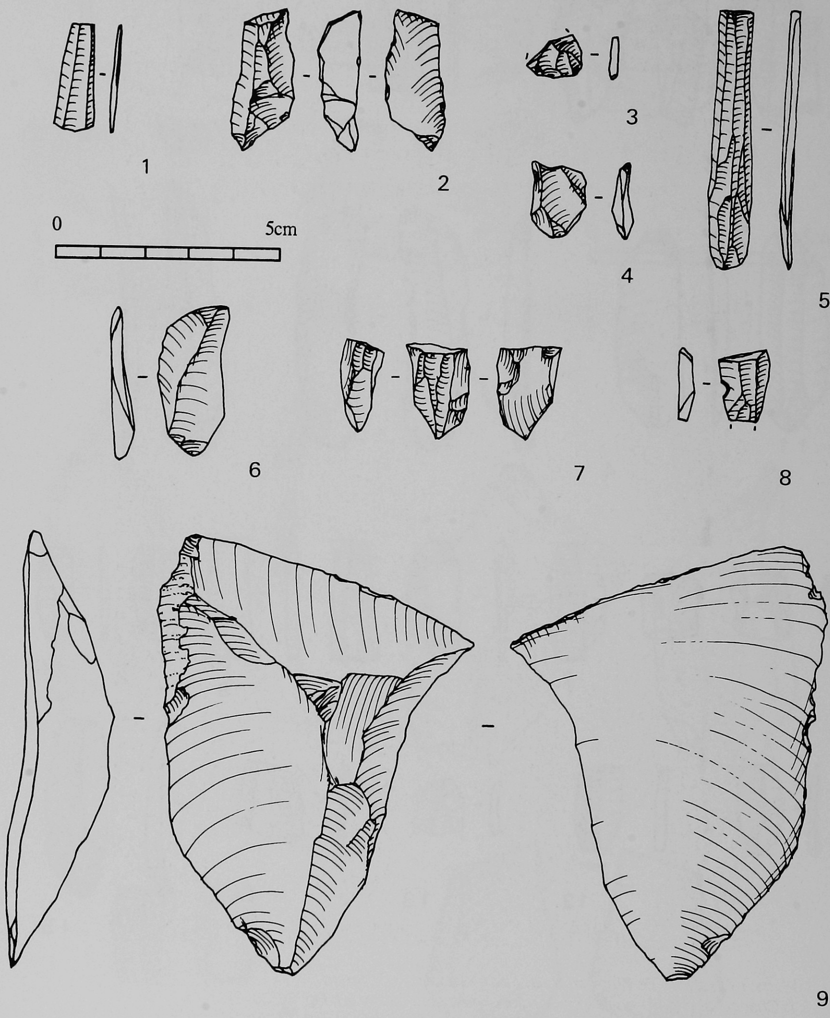
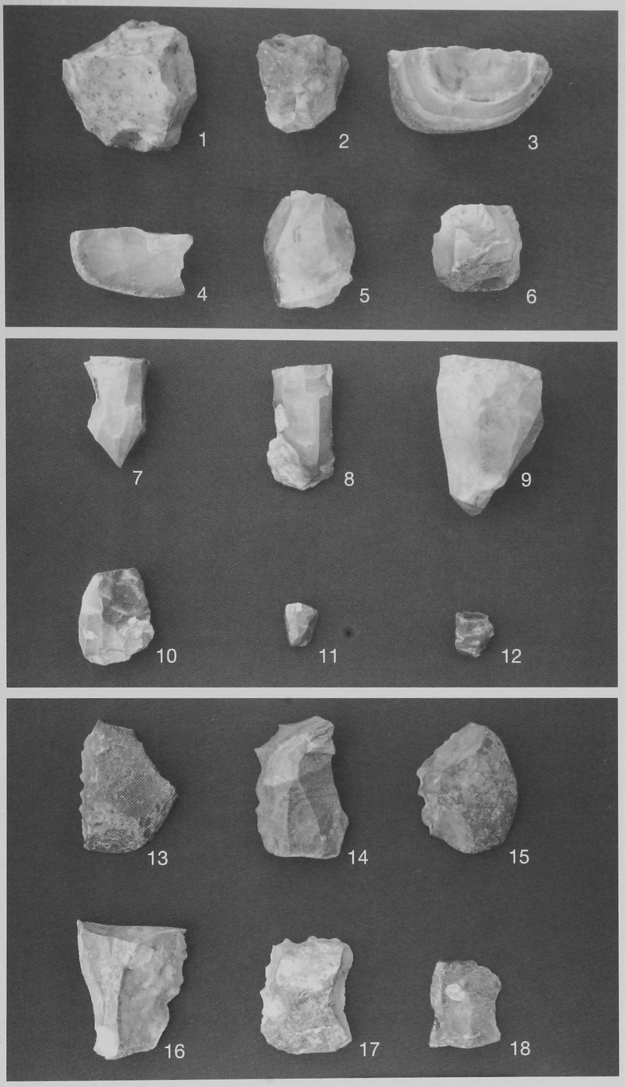
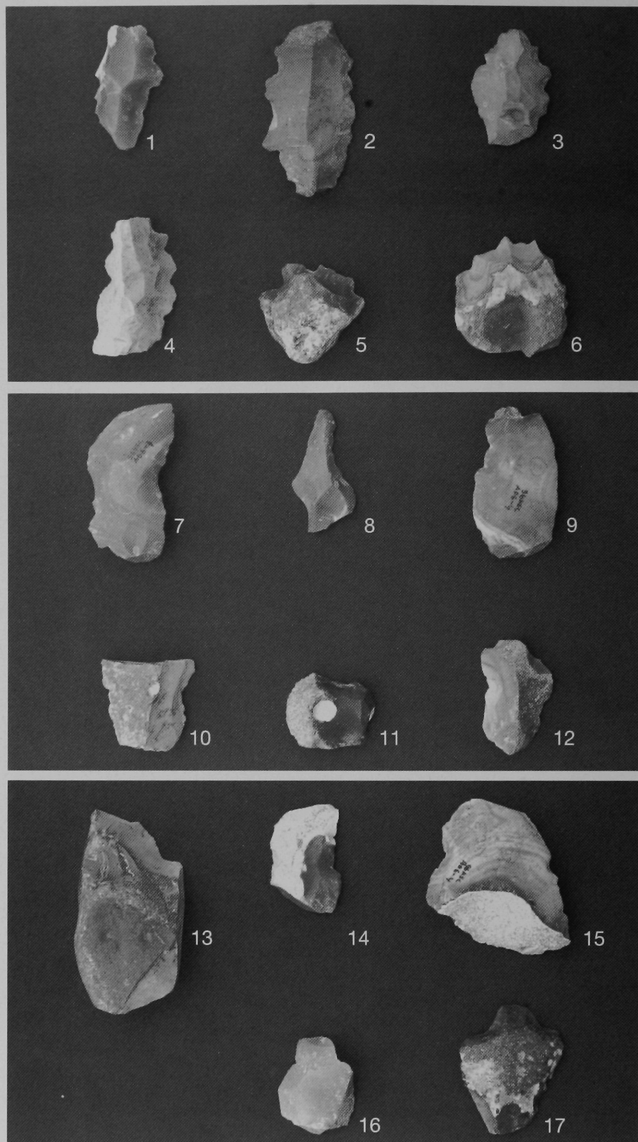


Fig. 11.53 Chalcolithic obsidian artifacts from Sector B.
1. Unretouched blade, pressure flaked (97KSL-BE5-12; Fill; Level 7).
2. Core-edge element, hard-hammer flaked (97KSL-BE6-20; Fill; Level 6).
3. Unretouched flake, hard-hammer flaked (97KSL-BE6-22; B601; Level 6).
4. Unretouched flake, hard-hammer flaked (97KSL-BE6-22; B601; Level 6).
5. Unretouched blade, pressure flaked (97KSL-BE5-3; Fill; Level 6).
6. Unretouched flake, hard-hammer flaked (96KSL-BD7-51; B608; Level 6).
7. Single-platform blade core (95KSL-BD6-19; Fill; Level 5).
8. Unretouched blade, pressure flaked (96KSL-BE7-11; Fill; Level 4).
9. Unretouched flake, hard-hammer flaked (96KSL-BD7-55; Fill; Level 5).

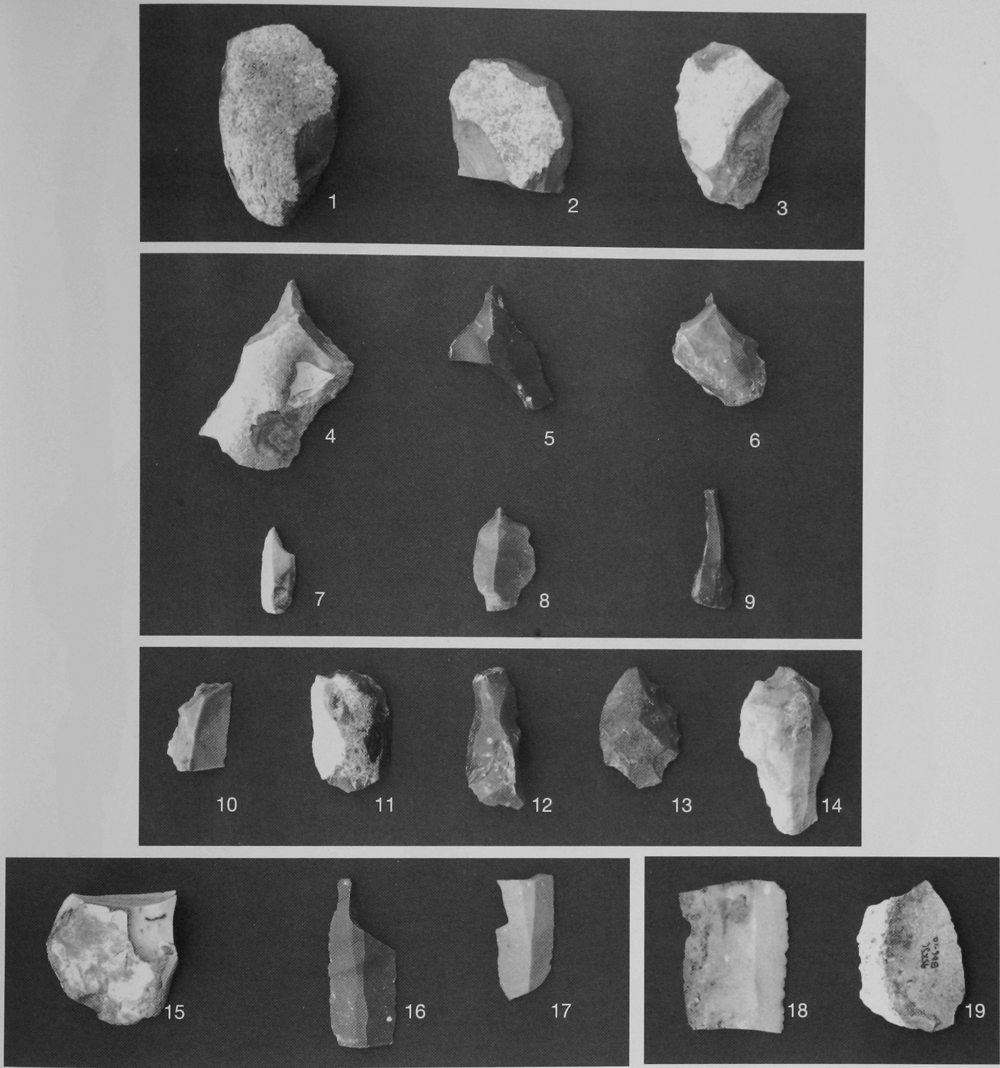


Pl. 11.1 Chalcolithic flint artifacts from Tell Kosak Shamali.

1. Change-of-orientation flake core, globular type, L: 6.6cm (cf. Fig. 11.38: 2).
2. Change-of-orientation flake core, globular type, L: 5.7cm (cf. Fig. 11.39: 1).
3. Single-platform flake core, flat type, L: 4.8cm (cf. Fig. 11.38: 1).
4. Single-platform flake core, prism type, L: 4.2cm (cf. Fig. 11.38: 3).
5. Single-platform flake core, flat type, L: 7.7cm (cf. Fig. 11.39: 2).
6. Change-of-orientation flake core, globular type, L: 5.6cm (cf. Fig. 11.38: 4).
7. Single-platform blade core, prism type, L: 5.8cm (cf. Fig. 11.11: 5).
8. Single-platform blade core, flat type, L: 6.4cm (cf. Fig. 11.15: 3).
9. Single-platform blade core, prism type, L: 8.5cm (cf. Fig. 11.15: 2).
10. Opposed-platform flake core, bifacial type, L: 4.9cm (cf. Fig. 11.29: 1).
11. Change-of-orientation blade core, bifacial type, L: 2.3cm (cf. Fig. 11.25: 2).
12. Single-platform blade core, prism type, L: 2.3cm (cf. Fig. 11.23: 5).
13. Denticulate, Type 1, L: 7.8cm (97KSL-AE4-34; 10A20; Level 10 of Sector A).
14. Denticulate, Type 1, L: 9.5cm (cf. Fig. 11.25: 8).
15. Denticulate, Type 1, L: 7.7cm (cf. Fig. 11.21: 7).
16. Denticulate, Type 1, L: 8.5cm (cf. Fig. 11.36: 3).
17. Denticulate, Type 3, L: 7.2cm (cf. Fig. 11.19: 4).
18. Denticulate, Type 2, L: 5.5cm (cf. Fig. 11.21: 8).



Pl.11.2 Chalcolithic flint artifacts from Tell Kosak Shamali.
1. Denticulate, Type 4, L: 5.8cm (cf. Fig. 11.19: 5)
2. Denticulate, Type 4, L: 8.5cm (cf. Fig. 11.36: 4)
3. Denticulate, Type 3, L: 5.7cm (cf. Fig. 11.19: 7)
4. Denticulate, Type 4, L: 6.6cm (cf. Fig. 11.13: 2)
5. Denticulate, Type 3, L: 9.8cm (cf. Fig. 11.37: 6)
6. Denticulate, Type 3, L: 5.6cm (cf. Fig. 11.13: 1)
7. Notch, Type 1, L: 7.5cm (cf. Fig. 11.35: 4)
8. Notch, Type 1, L: 5.1cm (cf. Fig. 11.21: 3)
9. Notch, Type 1, L: 7.1cm (cf. Fig. 11.37: 4)
10. Notch, Type 1, L: 4.4cm (cf. Fig. 11.16: 4)
11. Notch, Type 2, L: 3.6cm (cf. Fig. 11.36: 1)
12. Notch, Type 3, L: 5.5cm (cf. Fig. 11.19: 6)
13. Notch, Type 4, L: 10.3cm (cf. Fig. 11.35: 5)
14. Notch, Type 3, L: 5.5cm (cf. Fig. 11.13: 3).
15. Notch, Type 3, L: 6.9cm (cf. Fig. 11.37: 3)
16. Notch, Type 4, L: 5.0cm (cf. Fig. 11.21: 4)
17. Notch, Type 5, L: 6.4cm (cf. Fig. 11.36: 2)



Pl.11.3 Chalcolithic flint artifacts from Tell Kosak Shamali.
1. Scraper, Type 1, L: 8.2cm (cf. Fig. 11.16: 1)
2. Scraper, Type 3, L: 5.4cm (cf. Fig. 11.13: 4)
3. Scraper, Type 1, L: 7.2cm (cf. Fig. 11.37: 5)
4. Borer, Type 1, L: 7.7cm (cf. Fig. 11.29: 2)
5. Borer, Type 1, L: 5.4cm (cf. Fig. 11.14: 1)
6. Borer, Type 1, L: 4.8cm (cf. Fig. 11.47: 5)
7. Borer, Type 3, L: 3.5cm (cf. Fig. 11.20: 2)
8. Borer, Type 1, L: 4.1cm (cf. Fig. 11.20: 3)
9. Borer, Type 4, L: 4.8cm (cf. Fig. 11.26: 1)
10. Retouched blade, Type 4, L: 3.6cm (cf. Fig. 11.41: 6)
11. Scraper, Type 4, L: 5.2cm (cf. Fig. 11.41: 4)
12. Rod, L: 6.0cm (cf. Fig. 11.42: 4)
13. Denticulate, Type 1, L: 5.1cm (cf. Fig. 11.41: 1)
14. Denticulate, Type 4, L: 7.1cm (cf. Fig. 11.41: 2)
15. Burin, Type 1, L: 4.3cm (cf. Fig. 11.8: 6)
16. Burin, Type 1, L: 5.5cm (cf. Fig. 11.20: 4)
17. Burin, Type 6, L: 4.0cm (cf. Fig. 11.14: 2)
18. Sickle element, Type 6, Canaanean, L: 5.1cm (cf. Fig. 11.50: 6)
19. Retouched flake, Type 1, L: 4.9cm (cf. Fig. 11.51: 7)

Pl.11.4 Flint embedded Chalcolithic sickle from Tell Kosak Shamali.

1. Flint embedded sickle, L: 33.4cm (cf. Fig. 11.17).
2. Sickle element, Type 1, L: 8.6cm (cf. Fig. 11.18: 1).
3. Sickle element, Type 3, L: 4.4cm (cf. Fig. 11.18: 2).
4. Sickle element, Type 1, L: 6.6cm (cf. Fig. 11.18: 3).
5. Sickle element, Type 1, L: 7.1cm (cf. Fig. 11.18: 4).
6. Sickle element, Type 1, L: 7.7cm (cf. Fig. 11.18: 5).

Pl.11.5 Chalcolithic flint and obsidian artifacts from Tell Kosak Shamali.
1. Hoe-shaped tool, L: 20.0cm (cf. Fig. 11.27).
2. Pick, Type 2, L: 10.9cm (cf. Fig. 11.30: 1).
3. Pick, Type 2, L: 7.6cm (96KSL-AE6-2; Fill; Level 7 of Sector A).
4. Biface, L: 8.5cm (cf. Fig. 11.28: 7)
5. Chopper, L: 12.0cm (cf. Fig. 11.26: 6).
6. Crested blade, L: 9.7cm (96KSL-AE4-16-66; 10A08; Level 10 of Sector A).
7. Scraper, Type 6, L: 14.0cm (cf. Fig. 11.13: 5).
8. Flake, obsidian, L: 9.4cm (cf. Fig. 11.53: 9).
9. Unretouched blade, pressure flaked, obsidian, L: 5.9cm (cf. Fig. 11.52: 6).
10. Sickle element, shape-defined, Type 3, pressure flaked, obsidian, L: 5.2cm (cf. Fig. 11.52: 5).
11. Splintered piece, Type 2, pressure flaked, obsidian, L: 4.2cm (cf. Fig. 11.52: 4).
12. Truncated blade, pressure flaked, obsidian, L: 2.7cm (cf. Fig. 11.52: 9).
13. Unretouched blade, pressure flaked, obsidian, L: 1.9cm (cf. Fig. 11.52: 10).
14. Splintered piece, Type 2, pressure flaked, obsidian, L: 2.6cm (cf. Fig. 11.52: 8).
15. Exhausted core, obsidian, L: 1.2cm (cf. Fig. 11.52: 7).

CHAPTER 12 Element contents determined by ICP-AES and ICP-MS at Grenoble on nine obsidian artifacts from Tell Kosak Shamali: Results and inferences on provenance

Ludovic Bellot-Gurlet, Gérard Poupeau and Céline Bressy

12.1 Introduction

Results for trace elements including REE obtained by ICP-MS are presented in Table 12.1, and for major elements measured by ICP-AES in Table 12.2. They were obtained using the protocols described in Bellot-Gurlet (1998) and Bellot-Gurlet and others (1999). For provenance determination we compared the data on artifacts with those previously obtained in our laboratory on obsidian samples from various sources.

12.2 Comments on trace element contents

The data are conventionally presented in diagrams of normalized element abundances (e.g. Poidevin 1998; Chataigner *et al.* 1998). The norm selected is the composition of the primitive earth mantle as given by Sun and McDonaugh (1989).

In Fig. 12.1, the compositions of the nine artifacts are presented. It is clear that three compositional groups are present with respectively six, two and one samples.

In Fig. 12.2, the compositions of the six artifacts defining the most important group: BE7-11, AE4-16, AF5-8, AD5-39, AD4-28-28 and BD7-51 are reported. These artifacts present a peralcaline affinity of the "Bingöl-A"-type compositional group of Cauvin and others (1986, 1991).

This source compositional group includes geological obsidians from the Bingöl region (Orta Duz and Çavuşlar source areas; Cauvin *et al.* 1986, 1991) and from the Nemrut Dağ volcano, the only known prealcaline sources in Eastern Anatolia, which cannot be discriminated on the basis of their trace element contents (Poidevin 1998). This appears in Fig. 12.2 where we plotted our data on two peralcaline Bingöl samples (one from Orta Duz and one from Çavuşlar) and five Nemrut Dağ samples (three from the inside of the caldera, two from the south flank).

It also appears that the artifacts in this peralcaline group cannot be distinguished from the source samples presented. Thus, trace element data allows one to claim that these "archaeological" obsidians must come either from the Bingöl region or the Nemrut Dag volcano.

In Fig. 12.3, the composition of artifacts AE4-10 and AD 5-59 is compared to that of two geological samples from the Bingöl region (respectively: Çatak and Ala Tepe source areas) belonging to the "Bingöl-B"-type compositional group of Cauvin and others (1986, 1991) with a calco-alcaline affinity. The artifacts clearly belong to this group and therefore these obsidians come from one of the three source areas of the Bingöl region which provide calco-alcaline obsidians: Ala Tepe, Çatak, or Çavuşlar.

In Fig. 12.4 are reported the compositions of artifact AF5-19 and of source samples from the Göllü Dağ massif. The nine Göllü Dağ samples, which come respectively from Kayirli East (six samples) and Kömürcü (three samples), belong to the "Göllü Dağ East" geochemical group (Poidevin 1998). As shown in this figure, artifact AF5-19 pertains to this geochemical group and therfore comes from the Kömürcü or Kayirli East sources, known for the good knapping quality of their obsidians.

Table 12.1 Trace element content for the nine artifacts with their compositional source group attribution.

Compositional group	Bingöl-B		Göllü Dağ East	Bingöl-A					
Sample	AE4-10	AD5-59	AF5-19	AE4-16	AD5-39	AD4-28-28	BD7-51	BE7-11	AF5-8
Elements (ppm)									
Co	1.103	1.094	0.105	0.035	0.058	0.025	0.022	0.017	0.015
Rb	219.65	221.16	189.95	213.53	219.98	203.43	203.48	209.01	208.2
Sr	43.982	41.957	12.109	0.732	1.031	0.907	0.291	0.375	0.382
Y	31.245	30.753	22.129	132.02	149.87	134.19	132.08	135.21	135.55
Zr	352.17	344.03	80.042	1201.0	1337.1	1303.1	1273.9	1316.5	1315.7
Nb	18.941	19.361	25.585	54.024	61.462	64.734	69.245	66.799	67.163
Cs	10.616	10.856	7.804	12.402	14.093	7.325	6.859	7.300	7.277
Ba	374.53	375.5	165.47	5.315	4.49	1.666	4.171	3.931	3.786
La	36.546	36.737	22.629	82.01	87.483	84.172	85.172	84.996	87.371
Ce	69.502	71.411	44.299	176.32	189.57	182.64	184.55	183.99	188.8
Pr	7.173	7.309	4.334	21.111	22.527	21.698	21.835	21.766	22.195
Nd	23.431	23.759	13.182	80.511	85.897	81.42	81.788	81.95	83.639
Sm	4.324	4.354	2.628	17.569	19.033	17.829	17.723	17.892	18.159
Eu	0.462	0.451	0.155	0.441	0.559	0.364	0.355	0.370	0.363
Gd	4.443	4.433	2.796	17.853	19.48	17.825	17.988	17.797	18.301
Tb	0.761	0.751	0.501	3.424	3.816	3.435	3.351	3.491	3.464
Dy	4.385	4.388	2.976	20.284	23.124	20.586	20.201	20.694	20.555
Ho	0.952	0.962	0.649	4.387	5.004	4.454	4.388	4.479	4.471
Er	2.920	2.904	1.955	12.586	14.412	12.888	12.631	12.895	12.851
Yb	3.247	3.303	2.249	12.476	14.012	12.828	12.555	12.782	12.958
Lu	0.525	0.512	0.343	1.91	2.09	1.949	1.922	1.949	1.944
Hf	8.522	8.500	3.173	27.000	30.639	28.88	27.812	29.065	28.696
Ta	1.81	1.946	2.446	3.904	4.818	4.323	4.619	4.395	4.402
W	3.728	3.935	3.157	4.585	5.463	3.635	3.724	3.732	3.789
Pb	26.98	27.535	21.807	32.469	35.33	26.566	26.054	26.956	27.221
Th	25.299	26.218	20.837	26.375	28.888	23.671	23.388	23.84	23.724
U	8.664	8.885	8.015	9.786	10.943	7.665	7.708	7.723	7.678

Table 12.2 Major element content for the nine artifacts with their compositional source group attribution.

Compositional group	Bingöl-B		Göllü Dağ East	Bingöl-A					
Sample	AE4-10	AD5-59	AF5-19	AE4-16	AD5-39	AD4-28-28	BD7-51	BE7-11	AF5-8
Oxydes(%)									
Al_2O_3	14.78	14.20	12.55	10.99	10.71	10.92	11.18	11.39	11.73
Fe_2O_3	2.02	1.92	0.85	4.27	4.37	3.04	3.09	3.10	3.13
MnO	0.042	0.039	0.063	0.079	0.076	0.055	0.092	0.061	0.062
MgO	0.154	0.160	0.040	0.004	0.006	0.001	0.001	0.001	0.001
CaO	0.734	0.701	0.429	0.199	0.182	0.080	0.185	0.171	0.182
Na_2O	4.91	4.82	4.02	5.25	5.56	4.95	5.20	5.00	5.07
K_2O	5.05	4.99	4.37	4.63	4.40	4.84	4.53	4.70	4.46
TiO_2	0.211	0.193	0.061	0.207	0.202	0.150	0.156	0.156	0.162

Table 12.3 Summary of provenances for the nine Tell Kosak Shamali artifacts.

Samples	Provenances
AE4-10 AD5-59	Bingöl calco-alcaline sources: Ala Tepe, Çatak, and/or Çavulşlar
AF5-19	Göllü Dağ East obsidians: Kömürcü or Kayirli East sources
AE4-16 AD5-39	Bingöl peralcaline sources (Orta Duz and/or Çavuşlar) and/or obsidians from the caldera of Nemrut Dağ volcano
AD4-28-28 BD7-51 BE7-11 AF5-8	Bingöl peralcaline sources (Orta Duz and/or Çavuşlar) and/or obsidians from the South flank of Nemrut Dağ volcano

12.3 Comments on major element contents

As proposed by Poidevin (1998) it may be possible to discriminate Nemrut Dağ obsidians from Bingöl peralcaline artifacts on the basis of CNK/A vs. NK/A diagrams (Fig. 12.5), which illustrate the degree of peralcalinity of samples. Among our seven Nemrut Dağ and Bingöl peralcalines geological samples analyzed, Nemrut Dağ caldera lake obsidians are in the upper part of the diagram, South Nemrut Dağ ones in the lower part, and Bingöl obsidians are in between, with one Nemrut Dağ "undetermined" caldera sample (sample AG36 of Innocenti *et al.* 1976). The same kind of discrimination can be also illustrated by the Al vs. Fe binary diagram of Fig. 12.6 where again lake and South Nemrut Dağ geological samples are reported in two areas distinct from the Bingöl and the Nemrut Dağ "undetermined" caldera obsidian.

Our six peralcalines artifacts illustrate the limits of these discriminations between these obsidians with very similar compositions. Indeed artifacts AE4-16 and AD5-39 seem clearly to belong to the "Bingöl domain" (Figs. 12.5 and 12.6), but the other artifacts slip towards South Nemrut Dağ characteristics. Thus with the available analyses it is not possible to fix the precise limits of each group and therefore insure a provenance for all peralcaline obsidians. Thus for artifacts AD4-28-28, BD7-51, BE7-11 and AF5-8, we can only propose an attribution to peralcaline obsidians from either Bingöl or South Nemrut Dağ.

For compositions close to Bingöl peralcaline obsidians, because a caldera-lake composition has never been observed to date for Near Eastern artifacts (see compilation by Chataigner 1998) and because of the difficult access to the inside of the Nemrut Dağ caldera, one may guess for these samples a more probable Bingöl area origin.

12.4 Conclusions on provenance

From ICP data, the source material of the analyzed artifacts might come respectively from (see Table 12.3):
- the South flank of the Nemrut Dağ volcano and/or the peralcaline obsidians of the Bingöl area (Orta Duz and/or Çavulşlar) for four artifacts: BE7-11, AF5-8, BD7-51, and AD4-28-28,
- the Nemrut Dağ volcano or rather (see above) the Bingöl sources of peralcine obsidians (Orta Duz and/or Çavulşlar) for two artifacts: AE4-16 and AD5-39,
- the Bingöl sources of calco-alcaline obsidians (Ala Tepe and/or Çatak and/or Çavulşlar) for two artifacts: AE4-10 and AD5-59,
- the Kömürcü or Kayirli East sources in the Göllü Dağ massif for the last one: AF5-19.

References

Bellot-Gurlet, L. (1998) *Caractérisation par Analyse Élémentaire (PIXE et ICP-MS/-AES) d'un Verre Naturel: l'Obsidienne. Application à l'Étude de provenance d'Objets Archéologiques*. Ph. D. dissertation, 290 p. Université Joseph Fourier, Grenoble, France.

Bellot-Gurlet, L., F. Keller and G. Poupeau (1999) Description of the procedures for ICP-AES and ICP-MS analysis at Grenoble, France. In: An inter-laboratory comparison of element compositions for two obsidian sources, edited by M. D. Glascock, *International Association for Obsidian Studies Bulletin* 23: 13-25.

Chataigner, C. (1998) Sources des artefacts du proche-orient d'après leur caractérisation géochemique. In: *Obsidienne au Proche et Moyen Orient. Du Volcano à l'Outil,* edited by M.-C. Cauvin, A. Gourguard, B. Gratuze, N. Arnaud, G. Poupeau, J.-L. Poidevin and C. Chataigner, pp. 273-324. BAR International Series 738. Oxford: Archaeopress.

Chataigner, C., J.-L. Poidevin and N.O. Arnaud (1998) Turkish occurrences of obsidian and use by prehistoric peoples in the Near-East from 14,000 to 6,000 BP. *Journal of Volcanology and Geothermal Research* 85: 517-537.

Cauvin, M.-C., N. Balkan, Y. Besnus and F. Saroglu (1986) Origine de l'obsidienne de Cafer Höyük (Turquie): Premiers résultats. *Paléorient* 12: 87-97.

Cauvin, M.-C., Y. Besnus, J. Tripier and R. Montigny (1991) Nouvelles analyses d'obsidiennes du Proche-Orient: Modèle de geochimie des magmas utilisé pour la recherche archéologique. *Paléorient* 17: 5-19.

Innocenti, F., R. Mazzuoli, G. Pasquare, F. Radicarti di Brozolo and L. Villari (1976) Evolution of the volcanism in the area of interaction between the Arabian, Anatolian and Iranian plates (Lake Van, eastern Turkey). *Jouranl of Volcanology and Geothermal Research* 1: 103-112.

Poidevin, J.-L. (1998) Les gisements d'obsidienne de Turquie et Transcaucasie: Géologie, géochimie et chronométrie. In: *Obsidienne au Proche et Moyen Orient. Du Volcano à l'Outil,* edited by M.-C. Cauvin, A. Gourguard, B. Gratuze, N. Arnaud, G. Poupeau, J.-L. Poidevin and C. Chataigner, pp. 105-203. BAR International Series 738. Oxford: Archaeopress.

Sun, S. S. and W. F. McDonaugh (1989) Chemical and isotopic systematics of oceanic basalts: Implications for mantle composition and processes. In: *Magmatism in the Ocean Basins,* edited by A. D. Saunders and M. J. Norry, pp. 313-345. Special Publication 42. London: Geological Society.

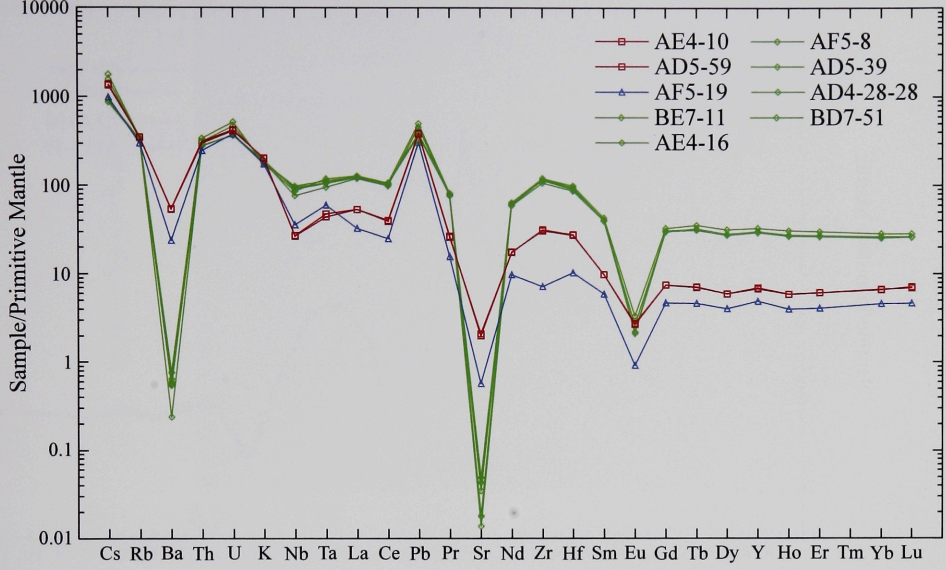


Fig. 12.1 Primitive mantle normalized diagram for the nine artifacts.

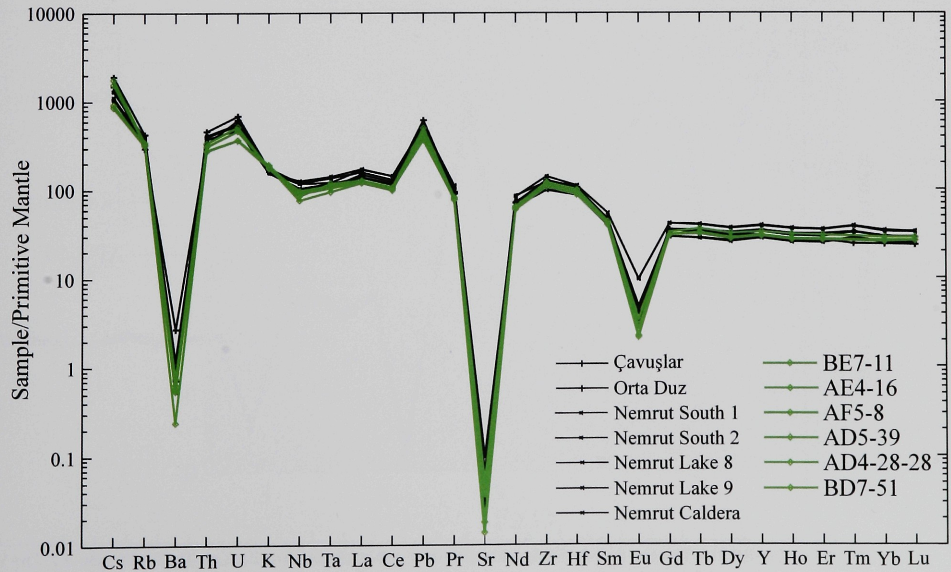


Fig. 12.2 Primitive mantle normalized diagram for the six artifacts which present a Bingöl-A composition.

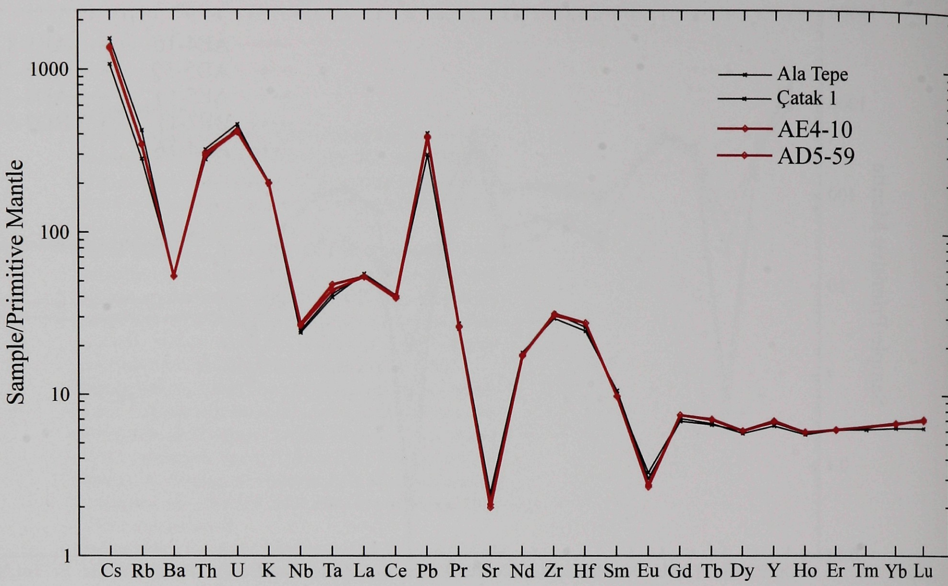


Fig. 12.3 Primitive mantle normalized diagram for the two artifacts which present a Bingöl-B composition.

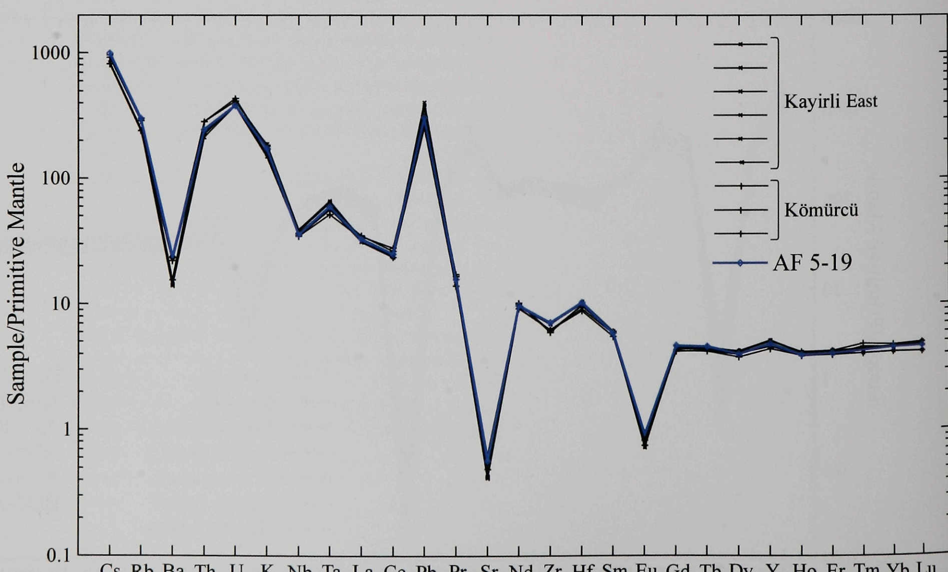


Fig. 12.4 Primitive mantle normalized diagram for the artifacts which present a Göllü Dağ East composition.

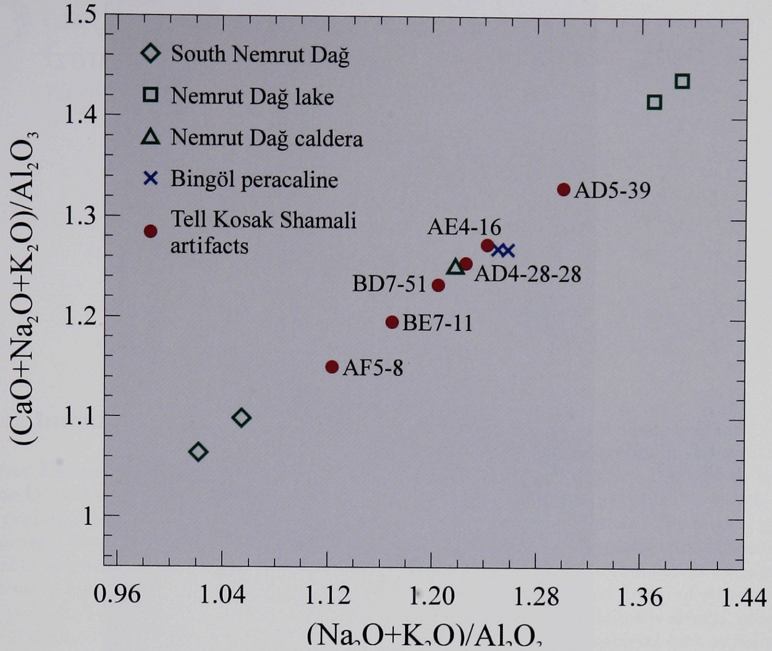


Fig. 12.5 ***(CaO+Na$_2$O+K$_2$O)/Al$_2$O$_3$ vs (Na$_2$O+K$_2$O)/Al$_2$O$_3$ diagram (CNK vs NK) for the six peralcaline artifacts and our peralcaline source samples from Bingöl and Nemrut Dağ.***

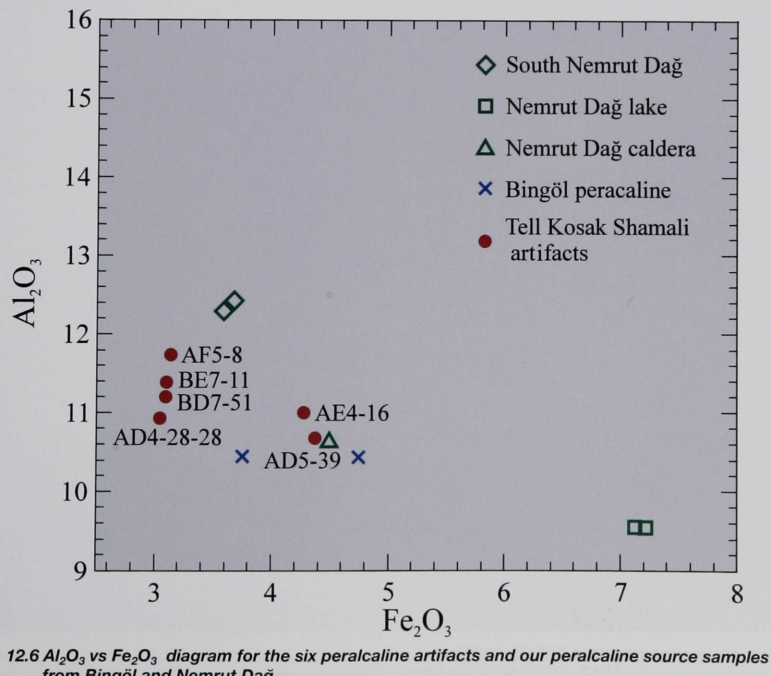


Fig. 12.6 ***Al$_2$O$_3$ vs Fe$_2$O$_3$ diagram for the six peralcaline artifacts and our peralcaline source samples from Bingöl and Nemrut Dağ.***

Chalcolithic smeared stones from Tell Kosak Shamali
Top: Collared smearer (cf. Fig.13.12: 15). Note red pigments at the bottom end.
Bottom: Mortar on slab (cf. Fig.13.18: 3). Note yellowish red pigments in the central depression.

CHAPTER 13

Functional and morphological observations on the Chalcolithic grinding stones from Tell Kosak Shamali

Yoshihiro Nishiaki

13.1 Introduction

Over 2300 grinding stones comprise the collection to be described in this chapter (Table 13.1). Grinding stones of the Near East have received attention from lithic analysts particularly in relation to study of the emergence and developments of food processing in the earlier Neolithic periods. Typological variation is accordingly well defined for the Neolithic grinding stone assemblages (e.g. Wright 1992; Gopher and Orrelle 1997; Mazlowski 1995), but less so for materials of later periods. The detailed databases available for the Chalcolithic grinding stones from the Jazireh or northern Mesopotamia are still limited, and largely confined to those from Iraq (e.g. Furuyama 1970; Jasim 1985). Presentation of the large collection from Tell Kosak Shamali, perhaps one of the largest to have been reported from a Chalcolithic site in North Syria, should be useful to fill this geographical and chronological gap in our knowledge of Chalcolithic grinding stones of the Near East.

In the following, the grinding stones are examined on functional and morphological grounds. It will be shown that the assemblages consist of items utilized for a wide range of activities, not only for grain processing, but also for other activities including notably pottery production. As they were derived from a long sequence from the earliest Northern Ubaid to the Middle Uruk, a preliminary stratigraphic analysis will also be attempted to understand the chronological changes of the grinding stone industries over these periods.

13.2 Method of analysis

Table 13.1 shows a general breakdown of the grinding stone materials by levels. Beside fragmentary pieces unsuitable for detailed analysis, the materials were classified into six major groups. The first group, or the most common one is the handstones, thought to have been used as tools held in hand(s) to grind, polish or pound other materials. The second group, on the other hand, represents stone objects that are considered to have functioned as passive tools or anvils. The third group of stone tools is referred to as miscellaneous objects, consisting of small, well-shaped objects such as polished celts and chisels. Stone beads, ornamental pieces and spindle whorls are excluded, however, since these are dealt with in the chapter of small finds (Chapter 15, this volume). Each of these groups was further subdivided according to their traceological and morphological features.

The fourth group corresponds to a particular kind of stone used as building material, door sockets. The remaining two groups of stones are those with no clear manufacturing traces: pigments and water-worn stones. These are manuports or natural stones brought into the settlement probably by the Chalcolithic people for some use. Pigments are represented by manganese and hematite pebbles, used almost certainly for painting of other materials like pottery and clay objects. The "water-worn stones" represent the rest of the unmodified natural stones. Many of them are small river pebbles with well-polished surfaces probably resulting from non-human agencies. Pebbles with similar polished surfaces are abundantly found in natural conditions on the nearby river banks of the Euphrates and Sarine, or even in fluvial gravel deposits of the terrace on which the mound of Tell Kosak Shamali is situated (Oguchi 2001: 20, Figs. 1.30 and 1.31). The "polish" may also have been caused by human use, but its precise identification was difficult especially on small pebbles. In the present study, all the doubtful stones were grouped into this category.

Table 13.1 Grinding stones from the Chalcolithic levels of Tell Kosak Shamali.

Sector A	Level																		
	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	Later pits	Mixed	Total
Handstones	1	7	34	70	123	56	58	115	48	53	99	37	26	94	14	14	17	8	21	895
Grinders/polishers	(1)	(2)	(16)	(37)	(61)	(15)	(12)	(49)	(19)	(28)	(59)	(16)	(13)	(44)	(4)	(7)	(8)	(3)	(4)	(398)
Smoothers	(0)	(0)	(7)	(8)	(28)	(25)	(25)	(25)	(14)	(8)	(16)	(6)	(5)	(10)	(4)	(1)	(2)	(2)	(12)	(198)
Pounders	(0)	(1)	(2)	(13)	(14)	(5)	(9)	(24)	(9)	(9)	(9)	(7)	(3)	(28)	(6)	(0)	(0)	(0)	(0)	(139)
Pestles	(0)	(1)	(2)	(2)	(4)	(1)	(2)	(4)	(5)	(2)	(7)	(3)	(0)	(4)	(0)	(1)	(4)	(3)	(2)	(47)
Smearers	(0)	(3)	(7)	(10)	(16)	(10)	(10)	(13)	(1)	(6)	(8)	(5)	(5)	(8)	(0)	(5)	(3)	(0)	(3)	(113)
Lower stones	0	2	6	6	20	4	0	19	4	7	3	6	5	18	1	1	0	1	1	104
Grinding slabs	(0)	(0)	(1)	(1)	(5)	(2)	(0)	(5)	(1)	(2)	(0)	(2)	(4)	(3)	(0)	(0)	(0)	(0)	(0)	(26)
Mortars	(0)	(0)	(1)	(1)	(4)	(0)	(0)	(4)	(0)	(1)	(0)	(1)	(1)	(4)	(0)	(0)	(0)	(0)	(0)	(17)
Palettes	(0)	(2)	(3)	(4)	(10)	(2)	(0)	(3)	(2)	(2)	(1)	(3)	(0)	(8)	(1)	(1)	(0)	(1)	(1)	(44)
Others	(0)	(0)	(1)	(0)	(1)	(0)	(0)	(7)	(1)	(2)	(2)	(0)	(0)	(3)	(0)	(0)	(0)	(0)	(0)	(17)
Miscellaneous objects	0	0	1	3	3	1	0	2	0	2	0	2	0	2	0	0	0	0	0	16
Pigments	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	3
Water-worn stones	2	0	11	17	45	35	25	65	14	32	60	56	11	39	3	8	0	5	3	431
Fragments	10	3	11	33	53	22	28	56	29	47	29	11	10	17	9	3	2	3	6	382
Total	13	12	63	129	244	118	111	259	96	141	191	112	52	170	27	26	19	17	31	1831

Sector B	Level										Grand total	%	%	%	%
	7	6	5	4	3	2	1	Later pits	Mixed	Total					
Handstones	28	52	39	29	18	6	14	1	15	202	1097	46.6	88.8	90.4	100.0
Grinders/polishers	(16)	(25)	(20)	(17)	(7)	(2)	(5)	(1)	(5)	(98)	(496)	(21.1)	(40.2)	(40.9)	(45.2)
Smoothers	(8)	(6)	(8)	(9)	(6)	(2)	(5)	(0)	(8)	(52)	(250)	(10.6)	(20.2)	(20.6)	(22.8)
Pounders	(3)	(19)	(10)	(3)	(4)	(2)	(4)	(0)	(1)	(46)	(185)	(7.9)	(15.0)	(15.2)	(16.9)
Pestles	(0)	(2)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(2)	(49)	(2.1)	(4.0)	(4.0)	(4.5)
Smearers	(1)	(0)	(1)	(0)	(1)	(0)	(0)	(0)	(1)	(4)	(117)	(5.0)	(9.5)	(9.6)	(10.7)
Lower stones	0	1	5	2	3	0	1	0	1	13	117	5.0	9.5	9.6	100.0
Grinding slabs	(0)	(1)	(4)	(1)	(0)	(0)	(1)	(0)	(1)	(8)	(34)	(1.4)	(2.8)	(2.8)	(29.1)
Mortars	(0)	(0)	(1)	(0)	(1)	(0)	(0)	(0)	(0)	(2)	(19)	(0.8)	(1.5)	(1.6)	(16.2)
Palettes	(0)	(0)	(0)	(0)	(2)	(0)	(0)	(0)	(0)	(2)	(46)	(2.0)	(3.7)	(3.8)	(39.3)
Others	(0)	(0)	(0)	(1)	(0)	(0)	(0)	(0)	(0)	(1)	(18)	(0.8)	(1.5)	(1.5)	(15.4)
Miscellaneous objects	0	1	2	2	0	0	0	0	0	5	21	0.9	1.7	-	-
Pigments	0	0	1	0	0	1	0	0	0	2	5	0.2	-	-	-
Water-worn stones	13	28	21	13	6	1	6	0	2	90	521	22.1	-	-	-
Fragments	42	57	30	36	13	8	14	2	9	211	593	25.2	-	-	-
Total	83	139	98	82	40	16	35	3	27	523	2354	100.0	100.0	100.0	-

Specimens of the first three groups were subdivided on two levels. They were classified first according to traces such as grinding and pounding wears, and then further divided by their morphological characteristics. The terminology to describe each type and shape followed as far as possible the standard of Wright (1992) proposed for the Neolithic grinding stones of the southern Levant. However, a number of revisions or simplifications were also made to adapt to particular situations encountered for the present collection. Terms such as "grinders" and "smoothers" may indicate their actual use for grinding and smoothing other materials, and "hand" and "lower" stones suggest their use in a pair. However, these were simply employed for the sake of convenience, and there is no intention to claim their actual use as such. It is in fact extremely difficult or even dangerous to specify a particular function of a grinding stone from surface traces or shape alone. There is admittedly a strong possibility that items with similar traceological and morphological features were used for different purposes.

Another point of caution to be made regarding the following concerns the raw material types. Due to reasons, raw material types for the present collection were examined only for a limited number of specimens. Also, the identification was a preliminary one rather than that founded on a rigorous scientific basis. The results shown in Tables 13.2 and 13.3 thus should be understood merely as giving a general impression.

Table 13.2 Raw materials for handstones from the Chalcolithic levels of Tell Kosak Shamali (selected sample).

	Andesite	%	Basalt	%	Flint	%	Limestone	%	Quartzite	%	Sandstone	%	Total	%
Grinders	**34**	16.2	**14**	6.7	**5**	2.4	**59**	28.1	**5**	2.4	**93**	44.3	**210**	100.0
Globular/polishers	22	(16.4)	10	(7.5)	3	(2.2)	31	(23.1)	5	(3.7)	63	(47.0)	134	(100.0)
Spherical	2	(8.7)	0	(0.0)	1	(4.3)	18	(78.3)	0	(0.0)	2	(8.7)	23	(100.0)
Loaf	9	(18.8)	4	(8.3)	0	(0.0)	8	(16.7)	0	(0.0)	27	(56.3)	48	(100.0)
Cylindrical	1	(20.0)	0	(0.0)	1	(20.0)	2	(40.0)	0	(0.0)	1	(20.0)	5	(100.0)
Conical	0	-	0	-	0	-	0	-	0	-	0	-	0	-
Smoothers	**3**	3.4	**0**	0.0	**2**	2.3	**8**	9.1	**0**	0.0	**75**	85.2	**88**	100.0
Discoidal	2	(3.3)	0	(0.0)	2	(3.3)	6	(9.8)	0	(0.0)	51	(83.6)	61	(100.0)
Crescent	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	6	(100.0)	6	(100.0)
Bar-shaped	1	(10.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	9	(90.0)	10	(100.0)
Spatula-shaped	0	(0.0)	0	(0.0)	0	(0.0)	1	(25.0)	0	(0.0)	3	(75.0)	4	(100.0)
Axe-shaped	0	(0.0)	0	(0.0)	0	(0.0)	1	(14.3)	0	(0.0)	6	(85.7)	7	(100.0)
Pounders	**12**	13.5	**27**	30.3	**16**	(18.0)	**11**	12.4	**4**	4.5	**19**	21.3	**89**	100.0
Globular	10	(14.5)	22	(31.9)	6	(8.7)	9	(13.0)	3	(4.3)	19	(27.5)	69	(100.0)
Discoidal	1	(50.0)	0	(0.0)	1	(50.0)	0	(0.0)	0	(0.0)	0	(0.0)	2	(100.0)
Cuboid	1	(5.6)	5	(27.8)	9	(50.0)	2	(11.1)	1	(5.6)	0	(0.0)	18	(100.0)
Pestles	**10**	34.5	**12**	41.4	**0**	0.0	**0**	0.0	**0**	0.0	**7**	24.1	**29**	100.0
Loaf	6	(50.0)	3	(25.0)	0	(0.0)	0	(0.0)	0	(0.0)	3	(25.0)	12	(100.0)
Cylindrical	4	(33.3)	5	(41.7)	0	(0.0)	0	(0.0)	0	(0.0)	3	(25.0)	12	(100.0)
Conical	0	(0.0)	4	(80.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(20.0)	5	(100.0)
Smearers	**24**	24.7	**5**	5.2	**0**	0.0	**12**	12.4	**0**	0.0	**56**	57.7	**97**	100.0
Globular	9	(32.1)	2	(7.1)	0	(0.0)	3	(10.7)	0	(0.0)	14	(50.0)	28	(100.0)
Spherical	0	(0.0)	0	(0.0)	0	(0.0)	7	(77.8)	0	(0.0)	2	(22.2)	9	(100.0)
Discoidal	8	(44.4)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	10	(55.6)	18	(100.0)
Collared	0	(0.0)	1	(100.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(100.0)
Loaf	5	(14.7)	2	(5.9)	0	(0.0)	1	(2.9)	0	(0.0)	26	(76.5)	34	(100.0)
Bar-shaped	2	(66.7)	0	(0.0)	0	(0.0)	1	(33.3)	0	(0.0)	0	(0.0)	3	(100.0)
Spatula-shaped	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	4	(100.0)	4	(100.0)
Total	**83**	16.5	**58**	11.5	23	4.6	**90**	17.9	9	1.8	**250**	49.6	**504**	100.0

13.3 Description of the materials

13.3.1 Handstones

These comprise the largest group of ground stone artifacts from Tell Kosak Shamali (1097 pieces). Nearly half of the total sample belongs to this group (46.8%; Table 13.1; also see Tables 13.8, 13.10, 13.12, 13.14, and 13.16). In terms of secondary wear visible to the naked eye, this group is divided into grinders/polishers (45.2%), smoothers (22.8%), pounders (16.9%), pestles (4.5%), and smearers (10.7%). When combined traces of wear are observed on a single specimen, the more dominant one was adopted as a marker for classification.

The shape of these handstones is indeed varied, reflecting a number of factors including the shape of the original blank and the use/manufacture processes. There is even a possibility that their function changed during the course of repeated use. The shape often shows a continuous spectrum of changes, from round to oval in plan, and from lens-shaped, plano-convex to circular in section, for instance. As a clear-cut normative division seemed impractical, a schematic system using metric criteria was developed for morphological classification. As shown in Table 13.4, handstones were classed into four major groups according to the ratios of length to width (L/W) and width to thickness (W/T), determined from the measurements of all the complete specimens. Each group was then divided by their particular shape, the definition of which will be explained

Table 13.3 Raw materials for lower stones from the Chalcolithic levels of Tell Kosak Shamali (selected sample).

	Andesite	%	Basalt	%	Flint	%	Limestone	%	Quartzite	%	Sandstone	%	Total	%
Grinding slabs	**0**	0.0	**18**	69.2	**0**	0.0	**4**	15.4	**0**	0.0	**4**	15.4	**26**	100.0
Circular, concave	0	(0.0)	13	(72.2)	0	-	2	(11.1)	0	-	3	(16.7)	18	(100.0)
Circular, convex	0	(0.0)	4	(66.7)	0	-	2	(33.3)	0	-	0	(0.0)	6	(100.0)
Oblong, concave	0	(0.0)	1	(50.0)	0	-	0	(0.0)	0	-	1	(50.0)	2	(100.0)
Mortars	**2**	15.4	**6**	46.2	**0**	0.0	**5**	38.5	**0**	0.0	**0**	0.0	**13**	100.0
Pitted, pebble	2	(28.6)	2	(28.6)	0	-	2	(28.6)	0	-	1	(14.3)	7	(100.0)
Pitted, slab	0	(0.0)	2	(50.0)	0	-	2	(50.0)	0	-	0	(0.0)	4	(100.0)
Multi-pitted, slab	0	(0.0)	0	(0.0)	0	-	1	(100.0)	0	-	0	(0.0)	1	(100.0)
Hollowed	0	(0.0)	3	(75.0)	0	-	1	(25.0)	0	-	0	(0.0)	4	100.0
Cylindrical	0	(0.0)	1	(50.0)	0	-	1	(50.0)	0	-	0	(0.0)	2	(100.0)
Palettes	2	6.5	**0**	0.0	**0**	0.0	**0**	0.0	**0**	0.0	**29**	93.5	**31**	100.0
Edged	1	(12.5)	0	(0.0)	0	-	0	(0.0)	0	-	7	(87.5)	8	(100.0)
Non-edged	1	(4.3)	0	(0.0)	0	-	0	(0.0)	0	-	22	(95.7)	23	(100.0)
Others	**0**	0.0	**2**	11.1	**0**	0.0	**14**	77.8	**0**	0.0	**2**	11.1	**18**	100.0
Incised	0	(0.0)	0	(0.0)	0	-	1	(100.0)	0	-	0	(0.0)	1	100.0
Slab abrader/palette	0	(0.0)	0	(0.0)	0	-	0	(0.0)	0	-	2	(100.0)	2	(100.0)
Anvil	0	(0.0)	2	(20.0)	0	-	8	(80.0)	0	-	0	(0.0)	10	(100.0)
Table	0	(0.0)	0	(0.0)	0	-	5	(100.0)	0	-	0	(0.0)	5	(100.0)
Total	4	5.6	**24**	33.8	**0**	0.0	**10**	14.1	**0**	0.0	**33**	46.5	**71**	100.0

Table 13.4 Classification scheme for grinding stones from Tell Kosak Shamali.

	W/T < 2.5 (Thick)	W/T ≧ 2.5 (Thin)
L/W < 2.0 (Short)	Globular Spherical Cuboid Collared	Discoidal Crescent
L/W ≧ 2.0 (Long)	Cylindrical Conical Loaf	Bar Spatula

below. This system for morphological classification is applied to all the functional groups of handstones.

(1) Grinders/polishers

This category consists of thick handstones (W/T < 2.5) with grinding or polishing traces on at least one wide area. The traces may have been derived not only from tool use but also from initial shaping of the objects themselves. The traces are distributed mostly on limited areas of the surface, but are occasionally seen on the whole surfaces. The exact uses or materials actually ground or polished with these tools are yet unknown. Nearly half of the handstones were classed into grinders (45.2%; 496/1097; Table 13.1), for which the following five morphological types were identified. Globular and spherical types represent relatively short pieces (L/W < 2.0), while loaf, cylindrical and conical types are longer (L/W ≧ 2.0).

Globular type (Fig. 13.1; Pl. 13.1: 2-4)

This type, the most common one in the present collection throughout the periods (70.0%; 338/483; Table 13.5), refers to grinders having a length/width ratio smaller than 2.0, and a width/thickness ratio smaller than 2.5. The overall shape is short and thick, hence termed globular. In principle, the ground facet(s) are visible on a wide and relatively flat area rather than at an edge or end of the object (Fig. 13.1). About one-third of the total have a plano-convex transverse section. Some of the specimens also show signs of battering, from either manufacture or use (Fig. 13.1: 1 and 2). Occasionally, a limited amount of flaking was applied to modify the original tool blank (Fig. 13.1: 6).

The maximum diameter varies from less than 5cm to nearly 20cm. The largest example measures 18.5cm x 16.2cm x 13.8cm (Fig. 13.1: 4).

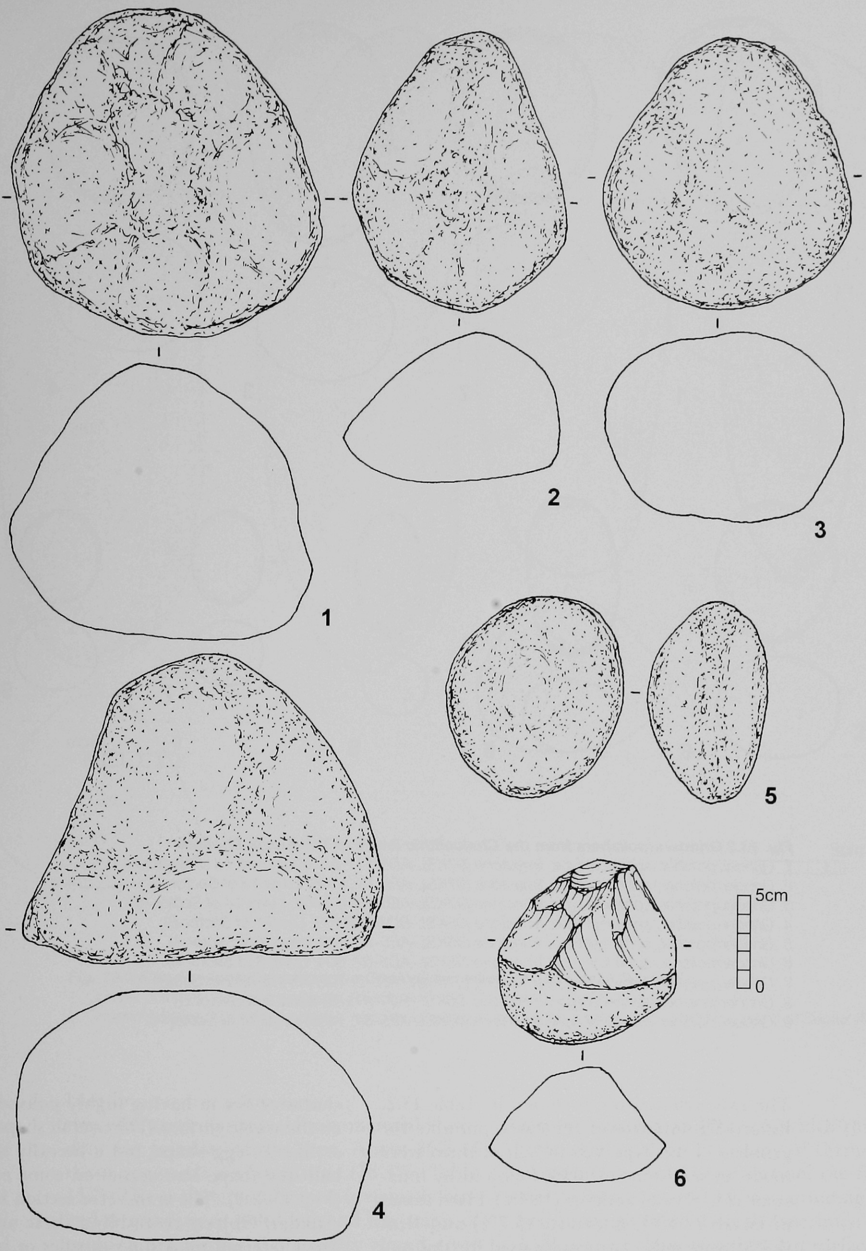


Fig. 13.1 Grinders/polishers from the Chalcolithic levels of Tell Kosak Shamali.
1. Grinder/polisher, globular type, basalt (96KSL-AE4-16-2+3; 10A08; Level 10 of Sector A).
2. Grinder/polisher, globular type, basalt (97KSL-AE5-51-9; 1305; Level 13 of Sector A).
3. Grinder/polisher, globular type, andesite (96KSL-AE4-14-8; 10A01; Level 10 of Sector A).
4. Grinder/polisher, globular type, basalt (96KSL-AE4-14-50; 10A01; Level 10 of Sector A).
5. Grinder/polisher, globular type, andesite (96KSL-BD7-48-3; B504; Level 5 of Sector B).
6. Grinder/polisher, globular type, andesite, flaked (96KSL-AD6-4; Fill; Level 2 of Sector A).

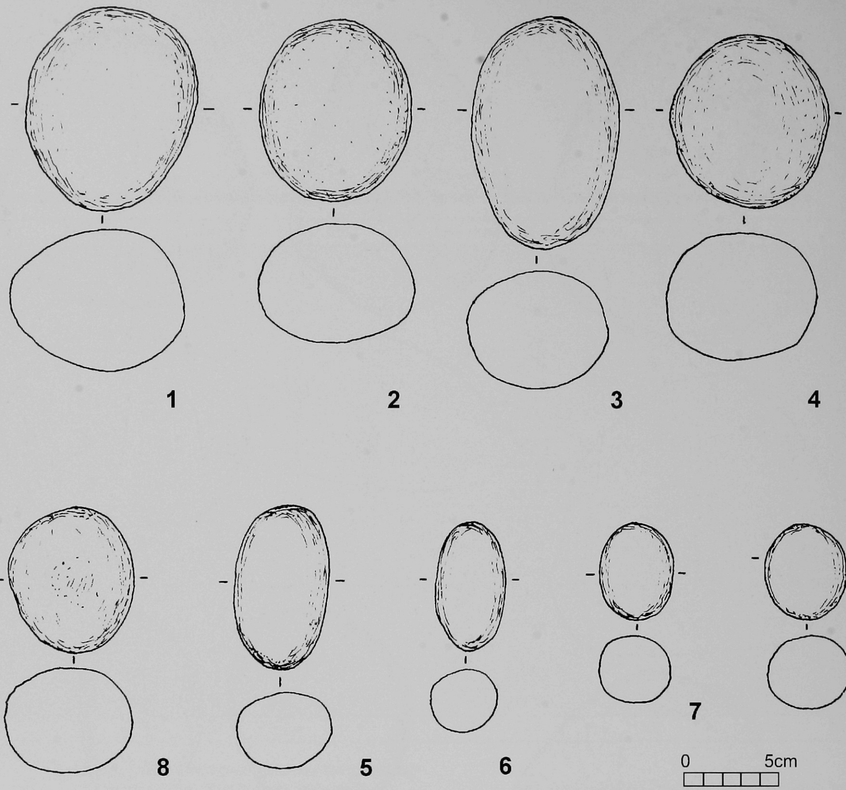


Fig. 13.2 Grinders/polishers from the Chalcolithic levels of Tell Kosak Shamali.
1. Grinder/polisher, spherical type, limestone (97KSL-AD5-117-5; 1304; Level 13 of Sector A).
2. Grinder/polisher, spherical type, limestone (97KSL-AF5-15; 1306; Level 13 of Sector A).
3. Grinder/polisher, spherical type, limestone (97KSL-AE5-53-4; 1406; Level 14 of Sector A).
4. Grinder/polisher, spherical type, limestone (95KSL-BD7-8; B103; Level 1 of Sector B).
5. Grinder/polisher, spherical type, limestone (95KSL-AE5-11; 709; Level 7 of Sector A).
6. Grinder/polisher, spherical type, limestone (95KSL-AD5-62; 604; Level 6 of Sector A).
7. Grinder/polisher, spherical type, limestone (945KSL-AE5-2; 706/707; Level 7 of Sector A).
8. Grinder/polisher, spherical type, limestone (96KSL-BD7-41; Fill; Level 5 of Sector B).
9. Grinder/polisher, spherical type, limestone (97KSL-AE5-53; 1406; Level 14 of Sector A).

The raw material use is shown in Table 13.2. Relatively soft stones are more popular for grinders of this type. About half of them were made on sandstone (47.0%), followed by limestone (23.1%) and andesite (16.4%). Hard stones of basalt (7.5%), quartzite (3.7%) and flint (2.2%) were only occasionally used for this tool category.

Spherical type (Fig. 13.2; Pl. 13.1: 1)

Grinders/polishers of this type are much rarer than the globular pieces, occupying only 4.8% of the handstone collection (23/483; Table 13.5). While the metric proportion falls in the range of the globular pieces, their distinguishing character lies in having highly polished traces on the whole surface. The overall shape is rather like an egg-shape, but a literally spherical ball-like shape also occurs on some examples (Fig. 13.2: 9). The transverse section is mostly circular. Objects resembling these are sometimes referred to as sling missiles or bolas (Jasim 1985: 83-84). However, the polishing traces may also have come from use rather than manufacturing. As mentioned below, some stones with a spherical shape clearly retain traces of pigment residues from use.

The maximum length or diameter is between 2.8cm to 9.4cm, and the average is 5.2cm. Selec-

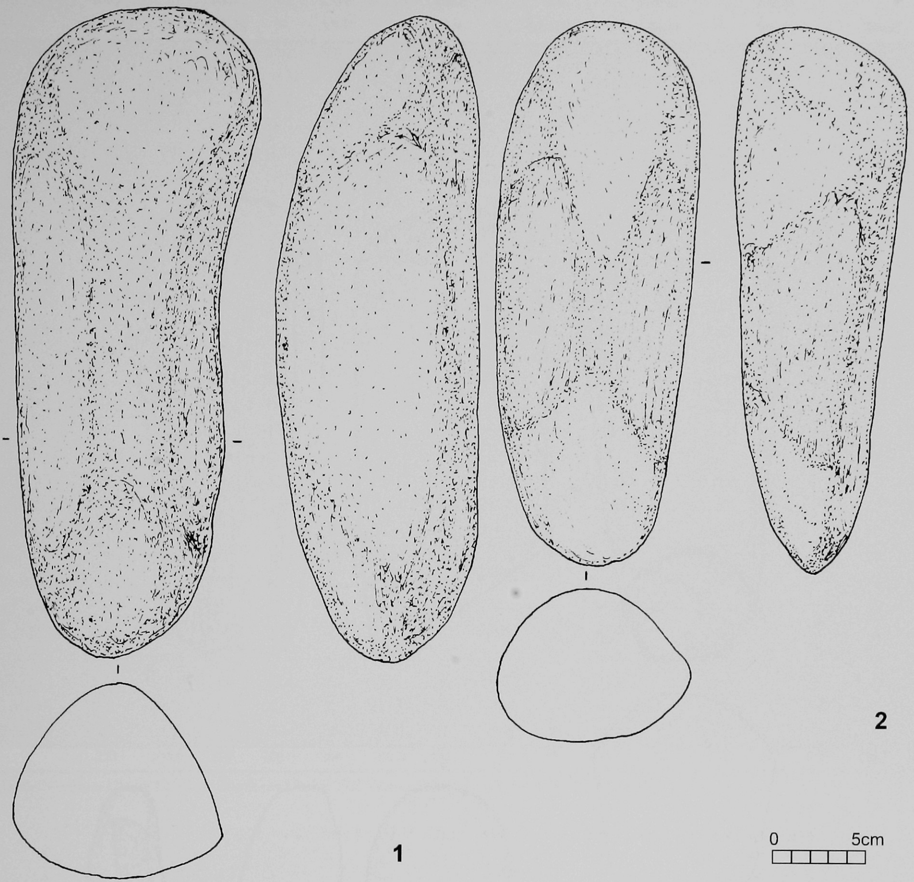


Fig. 13.3 Grinders/polishers from the Chalcolithic levels of Tell Kosak Shamali.
1. Grinder/polisher, loaf type, andesite (95KSL-AF5-21; 1501; Level 15 of Sector A).
2. Grinder/polisher, loaf type, andesite, hand-held wears at both ends (96KSL-AE5-14; 818; Level 8 of Sector A).

tion of a particular type of raw material is evident for grinders of this type. About 80% of them are made on limestone (78.3%; Table 13.2). The surface modification is virtually limited to grinding or polishing, and few traces of pecking are visible. Apparently round river pebbles served as the main source of the blanks.

Loaf type (Figs. 13.3 & 13.4; Pl. 13.1: 5-8)

Loaf-type grinders/polishers, representing a relatively elongated version of the globular grinders, are the second most common type in the assemblage (24.0%; 116/483; Table 13.5). They have a length/width ratio equal to or larger than 2.0, and have a width/thickness ratio smaller than 2.5. Many of them have a plano-convex transverse section, the flat surface of which retains traces of grinding and/or polishing. As evident on the specimen of Fig. 13.3: 2, some show heavily worn surfaces close to both ends, most likely due to hand manipulation. The striations on the use-surface suggest that they were mostly used in a motion perpendicular to the longer axis. Specimens indicating use on the longer axis are rarely encountered. An example of the latter is a unique specimen that has use-surfaces on the sides as well as the bottom (Fig. 13.4: 1). Its general shape resem-

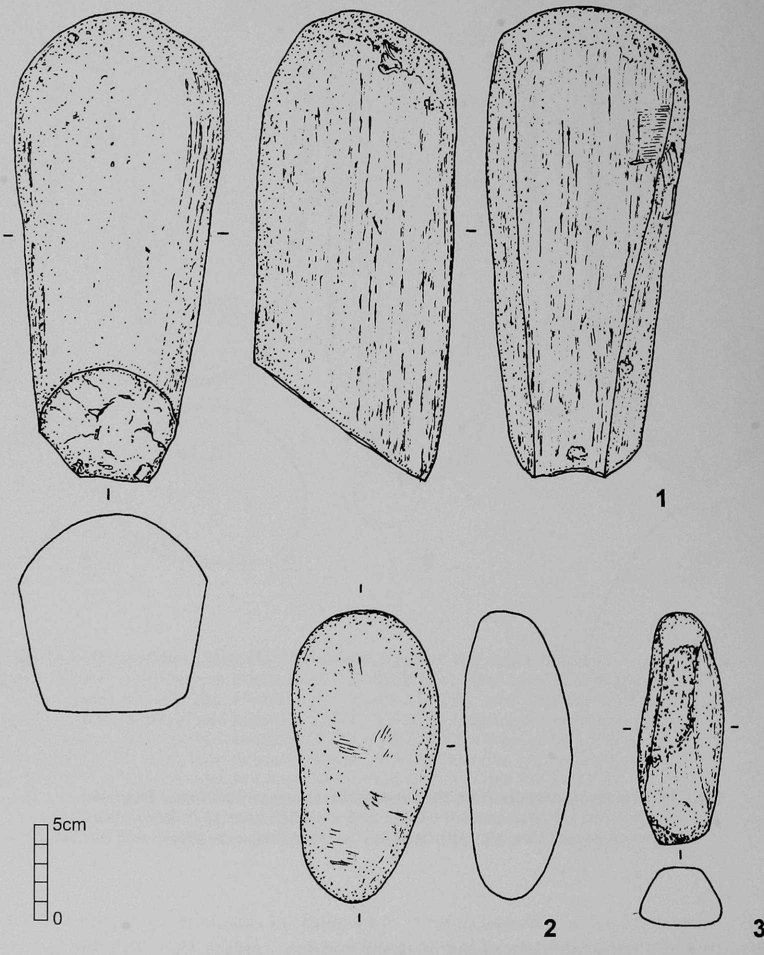


Fig. 13.4 Grinders/polishers from the Chalcolithic levels of Tell Kosak Shamali.
1. Grinder/polisher, loaf type, limestone, longitudinal striations on the sides and the back, shoe-shaped? (95KSL-AE5-6; 709; Level 7 of Sector A).
2. Grinder/polisher, loaf type, andesite (96KSL-AE4-14-38; 10A01; Level 10 of Sector A).
3. Grinder/polisher, loaf type, andesite, battered signs on the upper surface (97KSL-AE5-53-21; 1406; Level 14 of Sector A).

Table 13.5 Handstones from the Chalcolithic levels of Tell Kosak Shamali.

Type	EU1*		EU2		LU1		LU2		TU		PU		Uruk			
	A17-13	%	A12-10	%	A9-7	%	A6-4	%	A3-1/B7	%	B6-5	%	B4-1	%	Total	%
Grinders/polishers	**117**	49.8	**76**	33.2	**106**	53.0	**73**	46.5	**35**	47.9	**45**	49.5	**31**	46.3	**483**	45.9
Globular	81	(69.2)	46	(60.5)	77	(72.6)	44	(60.3)	26	(74.3)	34	(75.6)	30	(96.8)	338	(70.0)
Spherical	5	(4.3)	4	(5.3)	6	(5.7)	8	(11.0)	0	(0.0)	0	(0.0)	0	(0.0)	23	(4.8)
Loaf	28	(23.9)	25	(32.9)	22	(20.8)	20	(27.4)	9	(25.7)	11	(24.4)	1	(3.2)	116	(24.0)
Cylindrical	3	(2.6)	1	(1.3)	1	(0.9)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	5	(1.0)
Conical	0	(0.0)	0	(0.0)	0	(0.0)	1	(1.4)	0	(0.0)	0	(0.0)	0	(0.0)	1	(0.2)
Smoothers	**43**	18.3	**75**	32.8	**38**	19.0	**21**	13.4	**15**	20.5	**14**	15.4	**22**	32.8	**228**	21.7
Discoidal	32	(74.4)	61	(81.3)	27	(71.1)	17	(81.0)	11	(73.3)	12	(85.7)	13	(59.1)	173	(75.9)
Crescent	2	(4.7)	3	(4.0)	1	(2.6)	2	(9.5)	1	(6.7)	0	(0.0)	1	(4.5)	10	(4.4)
Bar-shaped	7	(16.3)	9	(12.0)	7	(18.4)	2	(9.5)	2	(13.3)	2	(14.3)	5	(22.7)	34	(14.9)
Spatula-shaped	0	(0.0)	1	(1.3)	1	(2.6)	0	(0.0)	1	(6.7)	0	(0.0)	1	(4.5)	4	(1.8)
Axe-shaped	2	(4.7)	1	(1.3)	2	(5.3)	0	(0.0)	0	(0.0)	0	(0.0)	2	(9.1)	7	(3.1)
Pounders	**30**	12.8	**38**	16.6	**27**	13.5	**38**	24.2	**9**	12.3	**29**	31.9	**13**	19.4	**184**	17.5
Globular	22	(73.3)	31	(81.6)	22	(81.5)	31	(81.6)	9	(100.0)	27	(93.1)	12	(92.3)	154	(83.7)
Discoidal	1	(3.3)	2	(5.3)	1	(3.7)	2	(5.3)	0	(0.0)	2	(6.9)	0	(0.0)	8	(4.3)
Cuboid	7	(23.3)	5	(13.2)	4	(14.8)	5	(13.2)	0	(0.0)	0	(0.0)	1	(7.7)	22	(12.0)
Pestles	**9**	3.8	7	3.1	**14**	7.0	**7**	4.5	**5**	6.8	**2**	2.2	**0**	0.0	**44**	4.2
Loaf	7	(77.8)	3	(42.9)	12	(85.7)	2	(28.6)	3	(60.0)	2	(100.0)	0	-	29	(65.9)
Cylindrical	1	(11.1)	2	(28.6)	2	(14.3)	4	(57.1)	1	(20.0)	0	(0.0)	0	-	10	(22.7)
Conical	1	(11.1)	2	(28.6)	0	(0.0)	1	(14.3)	1	(20.0)	0	(0.0)	0	-	5	(11.4)
Smearers	**36**	15.3	**33**	14.4	**15**	7.5	**18**	11.5	**9**	12.3	**1**	1.1	**1**	1.5	**113**	10.7
Globular	10	(27.8)	10	(30.3)	2	(13.3)	9	(50.0)	2	(22.2)	0	(0.0)	0	(0.0)	33	(29.2)
Spherical	0	(0.0)	1	(3.0)	1	(6.7)	4	(22.2)	4	(44.4)	0	(0.0)	0	(0.0)	10	(8.8)
Collared	0	(0.0)	0	(0.0)	1	(6.7)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(0.9)
Discoidal	2	(5.6)	7	(21.2)	0	(0.0)	2	(11.1)	0	(0.0)	0	(0.0)	0	(0.0)	11	(9.7)
Loaf	21	(58.3)	13	(39.4)	8	(53.3)	3	(16.7)	3	(33.3)	0	(0.0)	1	(100.0)	49	(43.4)
Bar-shaped	0	(0.0)	2	(6.1)	2	(13.3)	0	(0.0)	0	(0.0)	1	(100.0)	0	(0.0)	5	(4.4)
Spatula-shaped	3	(8.3)	0	(0.0)	1	(6.7)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	4	(3.5)
Total	**235**	100.0	**229**	100.0	**200**	100.0	**157**	100.0	**73**	100.0	**91**	100.0	**67**	100.0	**1052**	100.0

* EU: Early Northern Ubaid; LU: Late Northern Ubaid; TU: Terminal Northern Ubaid; PU: Post-Ubaid

bles that of the shoe-shaped limestone object reported from Tell al-'Abr (Fig. 5: 10 in Yamazaki 1999), but this specimen is much larger, 24.3cm long, 10.3cm wide, and 10.6cm high.

Although many of the loaf type grinders/polishers are smaller than 10cm long, some reach to over 30cm (Fig. 13.3: 1). This probably indicates that these stones do not represent a single functional type, but were used for diversified purposes. The pattern of raw material use very much parallels that of the globular grinders/polishers (Table 13.2); sandstone cobbles were used for about half (56.3%). Andesite (18.8%) and limestone (16.7%) were also used but in a far smaller frequency. Basalt was only occasionally utilized (8.3%).

Cylindrical type

The metric proportion of grinders/polishers of this type also matches that of the loaf-shaped pieces, but they have a cylindrical transverse section. They are very rare in the present collection (1.0%; 5/483; Table 13.5). Again the length is diversified, from 5.5cm to 24.3cm long. Limestone, flint and andesite were the raw materials (Table 13.2).

Conical type

This represents an even rarer type of grinders/polishers. Only one piece occurs in the present handstone collection (0.2%; 1/483; Table 13.5). It is an oblong stone, 12.5cm long and 7.3cm wide, with one end tapered. Its metric proportions fall in the range of the loaf-shaped pieces.

(2) Smoothers

Handstones referred to as smoothers are relatively thin and flat stones ($W/T \geqq 2.5$) with grinding/polishing traces. Unlike the grinders/polishers defined above, however, many of them have use traces at the periphery of the body. The traces are often distributed either on one or two sides, or around all the edges. In addition, regardless of their position, the striations often run perpendicular to the main surface, suggesting that many of these tools were used for smoothing or scraping some other materials.

About one-fifth of the handstones belong to this category (21.7%; 228/1052; Table 13.5). Morphologically, five sub-types were defined. Discoidal, crescent-shaped and axe-shaped pieces have a relatively short plan (L/W $<$ 2.0), and bar- and spatula-shaped pieces represent a more elongated one (L/W $\geqq$ 2.0).

Discoidal type (Fig. 13.5; Pl. 13.2: 1-3)

Smoothers with a round shape are termed the discoidal type. They have a length/width ratio smaller than 2.0, and have a width/thickness ratio equal to or larger than 2.5. The transverse section is generally flattened-oval or lens-shaped, but some have steep sides due to heavy use (Fig. 13.5: 9). This is the most common type of smoothers at Tell Kosak Shamali (75.9%; 173/228; Table 13.5). The diameter shows a relatively small range of 4.5cm to 13.2cm, and its average is 6.6cm. Sandstone was predominantly used for this type (83.6%; Table 13.2). Comparable specimens also made of sandstone are known at Tell Abada, where they were described as "sandstone abraders" and "stone discs" (Jasim 1985: 77).

Crescent-shaped type (Fig. 13.6: 2 & 7; Pl. 13.2: 4-6)

This type has the same metric proportion to that of discoidal pieces, but is distinguished by its asymmetrical plan: one side is round with the other side rather straight. The use-traces remain on the round side. There are only 10 specimens of this type in all the smoothers (4.4%; 10/228; Table 13.5). Seven of them are on natural river pebbles, but the other three are modified into the crescent-shape by intentional flaking (Fig. 13.6: 5-7). The flaking was applied unifacially to the blank so as to create a chopper-like edge, but it was probably intended for backing since the edge is obviously too dull and steep to serve a cutting edge.

The size of the crescent-shaped specimens is between 5.3cm x 3.7cm x 1.5cm and 13.4cm x 7.6cm x 3.9cm. The size and the general shape are both reminiscent of crescent-shaped clay scrapers, interpreted as potter's ribs (Chapter 15, this volume). All the crescent-shaped specimens in the sample are on sandstone (Table 13.2).

Bar-shaped type (Fig. 13.6: 1; Pl. 13.2: 8)

Those belonging to this type are handstones with a length/width ratio equal to or larger than 2.0, and a width/thickness ratio equal to or larger than 2.5. The plan is symmetric oval to rectangular, and their corners are round. Parallels are found at Tell Abada, referred to as "flat handstones" (Jasim 1985: 77). The smoother collection includes 34 specimens of this type (14.9%; 34/228; Table 13.5). Their length is between 5.5cm and 17.4cm, and the average is 9.2cm. The use-traces show a limited distribution at one or both sides closer to one end. They run perpendicularly to the main surface (Fig. 13.6: 1). Like the other smoothers, sandstone is predominantly used for this type (90.0%; Table 13.2).

Spatula-shaped type (Fig. 13.6: 8-10; Pl. 13.2: 7 & 9)

This type represents a variety of flat bar-shaped specimens, whose horizontal plan is asymmetric. The use-traces are observed at one end to the lateral edges of the round side. Only four specimens are present (1.8%; 4/228). They are slightly larger than the other smoothers, 7.8cm to 16.3cm long. Three have an elongated bow-like shape (Fig. 13.6: 8 and 9), and the other shows a narrow fan-like shape (Fig. 13.6: 10). One of the bow-like specimens retains flake scars at both ends (Fig. 13.6: 9), which seem to be intentional retouch to produce this distinct shape. It was defined as a potter's tool in a preliminary report of the Tell Kosak Shamali excavations (Fig. 5: 6 in Matsutani and Nishiaki 1995). Sandstone and limestone are the raw materials for smoothers of this type (Table 13.2).

Axe-shaped type (Fig. 13.7; Pl. 13.9: 7-9)

Smoothers of this type resemble polished celts (see below) in plan, but have no sharp working edge. Instead, they have a dull ground edge at the broader end. These may include unfinished celts. This is especially possible for the two pieces made on gabbro (Fig. 13.7: 1-3), the raw material commonly used for celts. However, their edge is clearly ground or steeply polished, on which striations or possible use-wear are

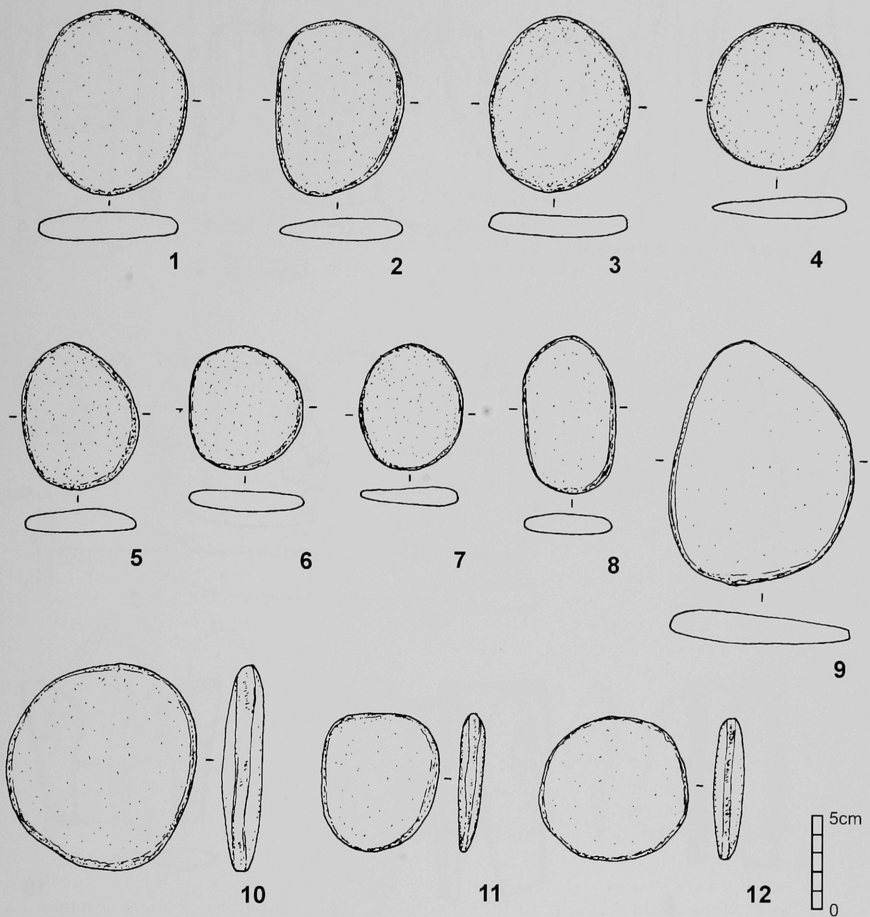


Fig. 13.5 Smoothers from the Chalcolithic levels of Tell Kosak Shamali.
1. Smoother, discoidal type, sandstone (97KSL-AE5-42; 12A06; Level 12 of Sector A).
2. Smoother, discoidal type, sandstone (97KSL-AE4-23; 1101; Level 11 of Sector A).
3. Smoother, discoidal type, sandstone (95KSL-AF6-7; 1504; Level 15 of Sector A).
4. Smoother, discoidal type, sandstone (95KSL-AF5-2; 706/707; Level 7 of Sector A).
5. Smoother, discoidal type, sandstone (975KSL-AE5-30/31; 1102; Level 11 of Sector A).
6. Smoother, discoidal type, sandstone (97KSL-AE5-20-11; 10A02; Level 10 of Sector A).
7. Smoother, discoidal type, limestone (94KSL-AD4-2; 101; Level 1 of Sector A).
8. Smoother, discoidal type, sandstone (97KSL-AD4-20; 1101; Level 11 of Sector A).
9. Smoother, discoidal type, gabbro (97KSL-AD4-50-1; 1303; Level 13 of Sector A).
10. Smoother, discoidal type, sandstone (96KSL-BD7-46-14; B504; Level 5 of Sector B).
11. Smoother, discoidal type, sandstone (96KSL-AD5-93; 1006; Level 10 of Sector A).
12. Smoother, discoidal type, sandstone (96KSL-BE6-15; B502; Level 5 of Sector B).

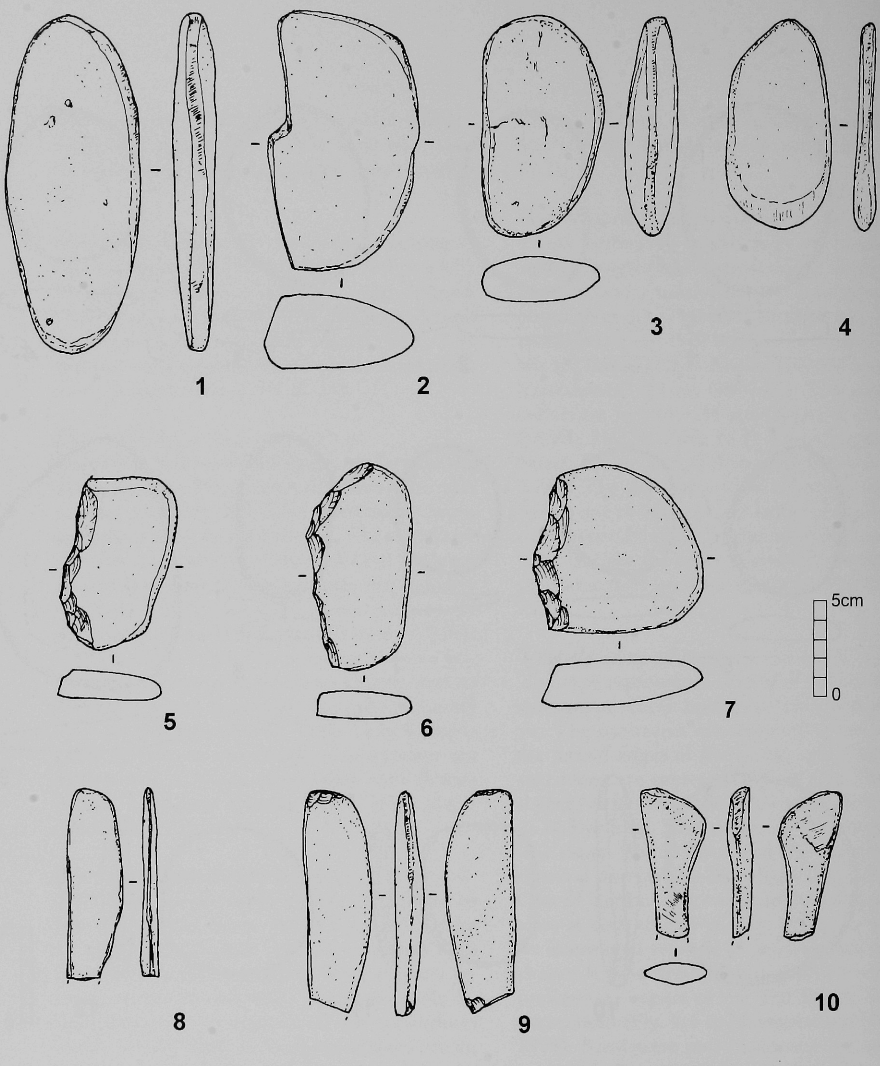


Fig. 13.6 Smoothers from the Chalcolithic levels of Tell Kosak Shamali.

1. Smoother, bar-shaped type, sandstone (97KSL-AF5-15; 1306; Level 13 of Sector A).
2. Smoother, crescent-shaped type, sandstone (97KSL-AD5-117-13; 1304; Level 13 of Sector A).
3. Smoother, crescent-shaped type, sandstone (97KSL-AD5-105; 12A02; Level 12 of Sector A).
4. Smoother, crescent-shaped type, sandstone (96KSL-AE4-14-323; 10A01; Level 10 of Sector A).
5. Smoother, crescent-shaped type, sandstone, flaked (96KSL-AF6-9; 903; Level 9 of Sector A).
6. Smoother, crescent-shaped type, sandstone, flaked (94KSL-B10-6; B701; Level 7 of Sector B).
7. Smoother, crescent-shaped type, sandstone, flaked (95KSL-BD7-TS; Topsoil; Sector B).
8. Smoother, spatula-shaped type, sandstone (96KSL-AE3-17; Fill; Level 10 of Sector A).
9. Smoother, spatula-shaped type, sandstone (94KSL-C10-4; Fill; Level 12 of Sector A).
10. Smoother, spatula-shaped type, limestone (96KSL-BD7-21; B302; Level 3 of Sector B).

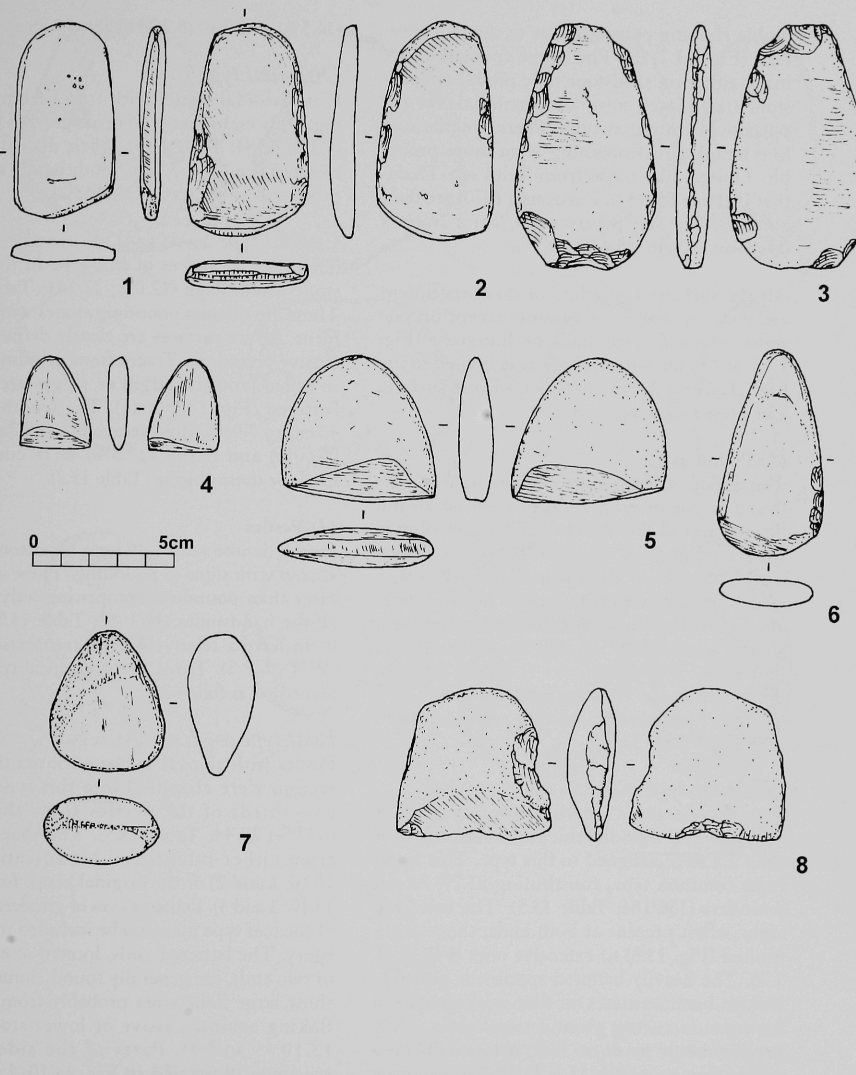


Fig. 13.7 Smoothers from the Chalcolithic levels of Tell Kosak Shamali.

1. Smoother, axe-shaped type, gabbro (97KSL-AE5-52; Fill; Level 14 of Sector A).
2. Smoother, axe-shaped type, gabbro (97KSL-AE5-42; 12A06; Level 12 of Sector A).
3. Smoother, axe-shaped type, gabbro, unfinished celt? (96KSL-AE6-3; Fill; Level 8 of Sector A).
4. Smoother, axe-shaped type, sandstone (97KSL-AD4-30; 806; Level 8 of Sector A).
5. Smoother, axe-shaped type, sandstone (97KSL-AD5-81; 901; Level 9 of Sector A).
6. Smoother, axe-shaped type, sandstone (97KSL-AF6-1; Mixed; Later pit of Sector A).
7. Smoother, axe-shaped type, sandstone (96KSL-BE7-15; Fill; Level 4 of Sector B).
8. Smoother, axe-shaped type, limestone, atypical one with notches (96KSL-BD7-39; Fill; Level 4 of Sector B).

visible running perpendicular to the main surface (Fig. 13.7: 2). The other specimens are made either on sandstone (five pieces) or limestone (one piece), unsuitable materials for the purpose of cutting as celts. Therefore, the uses like scraping or smoothing seem more probable. Objects like those from Telul eth-Thalathat II (Plate 85: 15 in Furuyama 1970) are their parallels. The size is between 3.2cm x 2.5cm x 0.7cm and 8.4cm x 5.4cm x 1.1cm.

All the surfaces and edges of these specimens are neatly polished or ground except on one rather atypical piece made on limestone (Fig. 13.7: 8). On the latter, polishing is limited to the part closer to the broader end of one surface, and a few notches are made.

(3) Pounders

This group of handstones exhibits signs of battering at one or both ends, or even on all the flat surfaces of the object. Vertical pounding is suggested as their most probable use. They could have been used together with lower stones, or as hammers to process other materials. Following the conventional terminology, shorter pieces (L/W $<$ 2.0) are designated as pounders. Elongated ones (L/W $\geqq$ 2.0) are dealt with in the next section as pestles. 17.5% of the handstones belong to pounders (184/1052; Table 13.5).

Globular type (Figs. 13.8 & 13.9: 1-7; Pl. 13.3: 5)

Pounders having a length/width ratio smaller than 2.0 and a width/thickness ratio smaller than 2.5 were assigned to this type. This is the most common type, constituting 83.7% of the pounders (154/184; Table 13.5). The battering signs, often present at both ends, range from limited (Fig. 13.8) to extensive ones (Fig. 13.9: 1-7). The heavily battered specimens probably include hammerstones for flint workng or even for manufacturing ground stone tools. They are commonly made on flint, occasionally on a reused flint core (Fig. 13.9: 3). Flaked chopper-like examples also exist (Fig. 13.9: 5-7).

The diameter of globular pounders tends to concentrate around 6cm to 8 cm, with an average of 7.9cm. The raw materials commonly used for globular pounders are basalt (31.9%) and sandstone (27.5%), followed by andesite (14.5%) and flint (8.7%) (Table 13.2).

Discoidal type

Flat discoidal stones with traces from pounding. Only eight pieces were assigned to this type (4.3%; 8/184; Table 13.5). Their diameter is between 5.0cm and 7.5cm. Both basalt and flint pebbles were utilized (Table 13.2).

Cuboid type (Fig. 13.9: 8-11; Pl. 13.3: 1 & 2)

There are 22 pieces of this type in the handstone assemblage (12.0%; 22/184; Table 13.5). These are distinct pounding stones with a cubic form. All six surfaces are clearly defined by intensive pounding. Traces from grinding are also noted, and the edges or ridges are heavily battered (Fig. 13.9: 8-11). The length is from 4.7cm to 7.9cm, the average being 5.7cm. Flint (50.0%) and basalt (27.8%) were commonly used for these objects (Table 13.2).

(4) Pestles

Pestles denote relatively long handstones (L/W $\geqq$ 2.0) with signs of pounding. These are much rarer than pounders, comprising only 4.2% of all the handstones (44/1052; Table 13.5). All of them have a relatively thick transverse section (W/T $<$ 2.5). Three morphological types were identified as follows.

Loaf type (Fig. 13.10: 1-4; Pl. 13.3: 6-9)

Pestles with an oval to plano-convex transverse section were classified into this type. About two-thirds of the pestles show this shape (65.9%; 29/44; Table 13.5). The shape results from either intentional modification (Fig. 13.10: 1 and 2) or the original blank forms (Fig. 13.10: 3 and 4). Reused pieces of grinders/polishers of the loaf type may also be included in this category. The battered ends, located at either one or two ends, are generally round. Some of them show large flake scars probably from counter-flaking against passive or lower stones (Fig. 13.10: 3 and 4). Parts of the sides of the specimen illustrated in Fig. 13.10: 1 are well-worn most likely by holding with the hands.

These pestles are 7.2cm to 21.1cm long and 2.7cm to 8.0cm wide. The average size is 13.1cm x 5.2cm. The raw material use is more or less similar to that for pounders, but flint, limestone and quartzite were absent from the

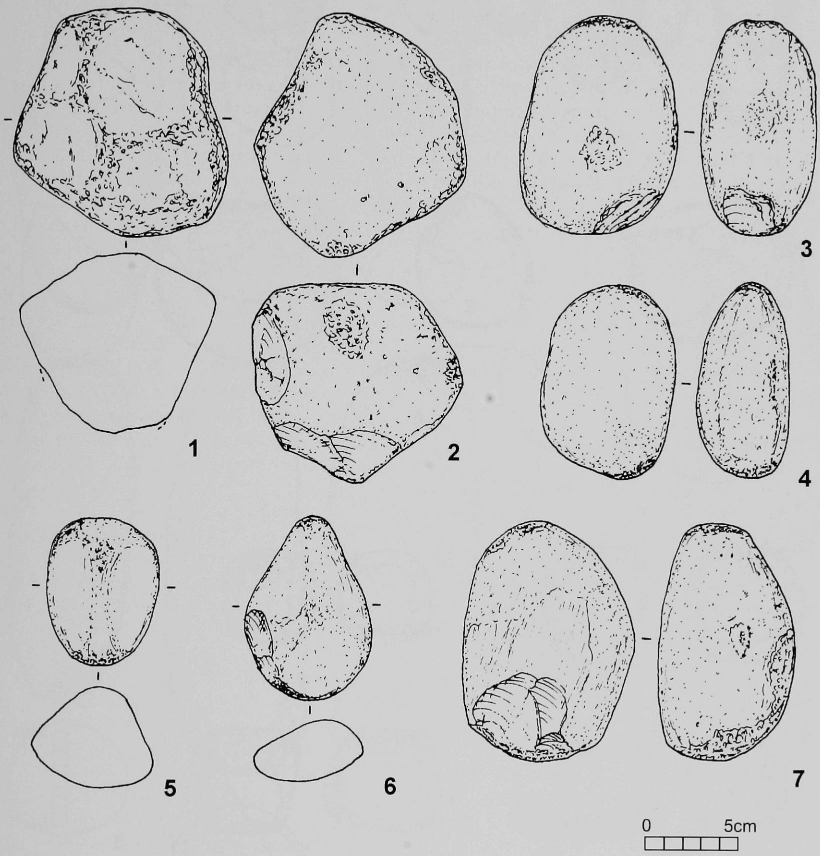


Fig. 13.8 Pounders from the Chalcolithic levels of Tell Kosak Shamali.
1. Pounder, globular type, basalt (96KSL-AE4-14-49; 10A01; Level 10 of Sector A of Level A).
2. Pounder, globular type, basalt (96KSL-AE4-14-49; 10A01; Level 10 of Sector A of Level A).
3. Pounder, globular type, andesite (95KSL-BD7-14; Fill; Level 3 of Sector B).
4. Pounder, globular type, andesite (95KSL-BD7-5; Level 1 of Sector B; Fill).
5. Pounder, globular type, sandstone (95KSL-AF6-2; 1112; Level 11 of Sector A).
6. Pounder, globular type, andesite (96KSL-BD6-20; Fill; Level 5 of Sector B).
7. Pounder, globular type, basalt (96KSL-AE4-14-5; 10A01; Level 10 of Sector A).

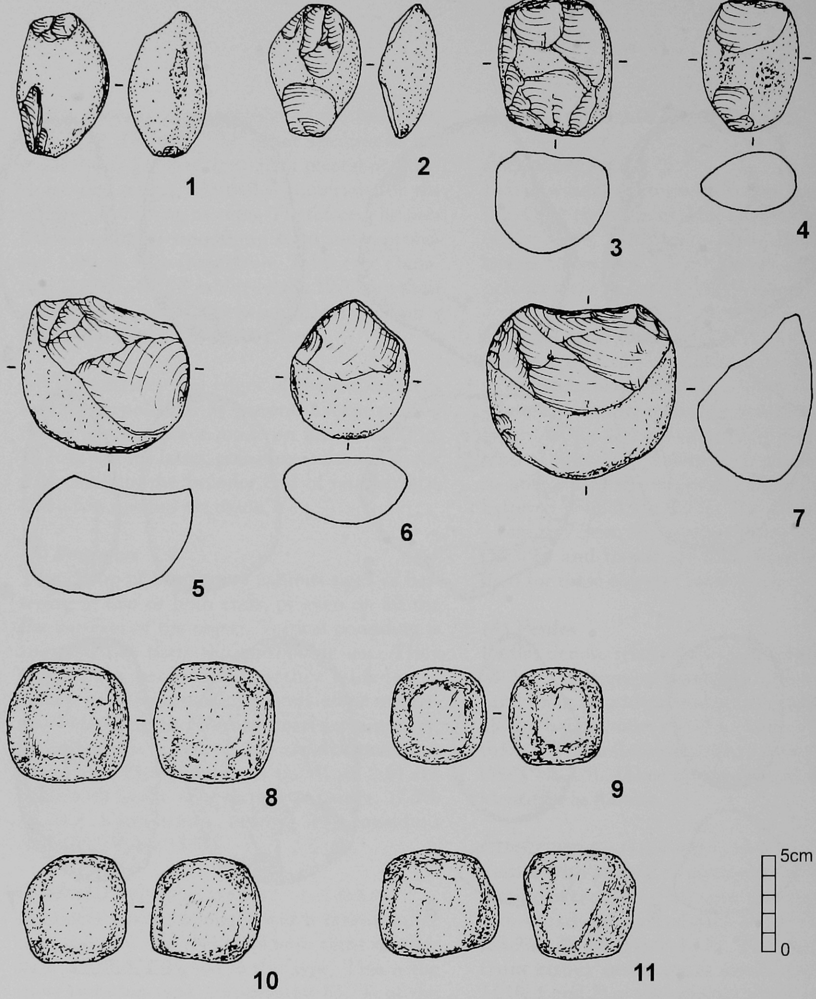


Fig. 13.9 Pounders from the Chalcolithic levels of Tell Kosak Shamali.
1. Pounder, globular type, flint, hammerstone? (95KSL-BE6-1; Fill; Level 3 of Sector B).
2. Pounder, globular type, flint, hammerstone? (965KSL-BE6-12; B603; Level 6 of Sector B).
3. Pounder, globular type, flint, hammerstone? (97KSL-AE5-21-3; 1102; Level 11 of Sector A).
4. Pounder, globular type, sandstone, hammerstone? (97KSL-AE5-23; 10A09; Level 10 of Sector A).
5. Pounder, globular type, sandstone, flaked (96KSL-AE5-13; 810; Level 8 of Sector A) .
6. Pounder, globular type, sandstone, flaked (97KSL-AE5-20-11;10A02; Level 10 of Sector A).
7. Pounder, globular type, sandstone, flaked, battered signs on the flaked edge as well (96KSL-AD6-20; Fill; Level 7 of Sector A).
8. Pounder, cuboid type, flint (94KSL-A6-11; 601/602/605; Level 6 of Sector A).
9. Pounder, cuboid type, andesite (96KSL-AD5-81; 901; Level 9 of Sector A).
10. Pounder, cuboid type, limestone (95KSL-AF6-7; 1504; Level 15 of Sector A).
11. Pounder, cuboid type, limestone (95KSL-AF6-7; 1504; Level 15 of Sector A).

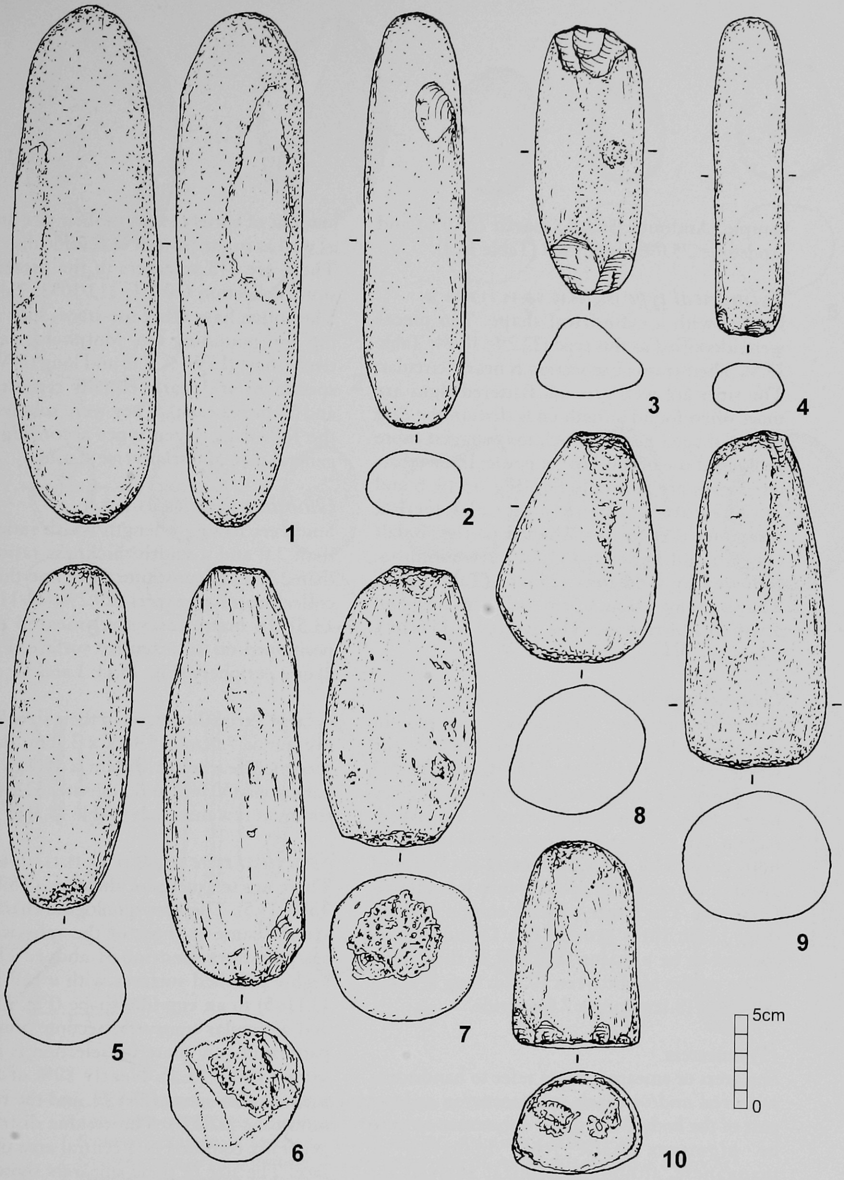


Fig. 13.10 Pestles from the Chalcolithic levels of Tell Kosak Shamali.

1. Pestle, loaf type, andesite, hand-held wears on the upper body (96KSL-BD7-49-1; B504; Level 5 of Sector B).
2. Pestle, loaf type, andesite (94KSL-D10-2; 1306; Level 13 of Sector A).
3. Pestle, loaf type, andesite, counter flake scars at both ends (95KSL-AD5-49; 402; Level 4 of Sector A).
4. Pestle, loaf type, sandstone, counter flake scars at the lower end (96KSL-AD6-6; 201; Level 2 of Sector A).
5. Pestle, cylindrical type, andesite (95KSL-AD5-49; 402; Level 4 of Sector A).
6. Pestle, cylindrical type, basalt (96KSL-AE4-14-68; 10A01; Level 10 of Sector A).
7. Pestle, cylindrical type, basalt (96KSL-AE4-14-6; 10A01; Level 10 of Sector A).
8. Pestle, conical type, sandstone (95KSL-AD4-12; 601; Level 6 of Sector A).
9. Pestle, conical type, andesite (97KSL-AF5-15; 1306; Level 13 of Sector A).
10. Pestle, conical type, sandstone (94KSL-A6-5; Fill; Level 1 of Sector A).

sample. Andesite (50.0%), basalt (25.0%) and sandstone (25.0%) were used (Table 13.2).

Cylindrical type (Fig. 13.10: 5-7; Pl. 13.3: 4 & 10)
Pestles with a cylindrical shape. Ten pieces were identified as this type (22.7%; 10/44; Table 13.5). Their transverse section is nearly circular. The sides are well ground. Battered signs are more often found at both ends than in the case of loaf-shaped pieces, which may suggest more prolonged use of this type of pestle. In fact, battered ends are generally flat (Fig. 13.10: 6 and 7). The pattern of raw material selection resembles that for loaf-shaped pestles: basalt (41.7%) and andesite (33.3%) are common, followed by sandstone (25.0%) (Table 13.2). The size ranges from 8.5cm to 28.5cm long and 3.1cm to 10.4cm wide. The average is 15.6cm x 6.2cm.

Conical type (Fig. 13.10: 8-10; Pl. 13.3: 3)
There are only five specimens of this type in the present handstone collection: 11.4% of the whole pestles (5/44; Table 13.5). Basalt (80.0%) was the major raw material (Table 13.2). They have a tapered end and a circular transverse section. All of them have traces of battering at both ends. The sides are neatly pecked and ground; the conical shape was thus intentionally created. The larger use-end on one of them (Fig. 13.10: 10) is ground flat. Grinding also seemed to be a major function of this piece. These pestles are between 10.2cm long x 4.6cm wide and 18.1cm long x 7.8cm wide.

(5) Smearers
Smearers or smeared stones refer to handstones with red and/or black substances on at least part of the body. Most of the substances seem to be pigments made from hematite or manganese, although chemical analysis for their precise identification is still in progress. There is a general trend that red substances are only faintly preserved while black ones leave clearer traces. The latter may include residues of bitumen. Elongated specimens with similar residues have been reported as "stirring rods" used for bitumen at Tell Abada (Jasim 1985: 80-81), as pestles at Tell Songor B (Matsumoto and Yokoyama 1995: 127) and at Telul ethThalathat II (Furuyama 1970: Plate 85: 10). In the Tell Kosak Shamali collection, however, a greater amount of variety exists in their size and shape, as well as in the pattern of residue distribution. There are 113 smearers in the present handstone collection (10.7%; 113/1052; Table 13.5). They often have other use-traces such as grinding and pounding too. Morphologically, relatively short (L/W $<$ 2.0) and long (L/W $\geqq$ 2.0) specimens are nearly equally represented (56 and 58 pieces each). They were subdivided into the following seven types according to their general plan and transverse section.

Globular type (Fig. 13. 11: 1-3)
Smearers having a length/width ratio smaller than 2.0 and a width/thickness ratio smaller than 2.5. They constitute about one-third of the collection of smearers (29.2%; 33/113; Table 13.5). In many cases the smeared parts are positioned on an extensive surface (Fig. 13.11: 2) or a periphery (Fig. 13.11: 1 and 3).

A large variability exists in their size. While the average is 7.6cm x 5.4cm x 3.7cm, the largest specimen reaches to 16.4cm x 10.9cm x 7.8cm. Sandstone (50.0%) and andesite (32.1%) are the common raw materials (Table 13.2).

Spherical type (Fig. 13.11: 4-8; Pl. 13.4: 10 & 11)
There are ten pieces of this type (8.8%; 10/113; Table 13.5). Their morphological characteristics are the same as those of the spherical grinders/polishers mentioned above. They have highly polished surfaces with a ball-like (Fig. 13.11: 5) to an egg-like shape (Fig. 13.11: 6-8), and a circular transverse section. Similarly the pattern of raw material selection is much the same (Table 13.2). Nearly 80% of them are made on limestone (77.8%), and the rest are on sandstone (22.2%). The residue distribution is generally confined to a central area of one surface. The size of these smearers shows a dense concentration between 4.0cm and 5.4cm in diameter, with an average of 5.1cm.

Discoidal type (Fig. 13.11: 9-11)
Smearers with a discoidal shape as defined in Table 13.4. In frequency they are second to the globular type among the smearers from Tell Kosak Shamali (9.7%; 11/113; Table 13.5). Their general morphology is identical to the discoidal smoothers, and the presence of smeared parts distinguishes them from the lat-

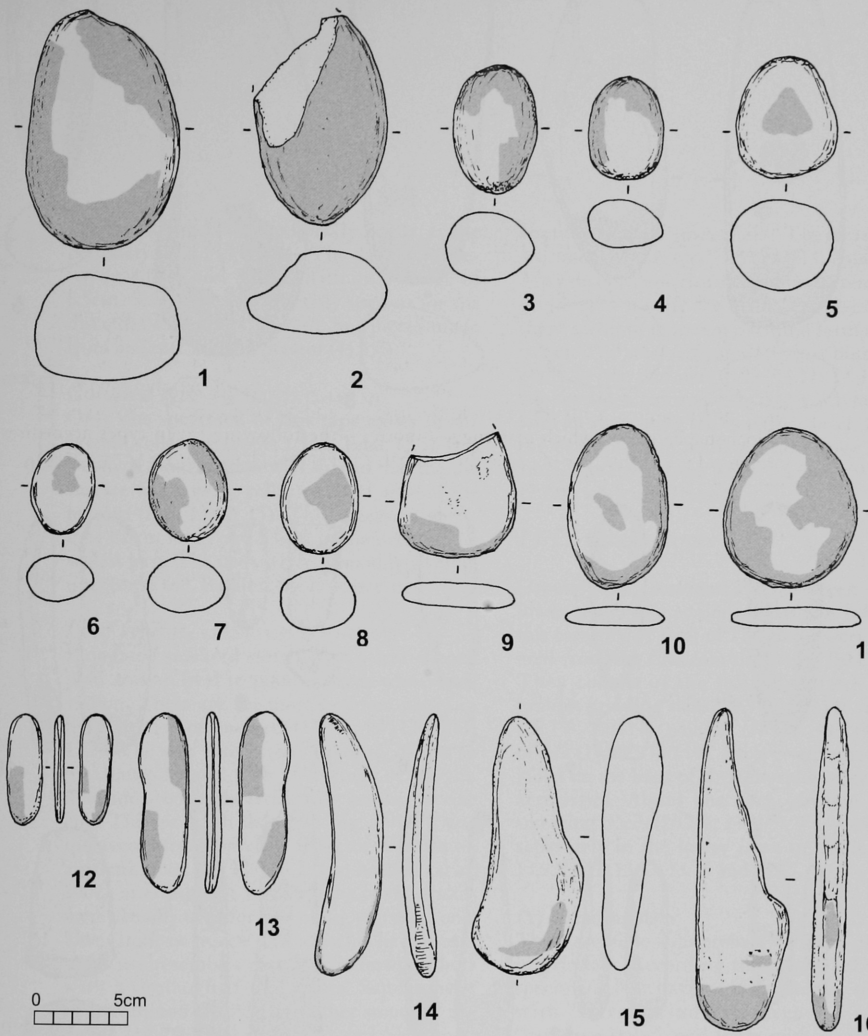


Fig. 13.11 Smearers from the Chalcolithic levels of Tell Kosak Shamali.
The shaded area indicates a distribution of smeared surface.
1. Smearer, globular type, sandstone (95KSL-AD5-45; 401; Level 4 of Sector A).
2. Smearer, globular type, andesite, one end broken (94KSL-A6-10; 501; Level 5 of Sector A).
3. Smearer, globular type, andesite (97KSL-AE4-47; 1109; Level 11 of Sector A).
4. Smearer, spherical type, limestone (95KSL-AD5-49; 402; Level 4 of Sector A).
5. Smearer, spherical type, limestone (95KSL-AD5-49; 402; Level 4 of Sector A).
6. Smearer, spherical type, andesite (97KSL-AE6-34; 1103; Level 11 of Sector A).
7. Smearer, spherical type, limestone (94KSL-AD4-2; 101; Level 1 of Sector A).
8. Smearer, spherical type, sandstone (96KSL-AD4-32; 805; Level 8 of Sector A).
9. Smearer, discoidal type, sandstone (97KSL-AF5-2; 1107; Level 11 of Sector A).
10. Smearer, discoidal type, andesite (97KSL-AE5-42; 12A06; Level 12 of Sector A).
11. Smearer, discoidal type, sandstone (95KSL-AD4-11; 601/602; Level 6 of Sector A).
12. Smearer, bar-shaped type, sandstone (96KSL-AD4-24; 803; Level 8 of Sector A).
13. Smearer, spatula-shaped type, sandstone (96KSL-AD4-34; Fill; Level 9 of Sector A).
14. Smearer, spatula-shaped type, sandstone (94KSL-D10-4; Fill; Level 15 of Sector A).
15. Smearer, spatula-shaped type, sandstone (95KSL-AF3-13; 1310; Level 13 of Sector A).
16. Smearer, spatula-shaped type, andesite (97KSL-AD5-117-4; 1304; Level 13 of Sector A).

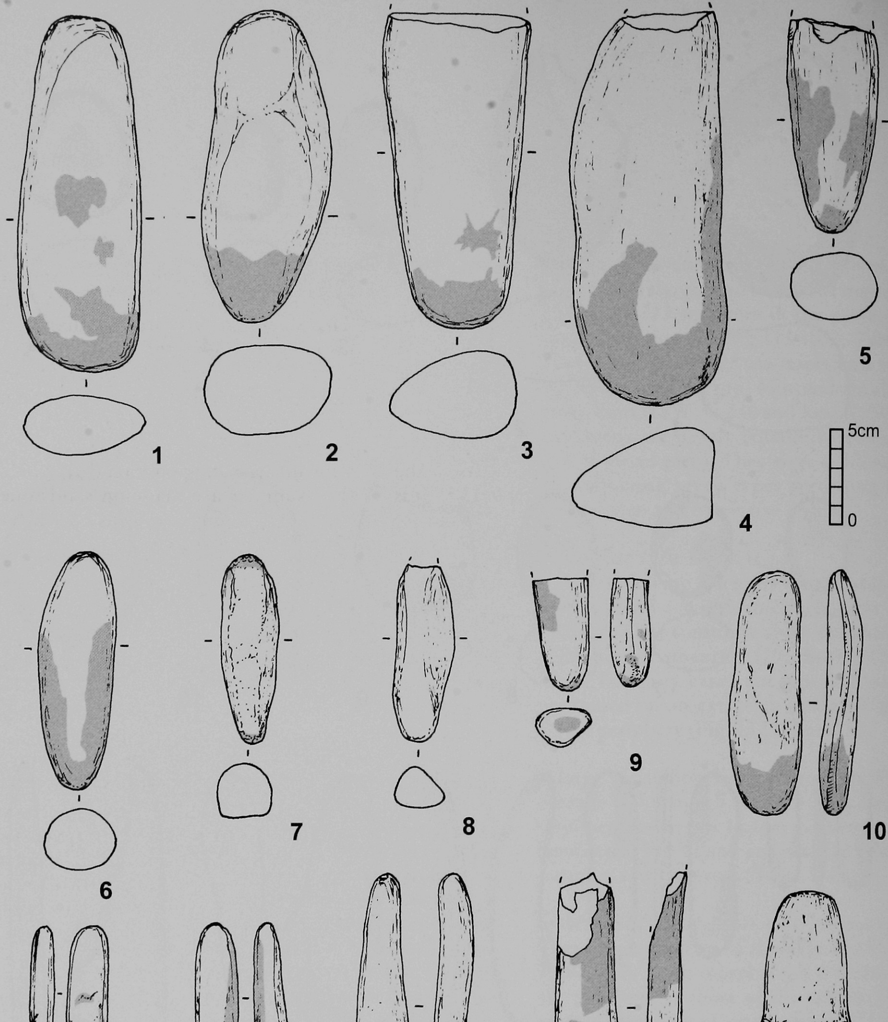


Fig. 13.12 Smearers from the Chalcolithic levels of Tell Kosak Shamali.
1. Smearer, loaf type, sandstone, black residue at one end (96KSL-AD5-21; 716; Level 7 of Sector A).
2. Smearer, loaf type, andesite (97KSL-AE5-53-11; 1406; Level 14 of Sector A).
3. Smearer, loaf type, andesite (94KSL-A7-4; 719; Level 7 of Sector A).
4. Smearer, loaf type, andesite (97KSL-AE4-24; 10A01; Level 10 of Sector A).
5. Smearer, loaf type, andesite (94KSL-A7-4; 719; Level 7 of Sector A).
6. Smearer, loaf type, andesite (97KSL-AE5-26-1; 1106; Level 11 of Sector A).
7. Smearer, loaf type, andesite, discovered on the palette of Fig. 13.22: 7 in situ
(97KSL-AE5-51-8; 1405; Level 14 of Sector A).
8. Smearer, loaf type, sandstone (96KSL-AE4-16-9; 10A08; Level 10 of Sector A).
9. Smearer, loaf type, sandstone (95KSL-AF4-6; Fill; Level 12 of Sector A).
10. Smearer, loaf type, sandstone (96KSL-BE5-12; Fill; Level 7 of Sector B).
11. Smearer, loaf type, andesite (95KSL-AE5-9; 808; Level 8 of Sector A).
12. Smearer, loaf type, sandstone (95KSL-AF4-3; Fill; Level 11 of Sector A).
13. Smearer, loaf type, andesite (97KSL-AE5-53-13; 1406; Level 14 of Sector A).
14. Smearer, loaf type, sandstone (97KSL-AE5-49-11; 1306; Level 13 of Sector A).
15. Smearer, collared type, basalt (95KSL-AE5-11; 709; Level 7 of Sector A).

ter. Smearing traces generally occur at the periphery (Fig. 13.11: 9-11). The diameter is between 4.0cm and 8.6cm, with an average of 6.5cm. Sandstone is commonly used as for the discoidal smoothers (55.6%), but pieces made from andesite are also present (44.4%).

Collared type (Fig. 13.12: 15; Pl. 13.4: 12)
Only one specimen of this type exists in the present collection (0.9%; 1/113; Table 13.5). It is a conical handstone so well shaped that the use surface has a weak collar or band around the bottom (Fig. 13.12: 15). This specimen measures 8.5cm long, and 5.0cm in diameter at the widest part. The use surface, smoothly ground, is smeared red. Basalt is the raw material.

Loaf type (Fig. 13.12: 1-14; Pl. 13.4: 1-4 & 6-9)
Elongated smeared stones with a loaf-shaped plan and an oval to plano-convex transversal section. These are the most common pieces in the collection of smearers (43.4%; 49/113; Table 13.5). The size varies from 4.2cm to 20.9cm in maximum length, with an average of 10.7cm. The smeared parts are mostly limited to one end. The specimen shown in Fig. 13.12: 7 was discovered from Level 13 of Sector A *in situ* on a palette stone (see Plate 3.2: 3 in Nishiaki *et al.* 2001), attesting that at least some of these tools were actually used for processing pigments on a lower stone or palette (see below). The raw material use resembles that of grinders/polishers with a similar loaf-like shape. Sandstone is most common (76.5%), and other stones of andesite (14.7%), basalt (5.9%) and limestone (2.9%) are only occasionally used (Table 13.2).

Bar-shaped type (Fig. 13.11: 12)
Smeared stones of this type have the same morphological features as those of the bar-shaped smoothers. They occur rarely in the present assemblage; only five specimens were identified (4.4%; 5/113; Table 13.5). Andesite and limestone examples were found (Table 13.2). The distribution of the smeared traces shows a distinct pattern. They are generally located along one edge close to an end (Fig. 13.11: 12). The size is between 5.9cm x 1.8cm x 0.6cm and 7.0cm x 3.2cm x 1.1cm.

Spatula-shaped type (Fig. 13.11: 13-16; Pl. 13.4: 5)
Smeared stones with the same shape as that of spatula-shaped smoothers. There are four specimens of this type (3.5%; 4/113; Table 13.5). They do not show clearly intentional retouch or grinding to modify the blank, and the distinct shape seems to represent a natural form of river stones. The smeared parts are distributed generally at one end only (Fig. 13.11: 14-16), but one specimen has smearing traces at both edges with an alternating position (Fig. 13.11: 13). All the examples are made on sandstone (Table 13.2). The size is from 9.8cm x 2.9cm x 0.8cm to 17.2cm x 5.1cm x 1.8cm.

13.3.2 Lower stones

Ground stones considered to have been used as lower stones in a stationary position belong to this category. A total of 114 pieces were recovered from the Chalcolithic levels (Table 13.6). They consist of the following four major groups: grinding slabs (28.9%; 33/114), mortars (16.7%; 19/114), palettes (38.6%; 44/114), and others (15.8%; 18/114). Each group was subdivided on the basis of their morphological characteristics. About one fifth of them retain smearing traces (20.2%; 23/105). They are listed separately in the lower rows in Tables 13.6, 13.9, 13.11, 13.13, 13.15 and 13.17.

(1) Grinding slabs
These are stone slabs probably utilized in a pair of grinders. According to Wright (1992: 63), specimens that have rectangular use surfaces with lateral grinding traces are termed "grinding slabs", and those with circular use surfaces indicating rotary motion of grinding are classed as "querns". In the present collection, both exist. Since identification of grinding direction is often difficult, however, all these are referred to as grinding slabs below.

Circular slabs with concave surface
(Figs. 13.13 - 13.15: 1; Pl. 13.5: 1)
Grinding slabs that have a more or less circular plan and a slightly concave to straight use surface. This is the most common type of grinding slab (78.8%; 26/33; Table 13.6). No smeared specimens are included. While the use-surface and the edges are both well ground smooth, the reverse surface of all the specimens but one is made convex by pecking, or left unmodified. The use-surface is generally only slightly con-

Table 13.6 Lower stones from the Chalcolithic levels of Tell Kosak Shamali.

Type	EU1* A17-13	%	EU2 A12-10	%	LU1 A9-7	%	LU2 A6-4	%	TU A3-1/B7	%	PU B6-5	%	Uruk B4-1	%	Total	%
(1) Total **																
Grinding slabs	**7**	20.6	**7**	30.4	**3**	21.4	**9**	31.0	**0**	0.0	**5**	83.3	**2**	33.3	**33**	28.9
Circular, concave	5	(71.4)	5	(71.4)	2	(66.7)	8	(88.9)	0	-	5	(100.0)	1	(50.0)	26	(78.8)
Circular, convex	2	(28.6)	2	(28.6)	0	(0.0)	1	(11.1)	0	-	0	(0.0)	1	(50.0)	6	(18.2)
Oblong, concave	0	(0.0)	0	(0.0)	1	(33.3)	0	(0.0)	0	-	0	(0.0)	0	(0.0)	1	(3.0)
Mortars	**6**	17.6	**4**	17.4	**1**	7.1	**6**	20.7	**0**	0.0	**1**	16.7	**1**	16.7	**19**	16.7
Pitted, pebble	3	(50.0)	1	(25.0)	0	(0.0)	4	(66.7)	0	-	0	(0.0)	1	(100.0)	9	(47.4)
Pitted, slab	0	(0.0)	2	(50.0)	0	(0.0)	1	(16.7)	0	-	0	(0.0)	0	(0.0)	3	(15.8)
Multi-pitted, slab	0	(0.0)	1	(25.0)	0	(0.0)	1	(16.7)	0	-	0	(0.0)	0	(0.0)	2	(10.5)
Hollowed	2	(33.3)	0	(0.0)	1	(100.0)	0	(0.0)	0	-	0	(0.0)	0	(0.0)	3	(15.8)
Cylindrical	1	(16.7)	0	(0.0)	0	(0.0)	0	(0.0)	0	-	1	(100.0)	0	(0.0)	2	(10.5)
Palettes	**19**	55.9	**5**	21.7	**5**	35.7	**11**	37.9	**2**	100.0	**0**	0.0	**2**	33.3	**44**	38.6
Edged	4	(21.1)	1	(20.0)	2	(40.0)	5	(45.5)	0	(0.0)	0	-	0	(0.0)	12	(27.3)
Non-edged	15	(78.9)	4	(80.0)	3	(60.0)	6	(54.5)	2	(100.0)	0	-	2	(100.0)	32	(72.7)
Others	**2**	5.9	**7**	30.4	**5**	35.7	**3**	10.3	**0**	0.0	**0**	0.0	**1**	16.7	**18**	15.8
Incised	0	(0.0)	0	(0.0)	0	(0.0)	1	(33.3)	0	-	0	-	0	(0.0)	1	(5.6)
Slab abrader/palette	0	(0.0)	0	(0.0)	1	(20.0)	0	(0.0)	0	-	0	-	1	(100.0)	2	(11.1)
Anvil	0	(0.0)	5	(71.4)	3	(60.0)	2	(66.7)	0	-	0	-	0	(0.0)	10	(55.6)
Turning table	2	(100.0)	2	(28.6)	1	(20.0)	0	(0.0)	0	-	0	-	0	(0.0)	5	(27.8)
Total	**34**	100.0	**23**	100.0	**14**	100.0	**29**	100.0	**2**	100.0	**6**	100.0	**6**	100.0	**114**	100.0
(2) Smeared lower stones																
Grinding slabs	**0**	0.0	**1**	4.3	**0**	0.0	**0**	0.0	**0**	0.0	**0**	0.0	**0**	0.0	**1**	0.9
Circular, concave	0	-	0	(0.0)	0	-	0	-	0	-	0	-	0	-	0	(0.0)
Circular, convex	0	-	1	(100.0)	0	-	0	-	0	-	0	-	0	-	1	(100.0)
Oblong, concave	0	-	0	(0.0)	0	-	0	-	0	-	0	-	0	-	0	(0.0)
Mortars	**3**	8.8	**2**	8.7	**0**	0.0	**0**	0.0	**0**	0.0	**0**	0.0	**0**	0.0	**5**	4.4
Pitted, pebble	1	(33.3)	0	(0.0)	0	-	0	-	0	-	0	-	0	-	1	(20.0)
Pitted, slab	0	(0.0)	2	(100.0)	0	-	0	-	0	-	0	-	0	-	2	(40.0)
Hollowed	1	(33.3)	0	(0.0)	0	-	0	-	0	-	0	-	0	-	1	(20.0)
Cylindrical	1	(33.3)	0	(0.0)	0	-	0	-	0	-	0	-	0	-	1	(20.0)
Palettes	**4**	11.8	**1**	4.3	**1**	7.1	**8**	27.6	**1**	50.0	**0**	0.0	**1**	16.7	**16**	14.0
Edged	1	(25.0)	0	(0.0)	0	(0.0)	4	(50.0)	0	(0.0)	0	-	0	(0.0)	5	(31.3)
Non-edged	3	(75.0)	1	(100.0)	1	(100.0)	4	(50.0)	1	(100.0)	0	-	1	(100.0)	11	(68.8)
Others	**0**	0.0	**0**	0.0	**1**	7.1	**0**	0.0	**0**	0.0	**0**	0.0	**0**	0.0	**1**	0.9
Incised	0	-	0	-	0	(0.0)	0	-	0	-	0	-	0	-	0	(0.0)
Slab abrader/palette	0	-	0	-	1	(100.0)	0	-	0	-	0	-	0	-	1	(100.0)
Anvil	0	-	0	-	0	(0.0)	0	-	0	-	0	-	0	-	0	(0.0)
Turning table	0	-	0	-	0	(0.0)	0	-	0	-	0	-	0	-	0	(0.0)
Total	7	20.6	4	17.4	2	14.3	8	27.6	1	50.0	0	0.0	1	16.7	23	20.2

* EU: Early Northern Ubaid; LU: Late Northern Ubaid; TU: Terminal Northern Ubaid; PU: Post-Ubaid. ** includes smeared ones.

cave, and specimens with a pronounced concavity are rare. One example of the latter is that illustrated in Fig. 13.14. It is the largest slab at Tell Kosak Shamali, with the maximum length up to 45.0cm, and has heavily ground use-surfaces on both sides. On the reverse are three narrow grooves, suggesting reuse as a whetstone after breakage. The grooves are very shallow in comparison with their width; the width is 7.5mm to 9mm, and the depth is 0.9mm to 2.0mm only. Another rare example is shown in Fig. 13.15: 1. It is a highbacked specimen, 31.8cm long, 18.0cm wide and 13.5cm high. The use-surface is ground and worn smooth.

Most of these tools are made on basalt (73.7%), but sandstone (15.8%) and limestone (10.5%) are also utilized (Table 13.3). The average diameter of the complete specimens (13 pieces) measures 23.9cm.

Circular slabs with convex surface

(Fig. 13.16; Pl. 13.5: 2)

Six of the grinding slabs were classified to this type (18.2%; 6/33; Table 13.6). They have a slightly convex use surface. By definition, these should be termed handstones (cf. Fig. 2 in Wright 1992). However, taking into consideration the relatively large size (up to 28.9cm in diameter), they were provisionally included in the lower stone group. The general shape is much comparable to that of circular slabs with con-

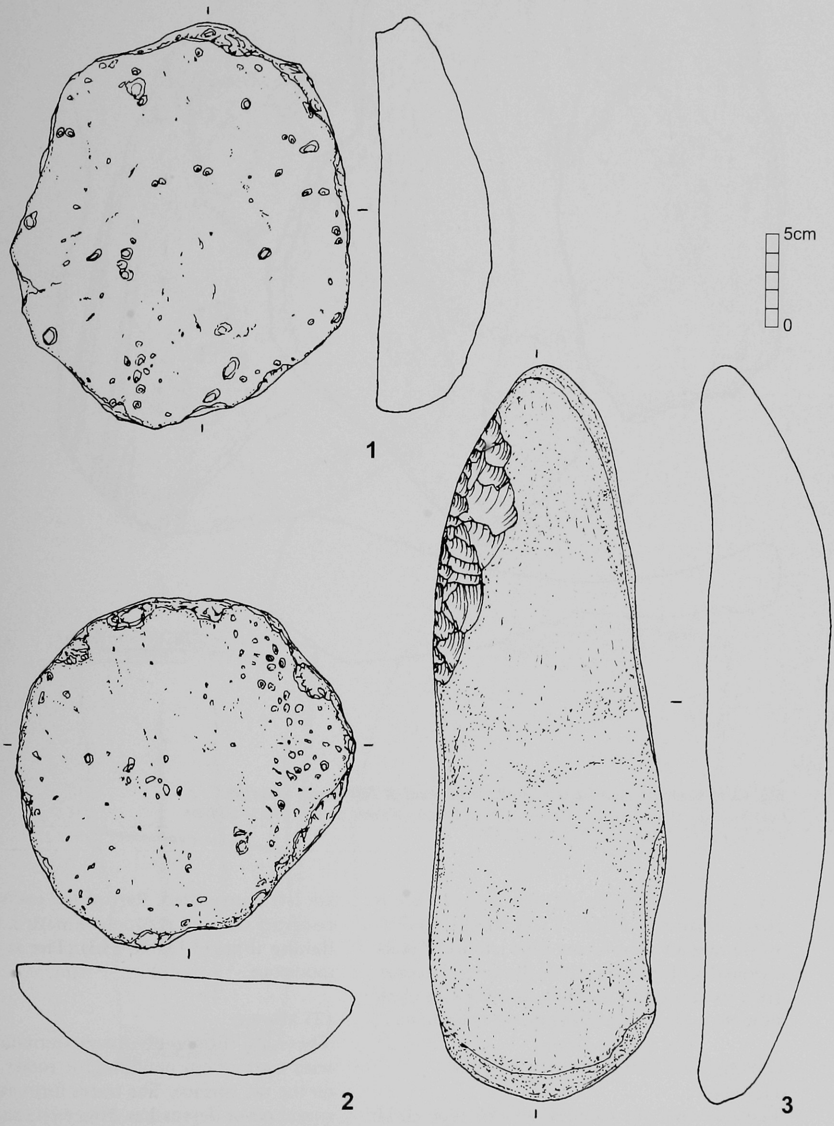


Fig. 13.13 Grinding slabs from the Chalcolithic levels of Tell Kosak Shamali.
1. Grinding slab, circular type, concave surface, basalt (95KSL-AD4-6; 501; Level 5 of Sector A).
2. Grinding slab, circular type, concave surface, basalt (95KSL-AD4-12-11; 601; Level 6 of Sector A).
3. Ground slab, oblong type, concave surface, sandstone (96KSL-AE4-15; 907; Level 9 of Sector A).

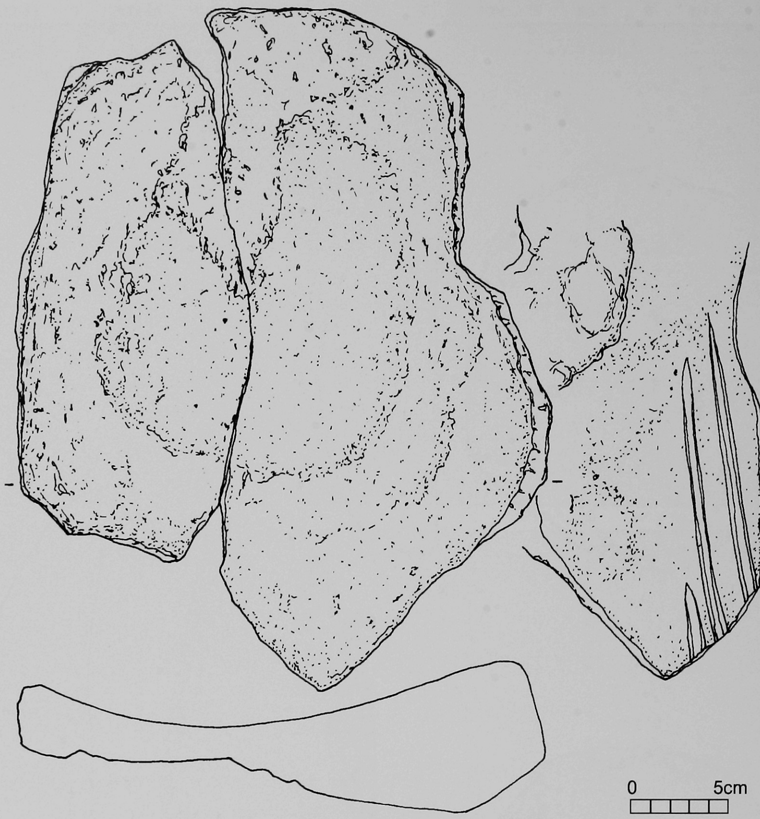


Fig. 13.14 Grinding slab from a Chalcolithic level of Tell Kosak Shamali.
Grinding slab, circular type, concave surface, basalt, grooves on the reverse surface (95KSL-AF6-7; Level 15 of Sector A; 1504).

cave surface. Likewise, the raw material use is also comparable (Table 13.3). Basalt (66.7%) and limestone (33.3%) are used. A single piece of smeared slab exists in this grinding slab category. Its use surface is much covered with black substance, probably not pigment but bitumen.

Oblong slab with concave surface
(Fig. 13.13: 3)

There is only one example of this type (1/33: 3.0%; Table 13.6). It is an elongated loaf-shaped slab with a well-ground concave use-surface, measuring 39.2cm x 12.4cm x 6.5cm. While the longitudinal section is concave, the use-surface is slightly convex in the transverse section. Thus lateral grinding with a rocking motion is suggested. The reverse surfaces of these slabs are left unmodified. Part of the use-surface of one specimen is retouched with a series of flaking (Fig. 13.13: 3). This piece is made on sandstone.

(2) Mortars

These are supposedly lower stationary stones with traces from pounding or rotary grinding on the use surface. The traces form at least one round pit or depression. Nineteen examples exist (16.7 %; 19/114), five of which retain smearing traces (Table 13.6).

Pitted mortars on pebbles (Fig. 13.17; Pl. 13.6: 1 & 2)

These correspond to the "pebble mortars" of Wright (1992). They are small stones, easily held in the hand, with one or two pits on a use

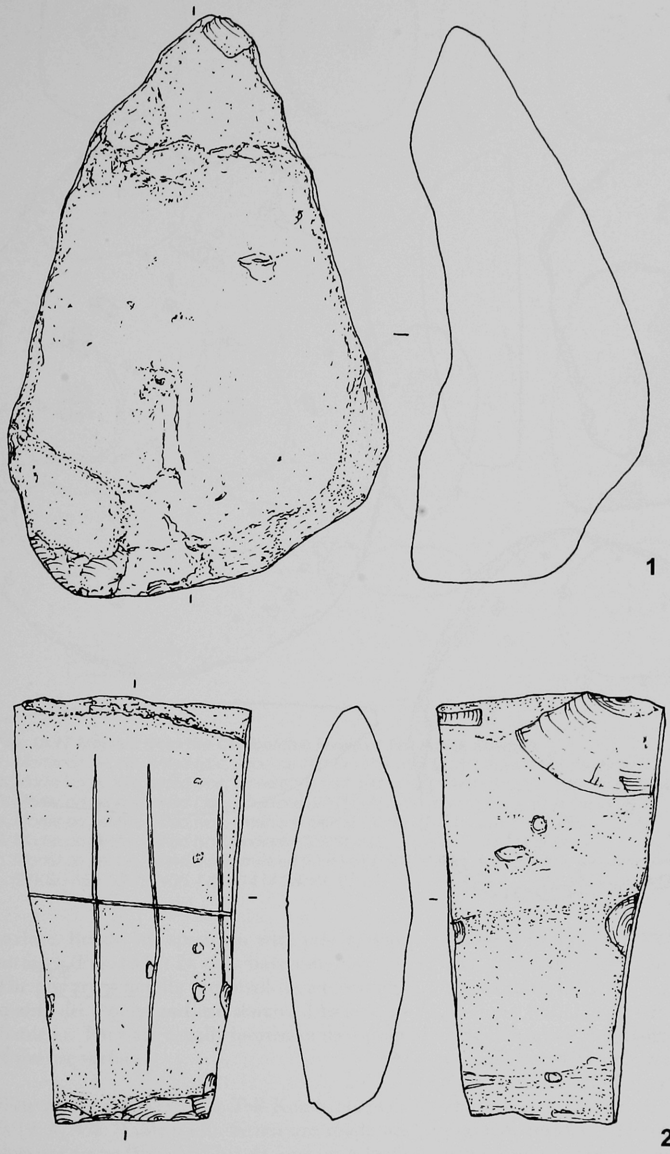


Fig. 13.15 Grinding slabs from the Chalcolithic levels of Tell Kosak Shamali.
1. Grinding slab, concave surface, basalt, high-backed (96KSL-AE4-14-48; 10A01; Level 10 of Sector A).
2. Incised slab, convex surface, limestone (95KSL-AD5-45; 401; Level 4 of Sector A).

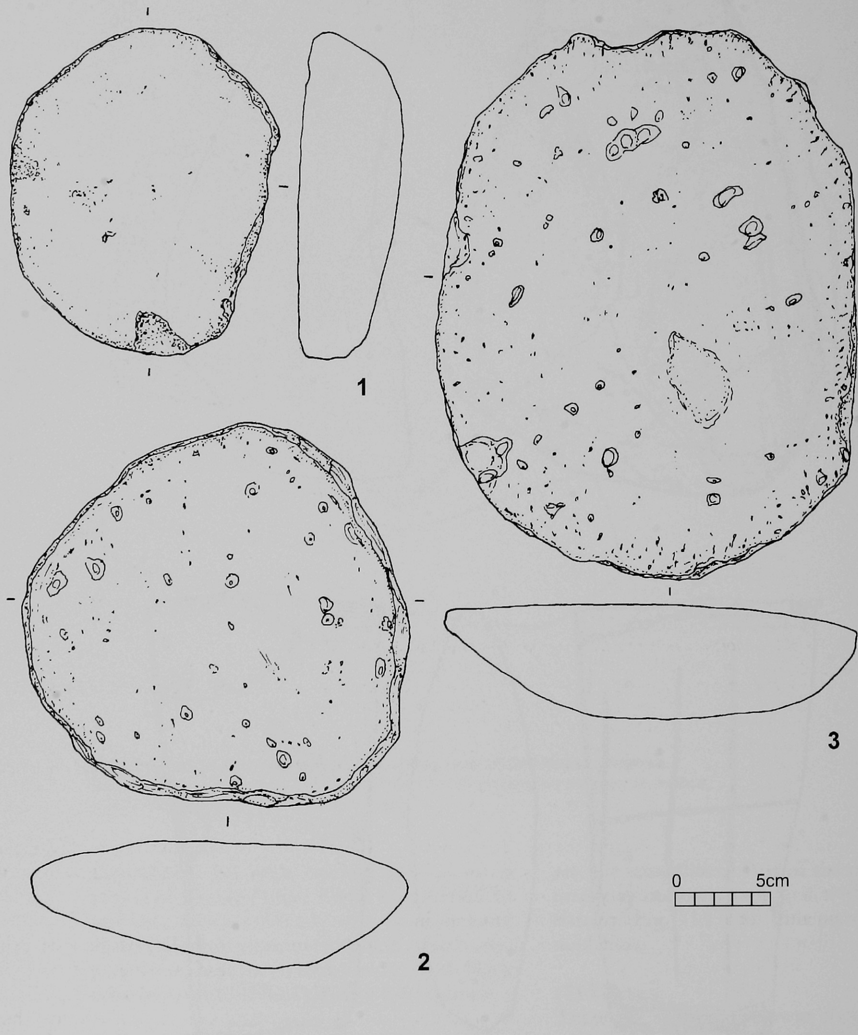


Fig. 13.16 Grinding slabs from the Chalcolithic levels of Tell Kosak Shamali.
1. Grinding slab, circular type, convex surface, basalt (96KSL-BE7-17; Fill; Level 4 of Sector B).
2. Grinding slab, circular type, convex surface, basalt (97KSL-AF6-5; 1308; Level 13 of Sector A).
3. Grinding slab, circular type, convex surface, basalt (95KSL-AD4-6; 501; Level 5 of Sector A).

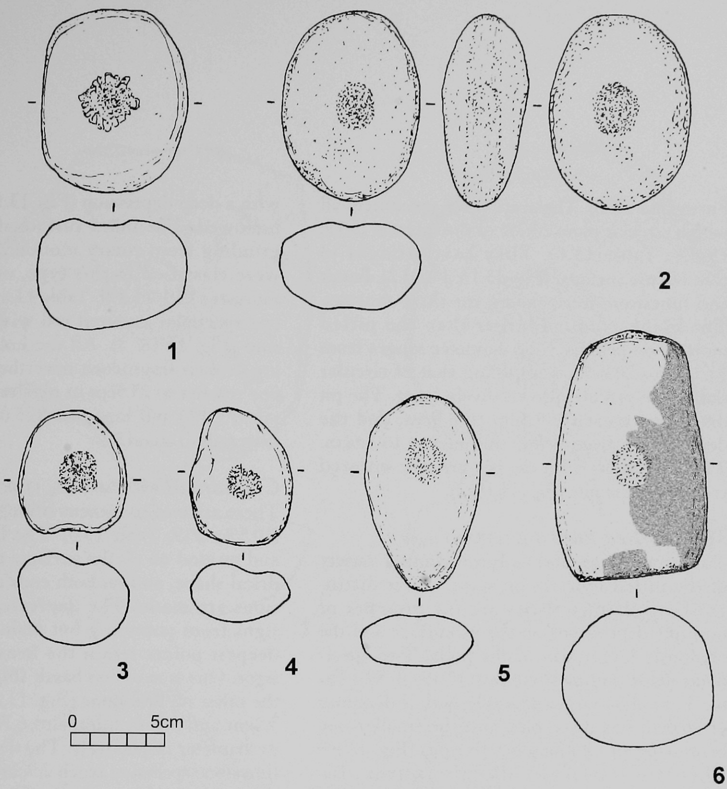


Fig. 13.17 Mortars from the Chalcolithic levels of Tell Kosak Shamali.
1. Mortar on pebble, pitted type, andesite (97KSL-AD4-50-7; 1303; Level 13 of Sector A).
2. Mortar on pebble, pitted type, smeared, basalt, pits on both faces (95KSL-AD5-50; 502; Level 5 of Sector A).
3. Mortar on pebble, pitted type, limestone (97KSL-AE5-17; 10A02; Level 10 of Sector A).
4. Mortar on pebble, pitted type, limestone (96KSL-AD5-67; 604; Level 6 of Sector A).
5. Mortar on pebble, pitted type, andesite (95KSL-AD5-51; 402; Level 4 of Sector A).
6. Mortar on pebble, pitted type, smeared (with bitumen?), basalt, reused mortar on pestle with a cylindrical shape (97KSL-AE5-53-3; 1406; Level 14 of Sector A).

surface. Beside one specimen with pits on both surfaces (Fig. 13.17: 2), they have only one pit. The pits are generally very shallow, a few millimeters deep only, and are around 2 to 3cm in diameter. They are usually located in the center of the use surface.

Nine pieces are present at Tell Kosak Shamali (9/19; 47.4%: Table 13.6). Seven are made on globular stone (Fig. 13.17: 1-4), one on a loaf-shaped stone (Fig. 13.17: 5) and the other on a cylindrical stone (Fig. 13.17: 6). The transverse section is irregularly egg-shaped in most cases. The more flat and wide surface is chosen as the use surface. Specimens with pounding signs at parts are also included (Fig. 13.17: 2). The length of these mortars is between 6.3cm and 10.3cm, with an average of 8.0cm. Basalt (28.6%), limestone (28.6%), andesite (28.6%) and sandstone (14.3%) are used as the raw material (Table 13.3).

Pebble mortars from Tell Abada have generally deeper pits, in which red pigments were identified (Jasim 1985: 76). However, pits of the above specimens are all shallow, and have no pigment residues. The smearing observed on one specimen (Fig. 13.17: 6) is apparently from bitumen. Pigment residues were instead often found on the pitted mortars on slabs mentioned below.

Pitted mortars on slabs (Fig. 13.18: 1 & 2; Pl. 13.6: 5)
Slab-shaped mortars with a shallow depression on the use surface. They have close parallels at Telul eth-Thalathat II (Plates 82-84 in

Furuyama 1970). There are three specimens, all with a circular plan: 22.2% of the mortars (3/19; 15.8%: Table 13.6). They have straight to concave use surfaces (Fig. 13.18: 1 and 2). Basalt and limestone were chosen for these mortars. The blank is much larger than the pitted mortars on pebbles. The diameter ranges from 13.5cm to 20.0cm, resembling that of circular slabs. The pits are also relatively large. The pit diameters measure 4.5cm to 8.5cm, and the depth varies from a few millimeters to 1.6cm. Two specimens with deeper pits are smeared red within the pits (Fig. 13.18: 2).

Multi-pitted slabs (Fig. 13.19; Pl. 13.6: 4)
This group of ground tools represents a variety of the pitted mortars on slabs. Their distinguishing characteristics are the presence of multiple depressions on the usesurface and the obviously larger size of the body. Two specimens made on limestone exist (2/19; 10.5%: Table 13.6). The larger example with a diameter of 46.0cm has three pits, and the smaller one measuring 40.1cm long has five pits (Fig. 13.19) Their use-surface is slightly convex. Interestingly, both examples were discovered *in situ* in unique workshop contexts. The larger multi-pitted slab was situated in Level 10 of Sector A, nearby the pierced stone on a flat limestone that may have been a lower part of a turning device to shape pottery (Nishiaki *et al.* 2001: 71 and Pl. 3.12: 2). The slab itself was situated on the ground within a circle of small angular limestone pebbles. The smaller example (Fig. 13.19). was recovered from the center of Room 402 (Level 4 of Sector A), surrounded by a group of craft tools quite likely to have been potter's tools (Nishiaki *et al.* 2001: 85 and Pl. 3.16: 1). From these discovery contexts, the multi-pitted slabs may also have functioned as tools or anvils related to pottery production. The diameter of the pits is between 4.5cm and 5.9cm. No smeared traces were recognized inside.

Hollowed mortars (Fig. 13.18: 3 & 4; Pl. 13.6: 6 & 7)
More or less round mortars with a deep circular depression on the use surface. The depression is clearly defined, and much larger than that of the pitted mortars mentioned above. They are between 10.1cm and 13.2cm in diameter, and over 3cm deep. One of the mortars of this type with a deep depression (Fig. 13.18: 4) is literally hollowed. The inner surface shows intensive grinding from rotary motion. Three mortars were classified to this type, or 16.7% of the mortars (3/19; 15.8%; Table 13.6). They include one specimen smeared red within the depression (Fig. 13.18: 3). All the hollowed mortars are broken fragments; nevertheless the largest one reaches to 25.5cm in maximum length. Basalt (75.0%) and limestone (25.0%) are the raw materials (Table 13.3).

Cylindrical mortars (Fig. 13.20: 1 & 2; Pl. 13.6: 3)
There are two specimens belonging to this type (10.5%; 2/19; Table 13.6). The blank is pecked and ground on all the surfaces to form a cylindrical shape, and on both ends circular depressions are made. The depressions show clear signs from pounding but little grinding. The deepest points retain the heaviest pounding signs. One is made on basalt (Fig. 13.20: 2), and the other on limestone (Fig. 13.20: 1). They are 5.3cm and 9.3cm high, and 6.7cm and 12.8cm in diameter respectively. The depressions of the limestone specimen reach 2.9cm in depth, while the basalt one has a depth of a few millimeters only.

(3) Palettes
These are the most common lower stones discovered at Tell Kosak Shamali. About two-fifths of the total sample belong to this type (38.6%; 44/114; Table 13.6). They are relatively small slabs with a more or less circular "dished" depression or basin on the use surface. Preparation of pigments is the most probable function of these tools. In fact over one third of them retain residues of red and/or black substances (36.4%; 16/44; Table 13.6). The blank form varies, obviously depending on the original form of river pebbles and cobbles. According to the shape of the depressions on the use-surface, the palettes were classified into the following two types. Both types commonly occur at Ubaid settlements in the Jazireh, e.g. Tell Abada (Fig. 73: a-b in Jasim 1985), and Telul eth-Thalathat II (Plate 86: 17 in Furuyama 1970), and Tell al-'Abar (Fig. 5: 3 in Yamazaki 1999).

Palettes, edged (Fig. 13.21; Pl. 13.7: 1-5)
Palettes with a circular depression on the use surface, whose perimeter is clearly defined. No

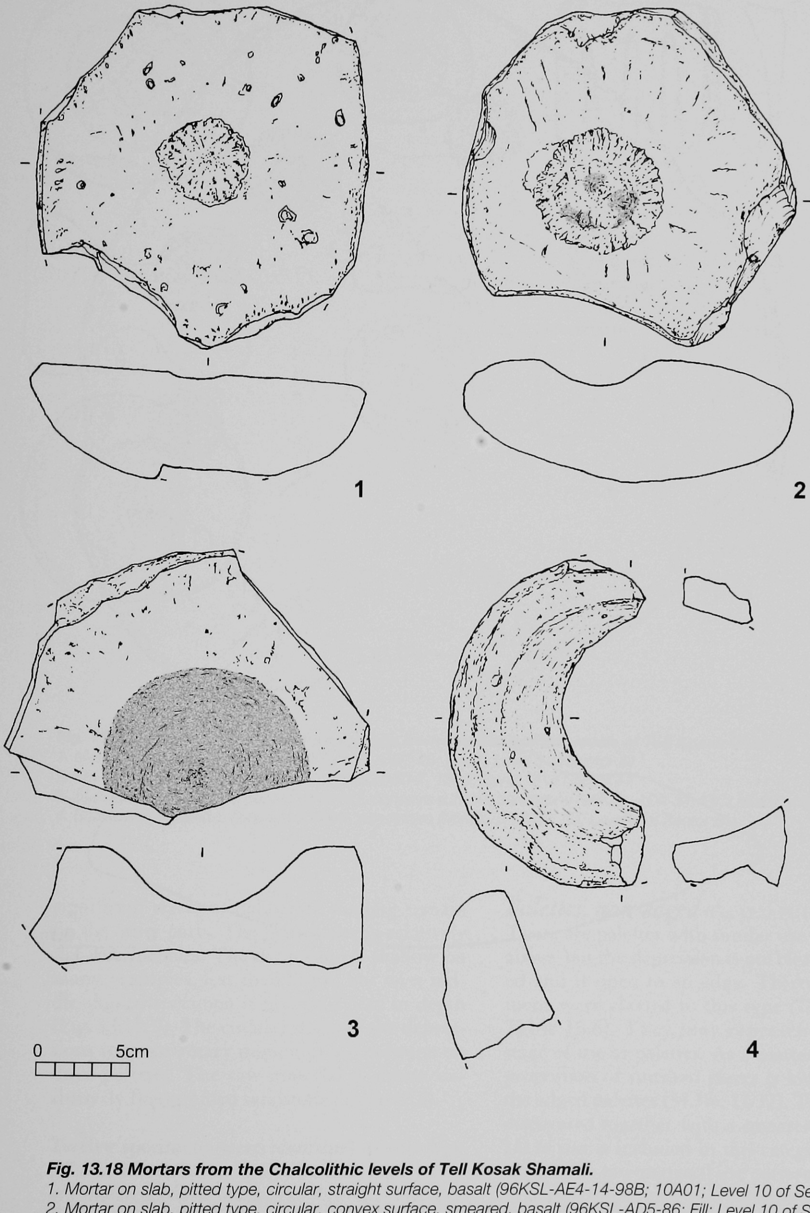


Fig. 13.18 Mortars from the Chalcolithic levels of Tell Kosak Shamali.

1. Mortar on slab, pitted type, circular, straight surface, basalt (96KSL-AE4-14-98B; 10A01; Level 10 of Sector A).

2. Mortar on slab, pitted type, circular, convex surface, smeared, basalt (96KSL-AD5-86; Fill; Level 10 of Sector A).

3. Mortar on slab, hollowed type, circular, straight surface, smeared, basalt (97KSL-AE5-51-6; 1305; Level 13 of Sector A).

4. Mortar on slab, hollowed type, circular, limestone (94KSL-D11-6; Fill; Level 15 of Sector A).

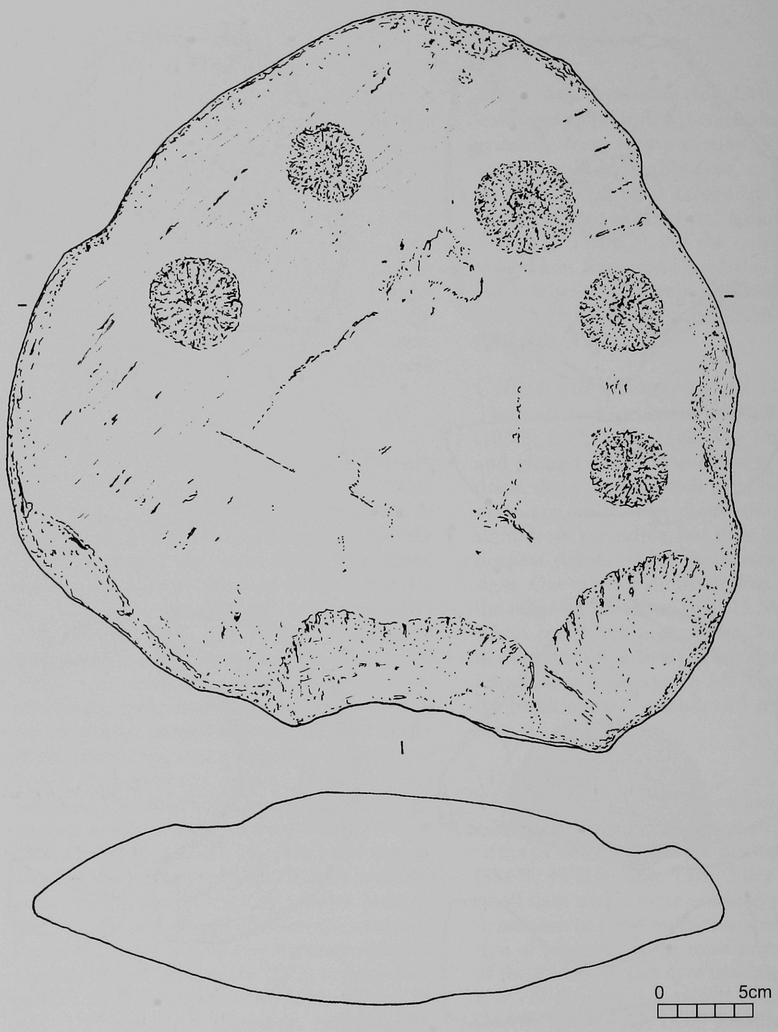


Fig. 13.19 Multi-pitted slab from a Chalcolithic level of Tell Kosak Shamali.
Multi-pitted slab, mortar?, circular, convex surface, basalt (95KSL-AD5-44; 402; Level 4 of Sector A).

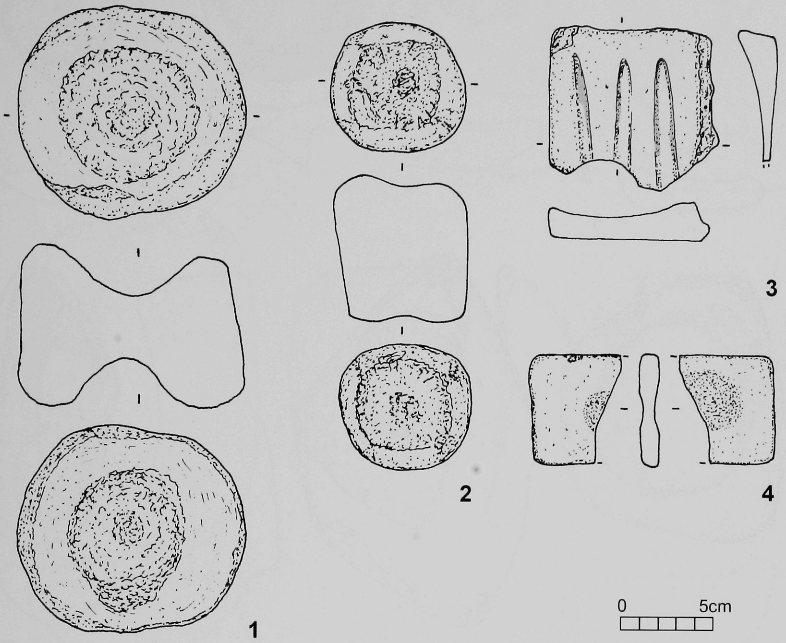


Fig. 13.20 Mortars and other grinding slabs from the Chalcolithic levels of Tell Kosak Shamali.
1. Mortar, cylindrical type, limestone (96KSL-BD7-25; B501; Level 5 of Sector B).
2. Mortar, cylindrical type, basalt (97KSL-AD4-50-7; 1303; Level 13 of Sector A).
3. Slab abrader/palette, smeared, grooved, concave surface, sandstone (96KSL-AD4-34; Fill; Level 9 of Sector A).
4. Slab abrader/palette, concave surface, sandstone (96KSL-BD7-33; Fill; Level 4 of Sector B).

significant traces of deliberate shaping remain on the other parts. The blanks are all relatively flat river pebbles. The depression is shallow on many examples, less than 5mm, but on a saddle-shaped specimen it reaches 2.5cm in depth (Fig. 13.21: 9). The circular shape of the depressions suggests rotary motion of a handstone on these palettes. The raw material is almost exclusively fine-grained sandstone (Table 13.3).

Twelve specimens were identified as this type (27.3%; 12/44; Table 13.6), of which nearly half are smeared red or black (41.7%; 5/12). The size ranges from 7.3cm x 5.2cm x 3.8cm to 21.1cm x 14.3cm x 8.1cm. The average length is 13.0cm.

Palettes, non-edged (Fig. 13.22; Pl. 13.7: 6 & 8)

There are palettes with similar use traces to the above, but the depression is not clearly delineated and is open to an edge. Thirty two specimens were classed to this type (72.7%; 32/44; Table 13.6). They may represent an earlier stage of use as palettes. As a matter of fact, the proportion of smeared pieces is lower than for the edged palettes (34.3%; 11/32). The specimen discovered together with a smearer (Fig. 13.12: 14) *in situ* is included in this category (Fig. 13. 22: 7). The raw material use pattern is the same as that of edged palettes. Sandstone is virtually the only raw material (95.7%; Table 13.3). The size is also much comparable. It varies from 6.5cm x 5.3cm x 1.8cm to 15.1cm x 11.0cm x

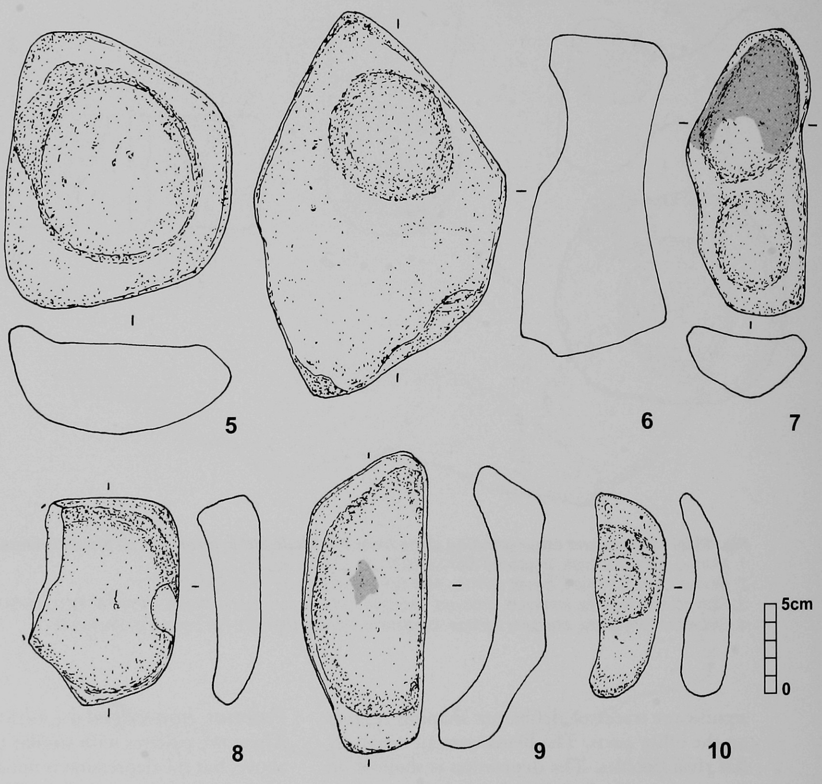


Fig. 13.21 Palettes from the Chalcolithic levels of Tell Kosak Shamali.

1. Palette, edged type, circular, smeared, sandstone (95KSL-AF5-9; 1309; Level 13 of Sector A).
2. Palette, edged type, circular, smeared, sandstone (95KSL-AD5-77-8; 804; Level 8 of Sector A).
3. Palette, edged type, circular, smeared, sandstone (95KSL-AD5-12-2; 402; Level 4 of Sector A).
4. Palette, edged type, circular, sandstone (95KSL-AD5-49; 402; Level 4 of Sector A).
5. Palette, edged type, circular, sandstone (95KSL-AD4-11; 601/602; Level 6 of Sector A).
6. Palette, edged type, circular, use-areas on both surfaces, smeared on the reverse, sandstone (95KSL-AD5-52-4; 402; Level 4 of Sector A).
7. Palette, edged type, oblong, smeared, sandstone (97KSL-AD4-50; 1303; Level 13 of Sector A).
8. Palette, edged type, circular, sandstone (97KSL-AF5-6; Fill; Level 12 of Sector A).
9. Palette, edged type, oblong, smeared, sandstone, red residue at the center (95KSL-AF6-10-14; Fill; Level 16 of Sector A).
10. Palette, edged type, oblong, sandstone (95KSL-AG5-3; 1310; Level 13 of Sector A).

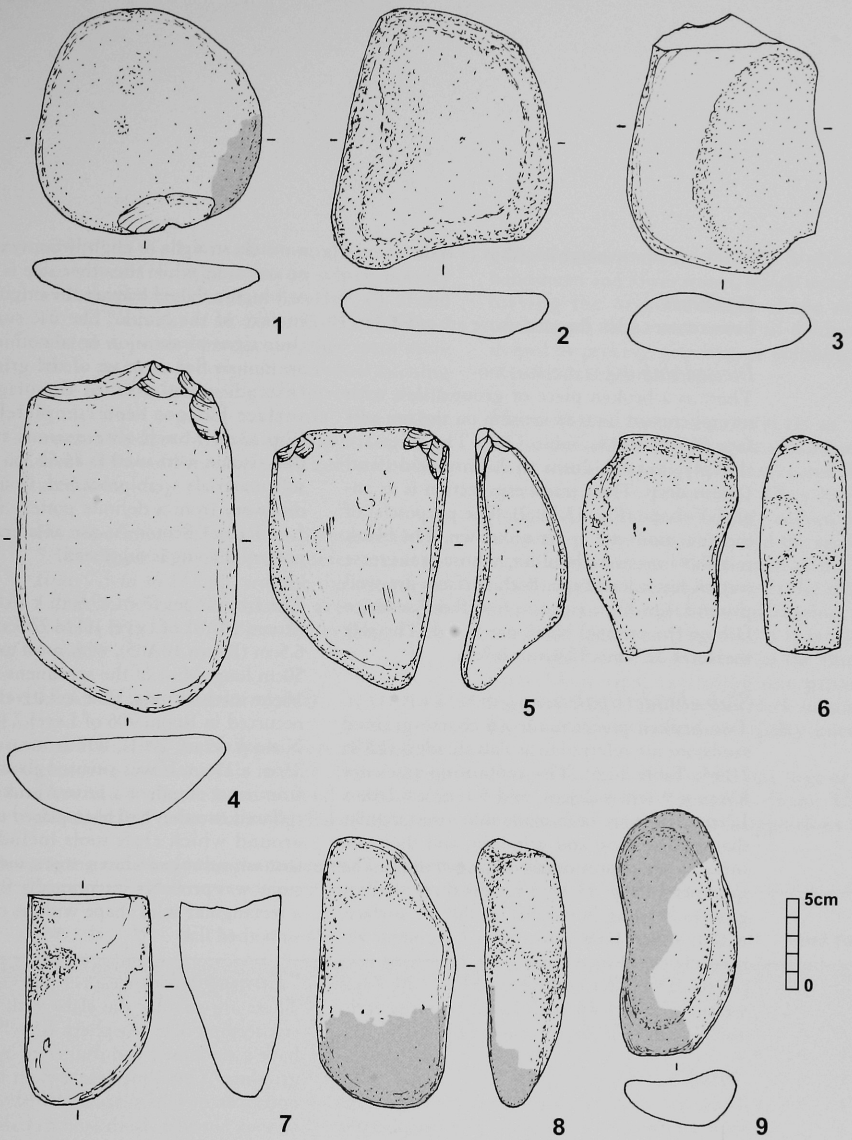


Fig. 13.22 Palettes from the Chalcolithic levels of Tell Kosak Shamali.

1. Palette, non-edged type, smeared, circular, sandstone, red residue at an edge (95KSL-AF6-10-14; Fill; Level 16 of Sector A).
2. Palette, non-edged type, circular, sandstone (95KSL-AF6-7; 1504; Level 15 of Sector A).
3. Palette, non-edged type, circular, sandstone (97KSL-AE5-53-7; 1406; Level 14 of Sector A).
4. Palette, non-edged type, oblong, sandstone, flaked (97KSL-AE5-53-12; 1406; Level 14 of Sector A).
5. Palette, non-edged type, circular, sandstone, flaked (96KSL-AE4-14-2; 10A01; Level 10 of Sector A).
6. Palette, non-edged type, oblong, sandstone (95KSL-BD7-19; B303; Level 3 of Sector B).
7. Palette, non-edged type, oblong, sandstone, discovered in situ *with the oblong smeared stone of Fig. 13.12: 7 on its top (97KSL-AE5-51-7; 1405; Level 14 of Sector A).*
8. Palette, non-edged type, smeared, oblong, sandstone, black residue at one end (95KSL-AF6-10-14; Fill; Level 16 of Sector A).
9. Palette, non-edged type, smeared, oblong, sandstone (96KSL-AD6-11; 408; Level 4 of Sector A).

4.4cm, and the average length is 11.8cm.

(4) Others

Lower stones other than the above are as follows.

Incised slab (Fig. 13.15: 2; Pl. 13.5: 4)

There is a broken piece of ground slab with several crossed lines of incision on the use surface (0.9%; 1/114; Table 13.6). The lines are sharply incised, 2mm to 2.2mm wide and 1.5mm deep. Their transverse section is as angled V-shape (Fig. 13.15: 2). The purpose(s) of these incisions are as yet unknown. The blank is a flat limestone boulder, whose transverse section has a lensshape. Both surfaces are well ground. On both sides, a few flake scars to fashion the original blank are noted. The size measures 22.5cm x 12.0cm x 6.7cm.

Slab abraders/palettes (Fig. 13.20: 3 & 4; Pl. 13.7: 9)

Two broken pieces made on coarse-grained sandstone are referred to as slab abraders (1.8%; 2/114; Table 13.6). The remaining sizes are 8.9cm x 9.4cm x 2.3cm, and 5.1cm x 6.1cm x 1.2cm. These are both made into a rectangular shape by pecking and grinding, and their use surfaces are depressed through grinding. The specimen of Fig. 13.20: 3 retains three shallow grooves running in parallel on the use surface, within which faint traces of red pigments remain. It could have been used or reused as a palette. The other example of Fig. 13.20: 4 has use surfaces on both sides. In the center of each, a shallow circular depression is visible.

Anvils (Fig. 13.23; Pl. 13.5: 3)

These are represented by relatively large slabs with a rather irregular plan. The periphery is roughly flaked at parts. It may not have been possible to identify them as artifacts or used stones unless discovered in proper contexts. The specimens described here are all from the floor remains of Ubaid architecture of Sector A. They were located close to the center of a room, together with scattered craft tools. Only a single piece was usually discovered in each room, but occasionally two pieces as in Room 10A05 of Level 10 and Room 807 of Level 8.

Ten specimens were recovered (8.8%; 10/114; Table 13.6). Eight were on limestone, and the two on basalt. In general these stone slabs have a nearly straight or slightly convex use surface on one side, while the other side is unmodified or roughly flaked leaving the original irregular surface of the blank. The use surface shows clear signs of abrasion or smoothing, but they are not so flat as those of the grinding slabs. Instead, undulation of the original blank surface has not been completely removed (Fig.13.23). Such observations suggest that these stones were used as anvils, on which some soft materials were processed. Considering the discovery from a definite pottery workshop of Level 10 of Sector A, use as a craft table for pottery shaping is suggested.

The size ranges from 19.0cm x 16.0cm x 3.3cm (Room 10A01 of Level 10) to 72.0cm x 38.0cm x 6.5cm (Room 10A05), with most examples over 50cm long. Most of the specimens are less than 10cm in thickness. One relatively thick one occurred in Room 706 of Level 7 (Pl. 3.14: 2 in Nishiaki *et al.* 2001), which measured 35cm x 33cm x 15cm. It was situated about 30cm apart from a pot-stand, or a reused broken jar with a collared rim that had been placed upside down, around which craft tools including ground stones and a goat horn were scattered. This stone was probably intentionally flaked to have a rectangular solid shape with its upper surface smoothed flat.

"Turning tables" (Fig. 13.24; Pl. 13.5: 5 & 6)

These are circular flat slabs with a plano-convex section. The periphery is well modified to have a smoothed and dull edge by flaking and grinding. The transverse section is mostly planoconvex or lens-shaped. All have at least one convex surface. Both surfaces show traces of use, which have removed most of the original flaking scars. The convex surface shows signs of rubbing, while the other is gently worn. This use pattern is particularly evident on the example of Fig. 13.24: 3, whose reverse side is so polished through rotary motion to have a lustrous surface.

These stone slabs resemble the gypsum objects described as "plano-convex discs" at Tell Abada. Accounting for their discovery from a pottery production workshop, Jasim (1985: 87) suggested their possible use as molds for making dishes. Interestingly, all five "turning tables" of Tell Kosak Shamali were also recovered from the levels in which pottery workshops were identified (Levels 7, 10, 13 and 15; see Nishiaki *et al.* 2001: 93-94). If indeed related to pottery production, they seem more likely to have functioned as a slow turning table for pottery shaping or a pivot for a table made from organic materials. The rather irregular edges of some specimens (e.g. Fig. 13.24: 1) would not have worked well when used as molds.

Five specimens exist, all on limestone (4.4%; 5/114; Table 3.6). Their diameter measures from 7.3cm to 14.2cm, and the thickness from 1.2cm to 5.5cm. The blanks are either flat cobbles (Fig. 13.24: 1-3) or flakes (Fig. 13.24: 4 and 5).

13.3.3 Miscellaneous objects

The following seven types were defined for grinding stone tools other than those mentioned above: horn-shaped piece, celt, chisel, drilled stone, stone ring, flaked disk, and grooved stone (Table 13.7). Unlike the handstones and lower stones, which were made leaving the original blank shape mostly unchanged, these tools were all deliberately shaped by pecking, grinding, or polishing so as to produce a distinct shape.

Horn-shaped pieces (Fig. 13.25; Pl. 13.9: 10)
These are unique objects with a standardized shape reminiscent of gazelle horn cores. Three specimens were recovered. They have an elongated conical body slightly curved to the pointed tip. The butt is flat, and the section is more or less circular. Modification of the body is achieved by pecking towards the tip and grinding in a longitudinal direction. The complete specimen (Fig. 13.25: 1) is 20.6cm long, and 5.4cm in diameter at the thickest part. Their tips, excluding one proximal fragment (Fig. 13.25: 2), retain black substances. These tools are all made on soft chalky limestone.

These tools remind us of the clay pegs or bent nails commonly reported from Ubaid settlements. A number of suggestions have

Table 13.7 Other grinding stone tools from the Chalcolithic levels of Tell Kosak Shamali.

	Sector A																	
Type	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	Mixed	Total
Horn-shaped stones	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	**3**
Celts	0	0	1	2	1	0	0	1	0	0	0	1	0	0	0	0	0	1	**7**
Chisel	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**
Drilled stone	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**1**
Stone rings	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	**2**
Flaked disks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Grooved stone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Total	**0**	**0**	**1**	**3**	**2**	**1**	**0**	**1**	**0**	**1**	**0**	**2**	**0**	**2**	**0**	**0**	**0**	**1**	**14**

	Sector B									
Type	7	6	5	4	3	2	1	Mixed	Total	Grand total
Horn-shaped stones	0	0	0	0	0	0	0	0	**0**	3
Celts	0	0	0	0	0	0	0	0	**0**	7
Chisel	0	0	0	0	0	0	0	0	**0**	1
Drilled stone	0	0	0	0	0	0	0	0	**0**	1
Stone rings	0	0	0	0	0	0	0	0	**0**	2
Flaked disks	0	1	1	2	0	0	0	0	**4**	4
Grooved stone	0	0	1	0	0	0	0	0	**1**	1
Total	**0**	**1**	**2**	**2**	**0**	**0**	**0**	**0**	**5**	19

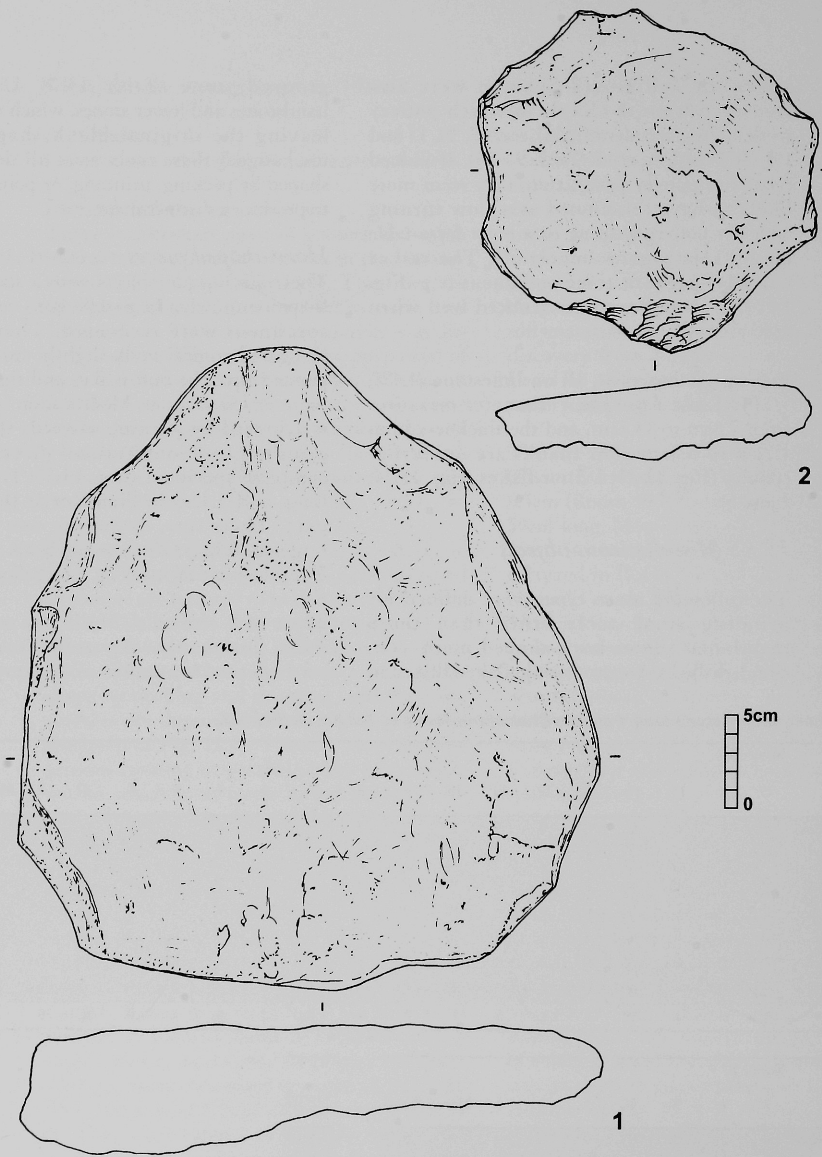


Fig. 13.23 Stone anvils from the Chalcolithic levels of Tell Kosak Shamali.
1. Anvil, convex worn surface, basalt (96KSL-AE6-20-2; 10A24; Level 10 of Sector A).
2. Anvil, convex worn surface, basalt (97KSL-AE4-24; 10A01; Level 10 of Sector A).

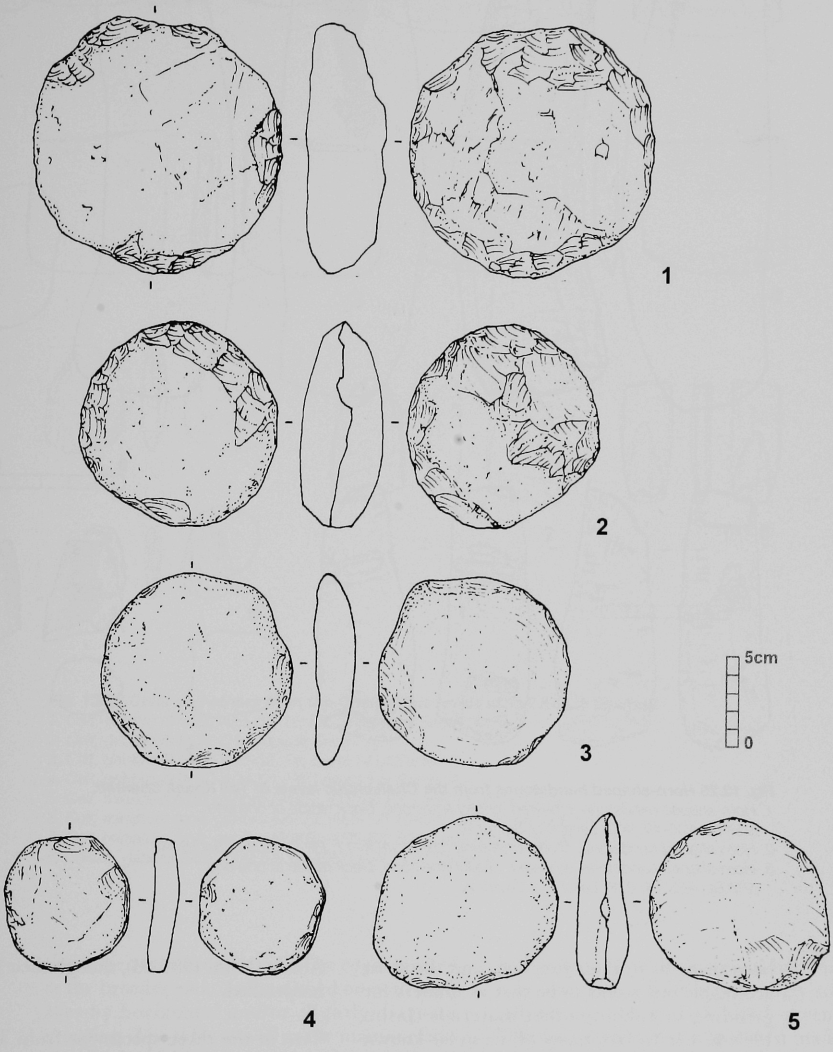


Fig. 13.24 Stone "turning tables" from the Chalcolithic levels of Tell Kosak Shamali.
1. Turning table, limestone (94KSL-C11-4; Fill; Level 15 of Sector A).
2. Turning table, limestone (96KSL-AE4-14-53; 10A01; Level 10 of Sector A).
3. Turning table, limestone (96KSL-AE4-2; Fill; Level 7 of Sector A).
4. Turning table, limestone (96KSL-AE4-14-29; 10A01; Level 10 of Sector A).
5. Turning table, limestone (97KSL-AD4-50; 1303; Level 13 of Sector A).

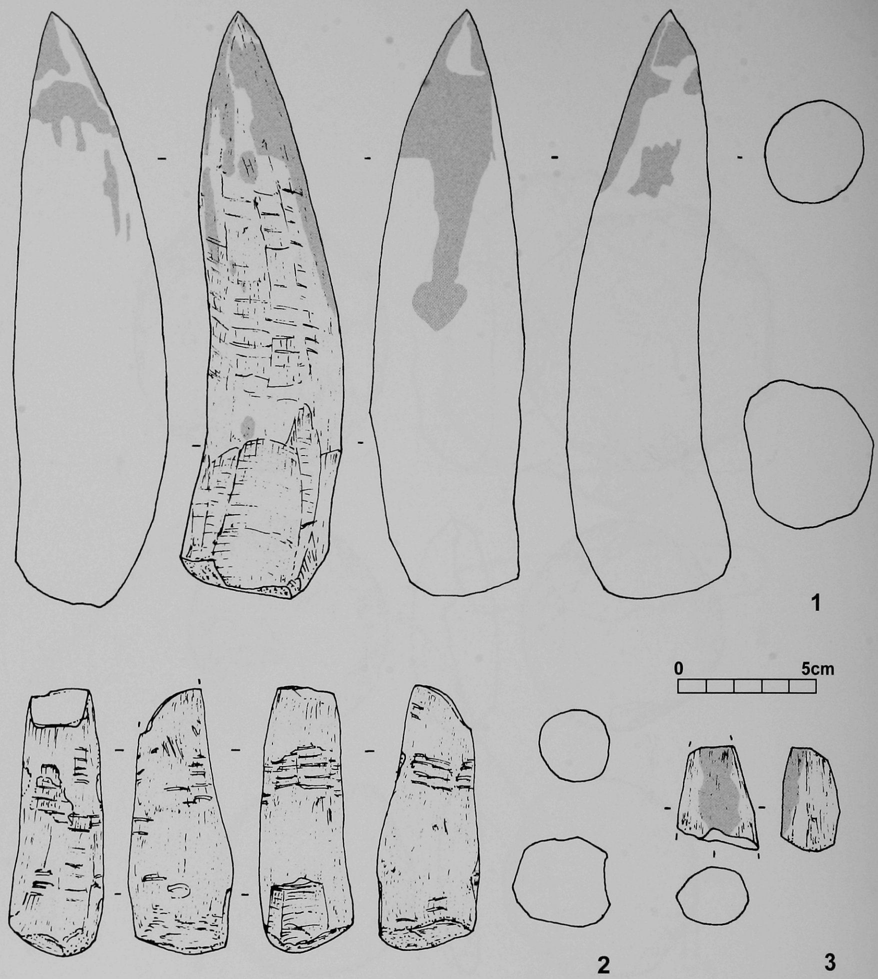


Fig. 13.25 Horn-shaped handstones from the Chalcolithic levels of Tell Kosak Shamali.
1. Horn-shaped handstone, smeared, chalky limestone, black reside at one end (95KSL-AD5-49; 402; Level 4 of Sector A).
2. Horn-shaped handstone, chalky limestone (96KSL-AD6-17; Fill; Level 6 of Sector A).
3. Horn-shaped handstone, smeared, chalky limestone, black reside at one end (96KSL-AE5-14; 818; Level 4 of Sector A).

been made as to their function, and the most acceptable one seems to be that as mullers for grinding or rubbing other materials (Jasim 1985: 62-63). In fact, many of the so far known clay examples retain usetraces at the butt end. However, this is not the case for the objects from Tell Kosak Shamali. They have neither convex butts nor ground traces at the butt. Instead, probable use traces are represented by black residues, suggesting their functional part was the tip. They may be more comparable to the "stone object in horn-shape" described at Tell eth-Thalathat II (Plate 54: 2-2 in Furuyama 1970) or the small stone cones of Tell Abada (Jasim 1985: 83), though their function is unspecified.

Two of the three specimens from Tell Kosak Shamali were discovered in pottery workshops (see Plate 3.15 in Nishiaki *et al*. 2001). Interestingly, pottery workshops were often associated with real gazelle horn cores, which also retain black residues at the tip as on the horn-shaped pieces (Chapter 14, this volume). These tools thus may have served a similar use.

Celts (Fig. 13.26: 1-7; Pl. 13.9: 1-5)

These are polished stone axes with a sharp cut-

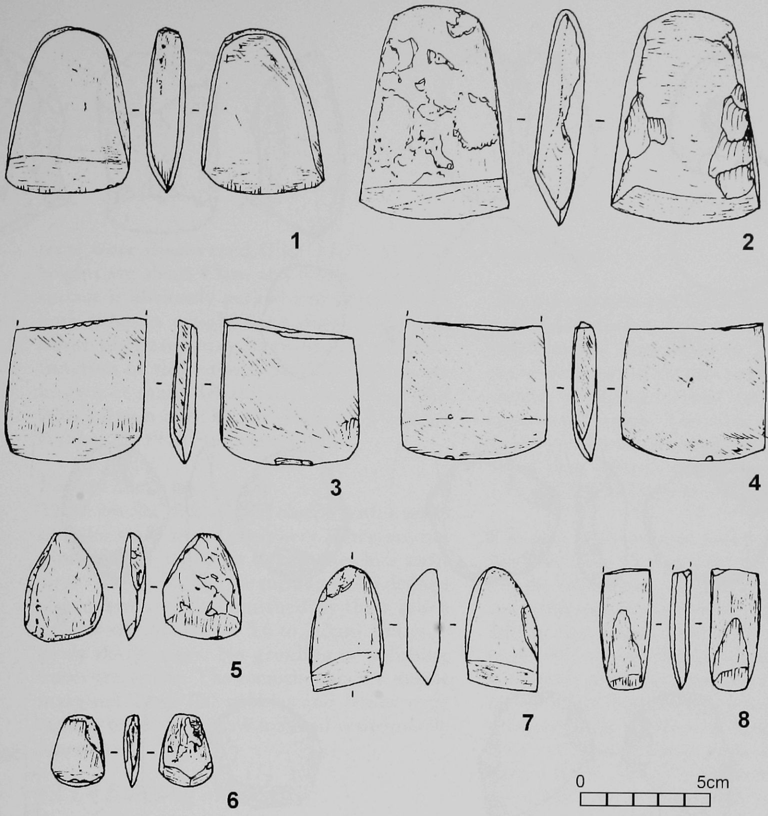


Fig. 13.26 Celts and others from the Chalcolithic levels of Tell Kosak Shamali.
1. Celt, gabbro (97KSL-AE5-55-12; Fill; Level 14 of Sector A).
2. Celt, gabbro (94KSL-D10-topsoil; Sector A).
3. Celt, gabbro (97KSL-AE5-52; Fill; Level 14 of Sector A).
4. Celt, gabbro (97KSL-AD4-50; Fill; Level 13 of Sector A).
5. Celt, miniature type, gabbro (94KSL-D10-4; Fill; Level 15 of Sector A).
6. Celt, miniature type, gabbro (96KSL-AE6-17; 10A04; Level 10 of Sector A).
7. Celt, miniature type, gabbro (96KSL-AD5-67; 604; Level 6 of Sector A).
8. Chisel, gabbro (96KSL-AE5-53; 1406; Level 14 of Sector A).

ting edge at the broader end. The edge, situated at the broader end, is all polished on both surfaces by horizontal and/or slightly diagonal grinding. The sides as well as the main surfaces are also highly polished so as to have a rectangular transversal section. While all the celts share the same general shape, they can be divided into two types on morphological grounds. One is a group of wider pieces with more or less straight sides (Fig. 13.26: 1-4; width: 4.6 to 5.4cm), and the other one has a narrower body with round convex sides (Fig. 13.26: 5-7; width: 2.0 to 2.9cm). The latter corresponds to the miniature celt defined by Wright (1992: 73). As both groups show little sign of battering at the butt, use with a handle is strongly suggested. All but one are on dark bluish-green gabbro. The only exception is a specimen made from a whitish-gray gabbro (Fig. 13.26: 7).

Chisel (Fig. 13.26: 8; Pl. 13.9: 6)

A single example of a polished stone tool was defined as a chisel (Fig. 13.26: 8). It has a much narrower and elongated body (1.9cm), and the broadest part is polished not at one end but at the mid part. The butt is broken off. All the surfaces are highly polished. The striations generally run parallel longitudinally, rather than

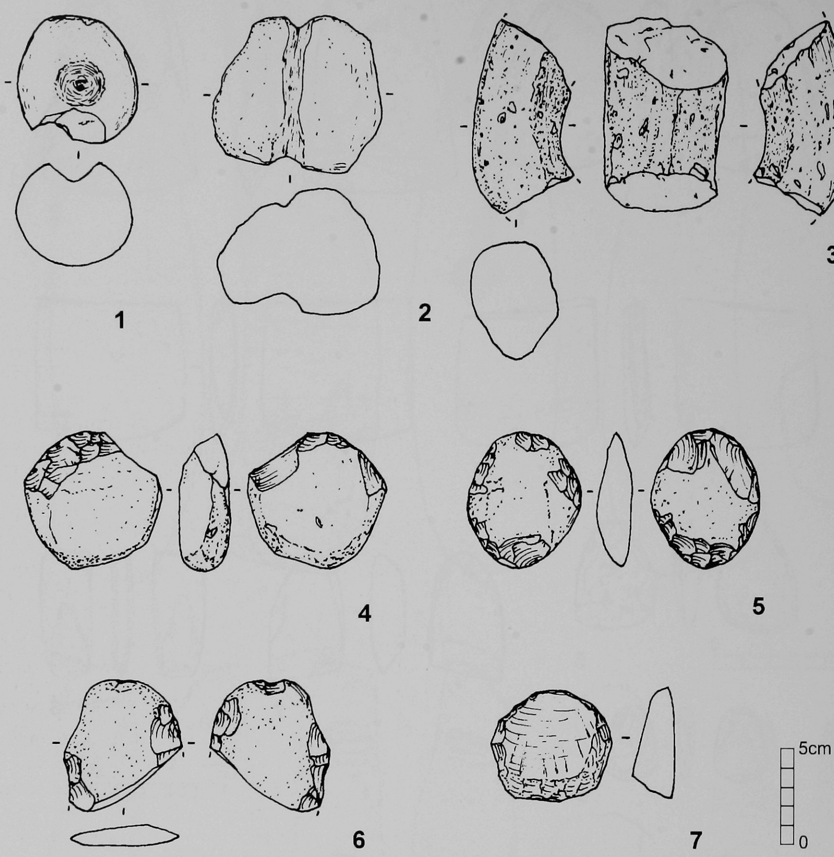


Fig. 13.27 Flaked heavy duty tools from the Chalcolithic levels of Tell Kosak Shamali.
1. Drilled stone, limestone (95KSL-AD5-55; 402; Level 4 of Sector A).
2. Grooved stone, limestone, striations within the groove (96KSL-BD7-56; 402; Level 5 of Sector B).
3. Stone ring, basalt (95KSL-AF5-17; 1306; Level 13 of Sector A).
4. Flaked disk, limestone (96KSL-BE7-11; Fill; Level 4 of Sector B).
5. Flaked disk, limestone (96KSL-BD6-24; Fill; Level 6 of Sector B).
6. Flaked disk, limestone (96KSL-BD6-29; B502; Level 5 of Sector B).
7. Flaked disk, limestone, on flake (96KSL-BE7-11; Fill; Level 4 of Sector B).

horizontally as on the celts. The raw material is dark bluish-green gabbro, the common one for the celts.

Drilled stone (Fig. 13.27: 1)

The present collection contains a drilled stone that could be an unfinished macehead. It is a polished limestone sphere with a circular pit on one face (Fig. 13.27: 1). The size is 6.7cm x 6.4cm x 5.3cm. The pit, 2.6cm in diameter and 1.5cm in depth, was evidently made by drilling. The cross section is open V-shaped, suggesting the use of a broad tool with a round tip to bore.

Grooved stone (Fig. 13.27: 2)

This is a soft chalky limestone cobble with a groove around the middle of the body. It may have worked as a loom weight or sinker. It measures 13.3cm x 12.2cm x 9.9 cm. All the surfaces are roughly pecked, and no careful polishing traces are visible. The groove is not well edged, and is some 2cm to 2.5cm wide and about 1cm deep. The inner surface of the groove is worn, probably due to abrasion from a string.

Stone rings (Fig. 13.27: 3)

Two small fragments of ring-shaped basalt objects were discovered (Fig. 13.27: 3). The heights are about 4.5cm and 6.3cm. The inner surface is obviously pecked and ground from both sides. A weight for a digging stick or other purposes may have been a possible function of these tools. Similar objects are known at many Ubaid sites including Tell Abada (Jasim 1985: 80) and Telul eth-Thalathat II (Plate 86: 19 in Furuyama 1970).

Flaked disks (Fig. 13.27: 4-7)
These are flat disk-shaped objects with a series of flake scars at the periphery. They are not ground stone tools but flaked ones in a strict sense. They resemble the turning tables defined above, but are distinguished by their much smaller size (diameter: 5.6 to 7.2cm) and relatively sharp edges. No grinding or polishing traces are visible. The retouch scars are mostly marginal. Both flat pebbles and flakes were used as blanks. The raw material is exclusively limestone.

13.3.4 Building materials

Most Chalcolithic buildings at Tell Kosak Shamali were built with mudbricks on stone foundations. The raw material for the foundation was almost exclusively limestone, the material readily available near the settlement. Broken grinding stones were also occasionally re-used as foundation stones to be mixed with limestone cobbles. In fact some of the larger grinding slabs made of basalt were discovered in such a secondary context.

As the grinding slabs were already described above, another type of building materials will be referred to here, namely door sockets. These are relatively flat stone cobbles with a round depression on its surface. The general appearance resembles that of mortars on slabs. However, unlike the mortars, the depressions of the door sockets are not generally located in the center of the upper surface. The depressions are small in comparison with their body size. Another distinguishing character lies in the treatment of the sides and the back, which are only roughly flaked, leaving the irregular surface un-smoothed. The Chalcolithic builders of Tell Kosak Shamali apparently did not care a lot about the shape of the nonfunctional parts of door sockets.

The excavations yielded a total of ten specimens identified as door sockets, all made on limestone and from Sector A. The door sockets were discovered *in situ* on walls between rooms, testifying to their actual use for the supposed purpose. The only exception is the specimen uncovered within Wall 823 of Level 8 along with other building materials (cf. Figs. 3.45 and 3.46 in Nishiaki *et al.* 2001).

The size of these door sockets shows a great diversity from 13cm x 10cm to 47cm x 34 cm. On the other hand, the size of the depressions when measured at the widest portion clearly falls in two ranges. Out of the ten specimens, eight have a diameter of the depression between 4 and 7cm, and the remaining two have a larger depression, around 18 to 20cm in diameter. The presence of larger depressions does not directly show that some posts were indeed up to 20cm thick, because the heavily worn parts are detected only in the center of the depressions. Nevertheless, this dichotomy suggests the use of perhaps two kinds of posts at Tell Kosak Shamali. At the same time, it indicates that most of the posts for doors were narrow ones. The door sockets with a larger depression were situated on the walls between Rooms 703 and 704 of Level 7, and Rooms 803 and 805 of Level 8 (Nishiaki *et al.* 2001).

13.3.5 Manuports

Stone items referred to as manuports are natural stones and minerals that were brought into the settlement but not utilized as tools. They include five pieces of pigments, and a number of "water-worn" stones.

(1) Pigments

Manganese (Pl. 13.9: 11)
There is one piece of manganese, a common material to produce black paint in Mesopotamia (Moorey 1994: 155). It has a conical shape with traces of deliberate grinding on all the surfaces. The bottom is flat, and the body surface is smoothed to round. The diameter at the bottom is 6.5cm, and the height is 5.4cm. This specimen was discovered at the bottom of Level

9 of Sector A, but is perhaps derived from the underlying potter's workshop of Level 10 (Nishiaki *et al.* 2001).

Hematite (Pl. 13.9: 12 & 13)

Four hematite pieces, most likely used to make brown to red paint on pottery (Moorey 1994: 152), were identified in the collection. The body is wholly ground to have a smooth surface. Three have an irregular egg-shape (Plate 13.9: 13), while the other is nearly spherical (Plate 13.9: 12). The size is between 3.6 and 3.7cm long, 2.1cm and 2.8cm wide, and 1.2cm and 3.1cm thick. Two of these were recovered from the potter's workshop of Level 10 of Sector A, one from Level 5 of Sector B also in association with pottery production facilities (Koizumi and Sudo 2001) and the other one was from fill of Level 2 of Sector B (see Appendix to Chapter 15).

(2) Water-worn stones (Pl. 13.8: 8)

These are natural stones without any visible traces of use or secondary modification. The present collection includes 521 specimens of such stones (22.1%; 521/2353; Table 13.1). A number of explanations are possible for their abundant presence at the settlement of Tell Kosak Shamali. Some of the stones would have indeed been brought in by the inhabitants for future uses as building materials, weights, sling missiles, raw materials of grinding stones, and so on. Others might have intruded into the archaeological deposits through building or pitting activities in the bedrock of the terrace on which the settlement was located. Oguchi (2001: 20) in fact reports the presence of buried fluvial gravel layers below the mound, which contain abundant rounded basalt, sandstone and metamorphoic rocks as well as limestone. The processes of intrusion of these stones into the archaeological deposits must be complicated, and the adequate explanation should be sought depending on the specific situation.

In the meantime, we shall mention one particular case that could give us insight into the use or function of some of these stones. It is concerned with two stone cashes of the Ubaid period discovered in Sector A. One is from Room 719 in Level 7, and the other one is from an open area to the southwest of Room 601 in Level 6. They yielded 17 and 40 water-worn stones respectively. From the morphological scheme of Table 13.4, these stones are all classed as the globular type without exception. Their sizes are also very similar to each other; the average length, width and thickness are 46.5mm (standard deviation: 7.10mm) x 35.2mm (standard deviation: 5.00mm) x 24.7mm (standard deviation: 3.93mm), and 46.7mm (standard deviation: 6.73mm) x 36.5mm (standard deviation: 6.14 mm) x 24.5mm (standard deviation: 4.73mm). While the size of naturally available stones in the vicinity of and below Tell Kosak Shamali has not yet been studied, the standardized size of these cached stones seems to reflect a human selection for some purpose.

One plausible function of these stones is that as sling missiles. Their shape and size well match those of the clay sling missiles widely reported from Ubaid sites of northern Mesopotamia (cf. Korfmann 1972). For instance, the metric data available on ten clay sling missiles from the Ubaid levels of Telul ethThalathat II, Iraq, have almost the same size as that of the above stones; the average length is 45.3mm, with a standard deviation of 7.53mm (Fukai *et al.* 1970). In addition, the average length and standard deviation are 48.0mm and 8.74mm at the Terminal Northern Ubaid/Post-Ubaid site of Tell Beydar III, upper Khabur, Syria (Suleiman and Nieuwenhuyse, n.d.). The sling missiles from Tell Abada in Iraq, middle Mesopotamia, are similarly reported to have a length between 3.5cm and 5.6cm (Jasim 1985: 62). In addition, despite the suggestion from faunal analysis that wild animals including plenty of birds were hunted at Tell Kosak Shamali in the Ubaid period (Chapter 16, this volume), no clay sling missiles or definite hunting tools have been discovered. There seems thus to be a high possibility that natural stones categorized as "water-worn" stones in this paper may well include at least some sling missiles.

13.6 Conclusions

The grinding stone assemblages of Tell Kosak Shamali consist of several major groups of tools. The most common are handstones that constitute nearly 90% of the total objects (88.8%) excluding building materials, manuports, water-worn stones and unclassifiable fragments, followed by a much smaller amount of lower stones (9.5%) and objects defined as miscellaneous objects (1.7%). These groups contain varied types of tools common at Ubaid to Late Chalcolithic sites of northern Iraq. For example, tools usually assigned to the use of food processing (e.g. grinders/polishers, pestles, pounders, grinding slabs, and mortars), craft activities (e.g. pounders/hammerstones, smoothers, celts, chisels and incised slabs), animal/bird hunting (e.g. spherical stones and "water-worn stones"), and pigment preparation (e.g. smearers, mortars, and palettes) are widely represented. In terms of specific morphological types too, most of them find good parallels in the known Iraqi sites as mentioned in the previous sections. These similarities evidently show that the Chalcolithic inhabitants of Tell Kosak Shamali maintained strong ties with the east both in subsistence and stylistic aspects despite their geographical position at the western edge of the vast Ubaid cultural sphere.

As unique elements of the Tell Kosak Shamali assemblages, we shall mention first the large size of the collection of grinding stones, as in the case of flaked stone artifacts (Chapter 11, this volume) recovered from the relatively small-scale excavations. This is probably explained at least partly by the geomorphological setting of Tell Kosak Shamali. It obviously provided rich sources of stones with a great diversity of size and shape, easily accessible by the Chalcolithic inhabitants (Oguchi 2001). The Chalcolithic people apparently made careful selection of stones for specific use. While sandstone was most commonly chosen for both handstones and lower stones, other stones were also used to produce particular types of tools (Tables 13.2 and 13.3). Among the handstones, for example, limestone and andesite were more commonly selected for certain grinders/polishers. Limestone was particularly favored to manufacture grinders/polishers of the spherical type. On the other hand, sandstone was nearly the only material selected to manufacture smoothers, and basalt and andesite were characteristically employed for pounders and pestles. The raw materials of smearers were most often sandstone, but andesite was also frequently used. As for the lower stones, basalt was the most favored raw material except for palettes. Palettes were almost exclusively made from sandstone, a pattern comparable to that of the smoothers probably used in a pair. Since all these stones were abundantly available in the vicinity of Tell Kosak Shamali, these patterns should reflect deliberate choices by the inhabitants based on their knowledge of the adequate quality of each stone.

Secondly, we can list as a characteristic of the present assemblages the abundant occurrence of tools that could be related to pottery production. Although functional interpretation of a specific tool is often very difficult, it would be appropriate to discuss this possibility for some indisputable pottery workshops have been recovered at this settlement from such levels as Level 10 of Sector A (Nishiaki *et al.* 2001) and Levels 6-5 of Sector B (Koizumi and Sudo 2001).

Stone objects regarded as potter's tools have been reported from many Chalcolithic sites. Examples are known from Tell Abada (Jasim 1985), Tepe Gawra (Speiser 1935; Tobler 1950; Rothman 2002), Tell Musharifa (Oguchi 1987) and Tell al-'Abr (Yamazaki 1999), as well as much later sites (Anderson 1987; Magrill and Middleton 1997). The literature survey by Ii (1991) designated several morphological types for them, which can be referred to, according to the typology of the present paper, as smoothers of crescent-, spatula-, axe-, and bar-shaped, discoidal types, polishers or burnishers on round river pebbles, and stone palettes. Similar or identical objects are abundantly present in the Tell Kosak Shamali collection. Needless to say, since they could have been used for other purposes as well, the morphological similarities alone would not testify to their actual use as potter's tools. Nevertheless, contextual evidence from Tell Kosak Shamali seems to help underscore such an interpretation; these tools often occurred in *in situ* contexts associated with pottery workshop constructions in several levels (Nishiaki *et al.* 2001). Plate 13.8: 1-5 shows an example of a possible tool kit from Level 13 of Sector A. These

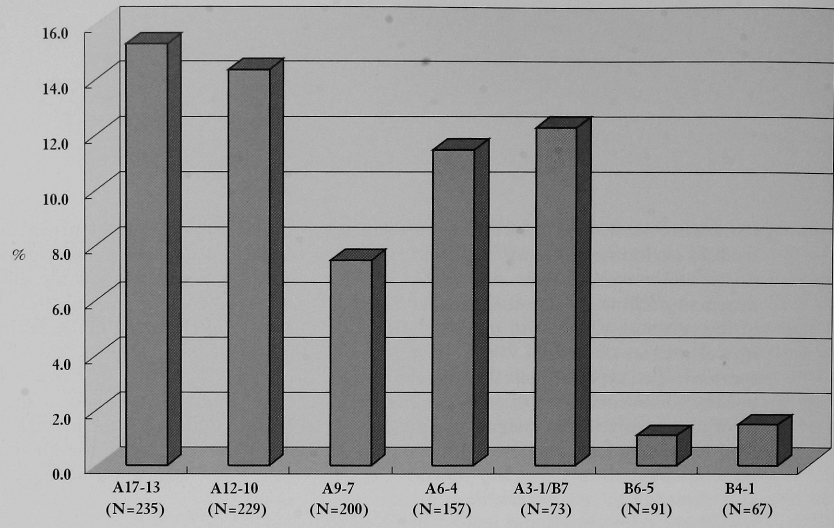


Fig. 13.28 Proportions of the smearers in the handstone assemblages from Tell Kosak Shamali by ceramic stages.

objects were discovered together all close to Feature 1306, a kiln presumably for firing pottery (Plate 3.3 in Nishiaki *et al.* 2001). They consist of a barshaped smearer, an axe-shaped smoother, a discoidal smoother, a palette of the nonedged type, and a pestle of the loaf type. Similarly, nearly all the types of "potter's tools" were recovered *in situ* from the large craft room (10A01) of the burnt building of Level 10, which included smoothers (Fig. 13.6: 4), palettes (Fig. 13.22: 5), smearers (Fig. 13.12: 4), smeared mortars (Fig. 13.18: 2), anvils/craft tables (Fig. 13.23: 1 and 2), "turning tables" (Fig. 13.24: 2 and 4) and so on.

Another indication comes from analysis of the lower stones, whose functions or uses may be determined with more certainty than for handstones; the lower stones also include numerous tools supposed to have been potter's tools. Palettes (46 specimens), anvils (10),"turning tables" (5), smeared mortars (5) and a smeared slab abrader (1) are such candidates among those described in the previous section. If all these were indeed used for the work of pottery production and pigment preparation, potter's tools comprise over half of the lower stones from Tell Kosak Shamali (58.8%; 67/114). The same might well apply to the handstones.

As such, analysis of the grinding stones from Tell Kosak Shamali could reveal details on the pottery manufacturing technologies of the Chalcolithic period. Although the analysis is still in progress, I would like to address a couple of lines of evidence on the grinding stones that could be related to the evolution of pottery production technologies. One is from "smearers" or supposed pigment preparation tools. When compared by levels or stages defined by the ceramic typology (Fig. 13.28), smearers appear in the Ubaid levels constantly at around 10 to 15%, but their frequency sharply drops in the Post-Ubaid and Uruk levels (Levels 6-1 of Sector B), down to less than a few percent. This trend undoubtedly reflects the decline of manufacturing of painting pottery in the period after the Post-Ubaid (Nishiaki *et al.* 1999). At the same time, this would in turn support the interpretation of the smearers to be associated with the production of painted pottery. A comparable trend is also observable in the lower stone assemblages, though less clearly perhaps because of the smaller sample size. Palettes presumably used in a pair of smearers also decrease from the Ubaid to the Post-Ubaid periods, from over 50% down to 0.0 to 33.3% (Table 13.6). In addition, the palettes discovered from the Post-Ubaid and Uruk levels are those of the nonedged type only, suggesting no more prolonged or intensive use as in the Ubaid period.

A similarly meaningful pattern is noted concerning the "turning tables". Stone objects defined as such were only recovered from the Early to the Late Northern Ubaid levels (Table 13.6). The preliminary analysis of the pottery chronology at Tell Kosak Shamali by Tatsundo Koizumi revealed a timevectored change in the use of turning wheels for pottery shaping as follows. In the Ubaid period, slow turning devices were used for securing a particular shape of pottery, but in its later stage the fast turning wheel was increasingly introduced. In the Post-Ubaid period, the use of the fast turning wheel became common to directly build vessel walls as well as to shape the vessel (Nishiaki *et al.* 1999: 31, 35). This observation seems to match the chronological position of the stone turning tables. Objects assignable to tables or turnnets have not been recovered from the Post-Ubaid levels, even though obvious pottery workshops existed there (Koizumi and Sudo 2001). Organic turning tables may have replaced the stone ones to facilitate fast rotating in this period.

Finally, a general trend of change between the Ubaid and the Post-Ubaid periods is addressed. The tool composition in the Post-Ubaid and Uruk levels seems much simpler than in the Ubaid periods. Grinding stones from the later periods are largely constituted of grinders and smoothers with little modification (Table 13.4). Well-shaped tools such as spherical grinders/polishers and axe-shaped smoothers are very rare, and discoidal smoothers lose their importance. The enigmatic tools of horn-shaped stone are also absent in the Post-Ubaid and Uruk periods. This change may reflect abandonment of the Ubaid-type potter's tools or replacement of them by other tools at the end of the Ubaid period. As a matter of fact, new types of potter's tools such as ceramic ring-scrapers appeared in this stage for the first time (Chapter 15). Whatever the case, further analysis focusing regarding potter's tools would be better made when other relevant data become available, particularly on tools made of clay and bone and the manufacturing traces of pottery itself. Examination of the spatial distribution should also produce useful information on the organization of craft activities in the Chalcolithic period. These will be presented in the next volume.

References

Anderson, W.P. (1987) The kilns and workshops of Sarepta (Sarafand, Lebanon): Remnants of a Phoenician ceramic industry. *Berytus* 35: 41-66.

Fukai, S., K. Horiuchi and T. Matsutani (eds.) (1970) *Telul eth-Thalathat, Vol. II, The Excavations of Tell II, The Third Season (1964).* Tokyo: The Institute of Oriental Culture, The University of Tokyo.

Furuyama, M. (1970) Stone artifacts. In: *Telul eth-Thalathat, Vol. II, The Excavations of Tell II, The Third Season (1964)*, edited by S. Fukai, K. Horiuchi and T. Matsutani, pp. 52-76. Tokyo: The Institute of Oriental Culture, The University of Tokyo.

Gopher, A. and E. Orrelle (1995) *The Ground Stone Assemblages of Munhata (A Neolithic Site in the Jordan Valley, Israel): A Report.* Quetigny: Association Paléorient.

Ii, H. (1991) Potter's tool in Mesopotamia during the fifth to third millennium BC. *Al-Rafidan* 12: 1-56.

Jasim, A.A. (1985) *The Ubaid Period in Iraq: Recent Excavations in the Hamrin Region.* BAR International Series 267. Oxford: Archaeopress.

Koizumi, T. and H. Sudo (2001) The stratigraphy and architectures of Sector B of Tell Kosak Shamali. In: *Tell Kosak Shamali - The Archaeological Investigations on the Upper Euphrates, Syria. Vol. I: Chalcolithic Architecture and the Earlier Prehistoric Remains*, edited by Y. Nishiaki and T. Matsutani, pp. 115-152. UMUT Monograph 1. Tokyo: The University Museum, The University of Tokyo / Oxford: Oxbow Books.

Korfmann, M. (1972) *Schleuder und Bogen in Südwestasien. Von den frühesten Belegen bis zum Beginn der historischen Stadtstaaten.* Bonn: Rudolf Habelt Verlag GmbH.

Magrill, P. and A. Middleton (1997) A Canaanite potter's workshop in Palestine. In: *Pottery in the Making: Ceramic Traditions*, edited by I. Freestone and D. Gaimster, pp. 68-73. Washington, D.C.: Smithsonian Institution Press.

Matsumoto, K. and S. Yokoyama (1995) Excavations at Tell Songor B. *Al-Rafidan* 16: 1-273.

Matsutani, T. and Y. Nishiaki (1995) Preliminary report on the archaeological investigations at Tell Kosak Shamali, the Upper Euphrates, Syria: The 1994 season. *Akkadica* 93: 11-20.

Mazlowski, R.F. (1997) *Nemrik 9, Vol. 3: Ground and Pecked Stone Industry in the Pre-Pottery Neolithic of Northern Iraq.* Warsaw: Institute of Archaeology, Warsaw University.

Moorey, P.R.S. (1994) *Ancient Meopotamian Materials and Industries: The Archaeological Perspectives.* Winona Lake: Eisenbrauns.

Nishiaki, Y., T. Koizumi, M. le Mière and T. Oguchi (1999) Prehistoric occupations at Tell Kosak Shamali, the Upper Euphrates, Syria. *Akkadica* 113: 13-68.

Nishiaki, Y., M. Tao, S. Kadowaki, M. Abe and H. Tano (2001) Excavations in Sector A of Tell Kosak Shamali: The stratigraphy and architectures. In: *Tell Kosak Shamali - The Archaeological Investigations on the Upper Euphrates, Syria. Volume 1: Chalcolithic Architecture and the Earlier Prehistoric Remains*, edited by Y. Nishiaki and T. Matsutani, pp. 49-113. UMUT Monograph 1. Oxford: Oxbow Books.

Oguchi, H. (1987) Tell Musharifa. In: *Researches on the Antiquities of Saddam Dam Basin Salvage and Other Researches*, pp. 49-55. Baghdad: State Organization of Antiquities and Heritage.

Rothman, M. S. (2002) *Tepe Gawra: The Evolution of a Small, Prehistoric Center in Northern Iraq*. Philadelphia: University of Pennsylvania.

Speicer, E. A. (1935) *Excavations at Tepe Gawra, Vol. I*. Philadelphia: University of Pennsylvania Press.

Suleiman, A. and O. Nieuwenhuyse (n.d.) A small Chalcolithic village in the Syrian Jezirah: Rescue excavations at Tell Beydar III (1996). *Subartu*.

Tobler, A. J. (1950) *Excavations at Tepe Gawra, Vol. II*. Philadelphia: University of Pennsylvania Press.

Table 13.8 Handstones from the Early Northern Ubaid levels of Tell Kosak Shamali.

Type	Sector A																	
	17	%	16	%	15	%	14	%	13	%	12	%	11	%	10	%	Total	%
Grinders/polishers	**1**	100.0	**2**	28.6	**16**	47.1	**37**	52.1	**61**	48.8	**15**	26.8	**12**	20.7	**49**	43.0	**193**	41.3
Globular	1	(100.0)	1	(14.3)	10	(29.4)	28	(39.4)	41	(32.8)	4	(7.1)	6	(10.3)	36	(31.6)	127	(27.2)
Spherical	0	(0.0)	1	(14.3)	0	(0.0)	1	(1.4)	3	(2.4)	3	(5.4)	0	(0.0)	1	(0.9)	9	(1.9)
Loaf	0	(0.0)	0	(0.0)	5	(14.7)	7	(9.9)	16	(12.8)	8	(14.3)	6	(10.3)	11	(9.6)	53	(11.3)
Cylindrical	0	(0.0)	0	(0.0)	1	(2.9)	1	(1.4)	1	(0.8)	0	(0.0)	0	(0.0)	1	(0.9)	4	(0.9)
Conical	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Smoothers	**0**	0.0	**0**	0.0	**7**	20.6	**8**	11.3	**28**	22.4	**25**	44.6	**25**	43.1	**25**	21.9	**118**	25.3
Discoidal	0	(0.0)	0	(0.0)	4	(11.8)	5	(7.0)	23	(18.4)	20	(35.7)	22	(37.9)	19	(16.7)	93	(19.9)
Crescent	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	2	(1.6)	1	(1.8)	1	(1.7)	1	(0.9)	5	(1.1)
Bar-shaped	0	(0.0)	0	(0.0)	2	(5.9)	2	(2.8)	3	(2.4)	3	(5.4)	2	(3.4)	4	(3.5)	16	(3.4)
Spatula-shaped	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(0.9)	1	(0.2)
Axe-shaped	0	(0.0)	0	(0.0)	1	(2.9)	1	(1.4)	0	(0.0)	1	(1.8)	0	(0.0)	0	(0.0)	3	(0.6)
Pounders	**0**	0.0	**1**	14.3	**2**	5.9	**13**	18.3	**14**	11.2	**5**	8.9	**9**	15.5	**24**	21.1	**68**	14.6
Globular	0	(0.0)	1	(14.3)	0	(0.0)	10	(14.1)	11	(8.8)	4	(7.1)	9	(15.5)	18	(15.8)	53	(11.3)
Discoidal	0	(0.0)	0	(0.0)	0	(0.0)	1	(1.4)	0	(0.0)	0	(0.0)	0	(0.0)	2	(1.8)	3	(0.6)
Cuboid	0	(0.0)	0	(0.0)	2	(5.9)	2	(2.8)	3	(2.4)	1	(1.8)	0	(0.0)	4	(3.5)	12	(2.6)
Pestles	**0**	0.0	**1**	14.3	**2**	5.9	**2**	2.8	**4**	3.2	**1**	1.8	**2**	3.4	**4**	3.5	**16**	3.4
Loaf	0	(0.0)	1	(14.3)	2	(5.9)	1	(1.4)	3	(2.4)	1	(1.8)	1	(1.7)	1	(0.9)	10	(2.1)
Cylindrical	0	(0.0)	0	(0.0)	0	(0.0)	1	(1.4)	0	(0.0)	0	(0.0)	0	(0.0)	2	(1.8)	3	(0.6)
Conical	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(0.8)	0	(0.0)	1	(1.7)	1	(0.9)	3	(0.6)
Smearers	**0**	0.0	**3**	42.9	**7**	20.6	**10**	14.1	**16**	12.8	**10**	17.9	**10**	17.2	**13**	11.4	**69**	14.8
Globular	0	(0.0)	0	(0.0)	1	(2.9)	2	(2.8)	7	(5.6)	3	(5.4)	2	(3.4)	5	(4.4)	20	(4.3)
Spherical	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(0.9)	1	(0.2)
Collared	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Discoidal	0	(0.0)	1	(14.3)	1	(2.9)	0	(0.0)	0	(0.0)	5	(8.9)	2	(3.4)	0	(0.0)	9	(1.9)
Loaf	0	(0.0)	2	(28.6)	4	(11.8)	8	(11.3)	7	(5.6)	2	(3.6)	5	(8.6)	6	(5.3)	34	(7.3)
Bar-shaped	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(1.7)	1	(0.9)	2	(0.4)
Spatula-shaped	0	(0.0)	0	(0.0)	1	(2.9)	0	(0.0)	2	(1.6)	0	(0.0)	0	(0.0)	0	(0.0)	3	(0.6)
Total	**1**	100.0	**7**	100.0	**34**	100.0	**70**	100.0	**123**	100.0	**56**	100.0	**58**	100.0	**115**	100.0	**464**	100.0

Wright, K. (1992) A classification system for ground stone tools from the prehistoric Levant. *Paléorient* 18(2): 53-81.

Yamazaki, Y. (1999) Excavations at Tell al-'Abr. In: *Archaeology of the Upper Syrian Euphrates, the Tishreen Dam Area*, edited by G. del Omo Lete and J.-L. Montero Fenollós, pp. 83-96. Barcelona: Universitat de Barcelona.

Table 13.9 Lower stones from the Early Northern Ubaid levels of Tell Kosak Shamali.

	Sector A																	
Type	17	%	16	%	15	%	14	%	13	%	12	%	11	%	10	%	Total	%
(1) Total*																		
Grinding slabs	**0**	-	**0**	0.0	**1**	16.7	**1**	14.3	**5**	25.0	**2**	50.0	**0**	-	5	25.0	**14**	23.3
Circular, concave	0	-	0	(0.0)	1	(16.7)	1	(14.3)	3	(15.0)	2	(50.0)	0	-	3	(15.0)	10	(16.7)
Circular, convex	0	-	0	(0.0)	0	(0.0)	0	(0.0)	2	(10.0)	0	(0.0)	0	-	2	(10.0)	4	(6.7)
Oblong, concave	0	-	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	-	0	(0.0)	0	(0.0)
Mortars	**0**	-	**1**	33.3	**1**	16.7	**2**	28.6	**4**	20.0	**0**	0.0	**0**	-	**5**	25.0	**13**	21.7
Pitted, pebble	0	-	0	(0.0)	0	(0.0)	1	(14.3)	2	(10.0)	0	(0.0)	0	-	1	(5.0)	4	(6.7)
Pitted, slab	0	-	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	-	2	(10.0)	2	(3.3)
Multi-pitted, slab	0	-	1	(33.3)	0	(0.0)	1	(14.3)	0	(0.0)	0	(0.0)	0	-	2	(10.0)	4	(6.7)
Hollowed	0	-	0	(0.0)	1	(16.7)	0	(0.0)	1	(5.0)	0	(0.0)	0	-	0	(0.0)	2	(3.3)
Cylindrical	0	-	0	(0.0)	0	(0.0)	0	(0.0)	1	(5.0)	0	(0.0)	0	-	0	(0.0)	1	(1.7)
Palettes	**0**	-	2	66.7	**3**	50.0	4	57.1	**10**	50.0	**2**	50.0	**0**	-	**3**	15.0	**24**	40.0
Edged	0	-	0	(0.0)	1	(16.7)	0	(0.0)	3	(15.0)	0	(0.0)	0	-	1	(5.0)	5	(8.3)
Non-edged	0	-	2	(66.7)	2	(33.3)	4	(57.1)	7	(35.0)	2	(50.0)	0	-	2	(10.0)	19	(31.7)
Others	**0**	-	**0**	0.0	**1**	16.7	**0**	0.0	**1**	5.0	**0**	0.0	**0**	-	**7**	35.0	**9**	15.0
Incised	0	-	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	-	0	(0.0)	0	(0.0)
Slab abrader/palette	0	-	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	-	0	(0.0)	0	(0.0)
Anvil	0	-	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	-	5	(25.0)	5	(8.3)
Turning table	0	-	0	(0.0)	1	(16.7)	0	(0.0)	1	(5.0)	0	(0.0)	0	-	2	(10.0)	4	(6.7)
Total	**0**	-	3	100.0	**6**	100.0	**7**	100.0	**20**	100.0	4	100.0	**0**	-	**20**	100.0	**60**	100.0
(2) Smeared lower stones																		
Grinding slabs	**0**	-	**0**	0.0	**0**	-	**0**	0.0	**0**	0.0	**0**	0.0	**0**	-	**1**	33.3	**1**	10.0
Circular, convex	0	-	0	(0.0)	0	-	0	(0.0)	0	(0.0)	0	(0.0)	0	-	1	(33.3)	1	(10.0)
Mortars	**0**	-	**0**	0.0	**0**	-	**1**	100.0	**1**	33.3	**0**	0.0	**0**	-	**2**	66.7	**4**	40.0
Pitted, pebble	0	-	0	(0.0)	0	-	1	(100.0)	0	(0.0)	0	(0.0)	0	-	0	(0.0)	1	(10.0)
Pitted, slab	0	-	0	(0.0)	0	-	0	(0.0)	0	(0.0)	0	(0.0)	0	-	2	(66.7)	2	(20.0)
Hollowed	0	-	0	(0.0)	0	-	0	(0.0)	1	(33.3)	0	(0.0)	0	-	0	(0.0)	1	(10.0)
Palettes	**0**	-	2	100.0	**0**	-	**0**	0.0	2	66.7	**1**	100.0	**0**	-	**0**	0.0	**5**	50.0
Edged	0	-	0	(0.0)	0	-	0	(0.0)	1	(33.3)	0	(0.0)	0	-	0	(0.0)	1	(10.0)
Non-edged	0	-	2	(100.0)	0	-	0	(0.0)	1	(33.3)	1	(100.0)	0	-	0	(0.0)	4	(40.0)
Total	**0**	-	2	100.0	**0**	-	1	100.0	3	100.0	1	100.0	**0**	-	3	100.0	**10**	100.0

* includes smeared ones

Table 13.10 Handstones from the Late Northern Ubaid levels of Tell Kosak Shamali.

Type	Sector A 9	%	8	%	7	%	6	%	5	%	4	%	Total	%
Grinders/polishers	**19**	39.6	**28**	52.8	**59**	59.6	**16**	43.2	**13**	50.0	**44**	46.8	**179**	50.1
Globular	14	(29.2)	13	(24.5)	50	(50.5)	12	(32.4)	5	(19.2)	27	(28.7)	121	(33.9)
Spherical	0	(0.0)	3	(5.7)	3	(3.0)	1	(2.7)	2	(7.7)	5	(5.3)	14	(3.9)
Loaf	5	(10.4)	12	(22.6)	5	(5.1)	3	(8.1)	6	(23.1)	11	(11.7)	42	(11.8)
Cylindrical	0	(0.0)	0	(0.0)	1	(1.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(0.3)
Conical	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(1.1)	1	(0.3)
Smoothers	**14**	29.2	**8**	15.1	**16**	16.2	**6**	16.2	**5**	19.2	**10**	10.6	**59**	16.5
Discoidal	7	(14.6)	6	(11.3)	14	(14.1)	5	(13.5)	5	(19.2)	7	(7.4)	44	(12.3)
Crescent	1	(2.1)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	2	(2.1)	3	(0.8)
Bar-shaped	4	(8.3)	1	(1.9)	2	(2.0)	1	(2.7)	0	(0.0)	1	(1.1)	9	(2.5)
Spatula-shaped	1	(2.1)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(0.3)
Axe-shaped	1	(2.1)	1	(1.9)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	2	(0.6)
Pounders	**9**	18.8	**9**	17.0	**9**	9.1	**7**	18.9	**3**	11.5	**28**	29.8	**65**	18.2
Globular	7	(14.6)	8	(15.1)	7	(7.1)	2	(5.4)	3	(11.5)	26	(27.7)	53	(14.8)
Discoidal	0	(0.0)	1	(1.9)	0	(0.0)	1	(2.7)	0	(0.0)	1	(1.1)	3	(0.8)
Cuboid	2	(4.2)	0	(0.0)	2	(2.0)	4	(10.8)	0	(0.0)	1	(1.1)	9	(2.5)
Pestles	**5**	10.4	**2**	3.8	**7**	7.1	**3**	8.1	**0**	0.0	**4**	4.3	**21**	5.9
Loaf	4	(8.3)	1	(1.9)	7	(7.1)	2	(5.4)	0	(0.0)	0	(0.0)	14	(3.9)
Cylindrical	1	(2.1)	1	(1.9)	0	(0.0)	0	(0.0)	0	(0.0)	4	(4.3)	6	(1.7)
Conical	0	(0.0)	0	(0.0)	0	(0.0)	1	(2.7)	0	(0.0)	0	(0.0)	1	(0.3)
Smearers	**1**	2.1	**6**	11.3	**8**	8.1	**5**	13.5	**5**	19.2	**8**	8.5	**33**	9.2
Globular	0	(0.0)	0	(0.0)	2	(2.0)	2	(5.4)	2	(7.7)	5	(5.3)	11	(3.1)
Spherical	0	(0.0)	1	(1.9)	0	(0.0)	1	(2.7)	2	(7.7)	1	(1.1)	5	(1.4)
Collared	0	(0.0)	0	(0.0)	1	(1.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(0.3)
Discoidal	0	(0.0)	0	(0.0)	0	(0.0)	1	(2.7)	0	(0.0)	1	(1.1)	2	(0.6)
Loaf	0	(0.0)	4	(7.5)	4	(4.0)	1	(2.7)	1	(3.8)	1	(1.1)	11	(3.1)
Bar-shaped	0	(0.0)	1	(1.9)	1	(1.0)	0	(0.0)	0	(0.0)	0	(0.0)	2	(0.6)
Spatula-shaped	1	(2.1)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(0.3)
Total	**48**	100.0	**53**	100.0	**99**	100.0	**37**	100.0	**26**	100.0	**94**	100.0	**357**	100.0

Table 13.11 Lower stones from the Late Northern Ubaid levels of Tell Kosak Shamali.

Type	Sector A 9	%	8	%	7	%	6	%	5	%	4	%	Total	%
(1) Total*														
Grinding slabs	**1**	25.0	**2**	28.6	**0**	0.0	**2**	33.3	**4**	80.0	**3**	16.7	**12**	27.9
Circular, concave	0	(0.0)	2	(28.6)	0	(0.0)	2	(33.3)	3	(60.0)	3	(16.7)	10	(23.3)
Circular, convex	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(20.0)	0	(0.0)	1	(2.3)
Oblong, concave	1	(25.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(2.3)
Mortars	**0**	0.0	**1**	14.3	**0**	0.0	**1**	16.7	**1**	20.0	**4**	22.2	**7**	16.3
Pitted, pebble	0	(0.0)	0	(0.0)	0	(0.0)	1	(16.7)	1	(20.0)	2	(11.1)	4	(9.3)
Pitted, slab	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(5.6)	1	(2.3)
Multi-pitted, slab	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(5.6)	1	(2.3)
Hollowed	0	(0.0)	1	(14.3)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(2.3)
Cylindrical	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Palettes	**2**	50.0	**2**	28.6	**1**	33.3	**3**	50.0	**0**	0.0	**8**	44.4	**16**	37.2
Edged	2	(50.0)	0	(0.0)	0	(0.0)	2	(33.3)	0	(0.0)	3	(16.7)	7	(16.3)
Non-edged	0	(0.0)	2	(28.6)	1	(33.3)	1	(16.7)	0	(0.0)	5	(27.8)	9	(20.9)
Others	**1**	25.0	**2**	28.6	**2**	66.7	**0**	0.0	**0**	0.0	**3**	16.7	**8**	18.6
Incised	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(5.6)	1	(2.3)
Slab abrader/palette	1	(25.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(2.3)
Anvil	0	(0.0)	2	(28.6)	1	(33.3)	0	(0.0)	0	(0.0)	2	(11.1)	5	(11.6)
Turning table	0	(0.0)	0	(0.0)	1	(33.3)	0	(0.0)	0	(0.0)	0	(0.0)	1	(2.3)
Total	**4**	100.0	**7**	100.0	**3**	100.0	**6**	100.0	**5**	100.0	**18**	100.0	**43**	100.0
(2) Smeared lower stones														
Palettes	**0**	0.0	**1**	100.0	**0**	-	**3**	100.0	**0**	-	**5**	100.0	**9**	90.0
Edged	0	(0.0)	0	(0.0)	0	-	2	(66.7)	0	-	2	(40.0)	4	(40.0)
Non-edged	0	(0.0)	1	(100.0)	0	-	1	(33.3)	0	-	3	(60.0)	5	(50.0)
Others	**1**	100.0	**0**	0.0	**0**	-	**0**	0.0	**0**	-	**0**	0.0	**1**	10.0
Slab abrader/palette	1	(100.0)	0	(0.0)	0	-	0	(0.0)	0	-	0	(0.0)	1	(10.0)
Total	**1**	100.0	**1**	100.0	**0**	-	**3**	100.0	**0**	-	**5**	100.0	**10**	100.0

* includes smeared ones

Table 13.12 Handstones from the Terminal Northern Ubaid levels of Tell Kosak Shamali.

	Sector A				Sector B					
Type	3	%	2	%	1	%	7	%	Total	%
Grinders/polishers	**4**	28.6	**7**	50.0	**8**	47.1	**16**	57.1	**35**	47.9
Globular	3	(21.4)	7	(50.0)	3	(17.6)	13	(46.4)	26	(35.6)
Spherical	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Loaf	1	(7.1)	0	(0.0)	5	(29.4)	3	(10.7)	9	(12.3)
Cylindrical	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Conical	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Smoothers	**4**	28.6	**1**	7.1	**2**	11.8	**8**	28.6	**15**	20.5
Discoidal	3	(21.4)	1	(7.1)	2	(11.8)	5	(17.9)	11	(15.1)
Crescent	0	(0.0)	0	(0.0)	0	(0.0)	1	(3.6)	1	(1.4)
Bar-shaped	0	(0.0)	0	(0.0)	0	(0.0)	2	(7.1)	2	(2.7)
Spatula-shaped	1	(7.1)	0	(0.0)	0	(0.0)	0	(0.0)	1	(1.4)
Axe-shaped	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Pounders	**6**	42.9	**0**	0.0	**0**	0.0	**3**	10.7	**9**	12.3
Globular	6	(42.9)	0	(0.0)	0	(0.0)	3	(10.7)	9	(12.3)
Discoidal	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Cuboid	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Pestles	**0**	0.0	**1**	7.1	**4**	23.5	**0**	0.0	**5**	6.8
Loaf	0	(0.0)	0	(0.0)	3	(17.6)	0	(0.0)	3	(4.1)
Cylindrical	0	(0.0)	1	(7.1)	0	(0.0)	0	(0.0)	1	(1.4)
Conical	0	(0.0)	0	(0.0)	1	(5.9)	0	(0.0)	1	(1.4)
Smearers	**0**	0.0	**5**	35.7	**3**	17.6	**1**	3.6	**9**	12.3
Globular	0	(0.0)	2	(14.3)	0	(0.0)	0	(0.0)	2	(2.7)
Spherical	0	(0.0)	2	(14.3)	2	(11.8)	0	(0.0)	4	(5.5)
Collared	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Discoidal	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Loaf	0	(0.0)	1	(7.1)	1	(5.9)	1	(3.6)	3	(4.1)
Bar-shaped	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Spatula-shaped	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Total	**14**	100.0	**14**	100.0	**17**	100.0	**28**	100.0	**73**	100.0

Table 13.13 Lower stones from the Terminal Northern Ubaid levels of Tell Kosak Shamali.

	Sector A				Sector B					
Type	**3**	%	**2**	%	**1**	%	**7**	%	**Total**	%
(1) Total*										
Grinding slabs	**0**	0.0	**0**	0.0	**0**	-	**0**	-	**0**	0.0
Circular, concave	0	(0.0)	0	(0.0)	0	-	0	-	0	(0.0)
Circular, convex	0	(0.0)	0	(0.0)	0	-	0	-	0	(0.0)
Oblong, concave	0	(0.0)	0	(0.0)	0	-	0	-	0	(0.0)
Mortars	**0**	0.0	**0**	0.0	**0**	-	**0**	-	**0**	0.0
Pitted, pebble	0	(0.0)	0	(0.0)	0	-	0	-	0	(0.0)
Pitted, slab	0	(0.0)	0	(0.0)	0	-	0	-	0	(0.0)
Multi-pitted, slab	0	(0.0)	0	(0.0)	0	-	0	-	0	(0.0)
Hollowed	0	(0.0)	0	(0.0)	0	-	0	-	0	(0.0)
Cylindrical	0	(0.0)	0	(0.0)	0	-	0	-	0	(0.0)
Palettes	**1**	100.0	**1**	100.0	**0**	-	**0**	-	**2**	100.0
Edged	0	(0.0)	0	(0.0)	0	-	0	-	0	(0.0)
Non-edged	1	(100.0)	1	(100.0)	0	-	0	-	2	(100.0)
Others	**0**	0.0	**0**	0.0	**0**	-	**0**	-	**0**	0.0
Incised	0	(0.0)	0	(0.0)	0	-	0	-	0	(0.0)
Slab abrader/palette	0	(0.0)	0	(0.0)	0	-	0	-	0	(0.0)
Anvil	0	(0.0)	0	(0.0)	0	-	0	-	0	(0.0)
Turning table	0	(0.0)	0	(0.0)	0	-	0	-	0	(0.0)
Total	**1**	100.0	**1**	100.0	**0**	-	**0**	-	**2**	100.0
(2) Smeared lower stones										
Palettes	**0**	-	**1**	100.0	**0**	-	**0**	-	**1**	100.0
Non-edged	0	-	1	(100.0)	0	-	0	-	1	(100.0)
Total	**0**	-	**1**	100.0	**0**	-	**0**	-	**1**	100.0

* includes smeared ones

Table 13.14 Handstones from the Post-Ubaid levels of Tell Kosak Shamali.

Type	Sector B 6	%	5	%	Total	%
Grinders/polishers	**25**	48.1	**20**	51.3	**45**	49.5
Globular	19	(36.5)	15	(38.5)	34	(37.4)
Spherical	0	(0.0)	0	(0.0)	0	(0.0)
Loaf	6	(11.5)	5	(12.8)	11	(12.1)
Cylindrical	0	(0.0)	0	(0.0)	0	(0.0)
Conical	0	(0.0)	0	(0.0)	0	(0.0)
Smoothers	**6**	11.5	**8**	20.5	**14**	15.4
Discoidal	6	(11.5)	6	(15.4)	12	(13.2)
Crescent	0	(0.0)	0	(0.0)	0	(0.0)
Bar-shaped	0	(0.0)	2	(5.1)	2	(2.2)
Spatula-shaped	0	(0.0)	0	(0.0)	0	(0.0)
Axe-shaped	0	(0.0)	0	(0.0)	0	(0.0)
Pounders	**19**	36.5	**10**	25.6	**29**	31.9
Globular	17	(32.7)	10	(25.6)	27	(29.7)
Discoidal	2	(3.8)	0	(0.0)	2	(2.2)
Cuboid	0	(0.0)	0	(0.0)	0	(0.0)
Pestles	**2**	3.8	**0**	0.0	**2**	2.2
Loaf	2	(3.8)	0	(0.0)	2	(2.2)
Cylindrical	0	(0.0)	0	(0.0)	0	(0.0)
Conical	0	(0.0)	0	(0.0)	0	(0.0)
Smearers	**0**	0.0	**1**	2.6	**1**	1.1
Globular	0	(0.0)	0	(0.0)	0	(0.0)
Spherical	0	(0.0)	0	(0.0)	0	(0.0)
Collared	0	(0.0)	0	(0.0)	0	(0.0)
Discoidal	0	(0.0)	0	(0.0)	0	(0.0)
Loaf	0	(0.0)	0	(0.0)	0	(0.0)
Bar-shaped	0	(0.0)	1	(2.6)	1	(1.1)
Spatula-shaped	0	(0.0)	0	(0.0)	0	(0.0)
Total	**52**	100.0	**39**	100.0	**91**	100.0

Table 13.15 Lower stones from the Post-Ubaid levels of Tell Kosak Shamali.

Type	Sector B 6	%	5	%	Total	%
(1) Non-smeared stones						
Grinding slabs	**1**	100.0	**4**	100.0	**5**	100.0
Circular, concave	1	(100.0)	4	(100.0)	5	(100.0)
Circular, convex	0	(0.0)	0	(0.0)	0	(0.0)
Oblong, concave	0	(0.0)	0	(0.0)	0	(0.0)
Mortars	**0**	0.0	**1**	25.0	**1**	20.0
Pitted, pebble	0	(0.0)	0	(0.0)	0	(0.0)
Pitted, slab	0	(0.0)	0	(0.0)	0	(0.0)
Multi-pitted, slab	0	(0.0)	0	(0.0)	0	(0.0)
Hollowed	0	(0.0)	0	(0.0)	0	(0.0)
Cylindrical	0	(0.0)	1	(25.0)	1	(20.0)
Palettes	**0**	0.0	**0**	0.0	**0**	0.0
Edged	0	(0.0)	0	(0.0)	0	(0.0)
Non-edged	0	(0.0)	0	(0.0)	0	(0.0)
Others	**0**	0.0	**0**	0.0	**0**	0.0
Incised	0	(0.0)	0	(0.0)	0	(0.0)
Slab abrader/palette	0	(0.0)	0	(0.0)	0	(0.0)
Anvil	0	(0.0)	0	(0.0)	0	(0.0)
Turning table	0	(0.0)	0	(0.0)	0	(0.0)
Total	**1**	100.0	**4**	125.0	**5**	120.0
(2) Smeared lower stones						
(Absent)						

Table 13.16 Handstones from the Uruk levels of Tell Kosak Shamali.

Type	Sector B 4	%	3	%	2	%	1	%	Total	%
Grinders/polishers	**17**	58.6	**7**	38.9	**2**	33.3	**5**	35.7	**31**	46.3
Globular	16	(55.2)	7	(38.9)	2	(33.3)	5	(35.7)	30	(44.8)
Spherical	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Loaf	1	(3.4)	0	(0.0)	0	(0.0)	0	(0.0)	1	(1.5)
Cylindrical	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Conical	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Smoothers	**9**	31.0	**6**	33.3	**2**	33.3	**5**	35.7	**22**	32.8
Discoidal	6	(20.7)	2	(11.1)	1	(16.7)	4	(28.6)	13	(19.4)
Crescent	0	(0.0)	0	(0.0)	0	(0.0)	1	(7.1)	1	(1.5)
Bar-shaped	1	(3.4)	3	(16.7)	1	(16.7)	0	(0.0)	5	(7.5)
Spatula-shaped	0	(0.0)	1	(5.6)	0	(0.0)	0	(0.0)	1	(1.5)
Axe-shaped	2	(6.9)	0	(0.0)	0	(0.0)	0	(0.0)	2	(3.0)
Pounders	**3**	10.3	**4**	22.2	**2**	33.3	**4**	28.6	**13**	19.4
Globular	3	(10.3)	4	(22.2)	1	(16.7)	4	(28.6)	12	(17.9)
Discoidal	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Cuboid	0	(0.0)	0	(0.0)	1	(16.7)	0	(0.0)	1	(1.5)
Pestles	**0**	0.0	**0**	0.0	**0**	0.0	**0**	0.0	**0**	0.0
Loaf	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Cylindrical	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Conical	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Smearers	**0**	0.0	**1**	5.6	**0**	0.0	**0**	0.0	**1**	1.5
Globular	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Spherical	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Collared	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Discoidal	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Loaf	0	(0.0)	1	(5.6)	0	(0.0)	0	(0.0)	1	(1.5)
Bar-shaped	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Spatula-shaped	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Total	**29**	100.0	**18**	100.0	**6**	100.0	**14**	100.0	**67**	100.0

Table 13.17 Lower stones from the Uruk levels of Tell Kosak Shamali.

	Sector B									
Type	**4**	%	**3**	%	**2**	%	**1**	%	**Total**	%
(1) Total*										
Grinding slabs	**1**	50.0	**0**	0.0	**0**	-	**1**	100.0	**2**	33.3
Circular, concave	0	(0.0)	0	(0.0)	0	-	1	(100.0)	1	(16.7)
Circular, convex	1	(50.0)	0	(0.0)	0	-	0	(0.0)	1	(16.7)
Oblong, concave	0	(0.0)	0	(0.0)	0	-	0	(0.0)	0	(0.0)
Mortars	**0**	0.0	**1**	33.3	**0**	-	**0**	0.0	**1**	16.7
Pitted, pebble	0	(0.0)	1	(33.3)	0	-	0	(0.0)	1	(16.7)
Pitted, slab	0	(0.0)	0	(0.0)	0	-	0	(0.0)	0	(0.0)
Multi-pitted, slab	0	(0.0)	0	(0.0)	0	-	0	(0.0)	0	(0.0)
Hollowed	0	(0.0)	0	(0.0)	0	-	0	(0.0)	0	(0.0)
Cylindrical	0	(0.0)	0	(0.0)	0	-	0	(0.0)	0	(0.0)
Palettes	**0**	0.0	**2**	66.7	**0**	-	**0**	0.0	**2**	33.3
Edged	0	(0.0)	0	(0.0)	0	-	0	(0.0)	0	(0.0)
Non-edged	0	(0.0)	2	(66.7)	0	-	0	(0.0)	2	(33.3)
Others	**1**	50.0	**0**	0.0	**0**	-	**0**	0.0	**1**	16.7
Incised	0	(0.0)	0	(0.0)	0	-	0	(0.0)	0	(0.0)
Slab abrader/palette	1	(50.0)	0	(0.0)	0	-	0	(0.0)	1	(16.7)
Anvil	0	(0.0)	0	(0.0)	0	-	0	(0.0)	0	(0.0)
Turning table	0	(0.0)	0	(0.0)	0	-	0	(0.0)	0	(0.0)
Total	**2**	100.0	**3**	100.0	**0**	-	**1**	100.0	**6**	100.0
(2) Smeared lower stones										
Palettes	**0**	0.0	**1**	100.0	**0**	-	**0**	-	**1**	50.0
Non-edged	0	(0.0)	1	(100.0)	0	-	0	-	1	(50.0)
Others	**1**	100.0	**0**	0.0	**0**	-	**0**	-	**1**	50.0
Slab abrader/palette	1	(100.0)	0	(0.0)	0	-	0	-	1	(50.0)
Total	**1**	100.0	**1**	100.0	**0**	-	**0**	-	**2**	100.0

* includes smeared ones

Plate 13.1 Grinders/polishers from the Chalcolithic levels of Tell Kosak Shamali.

1. Grinder/polisher, spherical type, L: 9.4cm (cf. Fig. 13.2: 2).
2. Grinder/polisher, globular type, L: 14.5cm (cf. Fig. 13.1: 3).
3. Grinder/polisher, globular type, L: 17.6cm (cf. Fig. 13.1: 1).
4. Grinder/polisher, globular type, L: 18.5cm (cf. Fig. 13.1: 4).
5. Grinder/polisher, loaf type, sandstone, L: 8.1cm (96KSL-AE6-21; 10A04; Level 10 of Sector A).
6. Grinder/polisher, loaf type, L: 11.8cm (cf. Fig. 13.4: 3).
7. Grinder/polisher, loaf type, L: 24.3cm (cf. Fig. 13.4: 1).
8. Grinder/polisher, loaf type, sandstone, L: 29.2cm (94KSL-A11-8; Mixed; Level 14-17 of Sector A).

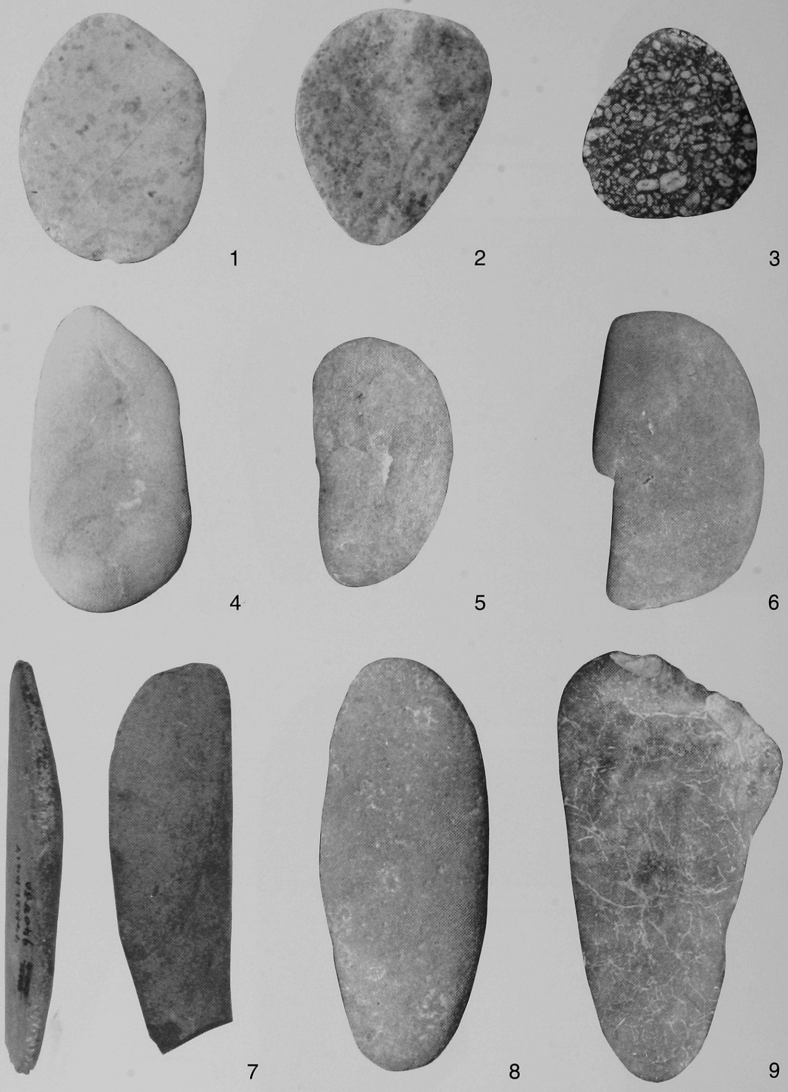


Plate 13.2 Smoothers from the Chalcolithic levels of Tell Kosak Shamali.

1. Smoother, discoidal type, sandstone, L: 13.2cm (97KSL-AD5-117-1; 1304; Level 13 of Sector A).
2. Smoother, discoidal type, L: 12.6cm (97KSL-AD4-50-1; 1303; Level 13 of Sector A).
3. Smoother, discoidal type, sandstone, L: 9.2cm (97KSL-AD5-117-15; 1304; Level 13 of Sector A).
4. Smoother, crescent-shaped type, L: 11.1cm (cf. Fig. 13.6: 4).
5. Smoother, crescent-shaped type, L: 11.4cm (cf. Fig. 13.6: 3).
6. Smoother, crescent-shaped type, L: 13.4cm (cf. Fig. 13.6: 2).
7. Smoother, spatula-shaped type, L: 11.4cm (cf. Fig. 13.6: 9).
8. Smoother, bar-shaped type, L: 17.4cm (cf. Fig. 13.6: 1).
9. Smoother, spatula-shaped type, sandstone, L: 16.3cm (94KSL-A7-2; Mixed; Sector A).

Plate 13.3 Pounders and Pestles from the Chalcolithic levels of Tell Kosak Shamali.

1. Pounder, cuboid type, L: 5.8cm (cf. Fig. 13.9: 10).
2. Pounder, cuboid type, L: 5.5cm (cf. Fig. 13.9: 11).
3. Pestle, conical type, L: 18.1cm (cf. Fig. 13.10: 9).
4. Pestle, cylindrical type, L: 15.6cm (cf. Fig. 13.10: 7).
5. Pounder, globular type, L: 13.1cm (cf. Fig. 13.8: 7).
6. Pestle, loaf type, andesite, L: 15.2cm (96KSL-AE4-14-34; 10A01; Level 10 of Sector A).
7. Pestle, loaf type, L: 8.5cm (cf. Fig. 13.10: 3).
8. Pestle, loaf type, L: 21.1cm (cf. Fig. 13.10: 2).
9. Pestle, loaf type, L: 27.4cm (cf. Fig. 13.10: 1).
10. Pestle, cylindrical type, L: 15.6cm (cf. Fig. 13.10: 6).

Plate 13.4 Smearers from the Chalcolithic levels of Tell Kosak Shamali.

1. Smearer, loaf type, L: 16.8cm (cf. Fig. 13.12: 3).
2. Smearer, loaf type, sandstone, L: 20.9cm (97KSL-AE4-22; 10A18; Level 10 of Sector A).
3. Smearer, loaf type, andesite, L: 5.6cm (96KSL-AD6-6; 201; Level 2 of Sector A).
4. Smearer, loaf type, sandstone, L: 12.1cm (97KSL-AD4-50-2; 1303; Level 13 of Sector A).
5. Smearer, spatula-shaped type, L: 13.9cm (cf. Fig. 13.11: 14).
6. Smearer, loaf type, sandstone, L: 9.9cm (97KSL-AE5-53-17; 1406; Level 14 of Sector A).
7. Smearer, loaf type, sandstone, L: 12.8cm (97KSL-AD5-117-11; 1304; Level 13 of Sector A).
8. Smearer, loaf type, L: 12.8cm (cf. Fig. 13.12: 10).
9. Smearer, loaf type, L: 15.5cm (cf. Fig. 13.12: 2).
10. Smearer, spherical type, L: 5.0cm (cf. Fig. 13.11: 4).
11. Smearer, spherical type, L: 5.0cm (cf. Fig. 13.11: 7).
12. Smearer, collared type, L: 8.5cm (cf. Fig. 13.12: 15).

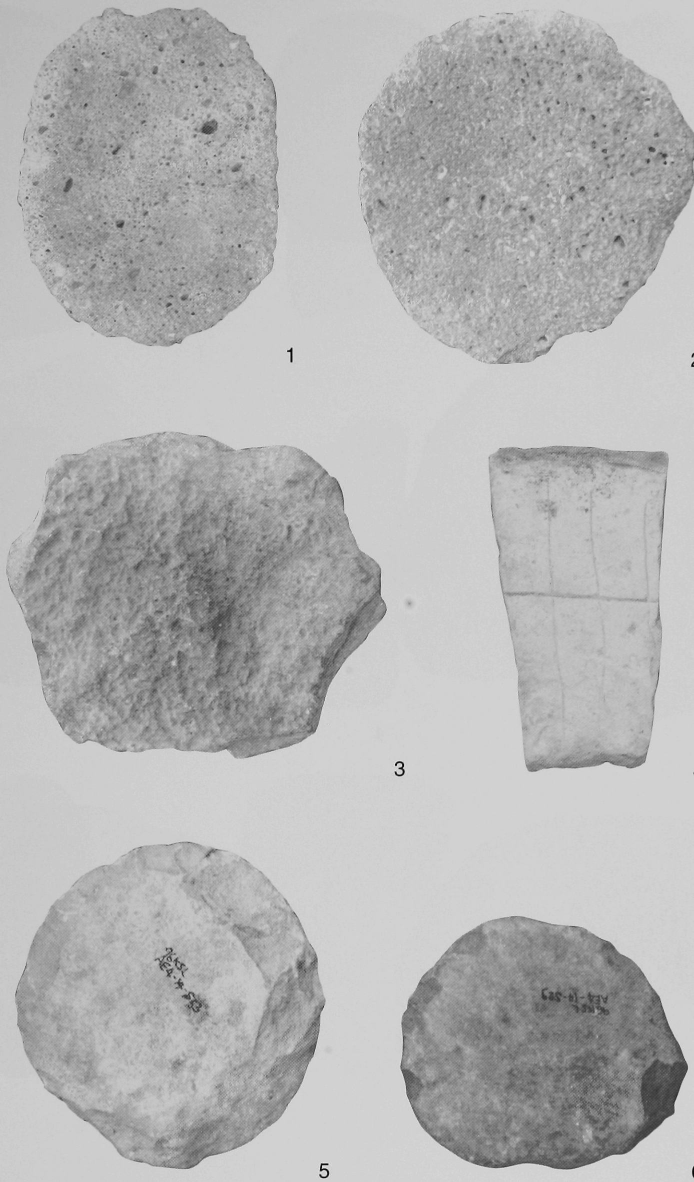
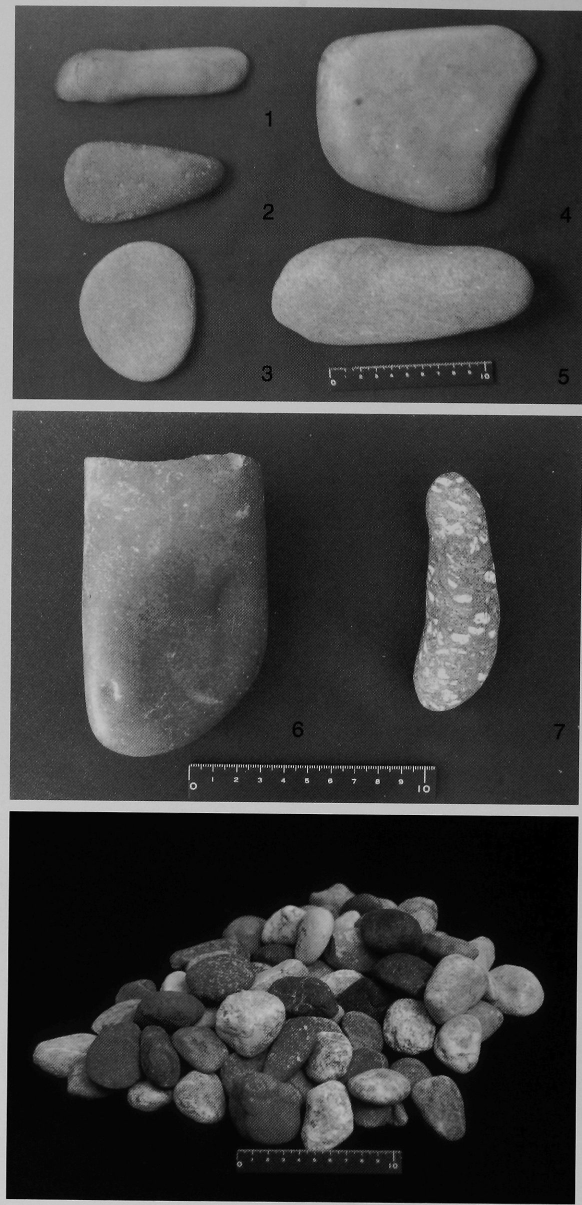


Plate 13.5 Grinding slabs, anvils and tables from the Chalcolithic levels of Tell Kosak Shamali.

1. Grinding slab, circular concave type, L: 18.3cm (cf. Fig. 13.13: 2).
2. Grinding slab, circular convex type, L: 28.9cm (cf. Fig. 13.16: 2).
3. Anvil, convex worn surface type, L: 19.0cm (cf. Fig. 13.23: 2).
4. Incised slab, L: 22.5cm (cf. Fig. 13.15: 2).
5. Turning table, L: 11.5cm (cf. Fig. 13.24: 2).
6. Turning table, L: 9.8cm (cf. Fig. 13.24: 4).

Plate 13.6 Mortars from the Chalcolithic levels of Tell Kosak Shamali.
1. Mortar on pebble, pitted type, L: 6.3cm (cf. Fig. 13.17: 3).
2. Mortar on pebble, pitted type, L: 7.8cm (cf. Fig. 13.17: 1).
3. Mortar, cylindrical type, L: 11.6cm (cf. Fig. 13.20: 1).
4. Multi-pitted slab, L: 40.1cm (cf. Fig. 13.19).
5. Mortar on slab, pitted type, L: 20.0cm (cf. Fig. 13.18: 2).
6. Mortar on slab, hollowed type, L: 10.7cm (cf. Fig. 13.18: 4).
7. Mortar on slab, hollowed type, L: 21.9cm (cf. Fig. 13.18: 3).

Plate 13.7 Palettes from the Chalcolithic levels of Tell Kosak Shamali.
1. Palette, edged type, L: 15.0cm (cf. Fig. 13.21: 5).
2. Palette, edged type, L: 12.5cm (cf. Fig. 13.21: 4).
3. Palette, edged type, L: 21.1cm (cf. Fig. 13.21: 6).
4. Palette, edged type, L: 9.7cm (cf. Fig. 13.21: 2).
5. Palette, edged type, L: 16.8cm (cf. Fig. 13.21: 9).
6. Palette, non-edged type, sandstone, smeared, L: 15.8cm (97KSL-AD4-50-14; 1303; Level 13 of Sector A).
7. Palette, non-edged type, L: 13.3cm (cf. Fig. 13.22: 9).
8. Palette, non-edged type, L: 14.7cm (cf. Fig. 13.22: 5).
9. Slab abrader/palette, L: 8.9cm (cf. Fig. 13.20: 3).



8

Plate 13.8 *Grinding stones discovered* in situ *from the Chalcolithic levels of Tell Kosak Shamali.*
Feature 1504, 95KSL-AF6-7, Level 15 of Sector A:
1. Smearer, bar type, sandstone, L: 5.0cm; 2. Smoother, axe-shaped type, sandstone, L: 10.8cm; 3. Smoother, discoidal type, L: 9.3cm (cf. Fig. 13.5: 3);
4. Palette, non-edged type, sandstone, L: 13.9cm; 5. Pestle, loaf type, andesite, L: 17.2cm; Room 1405, 97KSL-AD4-56, Level 14 of Sector A.
Floor of Room 1405, 97KSL-AE5-51, Level 14 of Sector A:
6. Palette, non-edged type, L: 11.0cm (cf. Fig. 13.22: 7); 7. Smearer, loaf type, L: 9.7cm (cf. Fig. 13.12: 7).
Southwest of Room 601, 95KSL-AD4-10, Level 6 of Sector A:
8. Water-worn stones, L: 3.5-6.2cm.

Plate 13.9 Grinding stones from the Chalcolithic levels of Tell Kosak Shamali.
1. Celt, L: 12.8cm (cf. Fig. 13.26: 2).
2. Celt L: 7.9cm (cf. Fig. 13.26: 1).
3. Celt, L: 2.7cm (cf. Fig. 13.26: 8).
4. Celt, L: 3.8cm (cf. Fig. 13.26: 5).
5. Celt, L: 4.5cm (cf. Fig. 13.26: 6).
6. Chisel, L: 4.6cm (cf. Fig. 13.26: 7).
7. Smoother, axe-shaped type, L: 3.2cm (cf. Fig. 13.7: 4).
8. Smoother, axe-shaped type, L: 6.7cm (cf. Fig. 13.7: 1).
9. Smoother, axe-shaped type, L: 6.9cm (cf. Fig. 13.7: 2).
10. Horn-shaped piece, L: 20.6cm (cf. Fig. 13.25: 1).
11. Manganese, Diameter: 6.5cm (96KSL-AD5-82; 901; Level 9 of Sector A).
12. Hematite, L: 3.6cm (97KSL-AE6-31; 10A03; Level 10 of Sector A).
13. Hematite, L: 3.7cm (96KSL-AE4-14-10; 10A01; Level 10 of Sector A).

CHAPTER 14

The Chalcolithic bone industry of Tell Kosak Shamali

Seiji Kadowaki

14.1 Introduction

Various bone and horn/antler implements were recovered from Tell Kosak Shamali (Table 14.1). These include 89 pieces, most of which were recovered from Sector A, accounting for 87% (n=77) of all pieces. The rests are from Sector B (n=12).

The collected specimens were classified according to their shape and manufacturing technique. Awls are predominant (n=57), comprising 64% of all categories. The remainder of the inventory encompasses needles (n=5), knives (n=5), spatulas (n=2), splintered pieces (n=2), flesher (n=1), bone plates (n=2), tube (n=1), debitage (n=2), and an unidentifiable piece (n=1). Several horns and antlers, which seem to have been used as tools, were also included (n=11). The context, in which they were recovered in the site, and the ground surface adjacent to the tip indicate that they served as some kind of implements.

In addition to these specimens, a bone would have been also used as a haft of a sickle, on which sickle blades were mounted and cemented with bitumen (see Chapter 11, this volume). However, because the remains of the bone haft are so fragmentary, this specimen cannot be described in further detail.

14.2 Description of the materials

14.2.1 Awls (Figs. 14.1-14.3 & 14.4: 1, 2; Pls. 14.1, 14.2, &14.3: 1-4)

Awls are predominant in the bone artifact inventory. They account for 61% (n=47) in Sector A and 83% (n=10) in Sector B. Examination of awls focused on several techno-morphological attributes, which were chosen in order to show the variation of the awls from Kosak Shamali. Three attributes are involved. The examination of these attributes has been proven to be useful for the classification and the description of bone awls. The first attribute, width of awls, was reported at Hajji Firuz and Jarmo (Voigt 1976; Watson 1983). The second attribute is shaft morphology, which was mentioned at Ganj Dareh and Amuq plain (Braidwood and Braidwood 1960; Stordeur 1993). The third attribute concerns a form of butt end, which was studied at Jarmo, Ganj Dareh, El Kowm 2 and Hallan Çemi (Goodarzi-Tabrizi 1999; Helmer and Stordeur 2000; Stordeur 1993; Watson 1983).

(1) Attribute analysis

Diversity of each techno-morphological attribute is assumed to reflect a set of technological options exercised by the occupants at Kosak Shamali.

Width of awls

The width of awls clearly shows two modes in their frequency. The narrower group (type I) ranges from 8.3mm to 13.5mm (Figs. 14.1: 1, 2, 4-7; 14.2: 2-7; 14.3: 3-5; 14.4: 2; Pls. 14.1:1, 3-9; 14.2: 1-6, 9, 10; 14.3: 1, 2), in contrast to the wider group (type II) that is broader than 20.5mm (Figs. 14.1: 3; 14.2: 1; 14.3: 1, 2; 14.4: 1; Pls. 14.1: 2; 14.2: 7, 8; 14.3: 3, 4). Type I (the narrower group) is dominant, accounting for 86% (n=38) of the total measurable specimens (n=44). The existence of the two modalities indicates the two different preferences for the width of bone awls.

Shaft morphology

The shaft morphology of awls can be divided into two groups. The first represents a long bone that was split longitudinally all the way to the base. We tentatively call this shaft form

Table 14.1 Bone implements from Tell Kosak Shamali.

Sector A	Level																		
	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	Later pits	Top-soil	Total
Awls	0	0	0	3	3	5	4	15	0	2	2	4	7	1	0	0	0	0	1	**47**
Needles	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	**4**
Knives	0	0	0	0	0	1	0	3	0	0	0	1	0	0	0	0	0	0	0	**5**
Spatulas	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	**2**
Splintered pieces	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**
Flesher	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**1**
Worked horns/antlers	0	0	0	0	0	1	2	3	0	0	1	0	1	3	0	0	0	0	0	**11**
Bone plates	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**2**
Tube	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**
Debitage	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	**2**
Unidentifiable piece	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**1**
Total	**0**	**0**	**1**	**3**	**5**	**8**	**9**	**23**	**0**	**2**	**3**	**6**	**9**	**6**	**0**	**0**	**0**	**1**	**1**	**77**

Sector B	Level							
	7	6	5	4	3	2	1	Total
Awls	3	3	0	3	1	0	0	**10**
Needles	0	0	0	1	0	0	0	**1**
Knives	0	0	0	0	0	0	0	**0**
Spatulas	0	0	0	0	0	0	0	**0**
Splintered pieces	0	0	1	0	0	0	0	**1**
Flesher	0	0	0	0	0	0	0	**0**
Worked horns/antlers	0	0	0	0	0	0	0	**0**
Bone plates	0	0	0	0	0	0	0	**0**
Tube	0	0	0	0	0	0	0	**0**
Debitage	0	0	0	0	0	0	0	**0**
Unidentifiable piece	0	0	0	0	0	0	0	**0**
Total	**3**	**3**	**1**	**4**	**1**	**0**	**0**	**12**

"type X" (Figs. 14.1: 1-7; 14.2: 1-7; 14.3: 1, 2; Pls. 14.1: 1-9; 14.2: 5, 6, 8-10; 14.3: 1-4). The second type of shaft is a long bone that was split only partly. Thus, this type, called "type Y", concomitantly retains the intact epiphysis at the base (Figs. 14.3: 3-5; 14.4: 1, 2; Pl. 14.2: 1-4, 7). Type X morphology is dominant, including 38 pieces, while type Y has 8 specimens. These two kinds of shafts are considered to be relevant to bone splitting technique to extract a bone blank for awls. This assumption will be discussed later.

Butt end morphology

Three types of butt ends were distinguished. The first type represents a flat base that was formed by fine flaking after the epiphysis was removed ("type A", Figs. 14.1: 1-3; 14.2: 2; 14.3: 1, 2; Pls. 14.1: 1, 2, 7; 14.2: 8; 14.3: 2, 4). The second type includes a base that shows a trace of a spiral flaking ("type B", Fig. 14.2: 3, 4; Pl. 14.2: 5, 6). The third group comprises a butt end that retains the epiphysis ("type C", Figs. 14.1: 5-7; 14.3: 3-5; 14.4: 1, 2; Pls. 14.1: 3, 4, 6, 9; 14.2: 1-4, 7). The third type of butt end is most popular, including 18 pieces. Following this, type A has 8 pieces, and 2 pieces fall in type B base form. This observation indicates that the occupants at Kosak Shamali tended not to modify the epiphysis of bones for the use of awls. On the other hand, the butt end of type A shows that they also intentionally modified the butt end into a flat form.

(2) Manufacturing techniques

The awls from Kosak Shamali, which are characterized by three techno-morphological attributes, will be considered below with regard to manufacturing techniques. According to Goodarzi-Tabrizi (1999: Fig. 4.2), the manufacturing process for bone tools generally involves three steps. The first step is a selection of bones to be worked. At Kosak Shamali, long bones of ungulates seem to have been preferred. As we have already seen, two kinds of long bones, which are different in width, were chosen for awls. However, it seems that these two kinds of bones would have undergone the same manufacturing technique in subsequent production stages. Bones would have been defleshed and cleaned by the method of soaking, boiling or steaming (*ibid*.: 68-9), although this practice could not be confirmed through observation of the specimens.

In the second step, long tubular bones are processed by several techniques. This process is to provide a suitable piece of bone that serves as a blank for awls. Based on the experimental studies and ethnological observations, Goodarzi-Tabrizi (1999: 68-73) has suggested several techniques which are employed for extracting a blank for bone tools. These techniques include percussion, longitudinal sawing, and sawing-and-snapping. Usually, identification of the splitting technique is difficult because the trace of the technique is likely to be obliterated by subsequent modification. Nevertheless, we may draw some evidence of the splitting technique from the examination of shaft morphology as well as butt end morphology. The result of the observation of these attributes suggests that at least three kinds of technique were employed by the occupants of Kosak Shamali for splitting long bones. Firstly, long slender awls, which were made on halved long bones (like Fig. 14. 1: 6), indicate that high precision was required to split metapodials without unwanted breakage. The longitudinal sawing is considered to fulfill this purpose. Secondly, the helical fracture, which is seen at the base of awls ("type B" butt form) or at the shaft ("type Y" shaft), indicates that the blank piece was chosen from spiral flakes which were produced by percussion of long bones (Johnson 1985: 172-4). The third technique would be longitudinal wedging which used an adze-like tool (Yamakawa 1992). The awls, which were fabricated by this technique, would retain type X shaft characteristics and some of type Y shaft characteristics, like Fig. 14.3: 3, 5. The wedging technique is sometimes associated with prior grooving which leads fracture force to an estimated split line (Campana 1991: 460).

In the third and final stage of manufacture, a split bone is sharpened at one end into a tapering point. No particular technique to form a pointed end was able to be specified from the observations of the specimens. Based on his experimental study, Campana suggests that the pointed end can be made through either whittling by chipped stones, or grinding with abrasive stones (Campana 1989: 30-4). Some of the specimens appear to represent the unfinished state with a blunt point (Fig. 14.2: 1, 2, 5; Pl. 14. 3: 1-3). They show chatter marks and undulating surfaces, indicating fabrication by whittling. However, many other awls, which exhibit symmetrical point tips, may have been formed by abrasion (*ibid*.: 33). The prevalent use of abrasion for the manufacture of bone awls from Kosak Shamali appears consistent with the diachronic trend in the Levant, where this technique was employed frequently after the PPNB (Campana 1991: 462). As for further modifications, we found that lateral sides of shaft were sometimes regulated by fine flaking (Figs. 14.1: 1; 14.2: 4; 14.3: 1). A comparable technique was detected at Ganj Dareh ("*poinçons à base rétrécie*" in Stordeur 1993: 253).

We have few evidences on the hafting technique. However, the Chalcolithic layers at Telul eth-Thalathat and Tepe Gawra yielded awls and a spatula to which bitumen or clay were attached at their bases (Fukai *et al.* 1970: PL. LXXXI; Tobler 1950: PL. LCVIII. b, XCIX. c). These awls and a spatula show long slender bodies, which seem to have been provided through splitting long bones longitudinally. Although some of the awls from Kosak Shamali have similar techno-morphological attributes to these hafted specimens (Fig. 14.1: 6; Pl. 14.2: 1), we could not detect the trace of hafting on them.

14.2.2 Needles (Fig. 14.4: 3, 4, 6, 7; Pl. 14.3: 5-9)

Five needles have so far been collected (four pieces from Sector A, one piece from Sector B). Despite the general resemblance of their shape to awls, needles were distinguished by their size and shape. Firstly, needles are narrower than awls (average width; 6.5mm in needles, 13.2mm in awls). The narrow shaft of needles shows traces of elaborate abrasion, indicating the effort to reduce the thickness of the body. Secondly, points of needles are tapered more sharply than those of awls. These two distinctive attributes of needles are probably relevant to their function. The sharp points and the narrow bodies may have facilitated penetration of worked materials.

The scarcity of the sample and the considerable modification of the original bone prevent us from examining the details of the production process. However, one of the specimens (Fig. 14.4: 3; Pl. 14.3: 6) exhibits a spiral fracture at its base, indicating the use of bone slivers provided by the percussion of long bones.

Only one piece has a perforation adjacent to the end (Fig. 14.4: 6). Cross section of the perforation indicates that it was worked from both surfaces. This specimen is broken, being split longitudinally. There is a specimen that exhibits a longitudinal short groove near the end, which does not penetrate into the other surface (Fig. 14.4: 7). It is not clear whether this grooving was attempted to make a perforation or not. If it is, this technique may be reminiscent of a specific perforation technique which prevailed in the Neolithic north Levant (Cauvin 1985; Stordeur 1988).

14.2.3 Knives (Fig. 14.5: 1-4; Pl. 14.4: 8)

Only Sector A yielded five pieces of this category, three of which were found in Level 10. They are all broken, but one of the specimens retains a large portion of the original body (Fig. 14.5: 2). These tools are all made of ribs of large ungulates (*Bos?*), which were sharpened by abrasion along an edge. Longitudinal striations, running parallel to the edge, may have been generated in the course of the production and tool use. The used edge is abraded and sometimes undulated, seemingly worn out, which indicates prolonged use of the tool. Morphologically similar specimens have been reported from several Neolithic assemblages which include El Kowm 2 ("*couteaux plats*", Helmer and Stordeur 2000: Fig. 4), Cafer Höyük ("*ciseau en os*", Stordeur 1988: Fig. 3. 3), Amuq plain, ("blade", Braidwood and Braidwood 1960: Fig. 38. 8), and Matarrah ("rib-blade", Smith 1952: Fig. 21. 9, 10) as well as from a Chalcolithic context (Mehmeh phase) of Tepe Sabz ("knife", Hole *et al*. 1969: Fig. 94. a).

14.2.4 Spatulas (Fig. 14.4: 5, 8; Pl. 14.4: 6, 7)

This category contains the specimens which are also called "smoothers (*lissoirs*)" or "burnishers" in other reports (de Contenson 1992; Stordeur 1993; Watson 1983). Only Sector A yielded spatulas (two pieces). Both specimens are poorly preserved, which hinders us from recognizing their original shape and manufacturing process. Striations and traces of abrasion were discerned on the surface of both specimens.

14.2.5 Splintered piece (Fig. 14.6: 1, 3; Pl. 14.4: 1, 5)

Two specimens were recovered, each from Sector A and B. They are made of long bones which were split longitudinally. One of the specimens has an edge which was made through obliquely truncating an end of the shaft. The edge is heavily worn out with battering and fluting on the end. A similar use-wear is reported on the bone tools which were experimentally wedged or chiseled into a pine (Campana 1989: 60-2). However, our specimens seem more heavily worn with traces of fluting, which indicates either that the worked material may have been harder than pine, or that tools were used in more exhaustive tool motion (e.g. chopping, or adzing). The overall morphology resembles "gouges" in other assemblages, such from Sabi Abyad (Spoor and Collet 1996: 453), Jarmo (Watson 1983: 352), and Matarrah (Smith 1952: Fig. 21. 14). However, its heavily worn edge rather resembles that of fleshers at

Ganj Dareh (cf. "*flensers*", Stordeur 1993: 257-9).

14.2.6 *Flesher* (Fig. 14.6: 6; Pl. 14.4: 2)

The piece is made of a fairy large metapodial of *Equus* that retains epiphysis. It is difficult to estimate the original tool form because of the breakage. However, the partly preserved edge shows flaking scars, and the shaft is partly polished. The overall morphology could be comparable to "*flensers*" from several Neolithic sites (Stordeur 1993: 257-9; Helmer and Stordeur 2000: 274).

14.2.7 *Worked horns/antlers* (Figs. 14.7-14.9; Pl. 14.5: 2-8)

Eleven pieces were recovered from Sector A. They may have served as some kind of tool. These horns and antlers have two characteristics in common. Firstly, they show clear striations and traces of abrasion on the surface near the tip. Secondly, they were found in a specific context in the site. They were located on floors or found in room fills and associated with other tools, such as chipped stones, ground stones, clay scrapers, bone awls, and spatulas. In addition, one of the specimens (Fig. 14.8: 1; Pl. 14.5: 3) retains black stains around the tip, indicating a usage for pulverizing pigments.

Comparable specimens to these horn and antler tools are not reported from other Chalcolithic sites. However, morphologically similar specimens have been reported from the Natufian period at the El-Wad cave and the Hayonim cave (Campana 1989: 50), and the Neolithic Ras Shamra Phase VC (de Contenson 1992), Zawi Chemi Shanidar (Solecki 1981: Pl. 11) and Hajji Firuz Tepe (Voigt 1976: 518-25). These pieces are made of antlers and have a smooth abraded surface around the tip. However, except for Ras Shamra and Zawi Chemi specimens, they are different from our specimens in that they appear more elaborately fabricated with a smooth flat end (like the spatula) after truncating a tip obliquely. Based on the use-wear analysis, Campana suggested that they served to abrade and finish skins (Campana 1989: 93-4).

It is difficult to estimate a function of the horns/antler tools from Kosak Shamali without use-wear analysis, but the black stains left on one of the specimens (Fig. 14.8: 1) imply that the tools were used for pulverizing pigments although the conclusion has to be waited until the black stains are proven to be pigments. The further understanding of these specimens requires the accumulation and analysis of samples from other sites.

14.2.8 *Tube* (Fig. 14.6: 2; Pl. 14.3: 10)

This piece from Sector A is elaborately smoothed at both exterior and interior surfaces of the tubular bone. It is perforated near the end. A wall at the other end tapers off to a thin edge. Despite the morphological resemblance to tubular beads, this piece is distinct by its large size. Specimens reported at Hallan Çemi (Goodarzi-Tabrizi 1999: 337) and Gawra Stratum XI (Tobler 1950: PL. CLXXXII, 6) seem comparable, but their technological or functional correspondence is not clear.

14.2.9 *Bone plates* (Fig. 14.6: 4, 5; Pl. 14.4: 3, 4)

These specimens from Sector A are rectangular and flat, showing traces of abrasion and striation on surface, which were presumably a result of manufacturing process. Both specimens have a plano-convex cross section. One of the surfaces retains spongy tissue, indicating the inside surface of long bones. There is a perforation on one specimen.

14.2.10 *Debitage* (Fig. 14.6: 7; Pl. 14.5: 1)

This specimen (metatarsal of *Bos*) is split longitudinally nearly half of its entire length. There are traces of whittling, chattering, and flaking on the split surface as well as at the snapped end. Bone splitting technique is frequently employed for the manufacture of bone awls and it is considered to be a major part of the manufacturing process of bone implements. Since the manufacture of this specimen does not seem completed, the piece was categorized as "debitage" of bone artifact production.

Table 14.2 Compositions of bone implements by ceramic periodization.

Sector A	Early NU (early)	Early NU (late)	Late NU	Terminal NU	Total
Level	13-17	10-12	4-9	1-3	
Awls	6	24	16	0	**46**
Needles	0	4	0	0	**4**
Knives	0	4	1	0	**5**
Spatulas	0	1	0	0	**1**
Splintered pieces	1	0	0	0	**1**
Flesher	0	0	1	0	**1**
Worked horns/antlers	0	6	5	0	**11**
Bone plates	1	0	1	0	**2**
Tube	1	0	0	0	**1**
Debitage	0	0	2	0	**2**
Unidentifiable piece	0	1	0	0	**1**
Total	**9**	**40**	**26**	**0**	75

Sector B	Terminal NU	Post-Ubaid	Middle Uruk	Total
Level	7	5, 6	1-4	
Awls	3	3	4	**10**
Needles	0	0	1	**1**
Knives	0	0	0	**0**
Spatulas	0	0	0	**0**
Splintered pieces	0	1	0	**1**
Flesher	0	0	0	**0**
Worked horns/antlers	0	0	0	**0**
Bone plates	0	0	0	**0**
Tube	0	0	0	**0**
Debitage	0	0	0	**0**
Unidentifiable piece	0	0	0	**0**
Total	3	4	5	12

Table 14.3 Number of bone implements per m².

Sector A

Level	Excavated area (m²)	Number	Number/ m²
1	22	0	0.00
2	17	0	0.00
3	18.8	0	0.00
4	45.9	6	0.13
5	53.2	9	0.17
6	53.2	6	0.11
7	101.3	3	0.03
8	101.3	2	0.02
9	103.8	0	0.00
10	121.4	23	0.19
11	163.6	9	0.06
12	87.1	8	0.09
13	144.4	5	0.03
14	121.5	3	0.02
15	28.6	1	0.03
16	21.9	0	0.00
17	56.3	0	0.00

Sector B

Level	Excavated area (m²)	Number	Number/ m²
1	24.7	0	0.00
2	34	0	0.00
3	41	1	0.02
4	64.7	4	0.06
5	64.7	1	0.02
6	64.7	3	0.05
7	64.7	3	0.05

Table 14.4 Frequencies of the techno-morphological variables of bone awls.

Sector A		Level																		Total
		18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
Width of awl	I	0	0	0	0	3	3	3	3	11	0	2	2	2	5	1	0	0	0	**35**
	II	0	0	0	0	0	0	1	0	3	0	0	0	0	2	0	0	0	0	**6**
Shaft form	X	0	0	0	0	0	3	5	1	13	0	2	2	2	6	1	0	0	0	**35**
	Y	0	0	0	0	3	0	0	2	1	0	0	0	1	1	0	0	0	0	**8**
Butt form	A	0	0	0	0	0	0	2	0	4	0	0	0	0	1	0	0	0	0	**7**
	B	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	**2**
	C	0	0	0	0	2	1	2	3	5	0	0	0	2	3	0	0	0	0	**18**

Sector B		Level								Total
		8	7	6	5	4	3	2	1	
Width of awl	I	1	1	0	0	0	1	0	0	**3**
	II	0	0	0	0	0	0	0	0	**0**
Shaft form	X	1	1	0	0	0	1	0	0	**3**
	Y	0	0	0	0	0	0	0	0	**0**
Butt form	A	0	0	0	0	0	1	0	0	**1**
	B	0	0	0	0	0	0	0	0	**0**
	C	0	0	0	0	0	0	0	0	**0**

14.2.11 Unidentifiable piece

This piece is too severely fragmented to be allocated to any of the above categories. The preserved fragment, which shows an abraded surface, seems to represent a portion of a handle of an unknown original tool.

14.3 Stratigraphic change of bone tool industry

As shown in Table 14.1, the bone implements of Kosak Shamali were recovered from a long stratigraphic sequence, and the bone tool assemblage appears to change through the sequence. The diachronic change of bone tool industry at Kosak Shamali is indicated by three aspects of the assemblage, which are 1) the composition of tool kits, 2) the amount of bone tools, and 3) the typological variety of bone awls.

14.3.1 Composition of the tool kits

Bone awls appear consistently and are dominant in the tool kits throughout the sequence, while other tools are encountered less frequently. Some tool types are so rare that their occurrence pattern is hardly discerned (for example; flesher, splintered pieces, tube etc.), but the occurrence of knives (n=5) and worked horns/antlers (n=11) appears meaningful indicating a diachronic change. They were recovered from a restricted portion of the stratigraphic sequence. The knives are encountered only at Levels 6, 10, 12 of Sector A, and the worked horns/antlers were recovered at Levels 4, 5, 7, 10, 11, 12 of Sector A. No specimens of these types were found in Sector B.

As shown in Table 14.2, the strata containing these two tool types are dated to the Late Northern Ubaid period and the late Early Northern Ubaid period based on a pottery chronology at Kosak Shamali.

It is also noted that the tool kit of Sector A is more varied than that of Sector B whose content of tool kit is almost confined to bone awls (Table 14.1). The bone assemblage of Sector B is characterized by limited diversity of tool kits, and this trait may be an indicator of the chronological position of Sector B that is suggested to be later than Sector A (from the Terminal Northern Ubaid to the Post-Ubaid and the Middle Uruk period).

14.3.2 Amount of bone tools

The amount of bone tools seems to vary considerably through the sequence as shown in Table 14.3 and Fig. 14.10 that show the number of bone tools recovered per one square meter unit of each level. This indicates that all the strata of Sector B have a smaller number of bone tools than Sector A and the top three levels of Sector A do not yield any bone implements, suggesting a decreasing trend of bone implements.

In contrast to the upper levels, a great deal of bone industry was recovered from Levels 4, 5, 6, 10, and 12 of Sector A. These strata are distinctive in the large size of bone industry and are dated to the late Early Northern Ubaid period to the Late Northern Ubaid period.

14.3.3 Typological variety of bone awls

Table 14.4 shows the frequencies of the three techno-morphological variables of bone awls. Generally it is noted that the techno-morphological attributes of Sector B are less varied than those of Sector A, indicating that the awl form becomes monotonous after the Terminal Northern Ubaid period.

The attributes of the bone awls in Sector A are more diverse, but the diversity is more intensive in certain levels than the others. For example, bone awls with a wide shaft (type II) are only encountered at Levels 5, 10, 12, and the truncated butt end (type A) is also only found among the awls from Levels 5, 10, and 12. These levels are dated to the late Early Northern Ubaid to the Late Northern Ubaid, and the awls from the other periods are less varied in the techno-morphological attributes.

The above three examinations all suggest the presence of some diachronic changes through the sequence. If we adopt the periodization scheme based on pottery, the late Early Northern Ubaid period and the Late Northern Ubaid period are characterized by a great amount of bone industry with a diverse range of tool kits and awl types. On the other hand, the amount of bone industry declines after the Terminal Northern Ubaid period and the variety of tools and awl types become monotonous.

The bone tool industry from the early Early Northern Ubaid period (Levels 13-17 of Sector A) is difficult to be evaluated because of the small sample size, but apparently it differs from the subsequent upper levels in the composition of tool kits, the amount of bone tools, and the diversity of awl types. The assemblage lacks knives and worked horns/antlers that show up in the upper levels and has a smaller number of bone tool industry. Bone awls do not contain type II (wide shaft type) and type A (retouched butt end type) that appear in the upper levels. However, in comparison with the periods after the Terminal Northern Ubaid, the early Early Northern Ubaid period shows more similarity to the subsequent late Early Northern Ubaid and the later Northern Ubaid in the range of tool kit and the diversity of bone awl types.

14.3.4 Examination of recovery contexts of bone tools

Bone tools were recovered from various contexts in the site including on floors, from room fills, and middens outside the buildings, and they were also found in stone foundations or in the walls of the buildings. Among the various contexts, artifacts recovered on floors or from room fills are considered to have gone through less transformation after the abandonment, and the finds from middens or architectural materials are assumed to be dislocated from the place where tools were finally used.

As shown in Fig. 14.11, recovery contexts of bone tools vary considerably by each occupational level. It is noticeable that Sector B does not contain artifacts from floors and mostly comprises other contexts in contrast to Sector A where floors and room fills yielded a substantial amount of bone implements. Particularly it is remarkable that no bone implements were recovered from floors or room fills in Levels 5 and 6 of Sector B although these levels retain well-preserved buildings that appear to be pottery workshop. The activity of pottery production is also indicated by several buildings in Sector A, and these buildings contain a considerable amount of bone tools on floors or in the room fills in contrast to the buildings in Sector B. Thus, it is suggested that the bone implements were more frequently employed at pottery workshop in Sector A (the Early Northern Ubaid to Late Northern Ubaid period), and the use of bone artifacts declined in the subsequent period of Sector B (the Post-Ubaid period).

14.4 Comparison with other sites

It is difficult to make a close comparison of the bone assemblage from Kosak Shamali with those from other sites, because the reports of bone assemblages of the Chalcolithic period are usually brief and not quantitatively presented. However, the attempt of comparison in a wider temporal and regional framework may be valuable to reveal characteristics of the bone industry of Kosak Shamali.

In southwest Asia, bone tools first took part in human artifact inventory in the Upper Paleolithic, although the abundance and the variety of the repertoire are not as large as those in Europe (Newcomer 1987: 289; Coinman 1997). The bone tool assemblages from this period, whether they are associated with "Levantine Aurignacian" or "Ahmarian" tradition, mainly consist of awls and points (Gilead 1991; Coinman 1997). In subsequent periods, especially the Natufian, a more developed bone industry encompasses varied tool types, indicating that they performed wide range of functions, but pointed tools remain a major category in tool kits (Stordeur 1991; Campana 1989: 45). Those pointed implements largely consist of hunting or fishing tools, such as double-pointed tools and barbed points (Bar-Yosef and Belfer-Cohen 1988: 28-9; Campana 1989: 45-53; Newcomer 1987), although they also include bone awls. Bone implements for hunting or fishing do not seem to exist in the tool kit of Chalcolithic Kosak Shamali whose pointed implements are mostly confined to awls.

The Neolithic bone industry is generally char-

Table 14.5 Correspondence of techno-morphological attributes between Kosak Shamali and three Neolithic sites (after Helmer and Stordeur 2000, Stordeur 1993, and Watson 1983).

	Typology of awls	Width of awl	Shaft form	Butt form
Ganj Dareh and El Kowm 2	*Poinçons sur os tronqué, à poignée intégrée*	no mention	type Y	type C
	Poinçons sur os fendu, à poignée intégrée	no mention	type X	type C
	Poinçons sur esquilles appointées	no mention	type X	type B
	Poinçons à base élargie	no mention	type X	type A
	Poinçons à base rétrécie	no mention	type X	type A
Jarmo	Light-Duty Awls	type I	type X, Y	type A, C
	Heavy-Duty Awls	type II	type X, Y	type A, C
	Splinter Awls	type I	type X	type B

acterized by the increased proportion of spatulas or smoothers in tool kits, and this trend can be discerned at a number of sites, including Ras Shamra Phase V (de Contenson 1992: 125-7), Amuq plain Phases A, B (Braidwood and Braidwood 1960: 65-7, 97-9), Tell Sabi Abyad (Spoor and Collet 1996: 452-73), Tell Mureybet (Stordeur 1977), Hallan Çemi (Goodarzi-Tabrizi 1999: 250-1), Jarmo (Watson 1983: 363), and Ganj Dareh (Stordeur 1993: 273). It is noted that the Neolithic layer of Kosak Shamali also yielded a bone spatula (Nishiaki *et al*. 2001). In contrast, the Chalcolithic bone industry of Kosak Shamali contains very few spatulas.

The Kosak Shamali assemblage is also characterized by a low-degree modification of specimens. Elaborate surface modifications like carving or perforation were rarely found at Kosak Shamali. In contrast, many Neolithic assemblages contain considerable amount of specimens that are elaborately modified by perforation or carving (Akkermans *et al*. 1983: Plates 40, 41; Goodarzi-Tabrizi 1999; Stordeur 1993). Moreover, it is remarkable that the Chalcolithic layers of Telul eth-Thalathat and Tepe Gawra in northern Iraq yielded tubular bones that are decorated by carved lines and perforations (named "haft" in Fukai *et al*. 1970: Pls. LXXXI, LVII; "bone playing pipes" in Tobler 1950: 215, Pls. XCIX, CLXXXII).

In this way, the Chalcolithic bone industry of Kosak Shamali is characterized by the high proportion of awls and the low-degree modification of bones. To what causes can we ascribe these characteristics? The major cause may stem from the temporal traits of the Chalcolithic period. The reports on the bone assemblages from contemporary sites, such as Ras Shamra Phases III C, B, Amuq plain Phase E, and Hammam et-Turkman Periods IV and V also show the poorly varied inventory in which awls represent the predominant class. They also lack elaborate surface decoration like perforation or carving (Braidwood and Braidwood 1960: 224-5; de Contenson 1992: 132-4; van Loon 1988: 643-51). However, as I mentioned above, the paucity of data makes it difficult to characterize the artifacts from Kosak Shamali within the Chalcolithic period.

Finally, it should be remarked that there are also similarities between the Chalcolithic bone industry of Kosak Shamali and other bone assemblages of preceding ages. For example, most tool types of Kosak Shamali have comparable specimens in the Neolithic period. We may also point out the similarity of manufacturing technique of awls between Kosak Shamali and the several Neolithic sites. In this chapter, techno-morphological variables of awls and their production processes were examined. Because the cursory reports of other Chalcolithic bone assemblages impede the comparison among contemporary sites, the awls from Kosak Shamali were compared with those from Neolithic sites. Among the reports of bone assemblages from various Neolithic sites, awls are described in detail at El Kowm 2, Ganj Dareh and Jarmo (Helmer and Stordeur 2000; Stordeur 1993; Watson 1983). Table 14.5 shows that the typological classification of awls from the three Neolithic sites is largely based on the combination of techno-morphological attributes that are also detectable on the awls from Kosak Shamali. The fact that the variety of techno-morphological attributes are comparable between two different periods may be derived from the similarity of the fabrication technique and/or the tool function between the two periods. As we have seen, there are obvious differences between Neolithic and Chalcolithic bone assemblages with regards to the tool inventory and the degree of bone modification. However, it is presumed that there are considerable similarities in the production technique and the function of awls in two different periods. Since this is merely a tentative perspective, the assumption needs to be tested in future with closer examination based on more detailed data.

References

Akkermans, P. A., J. A. K. Boerma, A. T. Clason, S. G. Hill, E. Lohof, C. Meiklejohn, M. Le Mière, G. M. F. Molgat, J. J. Roodenberg, W. Waterbolk-van Rooyen and W. van Zeist (1983) Bouqras revisited: Preliminary report on a project in eastern Syria. *Proceedings of the Prehistoric Society* 49: 335-372.

Bar-Yosef, O. and A. Belfer-Cohen (1988) The Early Upper Paleolithic in Levantine caves. In: *The Early Upper Paleolithic, Evidence from Europe and the Near East,* edited by J. F. Hoffecker and C. A. Wolf, pp. 23-41. BAR International Series 437. Oxford: Archaeopress.

Braidwood, R. J. and L. S. Braidwood (1960) *Excavations in the Plain of Antioch I.* The University of Chicago, Oriental Institute Publications, Vol. LXI. Chicago: The University of Chicago Press.

Campana, D. V. (1989) *Natufian and Protoneolithic Bone tools: the Manufacture and Use of Bone Implements in the Zagros and the Levant.* BAR International Series 494. Oxford: Archaeopress.

Campana, D. V. (1991) Bone implements from Hayonim Cave: Some relevant issues. In: *The Natufian Culture in the Levant,* edited by O. Bar-Yosef and F. R. Valla, pp. 459-466. International Monographs in Prehistory, Archaeological Series 1. Madison: Prehistory Press.

Cauvin, J. (1985) Le Néolithique de Cafer Höyük (Turquie): Bilan provisoire après quatre campagnes (1979-1983). *Cahiers de l'Euphrate* 4: 123-133.

Coinman, N. R. (1997) Worked bone in the Levantine Upper Paleolithic: Rare examples from the Wadi al-Hasa, west-central Jordan. *Paléorient* 22(2): 113-121.

de Contenson, H. (1992) *Préhistoire de Ras Shamra: Les Sondages Stratigraphiques de 1955 à 1976*. Ras Shamra-Ougarit VIII. Paris: Editions Recherche sur les Civilisations.

Fukai, S., K. Horiuchi and T. Matsutani (eds.) (1970) *Telul eth-Thalathat, Vol. II: The Excavation of The Third Season (1964).* Tokyo University Iraq-Iran Archaeological Expedition, Report 11. Tokyo: Institute of Oriental Culture, The University of Tokyo.

Fukai, S. and T. Matsutani (eds.) (1981) *Telul eth-Thalathat, Vol. IV.* Tokyo: University of Tokyo Press.

Gilead, I. (1991) The Upper Paleolithic period in the Levant. *Journal of World Prehistory* 5(2): 105-154.

Goodarzi-Tabrizi, S. (1999) *The Worked Bone Remains of Hallan Çhemi Tepesi: An Early Neolithic Site in Southeastern Turkey.* Ph.D. dissertation. The University of California, Berkeley.

Helmer, D. and D. Stordeur (2000) Les outils en os d'El Kowm 2-Caracol: Matière sauvage ou domestique? In: *El Kowm 2, Une île dans le Désert,* edited by D. Stordeur, pp. 265-280. Paris: CNRS Editions.

Hole, F., K.V. Flannery and J. A. Neely (1969) *Prehistory and Human Ecology of the Deh Luran Plain.* Memoirs of the Museum of Anthropology University of Michigan, Number 1. Ann Arbor: University of Michigan.

Johnson, E. (1985) Current developments in bone technology. In: *Advances in Archaeological Method and Theory,* Vol. 8, edited by M. B. Schiffer, pp. 157-235.

Newcomer, M. (1987) Study and replication of bone tools from Ksar Akil (Lebanon). In: *Ksar Akil Lebanon,* by C. A. Bergman, pp. 284-307. BAR International Series 329. Oxford: Archaeopress.

Nishiaki, Y., H. Sudo and S. Kadowaki (2001) The other Neolithic finds from Tell Kosak Shamali. In: *Tell Kosak Shamali, Vol. I,* edited by Y. Nishiaki and T. Matsutani, pp. 225-230. UMUT Monograph 1. Oxford: Oxbow Books.

Smith, J. G. (1952) The Matarrah assemblage. *Journal of Near Eastern Studies* XI(1): 5-56.

Solecki, R. L. (1981) *An Early Village Site at Zawi Chemi Shanidar.* Bibliotheca Mesopotamica 13. Malibu: Undena Publications.

Spoor, R. H. and P. Collet (1996) The other small finds. In: *Tell Sabi Abyad, the Late Neolithic Settlement,* edited by P.M.M.G. Akkermans, pp. 452-473. Istanbul: Nederlands Historich-Archaeologisch Instituut te Istanbul.

Stordeur, D. (1977) Tell Mureybet: Quelque indications chrolonogiques et culturelles fournies par l'étude des os travaille. In: *Le Moyen Euphrate,* edited by J. C. Margueron, pp. 55-60. Strasbourg: Université des Sciences Humaines de Strasbourg.

Stordeur, D. (1988) L'industrie osseuse de Cafer dans son contexte Anatolien et Proche Oriental: Note préliminaire. *Anatolica* 15: 203-213.

Stordeur, D. (1991) Le Natufien et son évolution à travers les artefacts en os. In: *The Natufian Culture in the Levant,* edited by O. Bar-Yosef and F. R. Valla, pp. 467-482. International Monographs in Prehistory, Archaeological Series 1. Madison: Prehistory Press.

Stordeur, D. (1993) Outils et parures en os de Ganji Dareh (Iran, VII^{e} Millénaire B.C.). *Cahiers de l'Euphrate* 7: 245-296.

Tobler, A. J. (1950) *Excavations at Tepe Gawra.* Philadelphia: University of Pennsylvania Press.

van Loon, M. N. (1988) *Hammam et-Turkman: Report of the University of Amsterdam's 1981-1984 Excavations in Syria.* Uitgaven van het Nederlands Historisch-Archaeologisch Instituut te Istanbul 63. Leiden: Leiden University.

Voigt, M.M. (1976) *Hajji Firuz Tepe: An Economic Reconstruction of a Sixth Millennium Community in the Western Iran.* Ph.D. dissertation, the University of Pennsylvania.

Watson, P. J. (1983) Jarmo worked bone. In: *Prehistoric Archaeology along the Zagros Flanks,* edited by L. Braidwood, R.B. Howe, C. Reed and P.J. Watson, pp. 347-368. The University of Chicago, Oriental Institute Publications, Vol. 105. Chicago: The University of Chicago Press.

Yamakawa, F. (1992) Manufacturing technique of pointed tools in Jomon period. *Koukogaku Zasshi* 78(1): 61-106. (in Japanese)

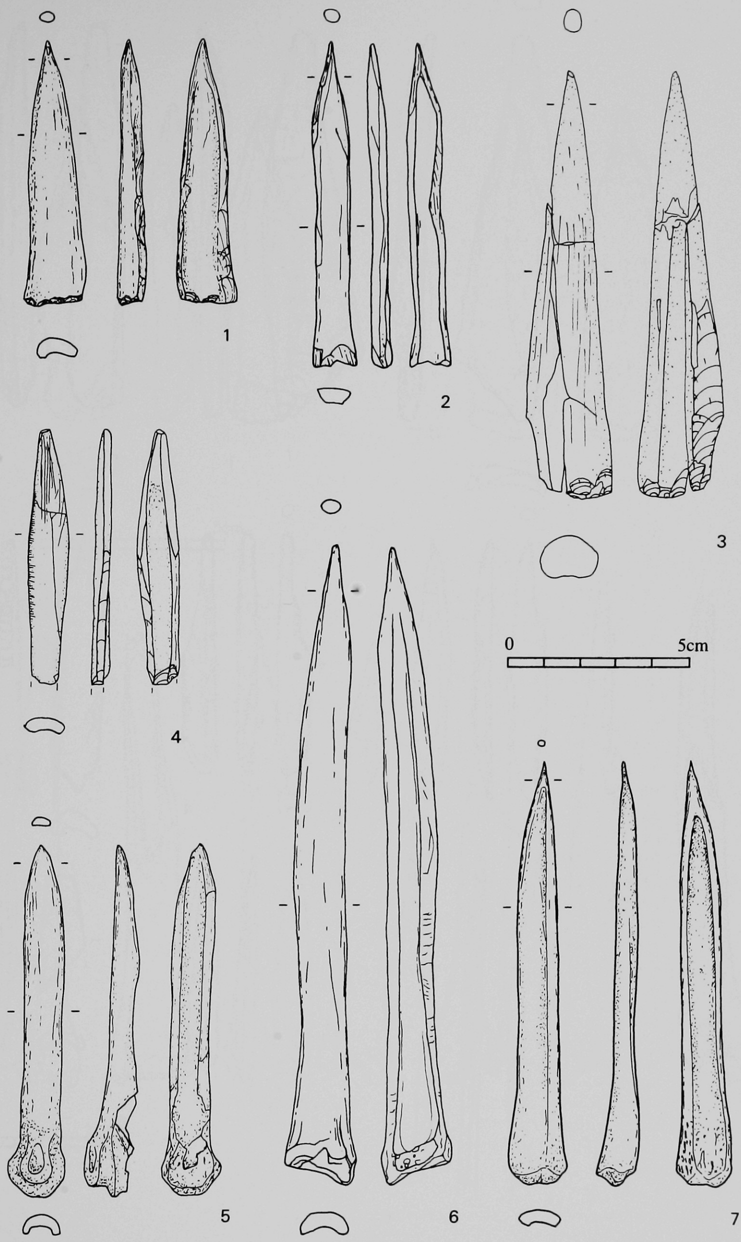


Fig. 14.1 Chalcolithic bone implements from Sector A.

1. Awl, Type I-X-A, L: 70.3mm, W: 13.3mm, T: 6.1mm (97KSL-AE5-17; 10A02; Level 10A).
2. Awl, Type I-X-A, L: 88.0mm, W: 10.0mm, T: 5.0mm (96KSL-AD5-93; 1006; Level 10).
3. Awl, Type II-X-A, L: 116.5mm, W: 21.2mm, T: 11.8mm (95KSL-AD5-48; 502; Level 5).
4. Awl, Type I-X-?, L: 69.5mm, W: 11.9mm, T: 4.3mm (95KSL-AD5-53; 501; Level 5).
5. Awl, Type I-X-C, L: 93.8mm, W: 10.8mm, T: 7.8mm (97KSL-AE6-31; 10A03; Level 10A).
6. Awl, Type I-X-C, L: 172.3mm, W: 13.5mm, T: 6.0mm (97KSL-AE6-31; 10A03; Level 10A).
7. Awl, Type I-X-C, L: 116mm, W: 11mm, T: 5.2mm (95KSL-AD4-7; Fill; Level 6).

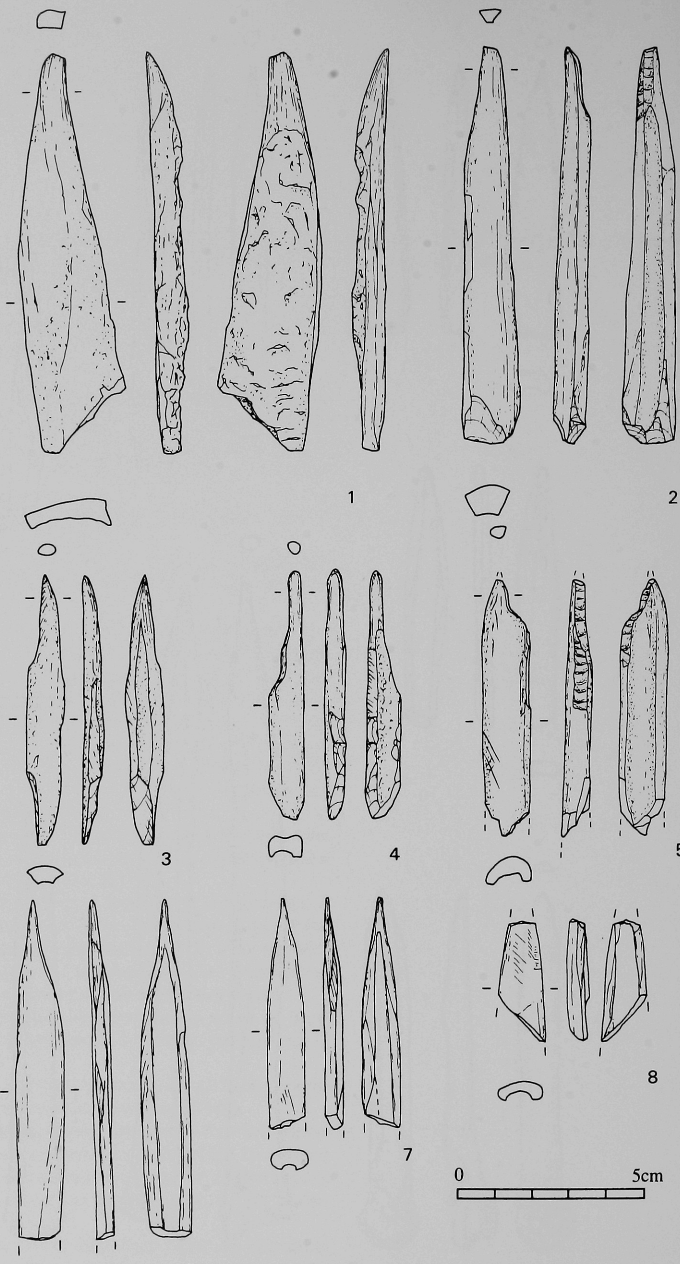


Fig. 14.2 ***Chalcolithic bone implements from Sector A.***
1. Awl, unfinished, Type II-X-?, L: 104mm, W: 23mm, T: 7mm (95KSL-AF3-10; Fill; Level 12).
2. Awl, unfinished, Type I-X-A, L: 102.0mm, W: 14.1mm, T: 7.8mm (95KSL-AF4-6; Fill; Level 12).
3. Awl, Type I-X-B, L: 71.0mm, W: 9.0mm, T: 4.1mm (96KSL-AE3-17; Fill; Level 10A).
4. Awl, Type I-X-B, L: 66.0mm, W: 8.9mm, T: 5.1mm (95KSL-AE4-3; Fill; Level 7).
5. Awl, unfinished, Type I-X-?, L: 67.0mm, W: 12.7mm, T: 8mm (94KSL-A6-10; 501; Level 5).
6. Awl, Type I-X-?, L: 90.0mm, W: 13.2mm, T: 4.8mm (95KSL-AE5-6; 709; Level 7).
7. Awl, Type I-X-?, L: 61.5mm, W: 10.0mm, T: 5.1mm (95KSL-AF5-9; 1309; Level 13).
8. Awl, Type ?, L: 32.1mm, W: 12.0mm, T: 5.0mm (95KSL-AG5-3; 1301; Level 13).

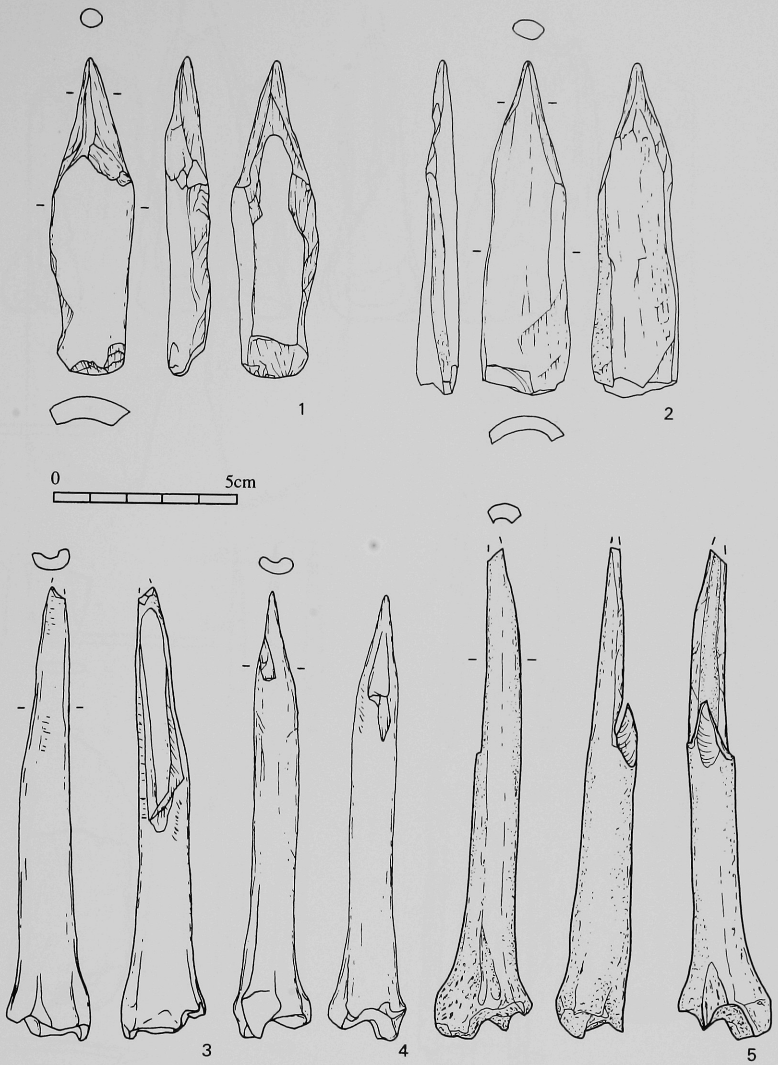


Fig. 14.3 Chalcolithic bone implements from Sector A.

1. Awl, Type II-X-A, L: 87.0mm, W: 23.0mm, T: 12.0mm (96KSL-AE4-14-154; 10A01; Level 10A).
2. Awl, Type II-X-A, L: 90.5mm, W: 20.5mm, T: 8.0mm (95KSL-AF4-1; Fill; Level 10A).
3. Awl, Type I-Y-C, L: 122.0mm, W: 14.0mm, T: 5.7mm (97KSL-AE5-52; Fill; Level 14).
4. Awl, Type I-Y-C, L: 120.1mm, W: 12.5mm, T: 4.4mm (97KSL-AD5-120; 1402; Level 14).
5. Awl, Type I-Y-C, L: 135mm, W: 14mm, T: 12.5mm (97KSL-AE4-49; 1119; Level 11).

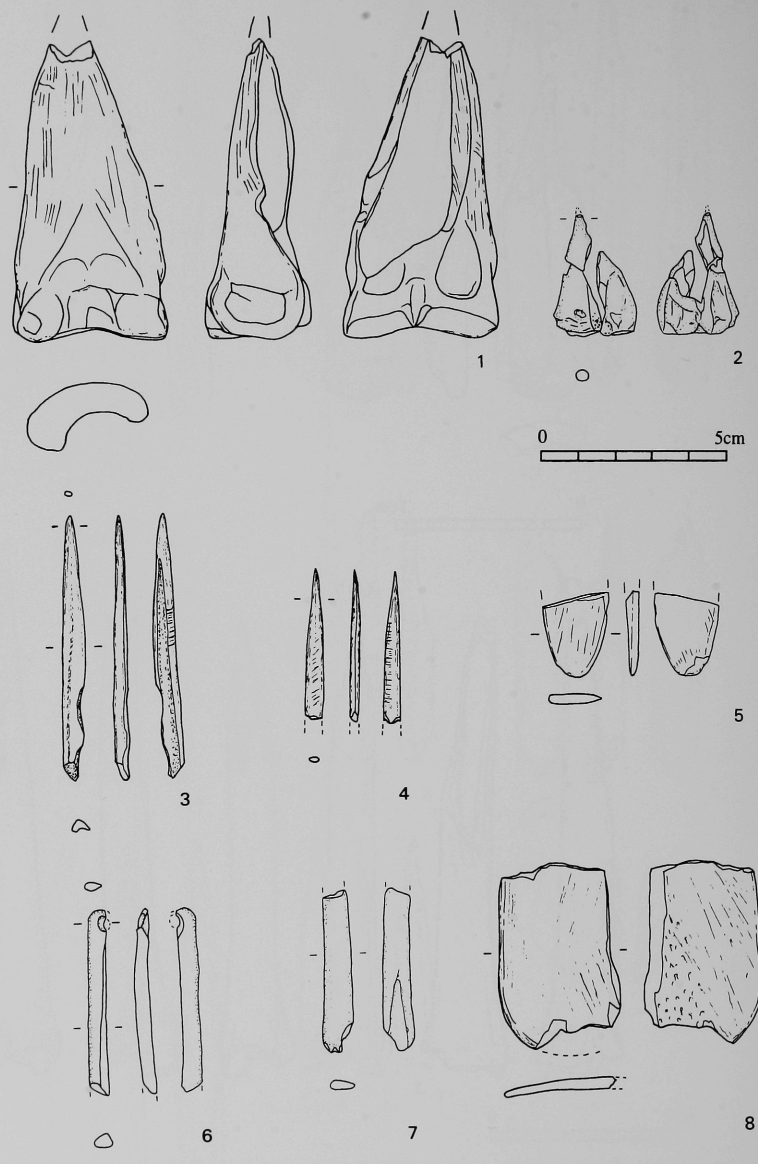


Fig. 14.4 Chalcolithic bone implements from Sectors A and B.
1. Awl, Type II-Y-C, L: 78.1mm, W: 32.2mm, T: 18.0mm (95KSL-AD4-6; 501; Level 5 of Sector A).
2. Awl, Type I-Y-C. L: 32.0mm, W: 21.6mm, T: 20.0mm (95KSL-AD5-66; Fill; Level 6 of Sector A).
3. Needle, L: 70.7mm, W: 6.4mm, T: 3.8mm (97KSL-AD4-47; 1208; Level 12 of Sector A).
4. Needle, L: 39.1mm, W: 4.9mm, T: 2.1mm (96KSL-BD7-40; Collapsed wall; Level 4 of Sector B).
5. Spatula, L: 23.0mm, W: 17.8mm, T: 3.5mm (95KSL-AF6-1; Pit; Mixed level, Sector A).
6. Needle, L: 48.9mm, W: 5.0mm, T: 4.8mm (95KSL-AF5-4; 1111; Level 11 of Sector A).
7. Needle, L: 43.2mm, W: 8.1mm, T: 3.5mm (95KSL-AF5-4; 1111; Level 11 of Sector A).
8. Spatula, L: 48.3mm, W: 32.1mm, T: 4.5mm (97KSL-AE5-17; 10A02; Level 10A of Sector A).

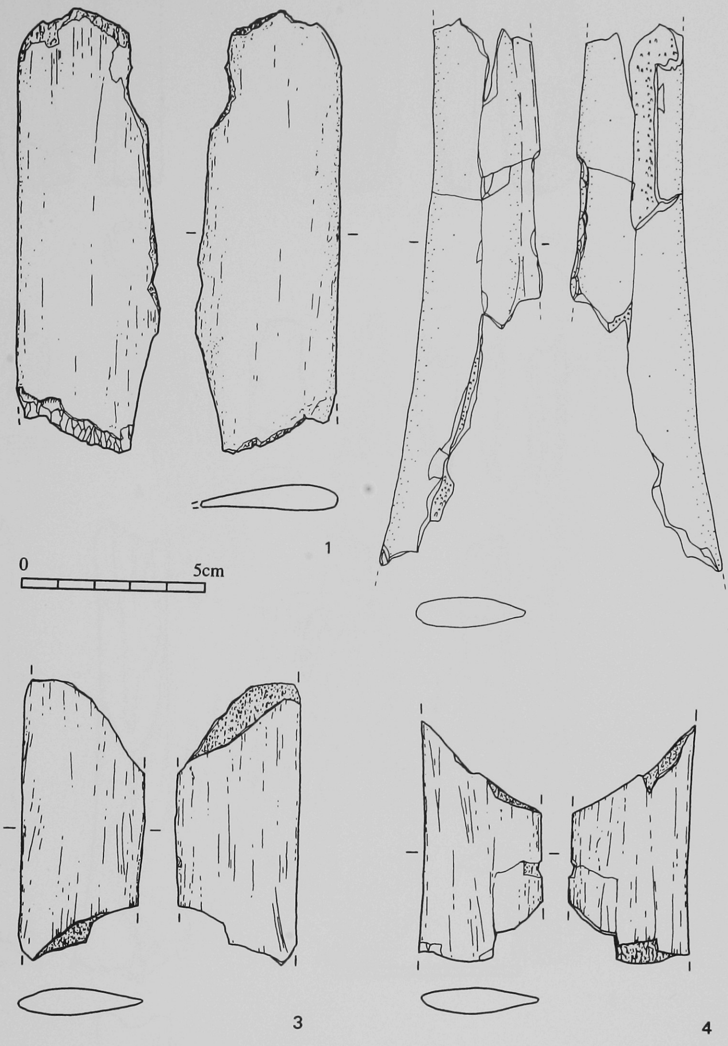


Fig. 14.5 Chalcolithic bone implements from Sector A.
1. Knife, L: 120.0mm, W: 39.0mm, T: 8.5mm (97KSL-AE5-42; 12A06; Level 12A).
2. Knife, L: 150.0mm, W: 32.8mm, T: 9.1mm (95KSL-AD5-93; 1006; Level 10).
3. Knife, L: 76.5mm, W: 33.0mm, T: 7.0mm (96KSL-AD5-90; 1013; Level 10).
4. Knife, L: 66.2mm, W: 32.0mm, T: 7.8mm (96KSL-AD5-90; 1013; Level 10).

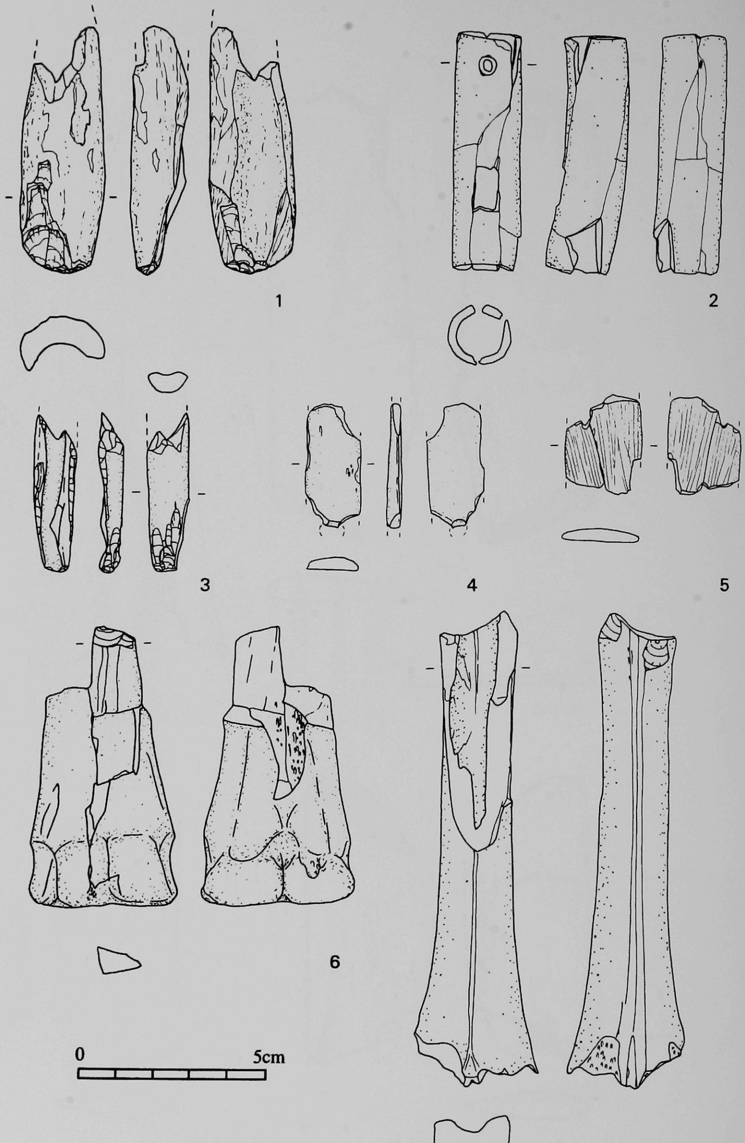
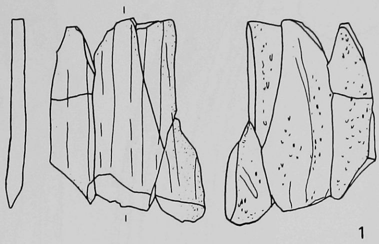


Fig. 14.6 Chalcolithic bone implements from Sectors A and B.

1. Splintered piece, L: 63.8mm, W: 21.8mm, T: 13.9mm (95KSL-AF4-9; Fill; Level 13 of Sector A).
2. Tube, L: 63.0mm, W: 19.0mm, T: 16.8mm (95KSL-AF5-22; Fill; Level 15 of Sector A).
3. Splintered piece, L: 42.0mm, W: 11.0mm, T: 5.5mm (96KSL-BD6-29; 502; Level 5 of Sector B).
4. Bone plate, L: 32.9mm, W: 15.0mm, T: 4.0mm (95KSL-AD5-66; Fill; Level 6 of Sector A).
5. Bone plate, L: 26.7mm, W: 21.0mm, T: 3.2mm (95KSL-AF5-8; Fill; Level 13 of Sector A).
6. Flesher, L: 76.4mm, W: 39.2mm, T: 29.3mm (95KSL-AD5-59; 503; Level 5 of Sector A).
7. Debitage, L: 126.9mm, W: 20.2mm, T: 19.5mm (95KSL-AD5-13; 403; Level 4 of Sector A).



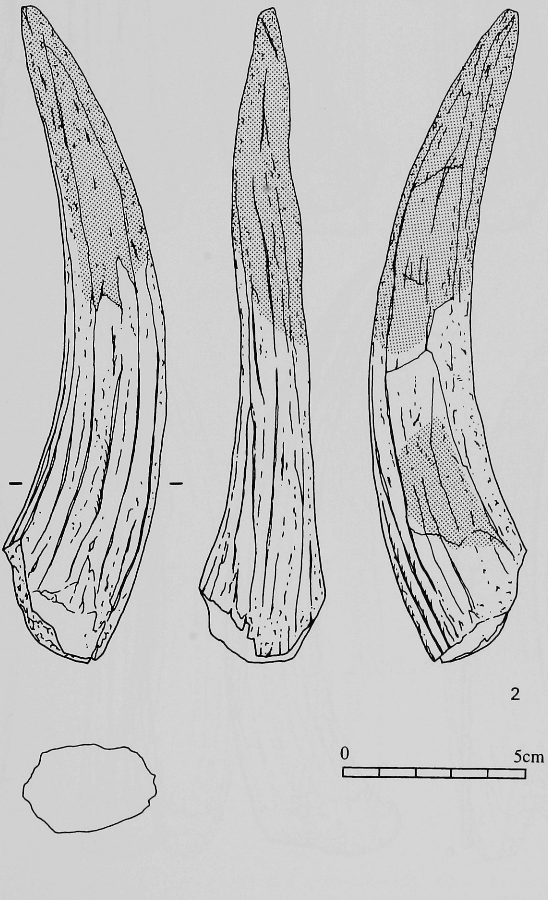


Fig. 14.7 Chalcolithic bone implements from Sector A.
1. Worked antler, L: 56.0mm, W: 41.8mm, T: 5.6mm (95KSL-AD5-57; 502; Level 5).
2. Worked horn, L: 179.0mm, W: 27.9mm, T: 19.4mm (95KSL-AD5-44; 402; Level 4).
The shadowed area indicates an abraded surface.

Fig. 14.8 Chalcolithic bone implements from Sector A.

1. Worked horn, L: 162.0mm, W: 27.7mm, T: 19.7mm (97KSL-AE6-36; 1103; Level 11). The shadowed area indicates an abraded surface.

2. Worked horn, L: 164.0mm, W: 24.0mm, T: 15.6mm (97KSL-AE5-20; 10A02; Level 10A). The shadowed area indicates an abraded surface.

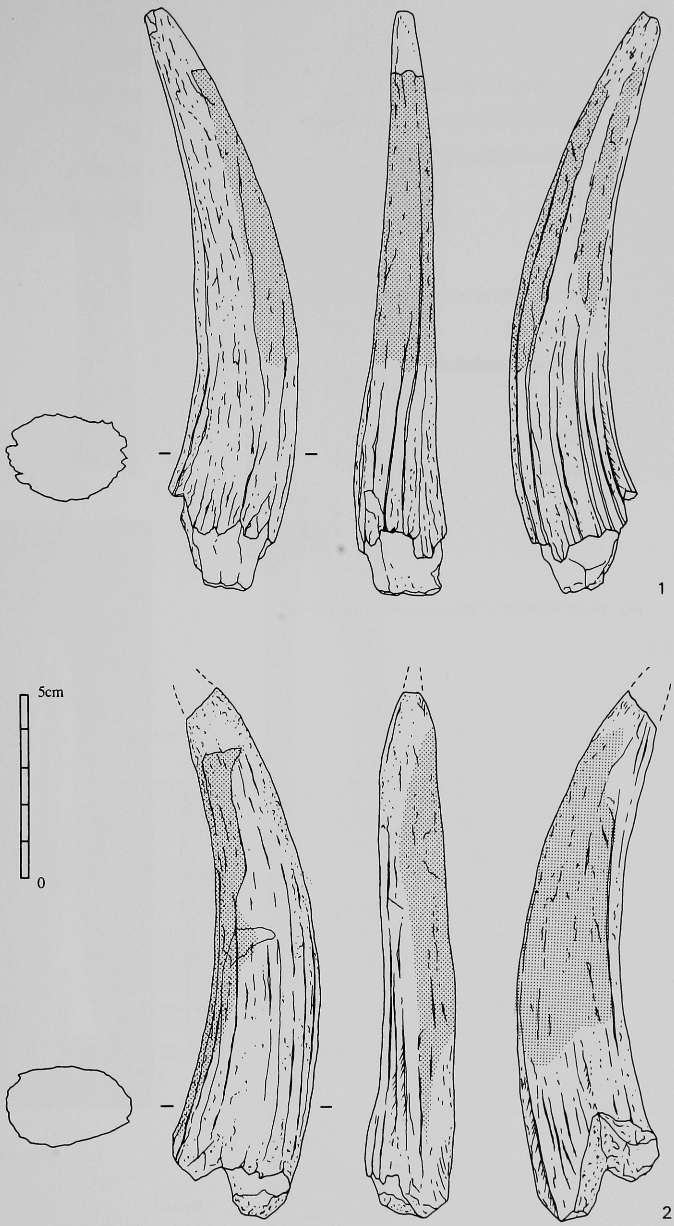


Fig. 14.9 Chalcolithic bone implements from Sector A.
1. Worked horn, L 157.5mm, W: 27.2mm, T: 17.5mm (95KSL-AG5-1; Fill; Level 12). The shadowed area indicates an abraded surface.
2. Worked horn, L: 143.0mm, W: 28.2mm, T: 19.2mm (95KSL-AD5-44; 402; Level 4). The shadowed area indicates an abraded surface.

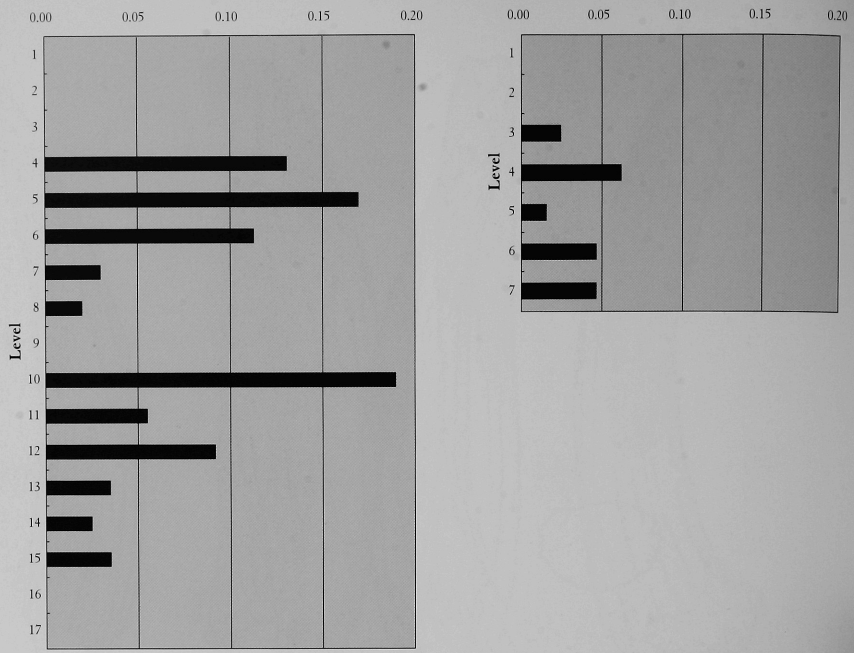


Fig. 14.10 Number of bone implements per m^2.

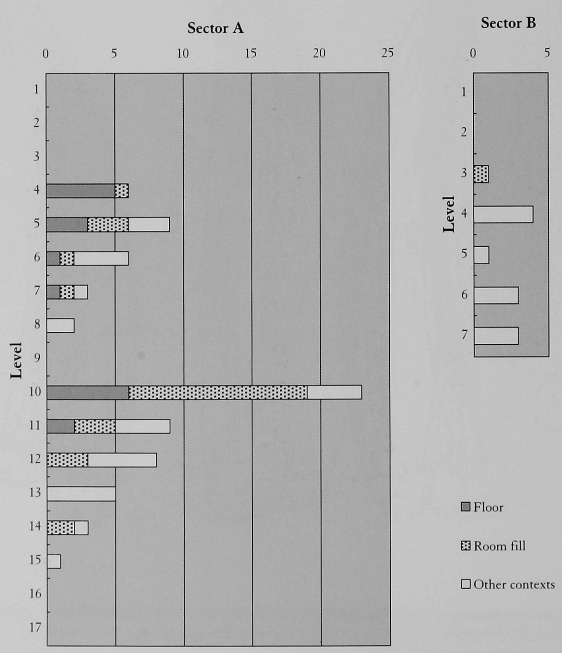


Fig. 14.11 Frequency of recovery contexts of bone implements.

Pl. 14.1 Chalcolithic bone implements from Sector A.

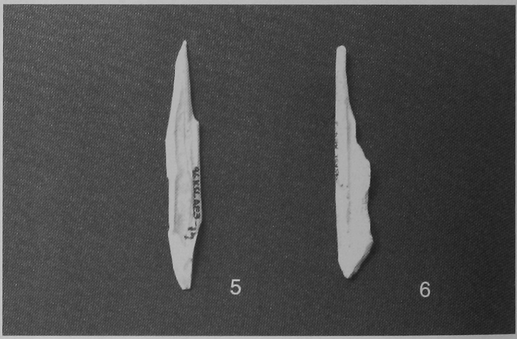
1. Awl (cf. Fig. 14.1: 2).
2. Awl (cf. Fig. 14.3: 1).
3. Awl (cf. Fig. 14.1: 5).
4. Awl, Type I-X-C, L: 77.2mm, W: 11.0mm, T: 6.5mm (96KSL-AD6-15; Fill; Level 5 of Sector A).
5. Awl (cf. Fig. 14.1: 4).
6: Awl (cf. Fig. 14.1: 7).
7: Awl (cf. Fig. 14.1: 1).
8: Awl, Type I-X-?, L: 82.1mm, W: 10.8mm, T: 6.7mm (96KSL-AE4-9; 10A01; Level 10A of Sector A)
9: Awl, Type I-X-C, L: 79.0mm, W: 10.4mm, T: 6.3mm (97KSL- AE4-49; 1119; Level 11 of Sector A)

1

2

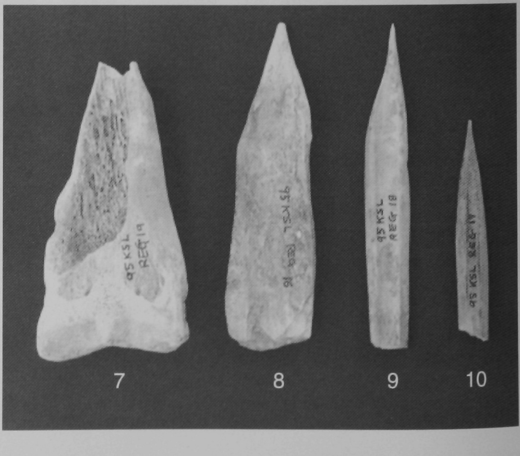
Pl. 14.2 Chalcolithic bone implements from Sector A.
1. Awl (cf. Fig. 14.1: 6).
2. Awl (cf. Fig. 14.3: 4).
3. Awl (cf. Fig. 14.4: 2).
4. Awl (cf. Fig. 14.3: 3).
5. Awl (cf. Fig. 14.2: 3).
6. Awl (cf. Fig. 14.2: 4).
7. Awl (cf. Fig. 14.4: 1).
8. Awl (cf. Fig. 14.3: 2).
9. Awl (cf. Fig. 14.2: 6).
10. Awl (cf. Fig. 14.2: 7).

3

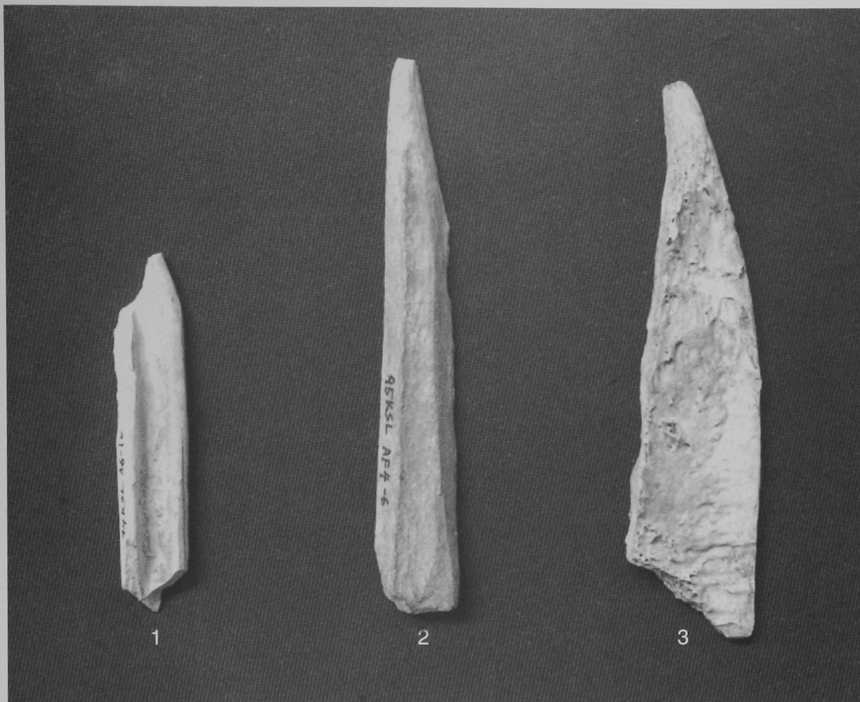


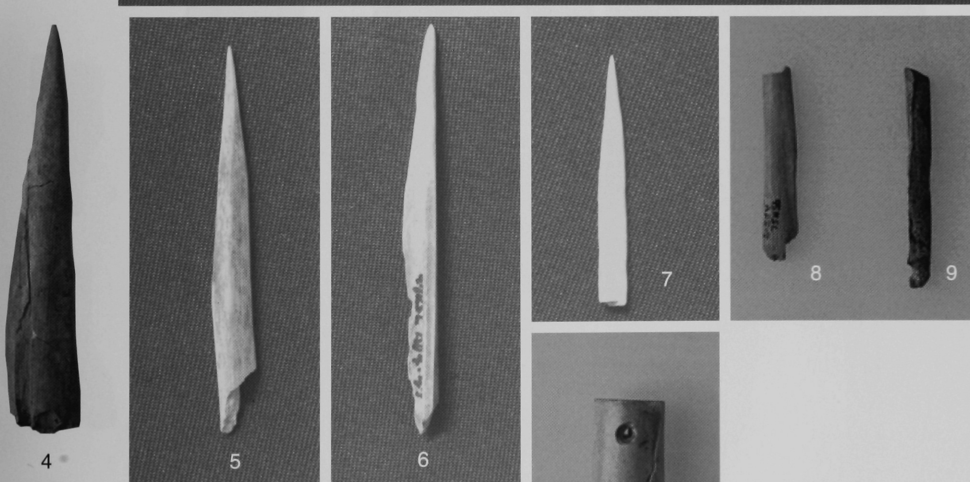
5 6

4



7 8 9 10





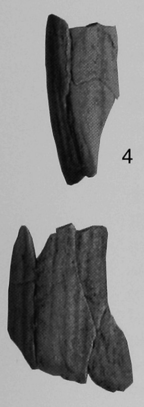
Pl. 14.3 Chalcolithic bone implements from Sectors A and B.

1. Awl (cf. Fig. 14.2: 5).
2. Awl (cf. Fig. 14.2: 2).
3. Awl (cf. Fig. 14.2: 1).
4. Awl (cf. Fig. 14.1: 3).
5. Needle, L: 62.4mm, W: 6.6mm, T: 4.2mm (97KSL-AD4-41; 1113; Level 11 of Sector A).
6. Needle (cf. Fig. 14.4: 3).
7. Needle (cf. Fig. 14.4: 4).
8. Needle (cf. Fig. 14.4: 7).
9. Needle (cf. Fig. 14.4: 6).
10. Tube (cf. Fig. 14.6: 2).

Pl. 14.4 Chalcolithic bone implements from Sector A and B.
1. Splintered piece (cf. Fig. 14.6: 1).
2. Flesher (cf. Fig. 14.6: 6).
3. Bone plate (cf. Fig. 14.6: 5).
4. Bone plate (cf. Fig. 14.6: 4).
5. Splintered piece (cf. Fig. 14. 6: 3).
6. Spatula (cf. Fig. 14.4: 8).
7. Spatula (cf. Fig. 14.4: 5).
8. Knife (cf. Fig. 14.5: 2).

Pl. 14.5 Chalcolithic bone implements from Sector A.

1. Debitage (cf. Fig. 14.6: 7).
2. Worked horn (cf. Fig. 14.8: 2).
3. Worked horn (cf. Fig. 14.8: 1).
4. Worked antler, L: 56.5mm, W: 25.0mm, T: 15.3mm (95KSL-AD5-57; 502; Level 5 of Sector A).
5. Worked antler (cf. Fig. 14.7: 1).
6. Worked horn (cf. Fig. 14.7: 2).
7. Worked horn (cf. Fig. 14.9: 1).
8. Worked horn (cf. Fig. 14.9: 2).



CHAPTER 15 The Chalcolithic small finds from Tell Kosak Shamali: Various aspects of the village activity

Hiroshi Sudo

15.1 Introduction

The small finds component of the vast amount of material from the Tell Kosak Shamali excavations comprised 180 artifacts. These so-called small finds, mainly consisting of miscellaneous clay, reused-potsherds and stone objects, provide a range of information on aspects of human activities which differs to that offered through pottery and stone artifacts, but such materials have not previously been paid sufficient attention in the literature. Although there were not many small finds from Tell Kosak Shamali, they were studied in detail in the hope of providing new information and showing the importance of small finds for future study. In the following, small finds are described under nine general categories, each further subdivided when necessary.

The Chalcolithic building levels of Tell Kosak Shamali were divided into chronological units on the basis of the pottery sequence (Nishiaki *et al.* 1999: 15-16). Sector A, Levels 17-10 are Early Northern Ubaid, further divided into an earlier (Levels 17-13) and a later (Levels 12-10) phases. Levels 9-4 are Late Northern Ubaid, also sub-divided into an earlier (Levels 9-7) and a later (Levels 6-4) phases. Levels 3-1 of Sector A represent the Terminal Northern Ubaid, which also includes Level 7 of Sector B. Levels 6 and 5 of Sector B are Post-Ubaid, while Levels 4-1 are Middle Uruk, composed of an earlier (Levels 4 and 3) and a later (Levels 2 and 1) phases. The later phase may compare to the Late Uruk. Chronological change in the Tell Kosak Shamali small finds will be examined following the pottery sequence.

15.2 Clay scrapers

Clay scrapers formed the largest group of small finds (55 examples; 30.6%) (Levels 17-10 of Sector A, Early Northern Ubaid: n=12; Levels 9-4 of Sector A, Late Northern Ubaid: n=4; Levels 3-1 of Sector A and Level 7 of Sector B, Terminal Northern Ubaid: n=4; Levels 6-5 of Sector B, Post-Ubaid: n=21; Levels 4-1 of Sector B, Middle Uruk: n=13, and topsoil: n=1).

These were mostly made from reused potsherds (n=42: 76.3% of all clay scrapers), but some seemed to have been made directly of clay (e.g. Figs. 15.5: 2 and 3; 15.6; 15.7: 2 and 3; Pls. 15.2: 6 and 7; 15.4). All have a tapered or sharpened edge. While their exact function(s) cannot be identified, some aspects of these clay scrapers will be examined. Although these objects are termed "scrapers" they must have served various functions, and indeed, it may be preferable to call them "clay objects with sharpened edge". However, to avoid the use of such long name, the term "scrapers" is maintained.

These scrapers were classified into two types according to different methods of edge manufacture: Type 1 was on potsherds sharpened by percussion and Type 2 has working edges sharpened by polishing or abrasion. Each type was further classified into subtypes according to plan form.

(1) Type 1a: Round clay scrapers

(Figs. 15.1 & 15.2; Pls. 15.1: 1; 15.2: 4; 15.3: 1 & 2)

Made on reused potsherds, these were flaked and sharpened around the edge into a round or oval shape. Seven examples were recovered from Sector A, and 8 from Sector B. Most were broken in half or less, while 4 were complete or nearly complete (Figs. 15.1: 1 and 2; 15.2: 3 and 4; Pls. 15.2: 4; 15.3: 1). However, it is unclear whether they were broken during use or before

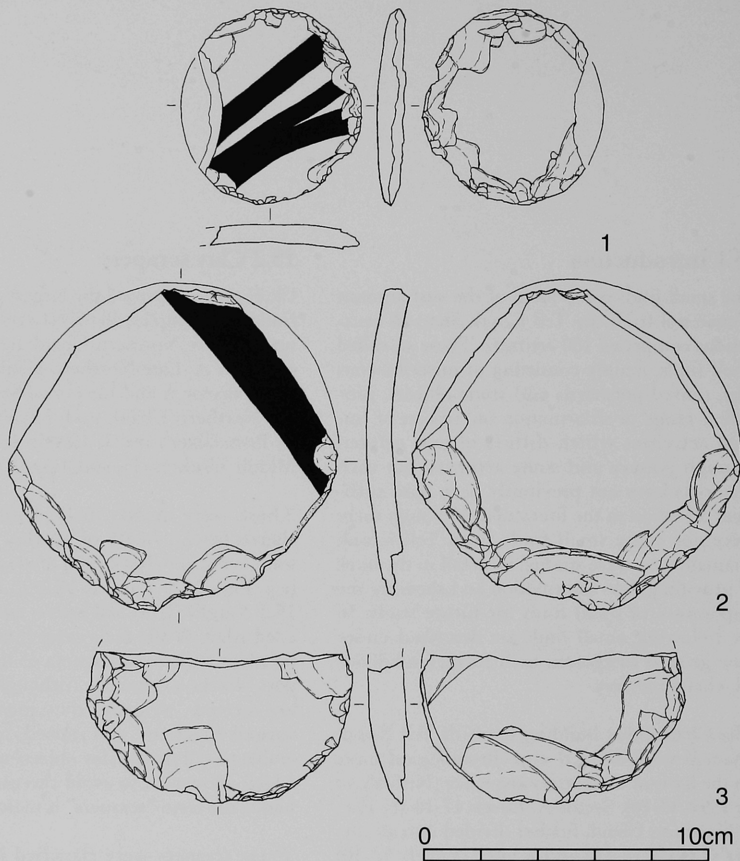


Fig. 15.1 Chalcolithic clay scrapers of Type 1a from Tell Kosak Shamali, Sector A
(: reconstructed; +: incomplete).*

1. *Clay scraper, potsherd, light yellow surface, pale yellow core, olive black paint, L: 6.9cm, W: 6.3cm, T: 0.7cm (97KSL-AD4-55; Floor/Fill of 1404; Level 14 of Sector A).*
2. *Clay scraper, potsherd, dull yellow orange surface, orange core, brownish black paint, L: 11.2+cm, W: 11.6cm, T: 0.9cm (95KSL-AF6-5; Fill of 1308; Level 13 of Sector A).*
3. *Clay scraper, potsherd, orange surface, orange core, L: 5.0+cm, W: 9.2cm, T: 1.2cm (97KSL-AD4-39; Fill; Level 11 of Sector A).*

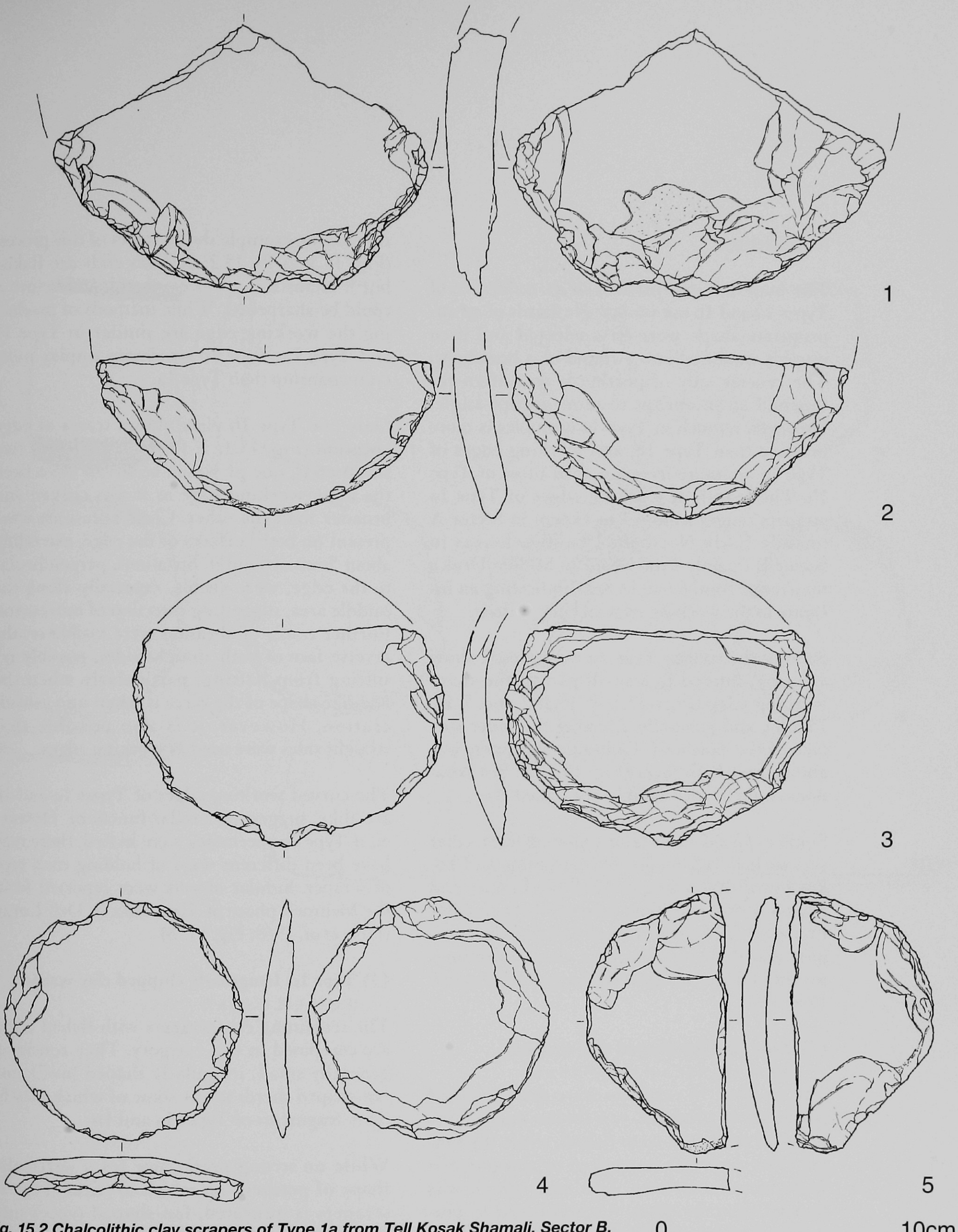


Fig. 15.2 Chalcolithic clay scrapers of Type 1a from Tell Kosak Shamali, Sector B.

1. Clay scraper, potsherd, pale yellow surface, orange core, L: 9.8+cm, W: 13.8+cm, T: 1.7cm (97KSL-BE6-23; Fill; Level 7 of Sector B).

2. Clay scraper, potsherd, light yellow surface, pale reddish orange core, L: 6.2+cm, W: 12.4cm, T: 1.3cm (94KSL-B9-2; Fill of B601; Level 5 of Sector B).

3. Clay scraper, potsherd, pale yellow surface, dull orange core, L: 8.0+cm, W: 11.3cm, T: 0.9cm (96KSL-BD7-48; Foundation of B504; Level 5 of Sector B).

4. Clay scraper, potsherd, light gray surface, dull orange core, L: 8.8cm, W: 9.0cm, T: 0.9cm (96KSL-BD7-48; Foundation of B504; Level 5 of Sector B).

5. Clay scraper, potsherd, dull yellow orange surface, dull orange core, L: 5.0+cm, W: 9.6cm, T: 0.9cm (97KSL-BE5-topsoil; Surface of Sector B).

manufacture.

The materials and method of manufacture of Types 1a and 1b are similar: potsherds of an appropriate shape were first selected and then roughly modified into a round or a hoe-shape. The reverse side of potsherds was often retouched at an abrupt to semi-abrupt angle. However, retouch in Type 1a examples is more invasive than Type 1b, and working edges of Type 1a are more irregular than those of Type 1b. The length of working edges of Type 1a scrapers ranges from 6.3 to 11.6cm in Sector A (mainly Early Northern Ubaid), whereas in Sector B (mainly Post-Ubaid to Middle Uruk), they range from 8.6 to 13.8cm, indicating an increase in the working edge in later periods.

Among the sixteen Type 1a examples, 3 show abrasion, limited to a small part of the sharp working edge (Figs. 15.1: 2; 15.2: 2 and 5; Pl. 15.1: 1), and generally affecting the outer surface of the potsherd. Only one specimen was abraded on both faces (Fig. 15.2: 2). No striations could be identified by the naked eye.

Similar objects have been reported from other sites such as Tell Songor B (Matsumoto and Yokoyama 1995), Chogha Mish (Delougaz and Kantor 1996), and Tepe Sabz (Hole *et al*. 1969: Fig. 91. c). The excavators of Chogha Mish propose that these scrapers were cheap substitutes for flint tabular scrapers (Delougaz and Kantor 1996: 109).

(2) Type 1b: Hoe-shaped clay scrapers

(Fig. 15.3; Pls. 15.1: 2; 15.2: 1-3; 15.3: 4 & 5)

The six Type 1b examples were also on reused potsherds. In principle, two shorter ends of trapezoidal potsherds were flaked, while the longer sides were left unworked or straightened with minimal flaking. One end, which was broader than the other, was sharpened to produce a working edge. In some cases, the opposite end was also flaked but not sharpened, except for one piece from the floor of Room 10A02 of Sector A (Early Northern Ubaid; Fig. 15.3: 3; Pl. 15.1: 2).

As mentioned above, appropriate trapezoidal potsherds were first selected for Type 1b specimens and then roughly shaped into a hoe-shape. One example shows traces of this process (Fig. 15.3: 2; Pl. 15.2: 2); both ends are flaked but it seems to have been abandoned before it could be sharpened. While methods of producing the working edge are similar in Type 1b and Type 1a, Type 1b specimens display more craftsmanship than Type 1a.

Only one Type 1b piece shows traces of edge abrasion (Fig. 15.3: 3; Pl. 15.1: 2). It has two sharp ends, one of which seems to have been the main working edge as it was curved and broader than the other. Clear abrasions were present on both surfaces of the edge, extending about 5mm around it. Striations, perpendicular to the edge, were visible, especially along the middle area, suggesting direction of movement. Further traces of abrasion were visible on the reverse face of both straight sides, possibly resulting from hafting, particularly when the hoe-like shape of the piece is taken into consideration. However, it is also possible that straight sides were used as working edges.

The curved working edges of Types 1a and 1b are alike, suggesting similar functions. However, if Type 1b specimens were hafted, there may have been different ways of holding each type of scraper. Similar objects were reported from the Mehmeh phase of Tepe Sabz in Deh Luran (Hole *et al*. 1969: Fig. 91. b).

(3) Type 1c: Irregularly chipped clay scrapers

(Fig. 15.4; Pl. 15.3: 6 & 7)

The remaining clay scrapers with flaked edges are combined in this category. They consist of generally small, irregularly shaped (n=7), and fan-shaped sherds (n=6), some of which may be mere fragments of Types 1a and 1b

While no strong preference for a particular shape of potsherd on which to make Type 1c scrapers is indicated, fan-shaped pieces may have been preferred as 6 of the 13 examples were on such pieces (e.g. Fig. 15.4: 2 and 6; Pl. 15.3: 7). The remainders are variously shaped. No pre-shaping was undertaken. A potsherd may have been selected at random and sharpened by retouch on one or more edges, mainly on the inside surface of potsherds. The angle and the extent of the retouch are similar to that on Types 1a and 1b.

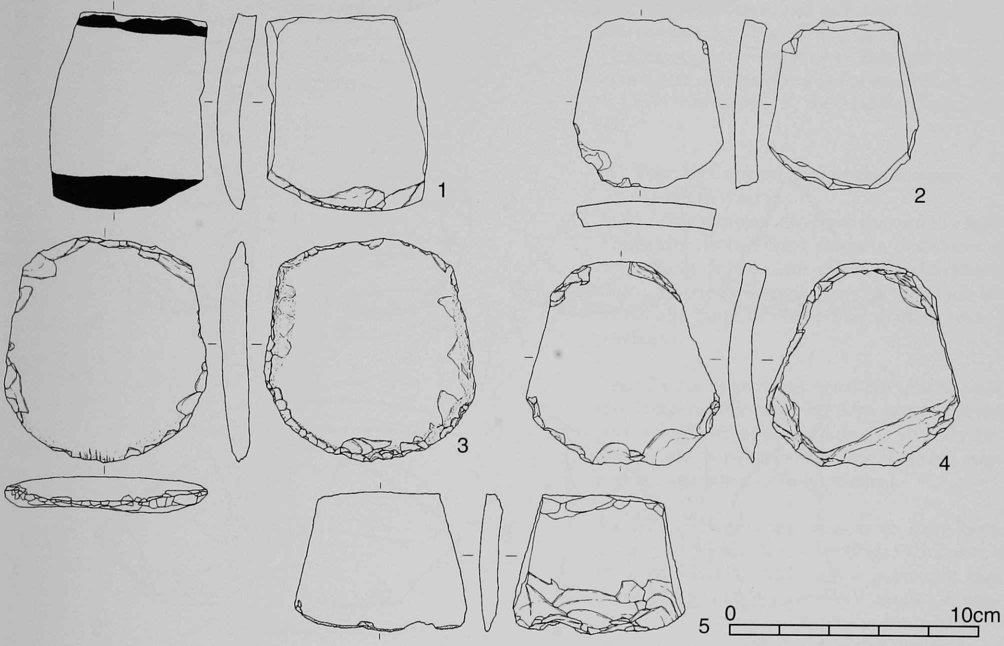


Fig. 15.3 Chalcolithic clay scrapers of Type 1b from Tell Kosak Shamali.

1. Clay scraper, potsherd, pale yellow surface, dull orange yellow core, brownish gray paint, L: 9.3cm, W: 7.5cm, T: 1.1cm (97KSL-AD5-116; Fill of 1301; Level 13 of Sector A).

2. Clay scraper, unfinished, potsherd, olive yellow surface, dull yellow orange core, L: 8.0cm, W: 7.1cm, T: 1.1cm (97KSL-AE5-22; Floor of 10A05; Level 10 of Sector A).

3. Clay scraper, potsherd, orange surface and core, L: 10.5cm, W: 9.8cm, T: 1.3cm (97KSL-AE5-20; Floor of 10A02; Level 10 of Sector A).

4. Clay scraper, potsherd, orange surface, dull orange core, L: 9.6cm, W: 9.3cm, T: 1.1cm (95KSL-AD4-8; Fill of 601; Level 6 of Sector A).

5. Clay scraper, potsherd, dull brown surface, grayish yellow brown core, L: 6.5cm, W: 8.2cm, T: 0.9cm (97KSL-BE5-9; Fill; Level 6-7 of Sector B).

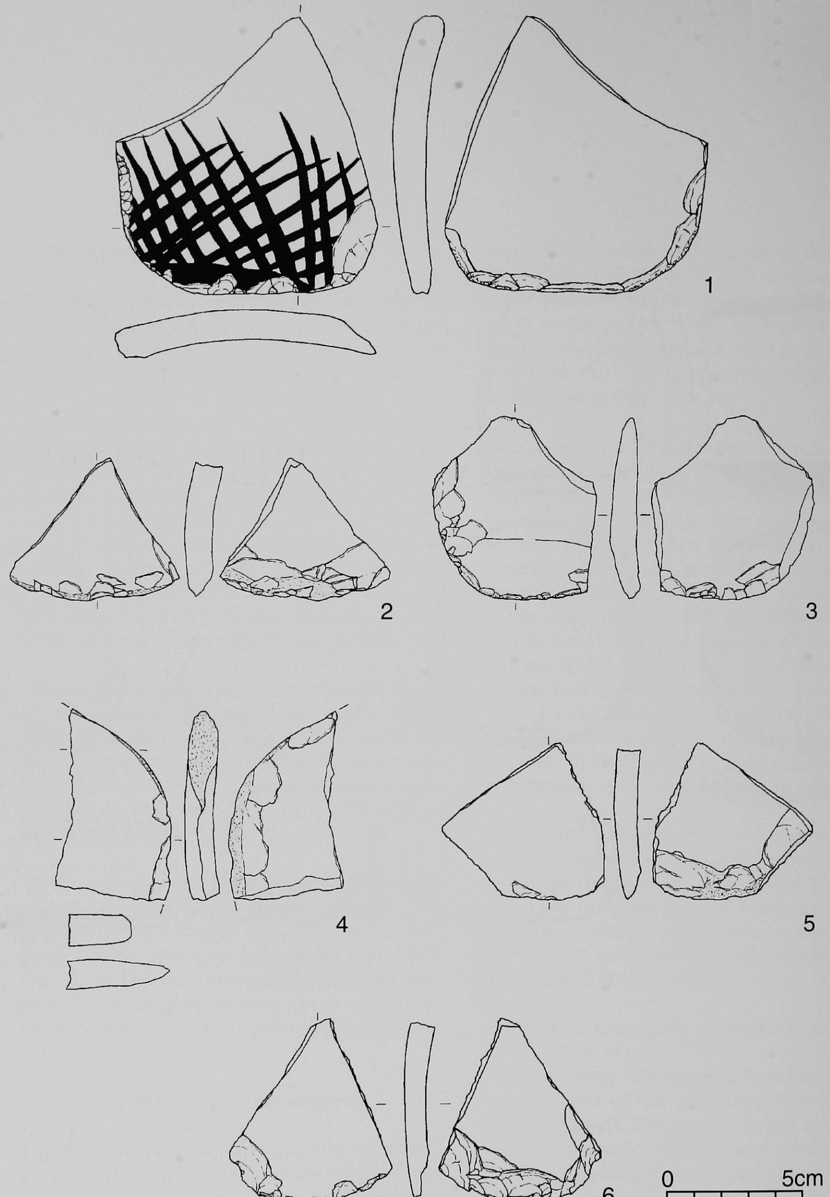


Fig. 15.4 Chalcolithic clay scrapers of Type 1c from Tell Kosak Shamali.

1. Clay scraper, potsherd, lightly worn, L: 10.0cm, W: 9.6cm, T: 1.2cm (96KSL-AD6-9; Fill of 301; Level 3 of Sector A).

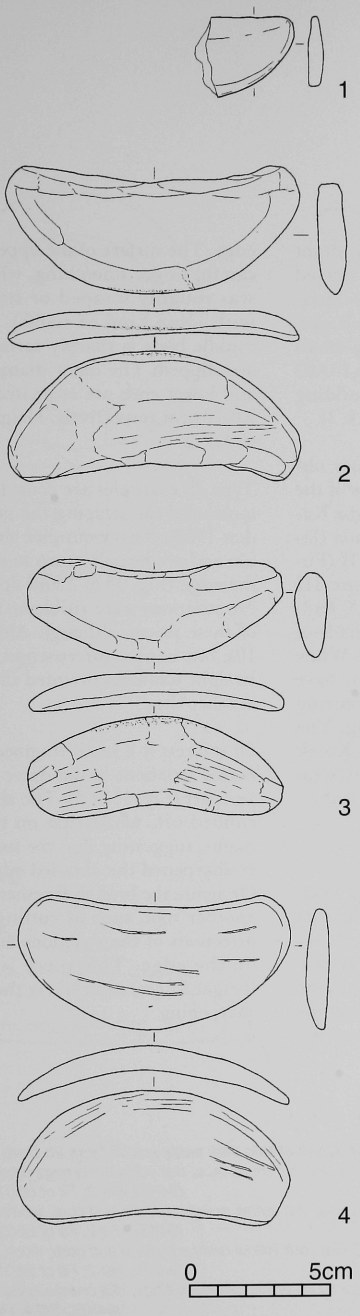
2. Clay scraper, fan-shaped, potsherd, pale yellow surface, light yellow orange core, worn, L: 5.2+cm, W: 6.1+cm, T: 1.0cm (96KSL-BD6-29; Pavement of B502; Level 5 of Sector B).

3. Clay scraper, potsherd, dull orange surface and core, lightly worn, L: 6.7cm, W: 6.0cm, T: 0.9cm (96KSL-BD7-46; Floor of B504; Level 5 of Sector B).

4. Clay scraper, potsherd, grayish yellow surface, dull brown core, heavily worn, L: 4.2cm, W: 7.0cm, T: 1.1 cm (96KSL-BE7-10; Level 4 of Sector B; Fill).

5. Clay scraper, potsherd, light yellow orange surface, dull orange core, worn, L: 5.7cm, W: 6.2cm, T: 0.8cm (95KSL-BD6-9; Fill; Level 2 of Sector B).

6. Clay scraper, fan shaped, potsherd, grayish yellow surface, dull yellow orange core, L: 6.7cm, W: 6.0cm, T: 0.9cm (95KSL-BD6-6; Foundation of B103; Level 1 of Sector B).



Type 1c pieces frequently show signs of widely distributed abrasion, and in 5 cases it affects the sharpened edge (Fig. 15.4: 1-5; Pl. 15.3: 6 and 7). One scraper is so heavily abraded that the upper part of the edge was flattened (Fig. 15.4: 4; Level 4 of Sector B, the Middle Uruk period).

(4) Type 2a: Crescent-shaped clay scrapers

(Fig. 15.5; Pl. 15.4: 2-5)

Type 2 clay scrapers also have sharpened edges. They differ from Type 1 pieces in that traces of burnishing or abrasion affect the sharpened edges. Moreover, Type 2 pieces include tools intentionally made of clay rather than on reused potsherds.

Type 2a are crescent or semi-circular shaped clay scrapers. The working edge is on a curved end, while the opposite edge is slightly incurved and not sharpened. The working edge is either smoothed or fully polished.

Two Type 2a scrapers appear to have been made intentionally from clay (Fig. 15.5: 2 and 3; Pl. 15.4: 3 and 4). Although it is possible that these pieces could have been made on potsherds, the surface treatment appears to have been done while the clay was still wet to make them intentionally. The surfaces were wet-smoothed, probably with a finger, while the edges seem to have been scraped, possibly with a tool, and then slightly smoothed. The incurved edges were also scraped but not sharpened. At least one Type 2a scraper was made on a large potsherd (Fig. 15.5: 4; Pl. 15.4: 2) and may represent a polished specimen of a Type 1a semi-circular scraper. Although the edge was polished so completely as to remove any trace of flaking, it must have been retouched into a nearly crescent shape before final polishing. The final Type 2a piece is too small a fragment to provide any information about blank type (Fig. 15.5: 1).

Fig. 15.5 Chalcolithic clay scrapers of Type 2a from Tell Kosak Shamali.

1. Clay scraper, potsherd ?, dull yellow orange surface, dull orange core, L: 2.9cm, W: 3.7+cm (95KSL-AF5-6; Fill; Level 12 of Sector A).

2. Clay scraper, clay, orange surface, found in a bowl with Fig.15.6: 3, L: 4.5cm, W: 10.5cm, T: 1.0 cm (96KSL-AE4-14; Floor of 10A01; Level 10 of Sector A).

3. Clay scraper, clay, orange surface, found in a bowl with Fig.15.6: 2, L: 3.6cm, W: 9.1cm, T: 1.2cm (96KSL-AE4-14; Floor of 10A01; Level 10 of Sector A).

4. Clay scraper, potsherd, dull orange, L: 4.8cm, W: 9.7cm, T: 0.9cm (94KSL-B9-2; Fill of B601; Level 5 of Sector B).

Two of the four Type 2a scrapers have slight traces of abrasion on the middle of their curved edge (Fig. 15.5: 2 and 3; Pl. 15.4: 3 and 4). Striations cannot be detected by the naked eye. These two specimens were found in a small bowl in the passage of Rooms 10A01 to 10A02 of the Early Northern Ubaid burnt building (Pl. 15.4: 5; Nishiaki *et al*. 2001: 69, P1. 3.8: 3).

Similar crescent-shaped or semi-circular objects have been reported from many sites of the 5th to 4th millennium BC such as Habuba Kabira (Sürenhagen 1978: 79-80), Tell Abada (Jasim 1985: Fig. 62), Telul eth-Thalathat II (Fukai *et al*. 1970: Pl. 35.6), Yarim Tepe III (Merpert and Munchaev 1993: Fig. 9.25.3; Bader *et al*. 1981: Pl. 24), and Arpachiyah (made of bone; Mallowan and Rose 1935: Pl. 12a). While their functions are as yet unknown, many have been considered to be pottery-manufacturing tools, particularly for surface smoothing. The same interpretation could apply to the Kosak Shamali examples, especially to the pair of scrapers found in the bowl in Room 10A01/10A02.

(5) Type 2b: Ring-shaped clay scrapers

(Fig. 15.6; Pl. 15.4: 1 & 6-9)

All 9 ring-shaped clay objects, from the Post-Ubaid and later levels, were made directly from clay. None was complete. Well-levigated clay was tempered with fine sand or mineral grit, and shaped into a ring. In vertical section, the upper part is narrower than the lower and the edge is sharpened, probably as the working edge. The surface of the upper part shows more careful finger smoothing, while the lower part was roughly scraped or smoothed probably with some kind of tool(s). Accordingly, the middle body is sharply carinated. Some pieces are slipped. The outer diameters of the upper and lower ends are estimated at 6.6-6.8cm and 9.0-10.6cm respectively. Height ranges from 2.0 to 3.0cm.

Type 2b examples are considered to be potters' tools used for scraping the pottery surface (Alden 1988). Two examples showed evidence of use and are heavily worn to make a flat face on the edge (Fig. 15.6: 2 and 3; Pl. 15.4: 8 and 9). No striations were visible on the working edges of these pieces, although Alden (1988), using a 10x bin-ocular microscope, identified small straight scratches oriented in a radial direction at other sites.

Of interest is a small fragment with deep horizontal striations at the outer surface of the upper part (Fig. 15.6: 5). The slip on this part has rubbed off, while that on the inner face remains, suggesting that the user appears to have re-sharpened the abraded edge for further use. Or again, the broken fragment has been used as another tool, such as cutting, considering the directions of the striations and a small flaking on the edge. This piece is relatively small (height 2.1cm) most likely the result of such re-sharpening.

▶ ***Fig. 15.6 Chalcolithic clay scrapers of Type 2b from Tell Kosak Shamali.***

*1. Clay scraper, clay, dull reddish brown surface, dull yellowish orange core, D: 9.0*cm, H: 2.5cm (94KSL-B9-2; Fill of B601; Level 5 of Sector B).*

2. Clay scraper, clay, dull yellow orange surface and core, worn, W: 6.4+cm, H: 2.9cm (94KSL-B9-2; Fill of B601; Level 5 of Sector B).

3. Clay scraper, clay, dull yellow orange surface and core, worn, W: 6.0+cm, H: 2.7cm (94KSL-B9-2; Fill of B601; Level 5 of Sector B).

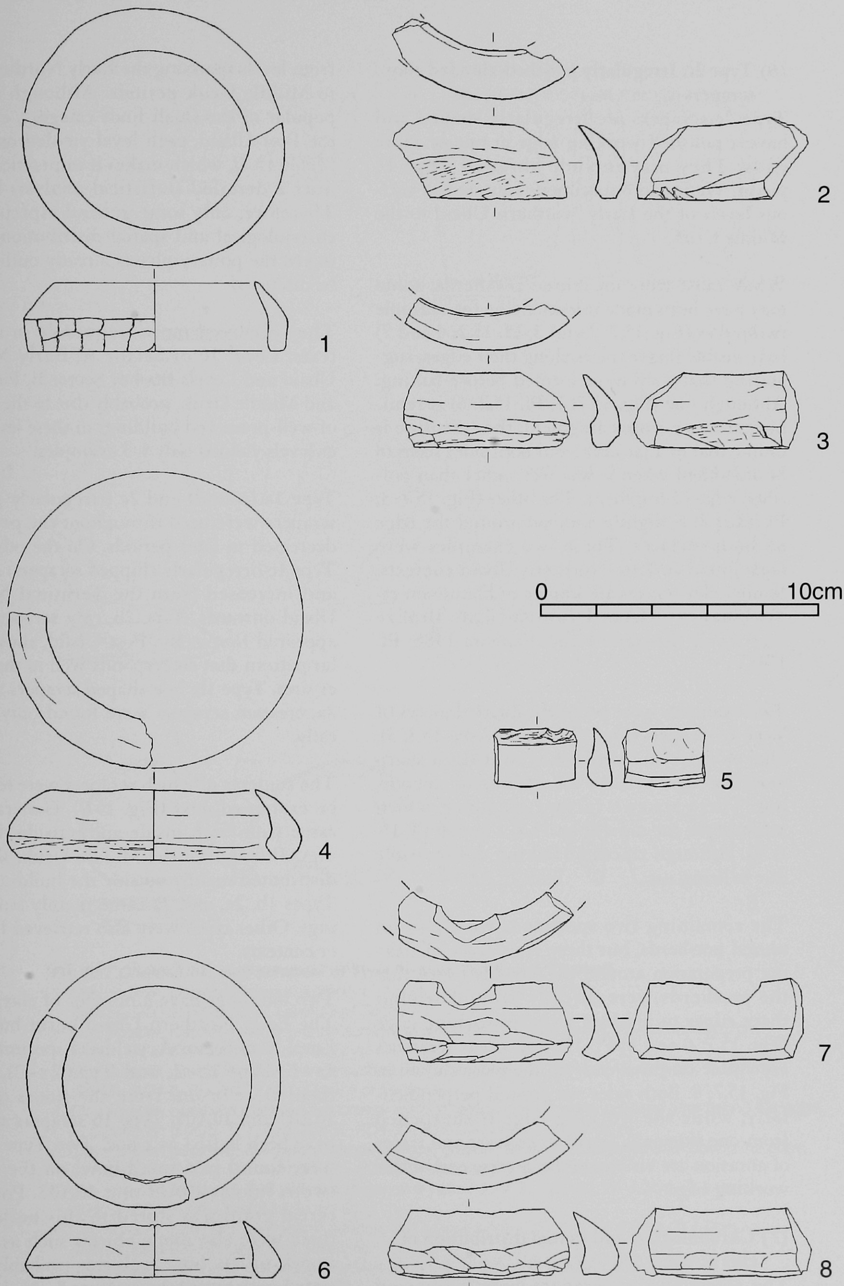
*4. Clay scraper, dull yellow orange surface, dull orange core, D: 10.6*cm, H: 2.2cm (94KSL-B8-4; Fill; Level 4 of Sector B).*

5. Clay scraper, clay, grayish yellow surface, dull orange core, re-sharpened edge, W: 3.0+cm, H: 2.1cm (95KSL-BD6-18; Fill; Level 4 of Sector B).

*6. Clay scraper, clay, light yellow orange surface, dull orange core, D: 9.0*cm, H: 2.0cm (94KSL-B9-3; Fill of B306; Level 3 of Sector B).*

7. Clay scraper, clay, light yellow surface, dull orange core, H: 2.8 cm (96KSL-BD7-32; Fill of B306; Level 3 of Sector B).

8. Clay scraper, clay, light yellow orange surface, dull orange core, H: 2.5cm (95KSL-BD7-11; Foundation of B201; Level 2 of Sector B).


2
1
3
0
10cm
5
4
7
6
8

(6) Type 2c: Irregularly polished/abraded clay scrapers (Fig. 15.7; Pls. 15.2: 5-7; 15.3: 3 & 8)

Type 2c scrapers are irregularly shaped and have a polished working edge at one or more ends. They may include abraded Type 1c pieces. We found 8 specimens scattered in various levels of the Early Northern Ubaid to the Middle Uruk.

While most were on reused potsherds, some may have been made intentionally; for example two pieces (Fig. 15.7: 2 and 3; Pl. 15.2: 6 and 7) have visible finger traces along their edges, suggesting that they were formed before baking. Although one (Fig. 15.7: 2; Pl. 15.2: 6) is reminiscent of a jar neck fragment, the curvature is unlike that of a jar neck, and both sides seem to be smoothed when it was wet rather than polished edge of fragment. The other (Fig. 15.7: 3; Pl. 15.2: 7) is slightly abraded around the edge on both surfaces. These two examples were both found in Late Northern Ubaid contexts. Similar clay objects are known at Hammam et-Turkman, but from Uruk and Late Bronze Age levels (Rossmeisl and Venema 1988: Pl. 174).

Two examples were probably abraded pieces of Type 1c scrapers (Fig. 15.7: 5 and 7; Pl. 15.3: 3). One or more end was flaked to make a sharp working edge, perhaps for rubbing or smoothing. There are two further examples, which may also be the same (Fig. 15.7: 1 and 4; Pl. 15. 2: 5), although traces of flaking are invisible due to heavy use.

The remaining two specimens were also on reused potsherds, but there is no trace of flaking preparation around the edge. It seems that the potsherds were directly ground around three edges to produce a sharp working edge (Fig. 15.7: 6 and 8; Pl. 15.3: 8). Clear scratches are visible on three ends on the piece shown in Fig. 15.7: 8. Both sides are ground perpendicularly, while the working edge is sharpened from one side only. Small flake scars and traces of abrasion are visible on the reverse end of this working edge.

(7) Chronological and spatial distribution of clay scrapers (Figs. 15.8 & 15.9)

The above 55 clay scrapers were discovered from levels spanning the Early Northern Ubaid to Middle Uruk periods. Although the most popular of the small finds category, except for the Post-Ubaid, each level yielded only a few (Table 15.1), which makes it impractical to conduct a detailed statistical analysis by level. Therefore, only some general aspects of their chronological and spatial distribution, according to the pottery phases already outlined, will be discussed.

They occurred more frequently in two contexts: Level 10 of Sector A, Early Northern Ubaid and Levels B6-4 of Sector B, Post-Ubaid and Middle Uruk, probably due to the presence of well-preserved buildings in these levels. Other levels yielded only 1-3 examples.

Type 1a (round) and 2c (irregularly polished) scrapers were used throughout the periods but decreased in later periods. On the other hand, Type 1c (irregularly chipped scrapers) appeared and increased from the Terminal Northern Ubaid onwards. Type 2b, ring scrapers, which appeared first in the Post-Ubaid, show a similar pattern that corresponds well to that of other sites. Type 1b, hoe-shaped scrapers and Type 2a, crescent scrapers were found only sporadically.

The contexts in which scrapers were found will be examined next (Fig. 15.9). Generally, they came from both inside and outside the buildings, although in the Middle Uruk, they were distributed mainly outside the buildings, while Types 1b, 2a, and 2b came mainly from buildings. Other types were also retrieved from other contexts.

Two buildings have a number of clay scrapers. The Early Northern Ubaid burnt building of Level 10 of Sector A, yielded 5 specimens (Type 1a=1, Type 1b=2, and Type 2a=2). Four of them were *in situ* from the floors of Rooms 10A02 and 10A05. Type 1b scrapers seemed to have been hafted as a hoe. Two Type 2a pieces were found in a small bowl on the floor between Rooms 10A01 and 10A02. Pottery and cereal grain was stored in this building and there were also many objects such as grinding stones, pallets, bone tools etc., probably all associated with pottery manufacture (Nishiaki *et al.*

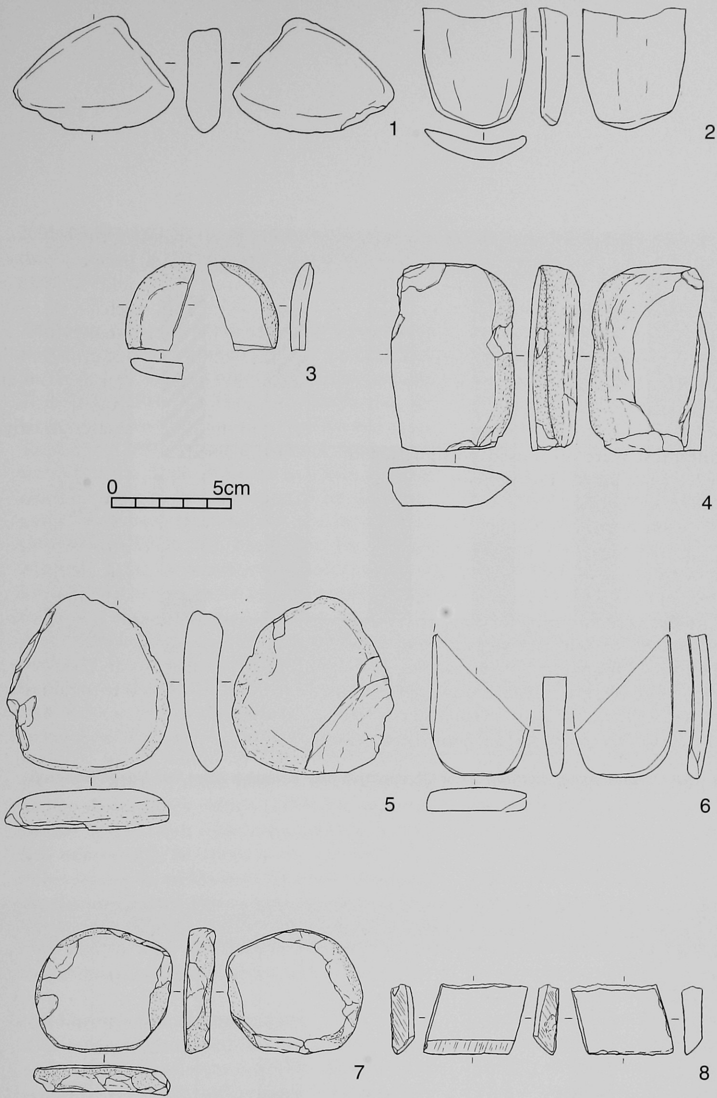


Fig.15.7 Chalcolithic clay scrapers of Type 2c from Tell Kosak Shamali.

1. Clay scraper, potsherd, orange surface, L: 4.9cm, W: 6.7cm, T: 1.4cm (94KSL-D10-2; Fill of 1306; Level 13 of Sector A).

2. Clay scraper, clay, dull yellow orange surface, dull orange core, L: 5.0+cm, W: 4.3cm, T: 0.7cm (95KSL-AD5-66; Fill; Level 6 of Sector A).

3. Clay scraper, clay, dull yellow orange surface, dull orange core, L: 3.0+cm, W: 3.7+cm, T: 0.7cm (95KSL-AD4-6; Floor/fill of 501; Level 5 of Sector A).

4. Clay scraper, potsherd, pale reddish orange surface, grayish brown core, polished after flaking the edge, L: 5.2cm, W: 8.0cm, T: 1.7cm (95KSL-AD4-2; Fill of 101; Level 1 of Sector A)

5. Clay scraper, potsherd, dull yellow orange surface, grayish yellow core, polished after flaking the edge, L: 7.6cm, W: 6.8cm, T: 1.4cm (97KSL-BE6-32; Fill; Level 6-8 of Sector B).

6. Clay scraper, potsherd, light yellow surface, olive yellow core; L: 6.2+cm, W: 4.3cm, T: 1.0cm (97KSL-BE5-3; Fill; Level 6 of Sector B).

7. Clay scraper, potsherd, pale yellow surface, dull orange core, L: 5.2cm, W: 5.8cm, T: 1.0cm (96KSL-BD6-23; Fill; Level 6 of Sector B).

8. Clay scraper, potsherd, dull orange surface and core, L: 3.0+cm, W: 4.4cm, T: 0.8cm (94KSL-B9-1; Fill; Level 1 of Sector B).

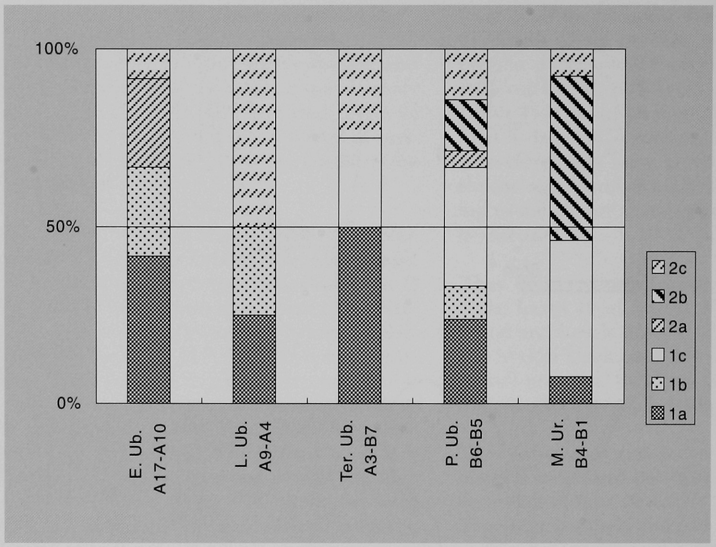


Fig. 15.8 Chronological distribution of Chalcolithic clay scrapers from Tell Kosak Shamali.

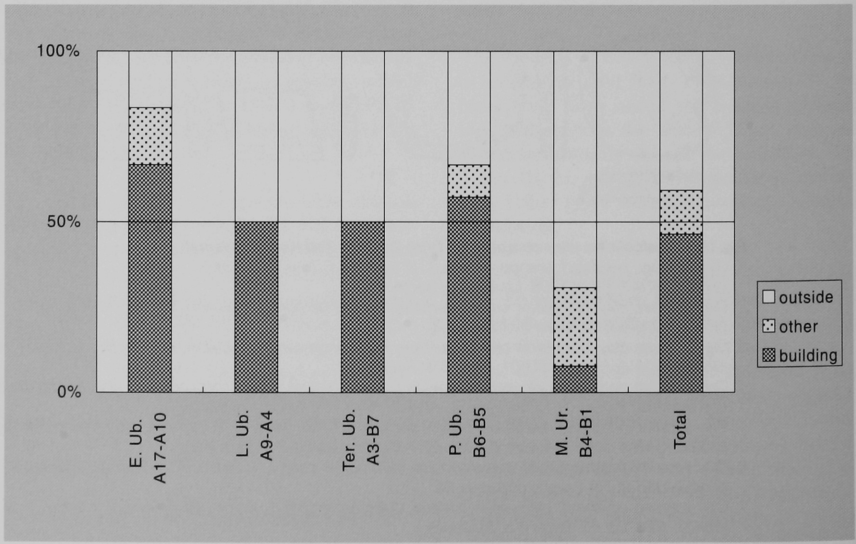


Fig. 15.9 Spatial distribution of Chalcolithic clay scrapers from Tell Kosak Shamali.

2001: 65-71). It is likely that the clay scrapers in this building were also tools used in pottery manufacture.

Ten clay scrapers were recovered from the Post-Ubaid pottery workshop of Level B5 of Sector B: two Type 1a (under the floor) and one Type 1c in B504; one Type 1c in B605; and, interestingly, two Type 1a, one Type 2a, and three Type 2b in B601, a pottery kiln. A "clay ring" similar to our Type 2b found in a kiln at Telul eth-Thalathat II was interpreted by the excavators as a pottery stand for use in the kiln (Matsutani 1970: 80). However, the Kosak Shamali Type 2b pieces, also discovered in a kiln (B601), are not seen as pot-stands for the following reasons: 1) they were not over-fired, despite their position, but were broken pieces probably thrown into the kiln; 2) if they had been indeed pot-stands, their sharp edges would have been unnecessary; 3) some were covered with slip, an element of careful craftsmanship which would not have been required for pot-stands; 4) some had traces of abrasion on the sharp edges. Alden (1988) has reported similar traces from other sites and has identified microscopic striations at the abraded edge of his pieces. In addition to the above points, as the Kosak Shamali pieces were found in association with pottery manufacturing contexts, they can be seen as scrapers for the surface treatment of pottery as Alden (1988) proposed.

(8) The function of clay scrapers

The artifacts described as clay scrapers must have been tools of some type, but their definite functions are as yet undetermined. A summary of the above analyses may aid further consideration.

Fifty-five examples were classified into 6 categories according to method of edge manufacture and shape. Variations in shape appear to be related to handling; Type 1a, 1b, 2a, and 2b pieces are relatively large and seem to have been grasped in the hand, whereas Type 1b may have been hafted when the hoe-like shape of the piece is taken into consideration. Contextual information indicates that Type 1b scrapers were used within a building and may have been attached to a short haft even if they were hafted. It was also possible that they have been used by hand without haft because there was not any evidence except for one specimen from the floor of 10A02 of Sector A that has abrasion on both sides (Fig. 15.3: 3; Pl. 15.1: 2). The remaining Type 1c and 2c pieces are small and suitable for finger use. Furthermore, Types 1a, 1b, 2a, and 2b are of regular and standardized shapes, which could accommodate specific functions.

Those pieces showing use-wear can help reconstruct function. Two Type 1a scrapers had light wear abrasion limited to their sharp edges suggesting that they were used at an almost perpendicular angle. Considering the angle of use, the sharpness of the edges, and the raw material (clay), it would appear that they were used for scraping something soft. However, it is also possible that Type 1a scrapers were used as substitutes for flint "tabular scrapers". Examples from Chogha Mish, Iran have been considered as cheap substitutes for flint tabular scrapers (Delougaz and Kantor 1996: 109). Only a few pieces made on flint flakes without cortex have been identified as tabular scrapers at Kosak Shamali (Scrapers of Type 6 in Chapter 13). The rarity of flint tabular scrapers and the existence of round clay scrapers at the site may be related.

Type 1b and Type 1c pieces, on the other hand, bear more invasive use-wear, suggesting that they were pressed obliquely against the worked materials. They may have been used for smoothing. The context (the floor of Room 10A02) of one Type 1b piece (Fig. 15.3: 3; Pl. 15.1: 2) indicates that this scraper, at least, could have been used for smoothing wet pottery surfaces.

Type 2a scrapers had a smooth working edge. Similar objects from other sites are considered to be pottery-manufacturing tools. Two of the Tell Kosak Shamali scrapers discovered in a small bowl on the floor between Rooms 10A01 and 10A02 are seen as definite evidence that these clay objects were potters' tools. Type 2b scrapers have also been reported from other sites as relating closely to pottery manufacturing, and can be confirmed at Tell Kosak Shamali as well. As Alden (1988) has suggested, Type 2b scrapers were most likely pottery-scraping tools.

The well-polished, smooth working edges of Type 2c scrapers seem to have been used for various purposes. Two examples (Fig. 15.7: 2 and 3; Pl. 15.2: 6 and 7) are similar to pieces reported from Uruk and Late Bronze age contexts of Tell Hammam et-Turkman (Rossmeisl and Venema 1988: Pl. 174), and although lacking definite evidence, they can be interpreted as pottery-smoothing tools. One scraper has a very sharp working edge resulting from polishing potsherds. It was the scraper deliberately sharpened by polishing on a potsherd (Fig. 15.7: 8). Tiny abrasions and micro flaking on the reverse face of this sharp edge indicate that it was used for scraping, in what appears to be a similar manner to that of Type 1a pieces, although Type 2c edges are straighter and smoother than those of Type 1a.

(9) Summary

Clay tools, many of which were reused potsherds, seem to have functioned as substitutes for stone tools at Tell Kosak Shamali. Potsherds, which were very common at the site, could easily have been modified to produce a broad working edge with less effort than that needed to make stone tools, which would have required core preparation prior to flaking.

New clay scraper types (1c and 2b) appeared after the Terminal Northern Ubaid. Type 2b ring scrapers, in particular, were closely related to a change in pottery manufacture, and correspond to a change of pottery itself.

A variety of clay scraper attributes have been examined in an attempt to interpret their function. Some were clearly related to pottery manufacture (Type 2a and 2b), whereas others seemed to be used for various purposes according to the contexts in which they were found. Given that they were found in various contexts both inside and outside buildings, it is suggested that they were made as convenient tools used in rather ad-hoc ways.

There is insufficient evidence to determine chronological change and use with certainty. Further microscopic examination and much more data from other sites are needed for future study.

15.3 Clay disks (plaques)

Clay disks represent one of the most popular clay objects of the Tell Kosak Shamali small finds, with 35 examples recovered from the Early Northern Ubaid to Middle Uruk levels. Some resemble the round clay scrapers mentioned above, but are distinguished by their edges that are neither tapered nor sharpened. Most were on potsherds. Many are round while a few are square or triangular in shape. They were classified into three types. Types 1 and 2 are distinguished from each other by their method of edge preparation: Type 1 pieces were flaked around the edges and Type 2 were polished around the edges. Type 3 examples were perforated at the center and some may be considered as spindle whorls.

(1) Type 1: Clay disks with flaked edge

(Fig. 15.10: 1-8; Pl. 15.5: 1-5 & 7-9)

This is the most common type in the clay disk category. Of the 18 specimens recovered, 9 were Early Northern Ubaid, 3 Late Northern Ubaid, 1 Terminal Northern Ubaid, 4 Post-Ubaid, and 1 Middle Uruk. All were on potsherds flaked to an almost round shape. They resemble the round clay scrapers with flaked edge mentioned above, but do not have sharp edges. Some edges were slightly polished after flaking. Each level yielded only a few specimens from varied contexts, although, some rooms (Rooms 1308, 501 of Sector A, and B504 of Sector B) yielded more than others.

(2) Type 2: Clay disks with polished edge

(Fig. 15.10: 9-14; Pl. 15.5: 6 & 10)

Nine examples of this type were identified: 3 Early Northern Ubaid, 1 Late Northern Ubaid, 2 Terminal Northern Ubaid, 1 Post-Ubaid, and 2 Middle Uruk. In general they are round with the exception of a few irregular-shaped pieces. Nevertheless, for the sake of convenience they are all termed "disks" here. Their edges show fine traces of polishing or abrasion, while some seem to have been flaked before polishing. These pieces were on potsherds, except for one example made directly from clay on which traces of finger pressure, applied before firing, are visible around the edge (Fig. 15.10: 9). The edges were not tapered. Scratches, running perpendicular to the edge, are visible on two examples (Fig. 15.10: 10 and 13; Pl. 15.5: 10). The triangular piece (Fig. 15.10: 13) may have been a pottery surface smoothing tool. There is a small non-penetrating hole on one fragment of a square plaque (Fig. 15.10: 12), but it is unknown whether this hole was intended for spindle whorl production, decoration or for other pur-poses.

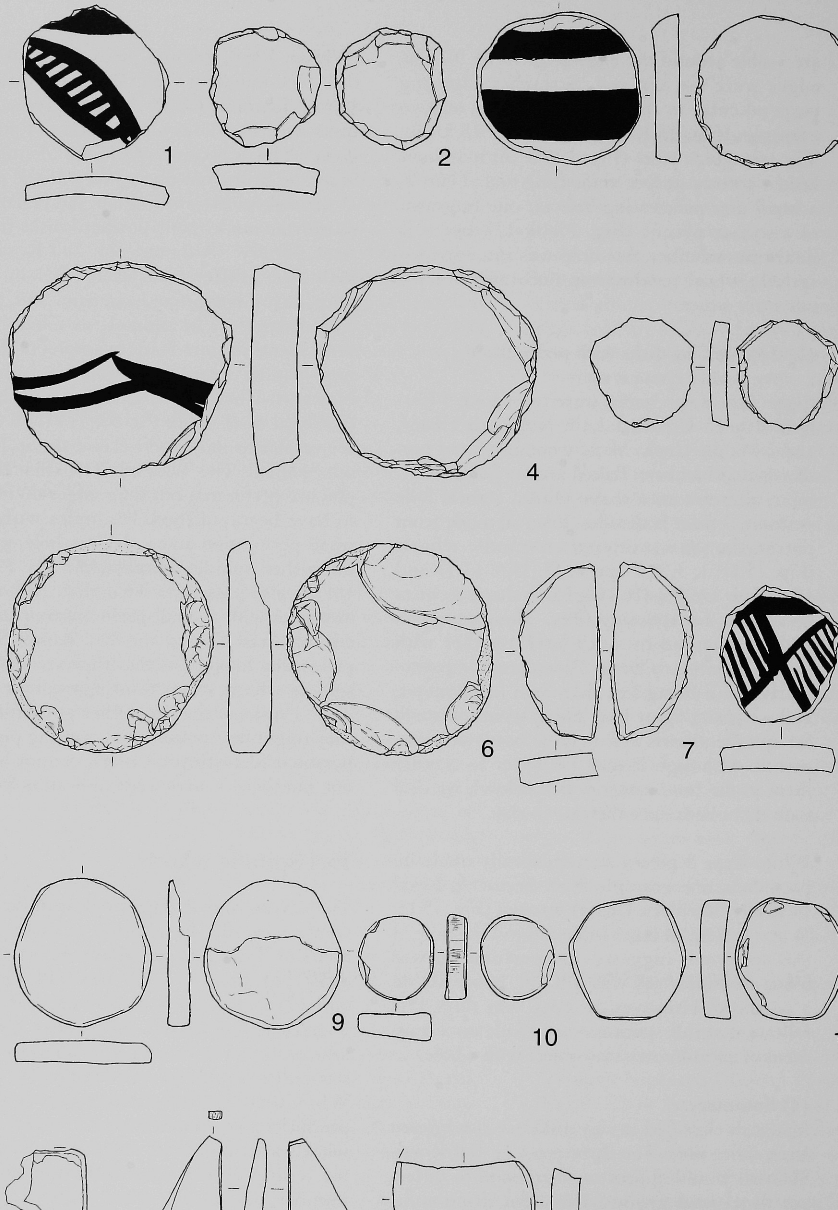
(3) Type 3: Clay disks with perforation
(Fig. 15.11; Pl. 15.6: 13-15 & 17)
Eight Type 3 specimens were recovered: 5 Early Northern Ubaid, 1 Late Northern Ubaid, and 2 Middle Uruk. Many were on reused potsherds that had been flaked and/or polished into an almost round shape with a central hole perforated from both sides. Five, all made from potsherds, are considered as spindle whorls (Fig. 15.11: 1, 3, 4, 7 and 8; Pl. 15.6: 13-15 and 17). Their weight (16-162g) and shape seem to be suitable for spinning fiber. These examples will be discussed in detail later together with biconical spindle whorls. Two pieces are particularly small being less than 3cm in diameter, and weighing 5g or less. These seem too small for spindle whorls and may be beads or ornaments. Although it may be better to classify them in the bead category (see below), we deal with them here since they are in clay.

While Type 3 pieces were generally made on potsherds, one example from Sector A, Level 10 (Early Northern Ubaid) was not (Fig. 15.11: 5). A swelling of clay visible around the hole of this specimen suggests that perforation was made when the clay was still soft, hence not on a potsherd. However, its edge was flaked. It follows that this specimen was made on a fragment of an unknown clay object with a hole.

(4) Summary
Materials classified as clay disks are also known from other sites. The three types at Tell Kosak Shamali would appear to correspond to different functional groups. Frequent discussions have been noted in the literature on the function(s) of Type 1. Watson suggests, with reference to the Halaf period, that these potsherd disks might have been either potters' tools (Watson 1983), gaming pieces, or material for disk-type spindle whorls (Watson and Le Blanc 1990). Tsuneki (1998: 119) suggests, "these disks were used ... as identification of person or goods. This is because we do not identify more than one disk from one pottery. If the purpose of the disks was so utilitarian, the Halaf people must have made many potsherd disks from the same pottery". Although the Tell Kosak Shamali pieces differ from each other in surface color, only a few pieces have paint and, as such, would therefore be unlikely as tokens of personal identification. Some examples of the disk-type spindle whorls reported from the Early Northern Ubaid levels at Telul eth-Thalathat II (Fukai *et al.* 1970: Pls. 59: 7; 81: 16 and 18) are similar to the Type I clay disks at Tell Kosak Shamali. The Telul eth-Thalathat II examples are perforated but their edges do not seem to have been polished. Examples with a very small perforation and a shallow hole, probably unfinished spindle whorls (*ibid.*, Pls. 59: 7; 81: 16) are also present at Thalathat. Although no examples with a small perforation or unfinished hole exist among the Tell Kosak Shamali pieces, the hypothesis that they are unfinished spindle whorls seems most appropriate for the Type 1 disks at the site. Other possibilities that they might be a potter's tool, gaming piece, and personal identification mark cannot be ruled out, but there is no definite indication for that.

15.4 Spindle whorls

Twenty biconical objects or spindle whorls were recovered. In addition to these, 5 specimens of Type 3 of the above-mentioned clay disks (Fig. 15.11: 1, 3, 4, 7 and 8; Pl. 15.6: 13-15 and 17) were also probably used as spindle whorls, as reported at many other sites. This interpretation is based on an analysis of their size and weight, and on ethnographic analogy. While there is little direct evidence for fiber production in archaeological contexts, spindle whorls provide useful, albeit indirect evidence for textile production. Although limited in number, the spindle whorls reflect a possible time-vectored change in textile production at Tell Kosak Shamali.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
0
5cm

◀ **Fig. 15.10 Chalcolithic clay disks of Types 1 and 2 from Tell Kosak Shamali.**

1. Clay disk, Type 1, potsherd, orange surface and core, brownish black paint, L: 5.4cm, W: 5.0cm, T: 0.6cm (95KSL-AG5-7; Fill; Level 15 of Sector A).
2. Clay disk, Type 1, potsherd, light yellow orange surface, dull orange core, L: 4.2cm, W: 3.9cm, T: 0.9cm (95KSL-AF4-4; Fill; Level 12 of Sector A).
3. Clay disk, Type 1, potsherd, dull brown surface and core, brownish gray paint, lightly polished around the edge, L: 5.4cm, W: 5.8cm, T: 0.8cm (94KSL- D10-1; Fill; Level 12 of Sector A).
4. Clay disk, Type 1, potsherd, dull orange surface, orange core, dark reddish brown paint, L: 7.4cm, W: 7.9cm, T: 1.6cm (96KSL-AE6-13; Fill; Level 10 of Sector A).
5. Clay disk, Type 1, potsherd, grayish yellow surface and core, L: 3.7cm, W: 3.6cm, T: 0.6cm (96KSL-AE6-13; Fill; Level 10 of Sector A).
6. Clay disk, Type 1, potsherd, pale yellow surface, dull yellow orange core, lightly polished around the edge, L: 7.4cm, W: 7.2cm, T: 1.4cm (94KSL-A6-11; Fill of 601/602/605; Level 6 of Sector A).
7. Clay disk, Type 1, potsherd, light gray surface, dull orange core, L: 6.0cm, W: 2.8+cm, T: 0.8cm (95KSL-AD5-53; Fill/Floor of 501; Level 5 of Sector A).
8. Clay disk, Type 1, potsherd, light yellow orange surface, orange core, brownish black paint, L: 4.8cm, W: 4.4cm, T: 0.9cm (95KSL-BD6-6; Foundation of B101; Level 1 of Sector B).
9. Clay disk, Type 2, clay, dull orange surface and core, L: 5.3cm, W: 4.9cm, T: 0.8cm (94KSL-D10-2; Fill of 1306; Level 13 of Sector A).
10. Clay disk, Type 2, potsherd, dull orange surface, orange core, L: 3.0cm, W: 2.7cm, T: 0.8cm (95KSL-AF5-9; Fill of 1309; Level 13 of Sector A).
11. Clay disk, Type 2, potsherd, dull orange surface, L: 4.3cm, W: 4.1cm, T: 0.9cm (96KSL-AE6-13; Fill; Level 10 of Sector A).
12. Clay disk, Type 2, potsherd, brownish gray surface, dull orange core, L: 3.0+cm, W: 2.8+cm, T: 1.0cm (95KSL-AE5-4; Fill of 710; Level 7 of Sector A).
13. Clay disk, Type 2, potsherd, L: 4.1cm, W: 2.8+cm, T: 0.7cm (97KSL-BE6-21; Fill; Level 7 of Sector B).
14. Clay disk, Type 2, potsherd, dull orange surface and core; L: 3.1+cm, W: 5.0cm, T: 1.0cm (95KSL-BE6-5; Fill; Level 5 of Sector B).

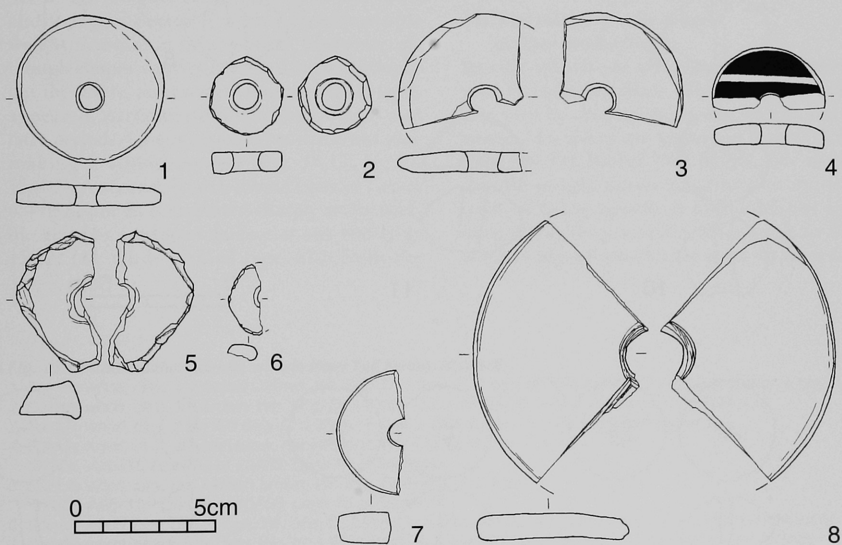
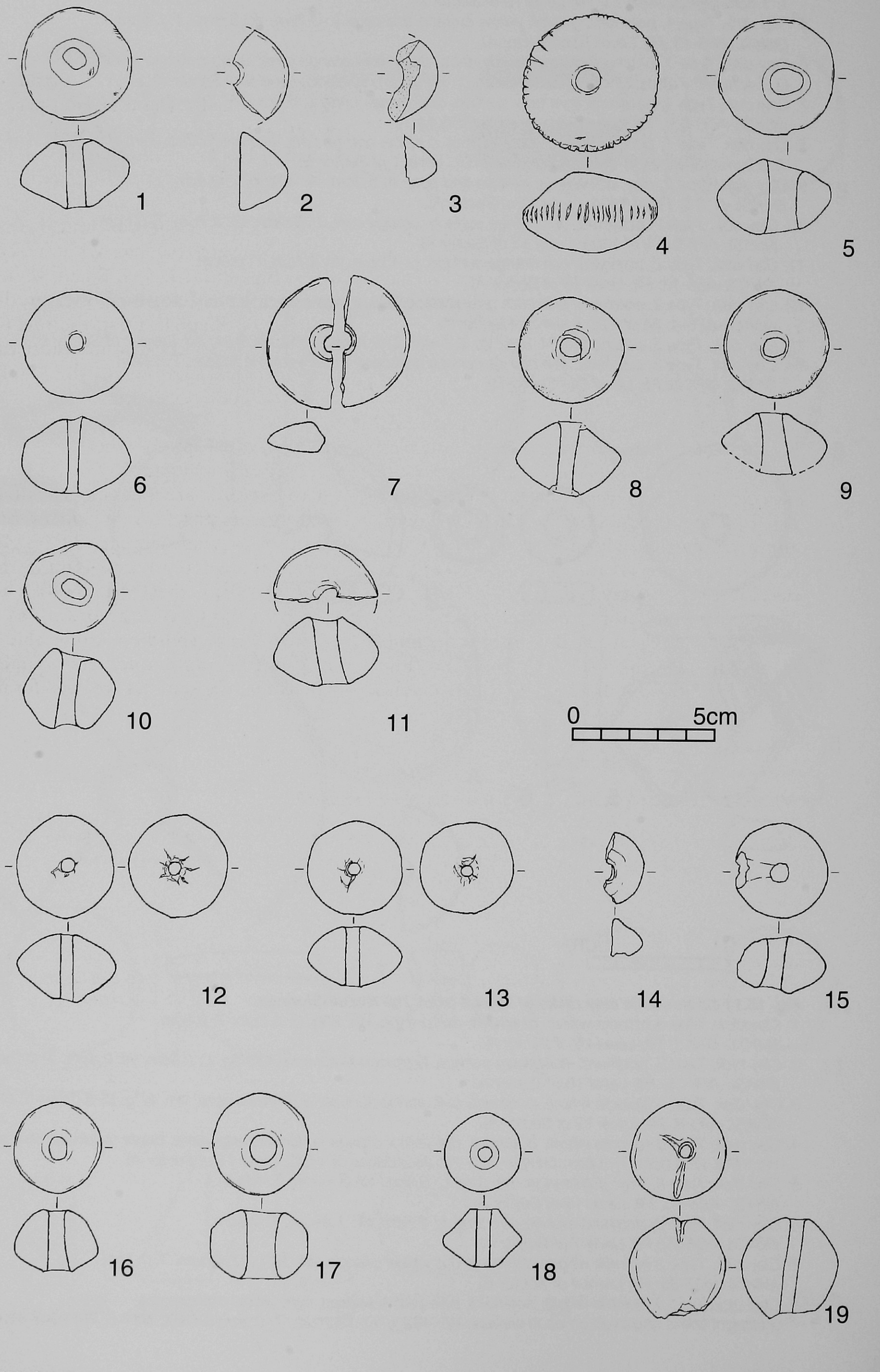


Fig. 15.11 Chalcolithic clay disks of Type 3 from Tell Kosak Shamali.

1. Clay disk, Type 3 (spindle whorl), potsherd, dull orange, Wt: 29g, D: 5.3cm, T: 0.8cm (94KSL-D10-5; Fill; Level 16 of Sector A).
2. Clay disk, Type 3, potsherd, dull brown surface, brownish black core, Wt: 5g, L: 2.9cm, W: 2.5cm, T: 0.7cm (95KSL-AF6-10; Fill; Level 16 of Sector A).
3. Clay disk, Type 3 (spindle whorl), potsherd, dull orange surface, dull brown core, Wt: 42*g, D: 6.0*cm, T: 0.8cm (95KSL-AF5-8; Fill; Level 13 of Sector A).
4. Clay disk, Type 3 (spindle whorl), potsherd, dull yellow orange surface, orange core, bright reddish brown paint, Wt: 16*g, D: 4.0cm, T: 0.8cm (97KSL-AE6-23; Foundation of 1122; Level 11 of Sector A).
5. Clay disk, Type 3, clay, dull orange, Wt: 32g, L: 5.0cm, W: 3.1+cm, T: 1.0cm (96KSL-AE6-13; Fill; Level 10 of Sector A).
6. Clay disk, Type 3, potsherd orange, Wt: 2+g, L: 2.5cm, W: 1.2+cm, T: 0.6cm (96KSL-AD6-20; Fill; Level 7 of Sector A).
7. Clay disk, Type 3 (spindle whorl), potsherd, dull yellow orange, Wt: 20*g, D: 4.5cm, T: 1.1cm (96KSL-BD7-45; Fill; Level 4 of Sector B).
8. Clay disk, Type 3 (spindle whorl), potsherd, pale yellow surface, light yellow orange core, a straight line is engraved on each surface, Wt: 162*g, D: 12.2*cm, T: 0.9cm (96KSL-BE7-8; Fill; Level 4 of Sector B).


1
2
3
4
5
6
7
8
9
10
11
0
5cm
12
13
14
15
16
17
18
19

(1) Biconical spindle whorls

(Fig. 15.12; Pl. 15.6: 1-12 & 16)

Among the twenty biconical whorls, nineteen examples are of well-fired clay, and one of stone from Feature 806 in Sector A, Late Northern Ubaid (Fig. 15.12: 7; Pl. 15.6: 16). The surfaces of all the clay examples were carefully smoothed, except for one which had nail incisions around its edge (Fig. 15.12: 4; Pl. 15.6: 5). All had a central perforation. Diameters range from 33 to 47mm in Sector A (Ubaid), and from 25 to 39mm in Sector B, (Post-Ubaid to Middle Uruk). Thickness ranges from 18 to 29mm in Sector A, and from 13 to 36mm in Sector B. Weights range 20-39g in Sector A, and 9-36g in Sector B with a trend towards weight decrease in later periods. Moreover, although shapes were generally similar throughout the levels, several new morphological types appeared, particularly in the Post-Ubaid and later periods. One is carinated at the lower area making it almost conical (Fig. 15.12: 16; Pl. 15.6: 9). A second, from a mixed layer of Levels 6-4 of Sector B, is carinated sharply at the middle and has a scraped surface at one end (Fig. 15.12: 18), while a third type, also from the same mixed layer, has two carinations (Fig. 15.12: 17). Finally, from the later periods, was a piece, almost globular shape with two striations radiating from one end that do not seem to be decorative (Fig. 15.12: 19; Pl. 15.6: 12).

In the following these biconical type whorls will be analyzed, together with the Type 3 clay disks (Fig. 15.11: 1, 3, 4, 7 and 8), in order to investigate the nature of fiber production at Tell Kosak Shamali. First, the role of spindle whorls in fiber production, and then their chronological changes in the Chalco-lithic period will be discussed.

(2) The role of spindle whorls in fiber production

Spindle whorls are a component of a spindle, used for spinning fiber. When one twists fiber into yarn by drop spinning, the weight and diameter of a whorl are important factors (Keith 1998: 500-503; Barber 1991: 51-54). The suitable spindle weight varies according to the fiber spun. A heavy spindle is preferable for spinning hard, long-stapled fiber such as flax, whereas lighter spindles are good for finer fiber

◀ ***Fig. 15.12 Chalcolithic spindle whorls from Tell Kosak Shamali.***

1. Spindle whorl, clay, dull reddish brown, Wt: 29g, D: 4.0cm, T: 2.4cm (97KSL-AD5-106; Fill; Level 12A of Sector A).
*2. Spindle whorl, clay, dull brown, Wt: 39*g, D: 3.9*cm, T: 2.6cm (95KSL-AF4-3; Fill; Level 11 of Sector A)*
*3. Spindle whorl, clay, gray, Wt: 6+g, D: 3.3*cm, T: 1.8cm (95KSL-AF3-5; Fill; Level 11 of Sector A).*
4. Spindle whorl, clay, grayish yellow, nail incisions, Wt: 47g, D: 4.7cm, T: 2.9cm (97KSL-AE6-31; Floor/Fill of 10A03; Level 10 of Sector A).
5. Spindle whorl, clay, dull reddish brown, Wt: 35g, D: 4.0cm, T: 2.7cm (97KSL-AE6-31; Floor/Fill of 10A03; Level 10 of Sector A).
6. Spindle whorl, clay, dull orange, Wt: 35g, D: 3.9cm, T: 2.8cm (96KSL-AD5-82; Floor of 901; Level 9 of Sector A).
*7. Spindle whorl, stone, light gray, Wt: 30*g, D: 4.5*cm, T: 1.0cm (96KSL-AD4-30; Fill; Level 8 of Sector A; 806).*
8. Spindle whorl, clay, orange, Wt: 23g, D: 3.7cm, T: 2.6cm (95KSL-AD5-66; Fill; Level 6 of Sector A).
9. Spindle whorl, clay, grayish brown, Wt: 23g, D: 3.8cm, T: 2.2cm (95KSL-AD5-59; Foundation of 503; Level 5 of Sector A).
10. Spindle whorl, clay, dull orange, Wt: 20g, D: 3.3cm, T: 2.9cm (95KSL-AD5-51; Floor of 402; Level 4 of Sector A).
*11. Spindle whorl, clay, dull brown, Wt: 22*g, D: 3.7cm, T: 2.4cm (95KSL-AD4-topsoil; Surface of Sector A).*
12. Spindle whorl, clay, grayish , Wt: 18g, D: 3.5cm, T: 2.4cm (96KSL-BE6-18; Fill of B601; Level 6 of Sector B).
13. Spindle whorl, clay, dull brown, Wt: 14g, D: 3.3cm, T: 2.1cm (96KSL-BE6-18; Fill of B601; Level 6 of Sector B).
*14. Spindle whorl, clay, pale yellow, Wt: 9*g, D: 2.5cm, T: 1.3+cm (96KSL-BD6-23; Fill; Level 6 of Sector B).*
15. Spindle whorl, clay, grayish yellow brown, Wt: 14g, D: 3.3cm, T: 2.1cm (96KSL-BD7-48; Foundation of B504; Level 5 of Sector B).
16. Spindle whorl, clay, grayish brown, Wt: 18g, D: 3.1cm, T: 2.1cm (95KSL-BD7-18; Fill of B501 north; Level 4 of Sector B).
17. Spindle whorl, clay, dull orange, Wt: 22g, D: 3.6cm, T: 2.4cm (94KSL-B8-6; Level 4/6 of Sector B; B504/606/607; Fill).
18. Spindle whorl, clay, orange, Wt: 11g, D: 2.7cm, T: 2.0cm (94KSL-B8-6; Fill of B504/606/607; Level 4/6 of Sector B).
19. Spindle whorl, clay, dull orange, Wt: 35g, D: 3.4cm, T: 3.6cm (95KSL-BE7-6; Foundation; Level 3 of Sector B).

such as short and softer sheep/goats' wool. Nevertheless, some weight is also necessary to draft fiber, stabilize continuous rotation and provide some tension, although if the spindle is too heavy it will tear the drafted fiber. The diameter of the whorl affects the rotation speed of the spindle, which in turn relates to the amount of twist of a given yarn. The degree of twist varies according to the types of fibers and kinds of yarn to be spun. More twist is needed to spin hard fibers and make a hard yarn, whereas less twist may be sufficient for wool and softer yarn. Over twisting by spinning too fast causes kinks and tangles, while too little twist results in a weak yarn. The speed at which the fiber rotates can be adjusted by selecting the diameter of the spindle whorl. In general, larger whorls spin more slowly and smaller ones more quickly.

Given the above, the following assumption may be made: the presence of small, round, lightweight whorls would indicate the spinning of short-stapled fibers into finer threads, whereas the spinning of heavier threads from, long-stapled fibers, or plying could be inferred from the presence of large or heavier whorls. In the next section, spindle whorls from Tell Kosak Shamali will be analyzed, particularly in reference to weight, diameter, and chronology.

(3) Chronological changes of spindle whorls at Tell Kosak Shamali

There are 25 spindle whorls in the present collection. Most are biconical to spherical in shape, while 5 are disk-shaped and made on potsherds. Spindle whorls were found from Level 16 of Sector A (Early Northern Ubaid), to Level 3 at Sector B (Middle Uruk), although on average each level yielded only 1 or 2 pieces (Table 15.1). Our examination of chronological change in spindle whorls at Tell Kosak Shamali follows the Chalcolithic chronology for the site as defined by the pottery sequence (Nishiaki *et al.* 1999).

Fig. 15.13 shows the diameter and weight of spindle whorls in each period: diameter ranges from 2.5cm to 6.0cm and weight from 9.0 to 47.0g, excluding one notable exception which is 12.2cm in diameter and weighs 162.0g. These weight and diameter of broken examples are reconstructed.

During the Early Northern Ubaid and the earlier phase of the Late Northern Ubaid (Fig. 15.13: a-c), spindle whorls generally weighed more than 29g (except for two much lighter ones, one of which is a badly broken fragment). Lightweight whorls (less than 23g) increase after the later phase of the Late Northern Ubaid, although a few heavier whorls (around 35g) were still in use (Fig. 15.13: e and f). And then, a remarkably large and heavy whorl appeared from the latest phase, Middle Uruk (Figs. 15.11: 8; 15.13: f).

There is not much morphological variety in the spindle whorls from Tell Kosak Shamali; most are almost biconical, with a few disk type whorls. Many other sites yielded a greater variety of shapes, and chronological changes were often observed (e.g. Sono 1970; Delougaz and Kantor 1996: 106, 251-253; Rossmeisl and Venema 1988: 561). The remarkable uniformity may characterize the Tell Kosak Shamali collection. Nevertheless, a slight chronological change in whorl shape can be seen; after the Post-Ubaid, whorls are no longer biconical, but include pieces that are carinated at the lower part, or have two carinations around the body, or a truncation at one end, or are almost spherical in shape. This change of shape as well as weight may relate to changes in fiber production at Tell Kosak Shamali, although details are unknown due to the limited sample size.

(4) Spinning activity at Tell Kosak Shamali

Spindle whorls from Tell Kosak Shamali are divided into three weight categories: heavy (162g), medium (29 to 47g) and light (less than 23g). Although all these seemed to have been used for spinning sheep/goats' wool (Keith 1998: 507), the increase in light spindle whorls from the later phase of Late Northern Ubaid indicates the more common spinning of softer and short-stapled fiber, and making of fine yarns. This interpretation is supported by preliminary results of faunal analysis by Gourichon and Helmer (Chapter 17). They demonstrate that, in the Early Northern Ubaid, sheep and goats were exploited mainly for tender meat and some secondary products, whereas in the Late and Post-Ubaid, exploitation of secon-

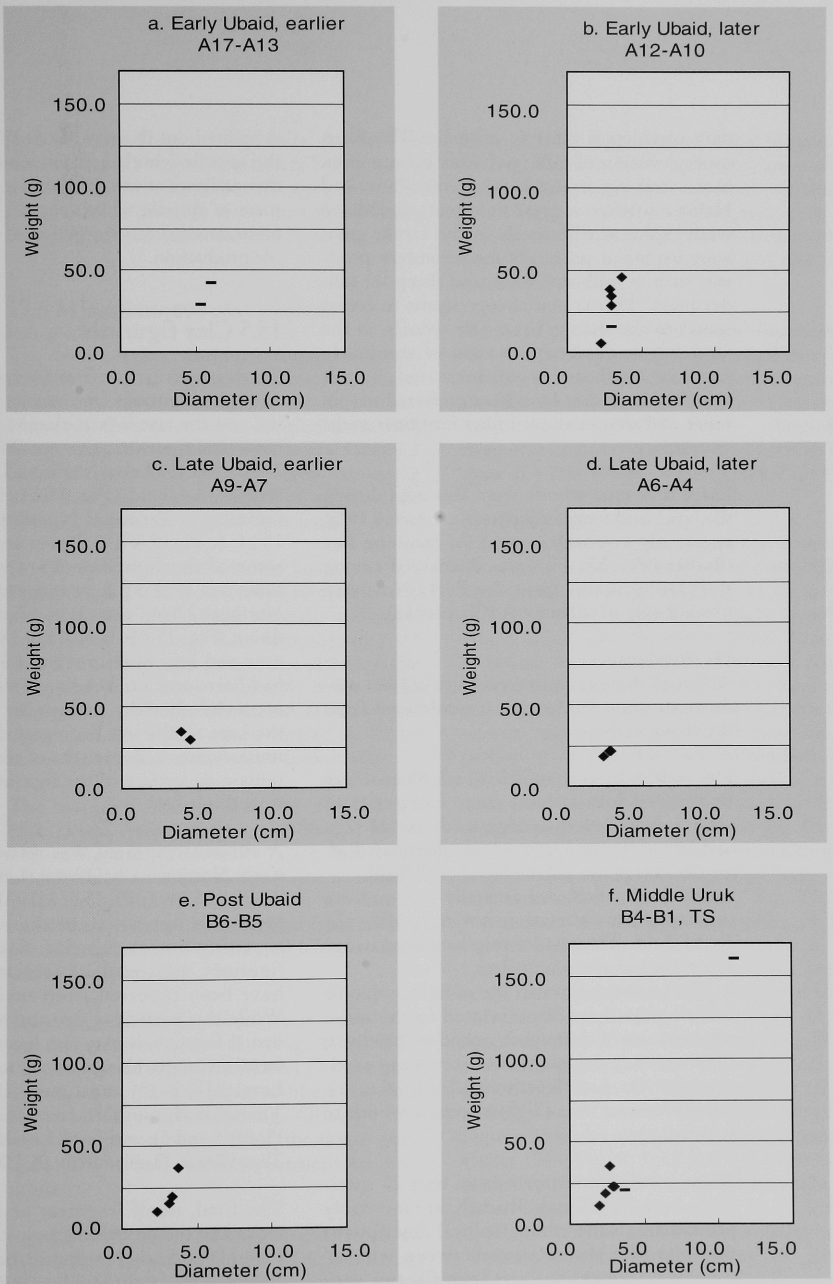


Fig. 15.13 Weights and diameters of Chalcolithic spindle whorls from Tell Kosak Shamali
(◆: biconical whorls; ▬: disk type whorls selected from clay disks of Type 3).

dary products is more in evidence. The focus on exploitation of milk and wool became even more striking in the Uruk. Gourichon and Helmer further suggest that goats and sheep were exploited differently in the Uruk; goats were exploited primarily for secondary products such as milk and wool, and sheep for tender meat. This faunal change seems to correspond to the change in spindle whorls; as the tendency toward exploitation of secondary products (milk and wool) increased, lighter spindle whorls may have been preferred to spin softer and shorter-stapled fiber into finer yarns than before.

Large disk-type whorls were also used during the Uruk and weighed up to an estimated 162g, apparently a suitable weight for spinning flax (Barber 1991: 52). Flax was discovered among the plant remains from the Early Northern Ubaid Level 10 of Sector A (Chapter 16).

(5) Conclusion

Although there is limited evidence of fiber production, some tendencies are indicated from the above analysis:

1- Spindle whorls from Tell Kosak Shamali can be divided into at least three categories of weight: light (less than 23g), medium (29-47g), and heavy (162g). Light whorls dominated after the later phase of Late Northern Ubaid.
2- Although whorls are generally very uniform in shape, some variation is visible after the Post-Ubaid. The relationship between change in weight and shape is unclear.
3- The tendency towards use of lighter spindle whorls must have been related to the more common use of sheep/goat secondary products; the increasing exploitation of secondary products after the Late Northern Ubaid led to the more prevalent use of lighter spindle whorls to spin fine yarn.

These conclusions, drawn from only 25 specimens from Tell Kosak Shamali, are inevitably provisional. Some ethnographical descriptions do not admit the relation between whorls' weights or dimensions and spun fiber or yarn (Kurata 1998: 215; Watson 1979: 174-179). If anything, the difference of whorls' shape according to spinning fiber or twisting the yarns is pointed out (Kurata *op. cit.*). The data about the spindle whorls are not enough so far. Further analyses of weight, diameter and other features of spindle whorls should help towards a more detailed reconstruction of prehistoric textile production.

15.5 Clay figurines (Fig. 15.14: 1-6; Pl. 15.6: 18-21)

Six clay figurines were recovered. Four are zoomorphic figurines, one may be a human figurine and the rest is boat-shaped. As for the zoomorphic figurines, two are (Fig. 15.14: 2 and 3; Pl. 15.6: 18) Early Northern Ubaid, one Late Northern Ubaid (Fig. 15.14: 4), and the remaining is Terminal Northern Ubaid (Fig. 15.14: 5; Pl. 15.6: 19). Pieces are missing from some of the figurines: 3 are without heads; some are missing legs and a tail. One Early Northern Ubaid piece is in relatively good condition (Fig. 15.14: 3; Pl. 15.6: 18); although the nose and legs were broken, it apparently once had horns and a tail. A line of stick impressions on the left shoulder, and similar impressions on the base of the left horn and the front chest, must depict characteristics of the animal as the remaining surface of the figurine has fingertip smoothing.

A curious fragment was recovered from an Early Northern Ubaid level (Level 15 of Sector A; Fig. 15.14: 1; Pl. 15.6: 21). Although mostly broken, it appears to be the lower part of a squatting human figurine. Squatting human figurines, most of them representing females, have been reported from many other sites. While this particular figurine has no defining sexual features, it may also have been part of a female. Comparable examples are known from Level XIV, R-131 and Level XIIb at Telul eth-Thalathat II, northern Iraq (Fukai *et al.* 1970: Pl. 61: 4 and 5), and from Levels XIX-XVIII at Tepe Gawra (Tobler 1950: Pl. LXXXI).

The final, small fragment of a clay figurine looks like the protruding bow of a boat. It was found in an Early Northern Ubaid fill of Room 10A08 of the burnt building in Sector A, Level 10A (Fig. 15.14: 6; Pl. 15.6: 20). A similar object from Chogha Mish, Iran (Delougaz and Kantor 1996: Fig. 26), with a fully painted outer surface, is 10.6cm long x 3.4cm wide. As the Tell Kosak Shamali fragment is nearly 5cm wide, it would therefore have been longer than the Chogha Mish piece. It is not painted, but has been shaped and well smoothed by hand.

15.6 Miscellaneous clay objects

The materials described here cannot be categorized into any of the above-mentioned groups because of their non-characteristic shapes. However, they have been divided them into two groups for descriptive purposes. Group 1 includes relatively large clay objects measuring more than about 5cm in length or width, while Group 2 objects are smaller than 5cm.

(1) Group 1 (Fig. 15.14: 7-10; Pls. 15.7: 1 & 3-6; 15.8: 1)
Fig. 15.14: 7 (Pl. 15.7: 3) shows a pestle-like clay object, found near a kiln (10A10) in Square AE3, Sector A. It may have been slightly fired as it has a dark gray paste core, although the firing may have been accidental. A few drops of pigment, probably not meant as intentional decoration, are visible on the surface, and a bit of sand is attached to the upper broken edge.

The specimen illustrated in Fig. 15.14: 8 (Pl. 15.8: 1) was recovered from the floor of Room 901 in Sector A, Level 9 (Late Northern Ubaid). It is impossible to determine its original shape because it is heavily broken; at present it looks like a hollowed cone with a truncation at one end. Clear traces of scraping with a tool are visible on the surface.

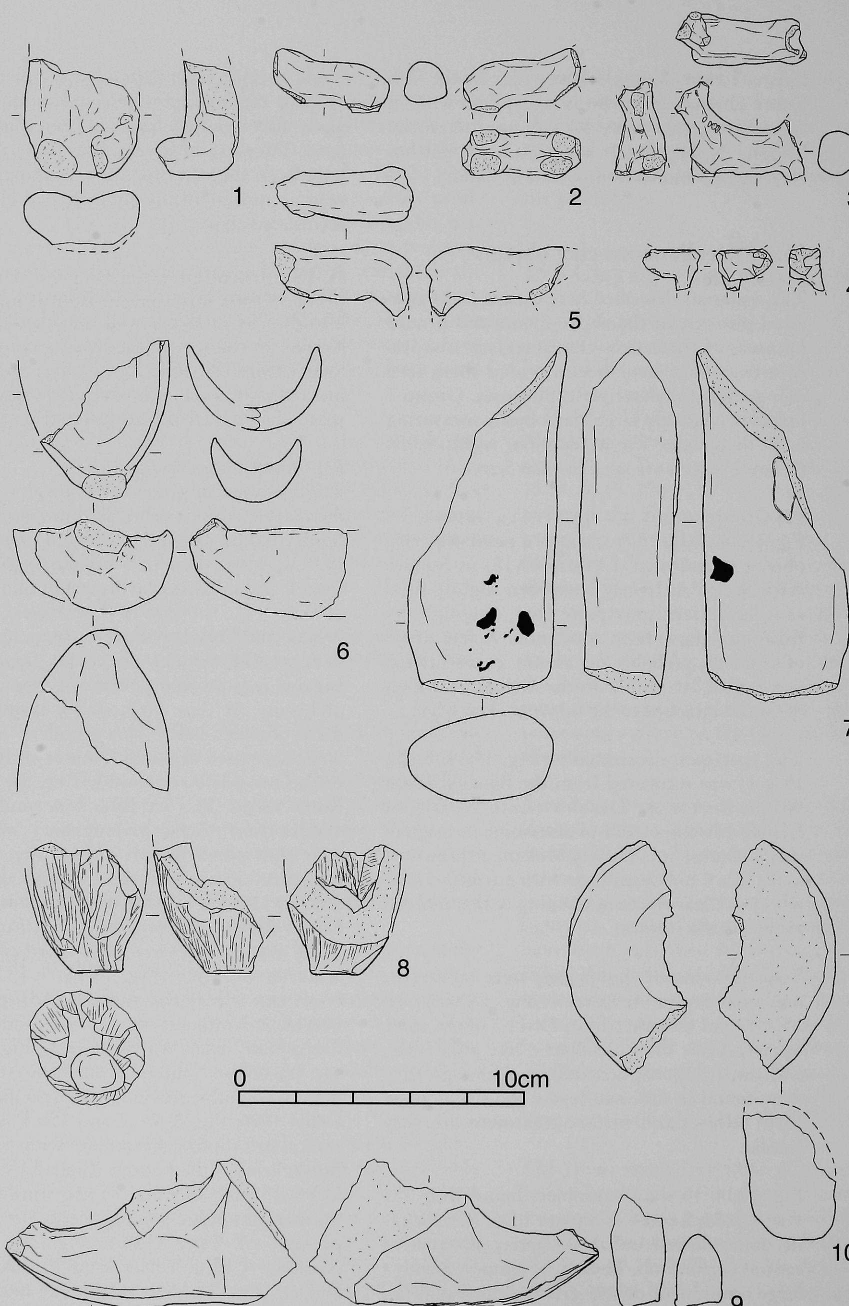
Two shoe-shaped clay objects were recovered, one from Sector A, Level 1 (Fig. 15.14: 9; Pl. 15.7: 1) and the other from Level 7 of the same square, AD6. They are shaped like a flat shoe, and show fingertip smoothing. Although they were found in different levels, the shape, paste (pale yellow) and surface treatment are very similar.

Fig. 15.14: 10 shows an object found from the Post-Ubaid, Level 6 of Square BD6. It is a fragile, dome-shaped, unbaked (?), clay piece with a central perforation. The clay is tempered with a large amount of coarse grit (1-2mm) making the surface remarkably coarse-grained.

Some curious fragments of wavy plaques (Pl. 15.7: 6) seem to have derived from a single piece, although they have not been conjoined to date. They are of a very fine paste that may have been slightly fired. The treatment of the edge is similar to the shoe-shaped clay piece mentioned above.

A curved square clay board was found in the fill of an ashy layer, B701 (Terminal Northern Ubaid). The surface is well smoothed and marble-like in color. A slight swell is visible in the longer sides (Pl. 15.7: 5). Finally, a large fragment of conical clay was recovered from an open space of a Post-Ubaid workshop (Pl. 15.7: 4).

(2) Group 2 (Fig. 15.15; Pl. 15.8: 2-15)
This group comprises 24 examples. Among them are 9 curious cylindrical or conical small, lightly baked clay pieces (Fig. 15.15: 1-6; Pl. 15.8: 2, 4 and 11-15), 8 are Early Northern Ubaid, and in particular from Levels 11 and 10 of Sector A, the last is Post-Ubaid. All are broken and measure about 2 to 4cm long and 1 to 3cm wide. Similar objects are known from various regions and periods of Near Eastern prehistory. At Tepe Ali Kosh, for example, hundreds of pieces called "clay cylinders" of several types have been reported (Hole *et al*. 1969: 227-230). One piece recovered from the floor of Room 10A03 (Pl. 15.8: 15) is very similar to examples from Ali Kosh, designated "clay cylinders with pinched ends" (*ibid*., Fig. 99: a-d). But most of the Ali Kosh examples date from the Bus Mordeh to Ali Kosh phases in the Deh Luran Plain, the aceramic Neolithic period, while our examples are Early Northern Ubaid. Another example (Fig. 15.15: 5; Pl. 15.8: 4) from the fill of the same building, Room 10A18, is similar to the "clay cylinders with flared ends" from Ali Kosh (*ibid*., Fig. 99: e, f, and h), or the "labrets" from Sabi Abyad, the pottery Neolithic site in north Syria (Spoor and Collet 1996: Fig. 8. 9: 12 and 13). Four nearly conical or cylindrical examples with slight dentitions around the bottom (Fig. 15.15: 2, 4 and 6; Pl. 15.8: 2, 11 and 14) are similar to the "anthropomorphic gaming pieces" or "gaming pieces" of Tepe Gawra, (Early to Late Northern Ubaid; Tobler 1950: Pl. LXXXIV: b and c), Chogha Mish (Delougaz and Kantor 1996: Pl. 234: B-T), to the "stud figurines" from


1
2
3
4
5
6
7
8
0
10cm
9
10

the Pottery Neolithic levels of Damishliyya (van Loon 1988: Pl. 11), and to the "human figurines", also of the Pottery Neolithic levels of Sabi Abyad (Collet 1996: Fig. 6.3: 5, 7, 8, 11 and 15).

While the shape of many Kosak Shamali examples cannot be determined because of poor preservation, they may be fragments of the types from other sites mentioned above. Most (8 pieces) were recovered from contexts related to building features, in particular those in Sector A, Levels 11 and 10, each of which yielded 3 pieces. In light of such distribution, these curious small clay objects may have been used in a ritual or a game performed within a building.

Some small, geometric clay objects, that seem to have been baked slightly, were also recovered. One such example, an oval pellet (Fig. 15.15: 7; Pl. 15.8: 6), which has scratches on one side, was found in Room 10A01, an Early Northern Ubaid pottery storage room. Similar objects, although their function is unknown, are known from Tell Songor B, Hamrin (Matsumoto and Yokoyama 1995: Fig. 82. 443-445). Another example, recovered from the Post-Ubaid Square BE5 (Fig. 15.15: 9; Pl. 15.8: 5), is worth mentioning; it is an egg-shaped clay object with shallow grooves scratched horizontally around both ends which, according to Shcmandt-Besserat (1992), may represent a complex token. Unfortunately, however, there are too few samples from Tell Kosak Shamali to enable reconstruction of any counting system at the site. A clay ball from the Late Northern Ubaid Square AD5, Level 6 is also worthy of attention (Fig. 15.15: 8). Such simple objects must have existed at many sites, although they are seldom mentioned in the literature. Very similar balls are reported at Tell Songor B (Matsumoto and Yokoyama 1995: Fig. 82: 438 and 439). At Tell Abada, Hamrin, similar clay balls are reported as tokens (Jasim 1985: Fig. 66). Two fragments of clay rings, apparently unbaked, from Tell Kosak Shamali look like finger rings (Fig. 15.15: 10 and 11; Pl. 15.8: 3). Similar objects are known from Tell Songor B (Matsumoto and Yokoyama 1995: Fig. 82. 440-442) and Chogha Mish (Delougaz and Kantor 1996: Pl. 23: Q-S).

Other fragments of clay objects could not be identified at all. Some are surely parts of specific clay objects, whereas others seem to be just lumps of clay with no craftsmanship (Pl. 15.8: 7-10).

◀ ***Fig. 15.14 Chalcolithic clay figurines and miscellaneous objects of Group 1 from Tell Kosak Shamali.***

1. Clay figurine, human being, probably squatting female, clay, grayish yellow brown surface, dull yellow brown core, L: 4.1+cm, W: 4.0cm, T: 1.5cm (95KSL-AF5-22; Fill; Level 15 of Sector A).
2. Clay figurine, zoomorphic, clay, brownish gray surface, bright brown core, H: 2.3+cm, L: 4.1+cm, T: 1.4cm (95KSL-AF3-7; Fill, Level 11 of Sector A).
3. Clay figurine, zoomorphic, clay, brownish gray surface, bright brown core, impressions of a stick on the neck, H: 3.3+cm, L: 4.6+cm, T: 1.5+cm (96KSL-AE3-17; Fill, Level 10 of Sector A).
4. Clay figurine, zoomorphic, clay, grayish brown surface, dull orange core, H: 1.5+cm, L: 2.0+cm (95KSL-AD5-6; Fill of 402; Level 4 of Sector A).
5. Clay figurine, zoomorphic, clay, dull yellow orange, H: 2.4+cm, L: 4.8+cm, T: 1.7cm (97KSL-BE6-27; Pavement of B704; Level 7 of Sector B).
6. Clay figurine, boat shaped, clay, pale yellow, H: 3.3cm, L: 5.5+cm, W: 4.7cm, T: 0.9-1.1cm (96KSL-AE4-11; Fill of 10A08; Level 10 of Sector A).
7. Miscellaneous object, Group 1, pestle like, clay, orange surface, brownish gray core, brownish black pigment, a bit of sand is attached on the upper surface, L: 12.3+cm, W: 5.3cm, T: 3.0cm (96KSL-AE3-17; Fill; Level 10 of Sector A).
8. Miscellaneous object, Group 1, hollowed cone, clay, L: 4.5+cm, W: 4.0cm (96KSL-AD5-84; Floor of 901; Level 9 of Sector A).
9. Miscellaneous object, Group 1, shoe shaped, clay, pale yellow surface, orange core, L: 5.3+cm, W: 10.2+cm, T: 2.0cm (96KSL-AD6-1; Fill; Level 1 of Sector A)
10. Miscellaneous object, Group 1, perforated dome, clay, pale yellow, coarse grit tempered, D: 9.5cm, H: 4.4cm, T: 3.3cm (96KSL-BD6-24; Fill; Level 6 of Sector B).

15.7 Seals and sealings

Four stamps and 7 sealings were found at Tell Kosak Shamali, mostly from the Early Northern Ubaid burnt building, Level 10 of Sector A, and from a Post-Ubaid workshop, Level 5 of Sector B. We shall discuss these administrative objects in detail on two points. One is a possible change in the sealing system between the Ubaid and the Post-Ubaid periods, and the other one is as to the unexpected discovery of a cylinder seal in the Post-Ubaid workshop.

15.7.1 Chalcolithic sealing system at Tell Kosak Shamali

(1) The Early Northern Ubaid Period

(Fig. 15.16: 1-7; Pl. 15.9: 1, 6 & 7)

A possible sealing was recovered first from the floor of Room 1404, Level 14 at Sector A (Fig. 15.13: 2), and a stamp seal and five sealings from the floor of the burnt building of Level 10A, Sector A (Fig. 15.16: 1, and 3-7; Pl. 15.9: 1, 6 and 7).

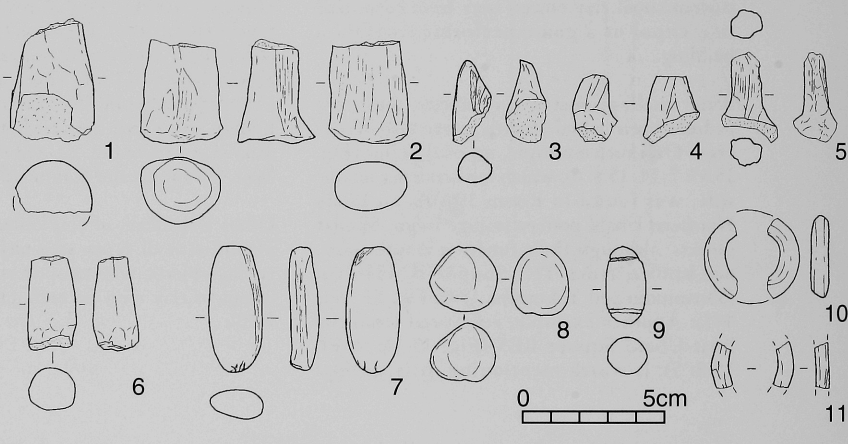


Fig.15.15 Chalcolithic clay objects of Group 2 from Tell Kosak Shamali.

1. Miscellaneous object, Group 2, cone, clay, brownish black surface, dull yellowish brown core, L: 4.3+cm, W: 2.7cm (95KSL-AG4-4; Fill of 1310; Level 13 of Sector A).
2. Miscellaneous object, Group 2, cone, clay, L: 3.6+cm, W: 1.8cm (97KSL-AE4-23; Floor of 1101; Level 11 of Sector A).
3. Miscellaneous object, Group 2, cone, clay, orange, L: 2.9+cm, W: 1.1cm (97KSL-AD5-103; Foundation of 1114; Level 11 of Sector A).
4. Miscellaneous object, Group 2, cone, clay, dull yellow orange, L: 2.4+cm, W: 2.0cm (97KSL-AE6-25; Foundation of 1122; Level 11 of Sector A).
5. Miscellaneous object, Group 2, cone, clay, L: 3.1+cm, W: 1.7cm, T: 1.0cm (97KSL-AE4-22; Fill of 10A18; Level 10 of Sector A).
6. Miscellaneous object, Group 2, cone, clay, dull yellow orange, L: 3.3+cm, W: 1.7+cm (96KSL-BD6-29; Pavement of B502; Level 5 of Sector B).
7. Miscellaneous object, Group 2, clay, orange, L: 4.4cm, W: 1.9cm, T: 1.0cm (96KSL-AE4-9; Fill of 10A01; Level 10 of Sector A).
8. Miscellaneous object, Group 2, ball, clay, light yellow orange, L: 2.3cm, W: 2.4cm, T: 2.1cm (95KSL-AD5-66; Fill; Level 6 of Sector A).
9. Miscellaneous object, Group 2, token?, clay, dull brown, L: 2.7cm, W: 1.4cm (97KSL-BE5-1; Fill; Level 4/5 of Sector B).
*10. Miscellaneous object, Group 2, finger ring?, clay, light gray, D: 3.5*cm, T: 0.7cm (97KSL-AE5-53; Fill of 1406; Level 14 of Sector A).*
11. Miscellaneous object, Group 2, finger ring?, clay, light gray, L: 1.7+cm, T: 0.5cm (97KSL-AE5-34; Floor of 1105; Level 11 of Sector A).

The "sealing" from Room 1404 was discovered close to the fragmentary round wall, 1409. The curved wall was similar to the so-called tholos of the Halaf period (Nishiaki *et al.* 2001: 58-59). The sealing has a fingerprint on one face and what appear to be botanical impressions on the reverse. There are no decorative motifs or thread impressions. It may not have been used for sealing.

A stamp seal was recovered from the floor of Room 10A01, a large rectangular, Early Northern Ubaid room in which a large amount of pottery was stored (Fig. 15.16: 1; Pl. 15.9: 1). This stamp is conical, 3.3cm high, and 2cm at the point of its largest diameter. The pointed end is cut obliquely, and there is a small perforation (3mm in diameter) on that flat face. The carved motif is very simple; 3 lines cross at the center, two are continuous while the third is divided at the center.

Sieving produced 5 fragments of sealings from rooms of the same building: 3 from Room 10A01 (Fig. 15.16: 3-5; Pl. 15.9: 6), and 2 from Room 10A08 (Fig. 15.16: 6 and 7; Pl. 15.9: 7). All have simple geometric impressions; either a rosette (Fig. 15.16: 3), concentric arcs (Fig. 15.16: 4; Pl. 15.9: 6), or wavy lines (Fig. 15.16: 7; Pl. 15.9: 7). One only has an impression of a stamp edge (Fig. 15.16: 6). The objects which were sealed can be determined from the reverse impression on some pieces; for example, Fig. 15.16: 7 shows two rows of arcs from a fibrous coil. Although this is a very small fragment, it may have sealed a coiled basket, as did many fragments of sealings from Tell Sabi Abyad (Duistermaat 1996). Two other examples have impressions of thick twisted fiber and a thin rope (Fig. 15.16: 3 and 4; Pl. 15.9: 6). These may have fastened a coil basket. One further sealing has no stamp seal impression, but only traces fingerprints and unidentifiable obscure impressions on its reverse (Fig. 15.16: 5). This may not have been a sealing for use on a container. No sealing with an impression of the stamp seal recovered from the same building existed.

The rooms from which the stamp seal and 5 sealings were recovered (10A01 and 10A08) are close together. Given that Room 10A01 is considered to be a pottery storage room (Nishiaki 2001; Nishiaki *et al.* 2001: 68-69), one would expect that there would have been some door sealings for this room. But no evidence of such sealings were found. Nevertheless, some system of material circulation must have existed in the Ubaid village of Tell Kosak Shamali. The fact that the excavated sealings did not bear the impression of the stamp seal found in the same building is important, since it suggests that the circulation of material was directed out of the village or at least towards other unknown buildings of the same village.

(2) The Post-Ubaid Period

(Fig. 15.16: 8-11; Pl. 15.9: 2, 4, 5 & 8)

One cylinder seal and two stamp seals were recovered from the Post-Ubaid workshop of Level 5, Sector B. The cylinder seal is one of the most debatable finds from the Tell Kosak Shamali excavations. Grooves about 1mm wide are carved horizontally around both ends of the seal and have cross-hatching lines incised in two directions between them. The central perforation along the long axis is about 3mm in diameter. Similar examples have been reported from the Late Uruk context of Habuba Kabira (Hammade 1996: 309). So far, the earliest cylinder seals in the Near East are known from the Middle Uruk period at Tell Brak (Matthews *et al.* 1994: Fig. 4: 2-4; Oates and Oates 1993: Figs. 32 and 42). The Tell Kosak Shamali example is obviously much earlier than those of Tell Brak. This implication will be discussed later.

One of the stamp seals is lozenge-shaped and lentoid in section (Fig. 15.16: 9; Pl. 15.9: 5). The two ends on the longer axis are slightly gouged. Similar objects have been reported from Tepe Gawra, Levels XV to X, as "engraved beads" (Tobler 1950: Pl. CLXXI: 7-14). Our example is roughly engraved on one face. Straight shallow lines are engraved along the long axis, and short lines are scratched obliquely within the triangular area divided by those lines. The central part has some lines running in random directions. The other seal is shaped like a four-leaf clover with a motif of shallow criss-cross lines, and deep lines carved toward the center from the two corner gouges (Fig. 15.16: 10; Pl. 15.9: 4). A similar pattern of deep lines running from the gouges to the center has also been carved on the reverse. Perforating method is visible because it is broken along the longer axis. A perforation (about 3mm in diameter) through the center along the longer axis has been made from both ends; therefore, we can see the gap at a contact point of perforations. One example from Değirmentepe, eastern Anatolia, is very similar in shape and depiction (Esin 1994: Fig. 5. 9). These two seals were from the fill of the pottery kiln (B601) of the earlier Post-Ubaid phase, Level 6 of Sector B. They were thrown there after the kiln had been abandoned.

The one sealing from the same level was relatively well preserved (Fig. 15.16: 11; Pl. 15.9: 8). It has two impressions made by the same stamp seal. Short lines run obliquely towards two lines crossing at right angles. Three rope impressions are evident on the reverse, one of which is on bottom of this sealing which must have fastened the shoulder of a jar.

(3) Summary

The administrative objects from Tell Kosak Shamali show a high concentration in two building units, an Early Northern Ubaid burnt building and a Post-Ubaid workshop. These contexts have important implications.

The Early Northern Ubaid building in Sector A, Level 10 yielded numerous complete pottery vessels, especially from the large rectangular storage room (10A01), and a smaller square room (10A03). A large quantity of cereal grain was also found nearby in small square rooms, 10A03, 04, 06, and 07. These rooms are considered as pottery storage and grain storage respectively (Nishiaki 2001; Nishiaki *et al.* 1999,

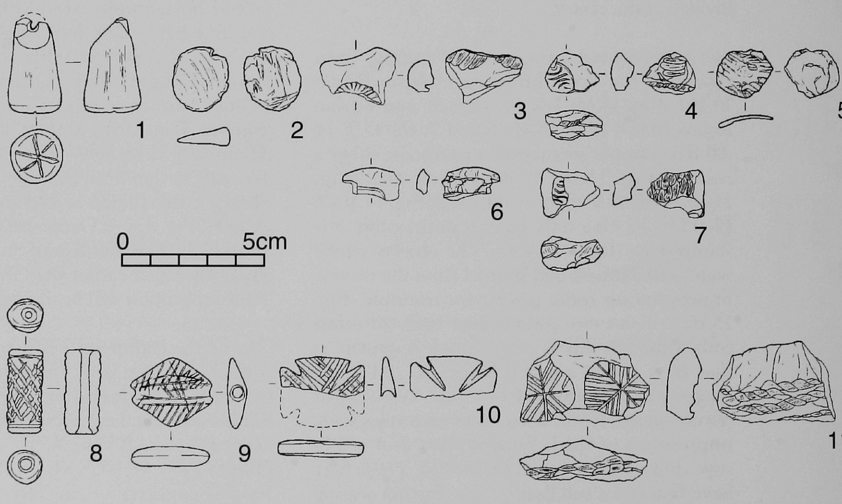


Fig. 15.16 Chalcolithic seals and sealings from Tell Kosak Shamali.
1. Stamp seal, stone, dull orange, L: 3.3cm, W: 2.0cm (96KSL-AE4-14; Floor of 10A01; Level 10 of Sector A).
2. Sealing?, clay, brownish gray, L: 2.3cm, W: 2.0cm (97KSL-AD4-55; Floor/Fill of 1404; Level 14 of Sector A).
3. Sealing, clay, dull orange, L: 2.1+cm, W: 2.7+cm (96KSL-AE4-14; Floor of 10A01; Level 10 of Sector A).
4. Sealing, clay, brownish gray, L: 1.5+cm, W: 1.9+cm (96KSL-AE4-14; Floor of 10A01; Level 10 of Sector A).
5. Sealing ?, clay, dull orange, L: 1.8cm, W: 2.0cm (96KSL-AE4-14; Floor of 10A01; Level 10 of Sector A).
6. Sealing, clay, dull yellow orange, L: 1.2+cm, W: 2.0+cm (96KSL-AE4-16; Floor of 10A08; Level 10 of Sector A).
7. Sealing, clay, olive black, L: 1.7+cm, W: 2.1+cm cm (96KSL-AE4-16; Floor of 10A08; Level 10 of Sector A).
8. Cylinder seal, stone, bluish black, L: 3.0cm, W: 1.2cm (96KSL-BD7-48; Foundation of B504; Level 5 of Sector B).
9. Stamp seal, stone, bluish black, L: 2.4cm, W: 3.0cm, T: 0.7cm (97KSL-B8/9-2; Fill of B601; Level 5 of Sector B).
10. Stamp seal, stone, bluish black, L: 2.2cm, W: 3.0cm, T: 0.6cm (94KSL-B9-5; Fill of B601; Level 5 of Sector B).
11. Sealing, clay, brownish black, L: 2.9+cm, W: 4.6+cm (96KSL-BD7-39; Fill; Level 4 of Sector B).

2001). The seals and sealings were from Rooms 10A01, and neighboring 10A08, an open space or possibly clay storage (Nishiaki 2001; Nishiaki *et al*. 2001: 71). These two rooms seem to have been closely related to administrative procedures; places where sealed containers with goods imported or stored were opened, or at least, removed sealings were discarded there selectively. While the types of goods imported or stored at this building or site are unknown, the fact that three of the five sealings have coiled basketry impressions suggests that the goods may have been small enough to allow keep in baskets.

The Early Northern Ubaid sealings have a single stamp seal impression, and only one stamp seal was recovered. Both of these factors differ from the evidence suggested by the later Post-Ubaid sealing system.

The three seals, including a cylinder seal and a sealing, from the Post-Ubaid pottery workshop suggest an element of transaction, although the detail is lacking. The sealing, which has two impressions of the same stamp seal, seems to have been used for shoulder of a jar from its shape in section and the reverse impression. These features were not observed in the Early Northern Ubaid evidence relating to the imprinting method and sealed containers. The existence of three seals may suggest the role of more than one person in managing circulation. The goods imported or stored may have been different from those in the Early Northern Ubaid period because they were put in jars, not baskets. The sealing system also changed between periods, with the use of a single stamp impression in the Early Northern Ubaid, but two in the Post-Ubaid.

The detailed system of the total sealing system could not be clarified, although the storage function at the Ubaidian burnt building and the pottery manufacture at Post-Ubaid workshop must be concerned with these administrative objects from Tell Kosak Shamali. Despite the paucity of materials, the above hypothesis merits further consideration and might indicate changes in the administrative system between the Early Northern Ubaid and the Post-Ubaid periods.

15.7.2 A brief note on the earliest cylinder seals

The cylinder seal from Level 5 of Sector B was discovered during the 1996 excavations at Tell Kosak Shamali (Fig. 15.16: 8; Pl. 15.9: 2). The overall shape of the object indicates a cylinder seal rather than a bead. It was found from a foundation of the Post-Ubaid workshop dated to around the end of the 5th millennium BC (Koizumi and Sudo 2001: 127). Cylinder seals are usually considered an invention of the late 4th millennium large cities of southern Mesopotamia and south-western Iran, such as Uruk and Susa, as part of an increasing administrative complexity (Nissen 1977; Collon 1987). The general consensus is that the use of cylinder seals expanded from those centers toward the northern periphery along with the so-called Uruk expansion. Consequently it has been assumed that cylinder seals should not be found on the northern periphery at sites that predate the late 4th millennium BC. Recently, however, the Uruk Expansion or Uruk World System phenomena which implies a uni-directional expansion, has been reconsidered in light of increasing new data from excavations at the northern periphery. New evidence has also emerged on the use of cylinder seals in the earlier period from northern Mesopotamia, and northern Syria. Here, after a review of the earliest evidence of cylinder seals, we will discuss the one found at Kosak Shamali.

(1) The earliest evidence of cylinder seals

The earliest archaeological evidence for the use of cylinder seals in southern Mesopotamia is represented by impressions found in the huge trash pit (10m long, 4m wide, and deeper than 4m) of Tepe Sharafabad, a small site in south-western Iran. The impressions were mixed with late Middle Uruk pottery dated to about 3500 BC. Although only 6 cylinder seal impressions were recovered, probably because of the small area excavated, many stamp seal impressions were found (Wright *et al*. 1980).

The earliest cylinder seals at the large site of Uruk in southern Mesopotamia came from the intermediate level D-C of the Anu Ziggurat area (Collon 1987: no. 5) dated to the late Middle Uruk, about the middle 4th millennium BC. Impressions also appeared in Levels V to IV of the Eanna area, in a Late Uruk context of the late 4th millennium BC (Amiet 1961: 23, Pls. 9-13; Brandes 1979). At Susa, another large site in southwest Iran, sealings with similar impressions to those of Sharafabad are claimed to have been found in excavations of the early Middle Uruk Acropolis I, Level 20 (Dittman 1986: 333; Porada *et al.* 1992: 99). However detailed information has not been yet published.

From these reports, the appearance of cylinder seals in southern Mesopotamia and southwestern Iran can be dated to the early Middle Uruk, about 3700 BC. Unfortunately, except for Sharafabad, there is little information about the contexts in which they were discovered. At Sharafabad, impressions of stamp and cylinder seals were found together, suggesting that there was no distinction in use between them.

Recently, new evidence for the early use of cylinder seals has come from the northern periphery, from Tell Brak in northeast Syria. At Tell Brak, the first evidence of cylinder seals was recorded in Area TW, Phase 16 of the northern slope of the mound, and Area HS 1, Phases 3 and 4 at the north-western slope dated from the Northern Middle Uruk, about 3500 BC (Oates and Oates 1994: Table 1).

The excavations of the Niched Building in Area TW, Phase 16, revealed a heavily burned exterior area with large casseroles smashed on the floor and five sealings nearby. One sealing had impressions of a short, fat cylinder seal, and the others had the same oval stamp seal impressions (Emberling *et al.* 1999: 8, Fig. 29). The ceramics from this area show few affiliations with southern Uruk pottery, but more with the local late Chalcolithic materials of northeastern Syria and southeastern Anatolia. In this phase, two further sealings with impressions of the same cylinder seal were excavated (Oates and Oates 1993: Fig. 32). Impressions on the reverse of these sealings indicate their use to seal basket containers. In the later Phase 13, a large soft-stone cylinder seal (4.5 x 3.0cm) was found on a floor associated with spouted vessels and casseroles (*ibid.*: 176, Fig. 31). This phase, dated to the Middle Uruk, about 3400 BC, has clear affiliations with the material culture of the south (*ibid.*: 171). This is the earliest stratified example of any cylinder seal (*ibid.*: 176).

At Area HS 1, nine sealings with cylinder seal impressions and string and wood impressions on their reverse were recovered. Five came from an ash deposit outside the main building, and 4 from the floor of the Phase 3 long room that had plastered inner walls and a niche (Matthews *et al.* 1994: 178-180, Fig. 4: 2-4). These examples were associated with local late Chalcolithic pottery resembling that of TW Phase 14-16.

(2) When and where were cylinder seals used first?

These examples raise two questions: when and where cylinder seals came into use. So far the earliest evidence for the use of cylinder seals is in the early middle Uruk period at Susa and Tell Brak. According to current consensus, then, cylinder seals should have appeared earlier in the south. This may suggest that even earlier examples should be found at southern sites in the future, or that the contact between the northern local late Chalcolithic and southern Uruk may have begun before the extensive Uruk expansion. An answer to this must await future discoveries.

With reference to "where" cylinder seals first appeared, the available data show the almost simultaneous appearance in both the southern center and northern periphery. This may also imply independent invention of cylinder seals in the northern region. In order to examine this problem, it may help to review the administrative aspects at the small site of Hacınebi Tepe in the Euphrates valley of southeastern Turkey (Stein *et al.* 1996, 1999). The site, which was recently excavated, produced new evidence of contacts between the southern Mesopotamian Uruk and northern local late Chalcolithic cultures. It demonstrates that the local late Chalcolithic culture was not swept away at Hacınebi but was maintained despite the extensive flow of southern Uruk material culture.

The sequence of Hacınebi is divided three phases. There was no Mesopotamian Uruk materials in Phase A (ca. 4000-3800 BC - early Uruk = early pre-contact phase), and few southern materials in Phase B1 (ca. 3800-3700 BC - early middle Uruk = late pre-contact phase). In Phase B2, (ca. 3700-3400 BC - late middle Uruk) south Mesopotamian Uruk materials such as pottery or administrative objects became clearly visible (= contact phase). Here, it is necessary to consider the change of administrative objects between Phases A to B2 at Hacınebi (Stein *et al.* 1996: 96-97).

In Phases A to B1, administrative objects such as stamp seals and sealings were similar to those of neighboring sites; there were no cylinder seals, only stamp seals used to seal bags and baskets. Two categories of stamp seals were distinguished; one of baked clay or limestone with coarse lines and the second of stone with elaborate depictions of animals and humans. The former were recovered from domestic contexts and the latter from niched and plastered buildings (Pittman 1996, 1998; Stein 1999: 128). In the contact phase B2, a series of south Mesopotamian Uruk administrative objects such as clay sealings to jars, hollow clay bulla, and clay tablets were used and had impressions of cylinder seals on them (Stein 1999: Figs. 7.12 and 7.17). Local stamp seals were also used, but for wooden containers, packets of reed matting, leather bags, and cloth sacks, but unlike cylinder seals, "they never appear on ceramic vessels, tablets, jar stoppers, or bullae" (Stein 1999: 155). Furthermore, they were found in different contexts: "Uruk-style, cylinder-sealed, record-keeping artifacts occur exclusively with Uruk-style ceramics, whereas local style stamp-sealed administrative artifacts were found almost always with local Anatolian ceramics" (*ibid.*).

Comparison of the administrative artifacts from Tell Brak and Hacınebi, particularly in terms of their discovery contexts, provides some clue to the birthplace of cylinder seals. At Hacınebi, cylinder seals came into use only after the inflow of southern Mesopotamian material culture in Phase B2, around 3700-3400 BC. The discovery contexts of administrative objects with cylinder seal impressions were exclusively those accompanied by southern materials. A clear distinction can thus be made between local and exotic administrative artifacts as to where and how they were used. This indicates that the cylinder seals at Hacınebi were part of the southern Mesopotamian administrative system. Other occurrences of cylinder seals in the northern periphery of the 4th millennium BC should also be interpreted in the same way. Perhaps the only exception is at Tell Brak, where the earliest cylinder seals were used in local contexts in the same manner as local traditional stamp seals. Our example from Tell Kosak Shamali was also from the context of north Syrian local tradition. Apparently the emergence of cylinder seals in the north cannot always be attributed to the Uruk Expansion. Indeed, in the northern periphery, there had been a long tradition of a recording system using stamp seals from the 7th millennium BC onwards. From this viewpoint, the possibility of independent innovation of cylinder seals in the northern periphery would also be plausible.

(3) The cylinder seal from Tell Kosak Shamali

The cylinder seal from Tell Kosak Shamali dates from the Post-Ubaid period, the final 5th to early 4th millennium BC. While the possible independent appearance of cylinder seals in the north has been noted above, the Kosak Shamali example precedes the earliest known examples by almost 500 years. This obvious gap needs to be explained.

The motifs on seals will be considered in the first instance. The cross-hatching lines of the Kosak Shamali motif do not occur on early 4th millennium cylinder seals; as mentioned above, the published examples usually represent animals and/or human figures, probably made by drilling. Such a simple geometric design as seen on the Kosak Shamali cylinder is popular on earlier stamp seals or much later cylinder seals such as those from the late Uruk enclave of Habuba Kabira, northern Syria and some other sites of even later periods (cf. Hammade 1994).

At Kosak Shamali, two other stamp seals were recovered from the same level (Level 5 of Sector B), from the fill of Kiln B601 built on an earlier level. They were probably thrown into the kiln together with broken sherds, pottery production tools, and other debris after it had been abandoned (Koizumi and Sudo 2001: 133-135), and from this context the seals were dated to Level 5 or at least earlier than Level 3. The stamps were engraved with simple motifs of shallow parallel or crosshatched lines (Fig. 15.16: 9 and 10; Pl. 15.9: 4 and 5). A stamp seal impression was recovered from the later Level 4 of Sector B and other seals and impressions came from the Early Northern Ubaid (Level 10 of Sector A) (Fig. 15.16: 2-7 and 11; Pl. 15.9: 6-8). All have simple geometric motifs. There were no subjective or descriptive designs on Tell Kosak Shamali seals and sealings of any period. The simple geometric designs may have been a characteristic of administrative objects at the site, which suggests a continuity of designs from stamp to cylinder seals here, wherever they originated.

With reference to cylinder seal shape, Collon (1987) pointed out that Uruk and Jamdat Nasr period cylinders were relatively short and fat becoming longer and thinner in the 3rd millennium BC. Indeed, most of the late Uruk examples from Habuba Kabira, Jabal Aruda, and Tell Brak have length to width rations of nearly 1:1. As has been noted, the earliest cylinder seal from Tell Brak TW 13 Phase measures 4.5 x 3.0cm, the length/width ratio being 1.5:1. On the other hand, the Kosak Shamali cylinder is 3 x 1.2cm, about a 3:1 length/width ratio, which resembles later cylinders rather than earlier ones.

The morphological data may cast doubt on the excavation context, despite our claims that the seal came from an *in situ* concentration of Post-Ubaid materials just below the floor (B504) of a Level 5 building in Sector B (Koizumi and Sudo 2001: 127). The floor extended eastward in front of a pottery kiln (B501). Many potsherds including nearly complete vessels, lithics, and small finds were scattered *in situ* on the floor. The deposits below this floor, which was about 10cm thick and tightly packed, contained large sherds, small finds, and the cylinder seal. The cylinder seal was almost at the center of B504 mixed with Post-Ubaid potsherds. Its location in such a context does not indicate any intrusion from a later level.

In sum, the available evidence is perhaps too sparse to explain these conflicting observations. New data and further study is essential. Nevertheless, investigation of these earliest cylinder seals from various viewpoints such as motif, morphological style, engraving technique, location contexts, and the like will help us understand developments of prehistoric administrative systems and regional interactions.

15.8 Beads/pendants

(Fig. 15.17: 1-14; Pls. 15.7: 2; 15.9: 3; 15.10: 1-8)

This section deals with stone and bone objects with perforation(s), which are considered as beads or pendants, and have been divided into four types according to the position and number of holes.

Type 1 represents beads with a single, central perforation (3 examples; Fig. 15.17: 1-3; Pl. 15.10: 7). One specimen from Level 5 of the Post-Ubaid period is on a flint flake (Fig. 15.17: 3).

Type 2 also has a single perforation but it is near an edge. We may call them pendants. Four examples were recovered from Early to Late Northern Ubaid levels (Fig. 15.17: 4-7; Pl. 15.10: 4 and 6). These include an incomplete, large limestone pendant that has been perforated from both faces but in wrong directions (Fig. 15.17: 6; Pl. 15.7: 2). One example made from obsidian flake was found from Level 7 of Sector A (Fig. 15.17: 7).

Type 3 has more than one hole (3 examples; Fig. 15.17: 8-10; Pl. 15.10: 3 and 8). They are in bone (Fig. 15.17: 8; Pl. 15.10: 8), in a well-polished light gray stone (Fig. 15.17: 9; Pl. 15.10: 1), and a flint flake (Fig. 15.17: 10; Pl. 15.10: 3). The edges of the holes in the latter two are heavily worn, probably due to abrasion from string.

Type 4 is consisted of beads with a perforation along the long axis. Four beads were recovered from various periods between the Early and the Terminal Northern Ubaid. They are made on a reddish purple stone (Fig. 15.17: 14; Pl. 15.9: 3), shell, bone, or unidentified material (Fig. 15.17: 11-13; Pl. 15.10: 2 and 5).

Beads were concentrated in the later phase of the Early Northern Ubaid and the earlier phase of Late Northern Ubaid periods. Each level yielded at most three examples, many from contexts closely related to building features, in particular with or near floors. This is perhaps the result of careful sieving of floor deposits.

15.9 Stone vessels (Fig. 15.17: 15-19; Pl. 15.10: 9-11)

Six fragments of stone vessels were recovered from the Early to Terminal Northern Ubaid levels. One piece is from a mixed layer of Sector B. They are in whitish marble and dark stone.

Two fragments were found in Sector A, Level 14; one a small bowl in blackish stone (Fig. 15.17: 16) with a very slight carination near the base, and the other a pale yellow plate (Fig. 15.17: 15; P1. 15.10: 9). A similar marble piece was reported from Tell Songor B, Level III (Matsumoto and Yokoyama 1995: Fig. 96. 588).

One fragment from the floor of Room 10A02, the burnt building of Sector A, Level 10 (Early Northern Ubaid) (Fig. 15.17: 17; Pl. 15.10: 10), is a small bowl in blackish stone, probably basalt. The rim is pinched out, and the base forms a slightly convex disk. A very similar example, in grayish-white marble, was reported from Tepe Gawra Stratum XVII, Late Northern Ubaid phase (Tobler 1950: Pl. CLXXXI. 84).

A disk base fragment of a black stone vessel, with whitish lime stuck to the surface, was found in a debris layer of Level 2, Sector A (Fig. 15.17: 18; P1. 15.10: 11) .

Sector B yielded a fragment of a single stone vessel fragment from a mixed layer in Level 4. Made in whitish-pink marble, it was part of a rim of unknown shape.

15.10 Conclusions

In this chapter, a variety of small finds have been discussed from which, despite the relatively small sample size, it has been possible to infer various activities at Tell Kosak Shamali.

Reuse of potsherds is a major feature at Kosak Shamali. Among the 180 small finds, 76 examples (42%) were made on potsherds. Due to their availability and ease of modification, potsherds were exploited as raw materials for tools; they were used for clay scrapers (n=42), clay disks (n=29), and spindle whorls (n=5). Clay scrapers seem to have been related to pottery manufacture, whereas most of the others were used in various contexts for various purposes. Chronologically, the occurrence of Type 2b ring scrapers corresponds well with Post-Ubaid pottery manufacture.

The analysis of spindle whorls provides an avenue to interpret changes in fiber production at Tell Kosak Shamali. Lighter and smaller whorls became more common after the late phase of Late Northern Ubaid reflecting a chronological development in spinning fiber. This transition appears to correspond with a changing pattern of sheep/goat exploitation. The change in spindle whorls occurred relatively earlier than that seen in other small finds, pottery and stone tools.

The examination of seals and sealings produced a range of evidence on resource controlling activities at Tell Kosak Shamali during the Chalcolithic. There was an obvious change in sealing systems between in the Early Northern Ubaid and the Post-Ubaid: changes in the number of seals, the number of impressions on each sealing, and containers that were sealed. In addition, one cylinder seal from a Post-Ubaid level is the most debatable object at Tell Kosak Shamali. At the moment, the earliest use of cylinder seals is documented only after the earlier Middle Uruk. More examples from other sites are needed in order to evaluate the Kosak Shamali cylinder seal.

It has been impossible to examine socio-economic implications for the other objects described above. Even with regard to those materials discussed in some detail, the proposals presented here are merely hypothetical. The collection and analysis of more related data will allow further research to continue.

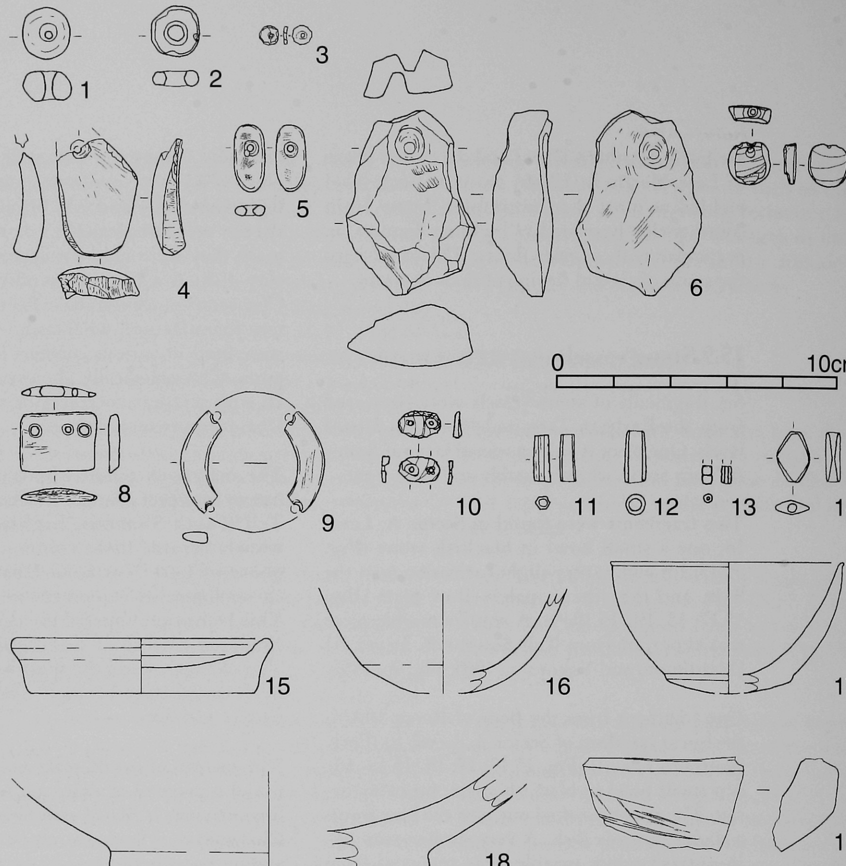


Fig.15.17 Chalcolithic beads/pendants, and stone vessels from Tell Kosak Shamali.

1. Bead, Type 1, stone, black, D: 1.8cm, T: 0.9cm (97KSL-AE5-30; Floor of 1102; Level 11 of Sector A).
2. Bead, Type 1, sand stone, dull orange, L: 1.6cm, W: 1.7cm, T: 6cm (97KSL-AD6-40; Floor of 1125; Level 11 of Sector A).
3. Bead, Type 1, flint flake, L: 0.6cm, W: 0.7cm, T: 0.2cm (96KSL-BD7-53; Fill; Level 5 of Sector B).
4. Pendant, Type 2, basalt, reused fragment of stone vessel, dark olive gray, L: 4.0+cm, W: 2.8cm, T: 0.8cm (97KSL-AD5-102; Fill; Level 11 of Sector A).
5. Pendant, Type 2, stone, black, L: 2.3cm, W: 1.0cm, T: 0.4cm (96KSL-AE4-16; Floor of 10A08; Level 10 of Sector A).
6. Pendant, Type 2, limestone, unfinished, L: 6.4cm, W: 4.4cm, T: 2.2cm (96KSL-AD5-82; Floor of 901; Level 9 of Sector A).
7. Pendant, Type 2, obsidian flake, L: 1.5cm, W: 1.6cm, T: 0.5cm (95KSL-AE5-8; Fill of 709; Level 7 of Sector A).
8. Bead, Type 3, bone, with three holes, L: 2.1cm, W: 2.7cm, T: 0.4cm (97KSL-AE6-31; Floor/fill of 10A03; Level 10 of Sector A).
*9. Bead, Type 3, stone, light gray, D: 5.0*cm, T: 0.4cm (96KSL-AE3-14; Fill; Level 9 of Sector A).*
10. Bead, Type 3, flint flake, brown, L: 0.9cm, W: 1.5cm, T: 0.3cm (96KSL-AD5-78; Floor of 807; Level 8 of Sector A).
11. Bead, Type 4, shell?, light gray, L: 1.7cm, T: 0.5cm (97KSL-AE5-42; Fill of 12A06; Level 12A of Sector A).
12. Bead, Type 4, shell?, pale yellow, L: 1.9cm, W: 0.7cm (96KSL-AD4-25; Foundation of 816; Level 8 of Sector A).
13. Bead, Type 4, unidentified material, black, L: 0.6cm, W: 0.4cm (96KSL-AE6-1; Fill of 708; Level 7 of Sector A).
14. Bead, Type 4, stone, dark red, L: 1.2cm, W: 1.9cm, T: 0.5cm (94KSL-A6-topsoil; Fill; Level 1 of Sector A).
*15. Stone vessel, stone, pale yellow, D: 9.2*cm. H: 2.0cm (97KSL-AE5-53; Fill of 1406; Level 14 of Sector A).*
16. Stone vessel, basalt, bluish black, H: 3.4+cm (97KSL-AE5-52; Fill; Level 14 of Sector A).
*17. Stone vessel, basalt, bluish gray, D: 8.3*cm, H: 4.6cm (96KSL-AD5-99; Floor of 1002; Level 10 of Sector A).*
*18. Stone vessel, basalt, dark bluish gray, D: 11.2*cm (at base) (96KSL-AD6-4; Fill; Level 2 of Sector A).*
19. Stone vessel, stone, light yellow orange, shoulder (97KSL-BE5-topsoil; Fill; Surface-Level 4 of Sector B).

References

Akkermans, P. M. M. G. (ed.) (1996) *Tell Sabi Abyad: The Late Neolithic Settlement. Report on the Excavations of the University of Amsterdam (1998) and the National Museum of Antiquities Leiden (1991-1993) in Syria*. Istanbul: Nederlands Historisch-Archaeologisch Instituut te Istanbul.

Alden, J. R. (1988) Ceramic ring scrapers: An Uruk period pottery production tool. *Paléorient* 14 (1): 143-150.

Amiet, P. (1961) *La Glyptique Mesopotamienne Archaïque*. Paris: Édition du Centre National de la Recherche Scientifique.

Bader, N. O., N. Merpert and R. M. Munchaev (1981) Soviet expedition's surveys in the Sinjar Valley. *Sumer* 37: 55-95.

Barber, E. J. W. (1991) *Prehistoric Textiles: The Development of Cloth in the Neolithic and Bronze Ages with Special Reference to the Aegean*. New Jersey/West Sussex: Princeton University Press.

Brandes, M. A. (1979) *Siegelabrollungen aus den archaischen Bauschichten in Uruk-Warka*. Freibutger altorientalische Studien 3. Wiesbaden: Franz Steiner Verlag GMBH.

Collet, P. (1996) The figurines. In: *P. M. M. G. Akkermans* (ed.), pp. 403-414.

Collon, D. (1987) *First Impressions: Cylinder Seals in the Ancient Near East*. London: British Museum Publications.

Delougaz, P. P. and H. J. Kantor (1996) *Chogha Mish, Vol. 1: The First Five Seasons of Excavations, 1961-1971*. The University of Chicago Oriental Institute Publications 101. Chicago/Illinois: The University of Chicago Press.

Dittmann, R. (1986) Seals, sealings and tablets: thoughts on the changing pattern of administrative control from the Late Uruk to the Proto-Elamite period at Susa. In: *Jamdat Nasr: Period or Regional Style? Papers Given at a Symposium Held in Tübingen No-vember 1983*, edited by U. Finkbeiner and W. Röllig, pp. 332-366. Wiesbaden: Dr. Ludwig Reichert Verlag.

Duistermaat, K. (1996) The seals and sealings. In: *P. M. M. G. Akkermans* (ed.), pp. 339-385.

Emberling, G., J. Cheng, T. E. Larsen, H. Pittman, T. B. B. Skuldboel, J. Weber and H. T. Wright (1999) Excavations at Tell Brak 1998: Preliminary report. *Iraq* 61: 1-41.

Esin, U. (1994) The functional evidence of seals and sealings of Değirmentepe. In: *Archives before Writing: Proceedings of the International Colloquium Oriolo Romano, October 23-25, 1991*, edited by P. Ferioli, E. Fiandra, G. G. Fissore and M. Frangipane, pp. 59-86. Rome: Centro Intrnazionale di Richerche Archeologiche Anthropologie e Storiche.

Fukai, S., K. Horiuchi and T. Matsutani (eds.) (1970) *Telul eth-Thalathat, Vol. II: The Excavation of Tell II, The Third Season (1964)*. Tokyo University Iraq-Iran Archaeological Expedition, Report 11. Tokyo: Institute of Oriental Culture, The University of Tokyo.

Hammade, H. (1994) *Cylinder Seals from the Collection of the Aleppo Museum, Syrian Arab Republic 2: Seals of Known Provenience*. BAR International Series 597. Oxford: Archaeopress.

Hole, F., K. V. Flannery and J. A. Neely (1969) *Prehistory and Human Ecology of the Deh Luran Plain: An Early Village Sequence from Khuzistan, Iran*. Memoirs of the Museum of Anthropology, University of Michigan 1. Ann Arbor: University of Michigan Museum of Anthropology.

Jasim, S. A. (1985) *The Ubaid Period in Iraq: Recent Excavations in the Hamrin Region*. BAR International Series 267. Oxford: Archaeopress.

Keith, K. (1998) Spindle whorls, gender, and ethnicity at late Chalcolithic Hacınebi Tepe. *Journal of Field Archaeology* 25(4): 497-515.

Koizumi, T. and H. Sudo (2001) The stratigraphy and architectures of Sector B of Tell Kosak Shamali. In: *Y. Nishiaki and T. Matsutani* (eds.), pp. 115-152.

Kurata, E. (1998) Domestic life in Tnenir Village. In: *A. Tsuneki and Y. Miyake* (eds.), pp. 215-219.

van Loon, M. (ed.) (1988) *Hammam et Turkman I. Istanbul: Nederlands* Historisch-Archaeologisch Instituut te Istanbul.

Mallowan, M. E. L. and J. C. Rose (1935) Excavations at Tall Arpachiyah 1933. *Iraq* 2(1): 1-178.

Matsumoto, K. and S. Yokoyama (1995) Excavations at Tell Songor B. *Al-Rāfidān* 14: 1-273.

Matsutani, T. (1970) Clay ring. In: *S. Fukai et al.* (eds.), p. 80.

Matthews, R. J., W. Matthews and H. McDonald (1994) Excavations at Tell Brak, 1994. *Iraq* 56: 177-194.

Merpert, N. and R. Munchaev (1993) Yarim Tepe III: The Halaf levels. In: *Early Stages in the Evolution of Mesopotamian Civilization: Soviet Excavations in Northern Iraq*, edited by N. Yoffee and J. J. Clark, pp.163-205 (originally in *Sumer* 1984). Tucson: The University of Arizona Press.

Nishiaki, Y. (2001) An Ubaidian burnt building from Tell Kosak Shamali, North Syria. In: *Proceedings of the First International Congress on the Archaeology of the Ancient Near East*, edited by P. Matthie, A. Enea, L. Peyronel and F. Pinnock, pp. 1213-1223. Rome: University of Rome.

Nishiaki, Y. and T. Matsutani (eds.) (2001) *Tell Kosak Shamali: The Archaeological Investigations on the Upper Euphrates, Syria. Vol. I: Chalcolithic Architecture and the Earlier Prehistoric Remains*. UMUT Monograph 1. Tokyo: The University Museum, The University of Tokyo / Oxford: Oxbow Books.

Nishiaki, Y., M. Tao, S. Kadowaki, M. Abe and H. Tano (2001) Excavations in Sector A of Tell Kosak Shamali: The stratigraphy and architectures. In: *Y. Nishiaki and T. Matsutani* (eds.), pp. 49-113.

Nishiaki, Y., T. Koizumi, M. Le Mière and T. Oguchi (1999) Prehistoric occupations at Tell Kosak Shamali, the upper Euphrates, Syria. *Akkadica* 113: 13-67.

Nissen, H. J. (1977) Aspects of the development of early cylinder seals. *Bibliotheca Mesopotamia* 6: 15-23.

Oates, D. and J. Oates (1993) Excavations at Tell Brak 1992-93. *Iraq* 55: 155-199.

Oates, D. and J. Oates (1994) Tell Brak: a stratigraphic summary, 1976-1993. *Iraq* 56: 167-176.

Pittman, H. (1996) The administrative artifacts. In: Hacınebi, Turkey: Preliminary report on the 1995 excavations, by G. Stein, C. Edens, N. Miller, H. Ozbal, J. P. Edens and H. Pittman. *Anatolica* 22: 98-100.

Pittman, H. (1998) Preliminary comments on the glyptic found in the 1997 season at Hacınebi Tepe. In: Southeast Anatolia before the Uruk expansion: Preliminary report on the excavations at Hacınebi, Turkey, by G. Stein, C. Edens, J. P. Edens, K. Boden, N. Laneri, H. Ozbal, B. Earl, A. M. Adriaens and H. Pittman. *Anatolica* 24: 170-173.

Porada, E., D. P. Hansen, S. Dunham and S. H. BaBCock (1992) The Chronology of Mesopotamia, ca. 7000-1600 BC. In: *Chronologies in Old World Archaeology, Vol. I*, 3rd ed., edited by R. W. Ehrich, pp. 77-121. Chicago: University of Chicago Press.

Rossmeisl, I. and P. Venema (1988) The other clay finds. In: *M. van Loon* (ed.), pp. 561-603.

Sono, T. (1970) Spindle whorl. In: *S. Fukai* et al. (eds.), pp. 76-77.

Spoor, R. H. and P. Collet (1996) The small finds. In: *P. M. M. G. Akkermans* (ed.), pp. 439-473.

Stein, G. J. (1999) *Rethinking World-Systems: Diasporas, Colonies, and Interaction in Uruk Mesopotamia*. Tucson: The University of Arizona Press.

Stein, G. J., C. Edens, N. Miller, H. Ozbal, J. P. Edens and H. Pittman (1996) Hacınebi, Turkey: Preliminary Report on the 1995 Excavations. *Anatolica* 22: 85-128.

Sürenhagen, D. (1978) *Keramikproduction in Habuba Kabira-Süd: Untersuchungen zur Keramikproduction innerhalb der Spät-Urukzeitlichen Siedlung Habuba Kabira-Süd in Nordsyrien*. Berlin: Verlag Bruno Hessling.

Tobler, A. J. (1950) *Excavations at Tepe Gawra, Vol. II: Levels IX-XX. Philadelphia*: University of Pennsylvania Press.

Tsuneki, A. (1998) Other objects. In: *A. Tsuneki and Y. Miyake* (eds.), pp. 108-122.

Tsuneki, A. and Y. Miyake (eds.) (1998) *Excavations at Tell Umm Quseir in Middle Khabur Valley, North Syria: Report of the 1996 Season*. Al-Shark 1. Tsukuba: University of Tsukuba.

Watson, P. J. (1979) *Archaeological Ethnography in Western Iran*. Viking Fund Publications in Anthropology 57. Arizona: The University of Arizona Press.

Watson, P. J. (1983) The soundings at Banahilk. In: *Prehistoric Archaeology along the Zagros Flanks*, edited by L. S. Braidwood, R. J. Braidwood, B. Howe, C. A. Reed and P. J. Watson, pp. 545-613. The University of Chicago, Oriental Institute Publications 105. Chicago/Illinois: The University of Chicago Press.

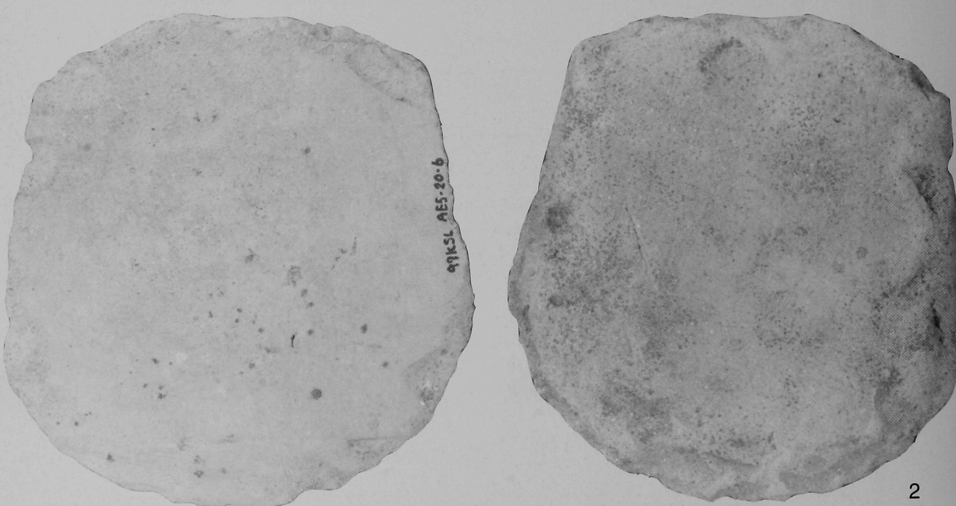
Watson, P. J. and S. A. LeBlanc (1990) *Girkihaciyan: A Halafian Site in Southeastern Turkey*. Monograph 33. Los Angels: Institute of Archaeology, University of California.

Wright, H. T., R. W. Redding, and N. Miller (1980) Time and process in an Uruk rural center. In: *L'Archéologie de l'Iraq du Début de l'Époque Néolithique à 333 avant Notre Ère: Perspectives et limites de l'interprétation anthropologique des document*, pp. 265-84. Colloques Internationaux du Centre National de la Recherche Scientifique 580. Paris: Édition du Centre National de la Recherche Scientifique.

Table 15.1 Chronological distribution of Chalcolithic small finds from Tell Kosak Shamali.

		Early N. Ubaid								Late N. Ubaid						Terminal N. Ubaid				Post-Ubaid		Middle Uruk					Total	
		earlier					later			earlier			later									earlier		later				
		A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	B7	B6	B5	B4	B3	B2	B1	TS		
Clay Scrapers	1a				2	1		1					1					1	1	1	4	1				1	15	
	1b					1			1				1							2							6	
	1c								2							1				3	4	3		1	1		13	
	2a						1		2												1						4	
	2b																				3	2	3	1			9	
	2c					1							1	1				1		3					1		8	55
Clay Disks	1			1		2	2	2	2				1	2			1			1	3				1		18	
	2					2			1			1						1	1		1		1			1	9	
	3		2			1		1	1			1										2					8	35
Spindle Whorls							1	2	2	1	1		1	1	1					4	1	3	1			1	20	
Clay Figurines				1				1	2						1				1								6	
Misceraneous	1								1	1		1						1	1	1	1		1				8	
Objects	2				1	1		4	5	1	1		2	1	1					1	2	1	1	1	1		24	32
Seals									1												3						4	
Sealings					1				5													1					7	
Beads/ Pendants	1							2													1						3	
	2							1	1	1		1															4	
	3								1	1	1																3	
	4						1				1	1						1									4	14
Stone Vessels					2				2		1						1									1	7	
Total		0	2	2	6	9	5	14	29	5	5	5	7	5	3	1	2	5	4	16	24	13	7	3	4	4	180	

1



2

Plate 15.1 Chalcolithic clay scrapers from Tell Kosak Shamali, Sector A.
1. Clay scraper, Type 1a, potsherd, W: 11.6cm (cf. Fig. 15.1: 2).
2. Clay scraper, Type 1b, potsherd, L: 10.5cm (cf. Fig. 15.3: 3).

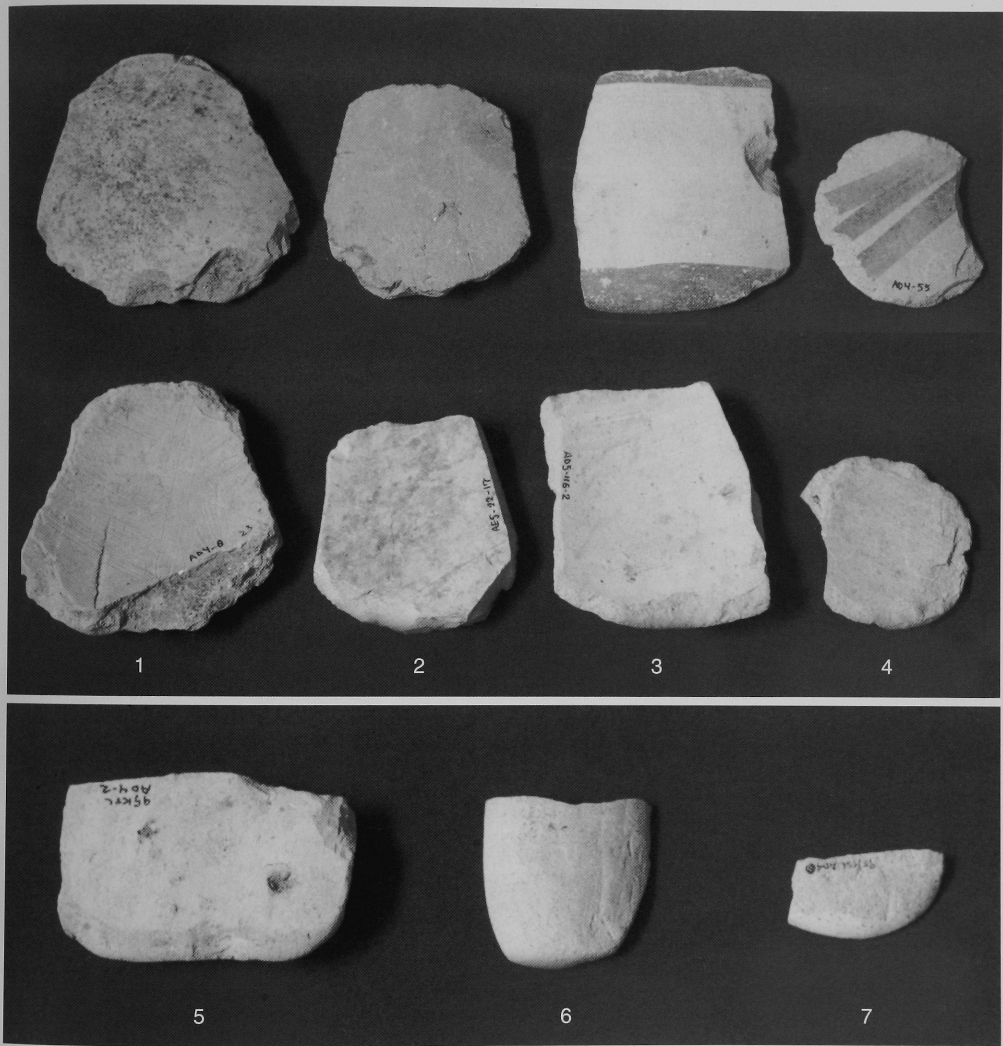
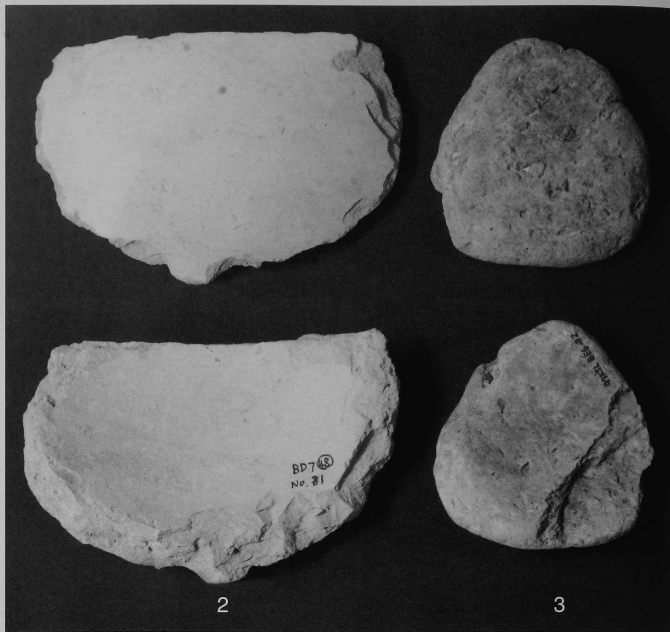
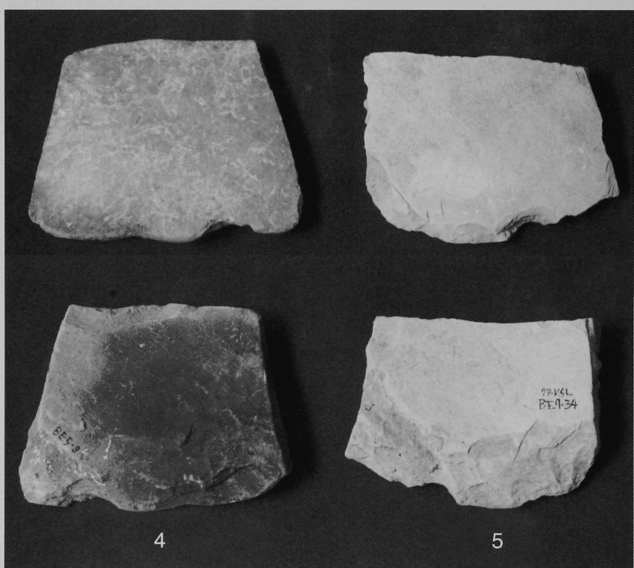
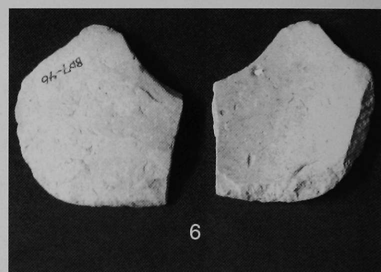


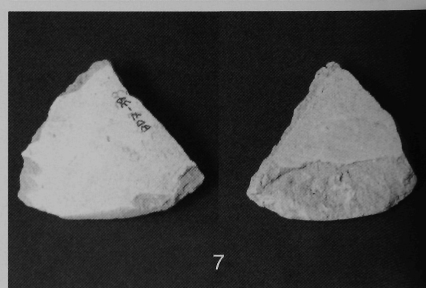
Plate 15.2 Chalcolithic clay scrapers from Tell Kosak Shamali, Sector A.

1. Clay scraper, Type 1b, potsherd, L: 9.6cm (cf. Fig. 15.3: 4).
2. Clay scraper, Type 1b, potsherd, L: 8.0cm (cf. Fig. 15.3: 2).
3. Clay scraper, Type 1b, potsherd, L: 9.3cm (cf. Fig. 15.3: 1).
4. Clay scraper, Type 1a, potsherd, L: 6.9cm (cf. Fig. 15.1: 1).
5. Clay scraper, Type 2c, potsherd, W: 8.0cm (cf. Fig. 15.7: 4).
6. Clay scraper, Type 2c, clay, L: 5.0+cm (cf. Fig. 15.7: 2).
7. Clay scraper, Type 2c, clay, W: 3.7+cm (cf. Fig. 15.7: 3).









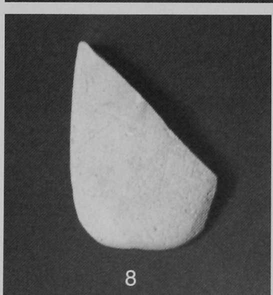
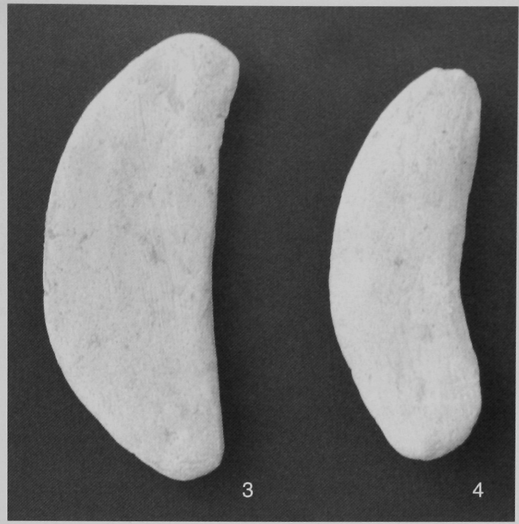


Plate 15.3 Chalcolithic clay scrapers from Tell Kosak Shamali, Sector B.

1. Clay scraper, Type 1a, potsherd, L: 8.8cm (cf. Fig. 15.2: 4).
2. Clay scraper, Type 1a, potsherd, W: 11.3cm (cf. Fig. 15.2: 3).
3. Clay scraper, Type 2c, potsherd, L: 7.6cm (cf. Fig. 15.7: 5).
4. Clay scraper, Type 1b, potsherd, L: 6.5cm (cf. Fig. 15.3: 5).
5. Clay scraper, Type 1b, potsherd, dull yellow orange surface, dull orange core, L: 5.5+cm, W: 7.6cm, T: 1.1cm (97KSL-BE7-34; Foundation of B609; Level 6 of Sector B).
6. Clay scraper, Type 1c, potsherd, L: 6.7cm (cf. Fig. 15.4: 3).
7. Clay scraper, Type 1c, potsherd, pale yellow surface, dull yellow core, L: 5.0cm, W: 5.9cm, T: 1.0cm (96KSL-BD7-39; Fill of B503; Level 4 of Sector B).
8. Clay scraper, Type 2c, potsherd, L: 6.2+cm (cf. Fig. 15.7: 6).

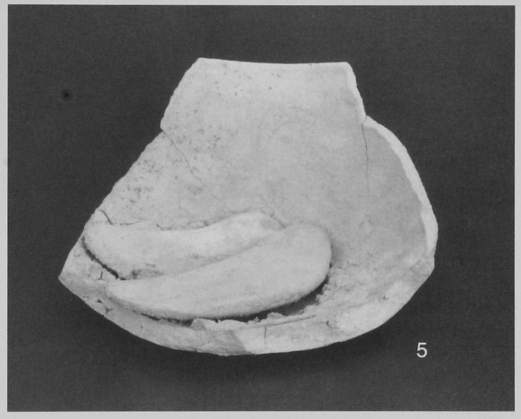
1 2



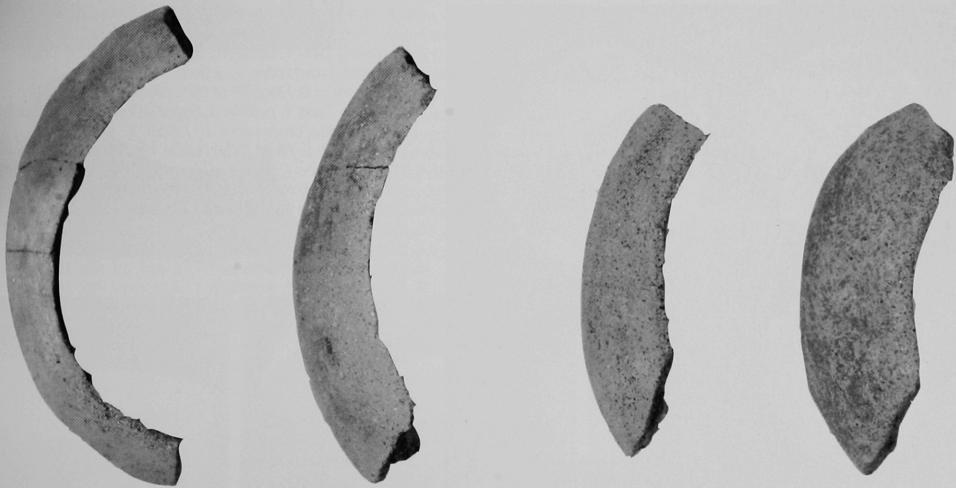
3 4

Plate 15.4 Chalcolithic clay scrapers of Types 2a and 2b from Tell Kosak Shamali.

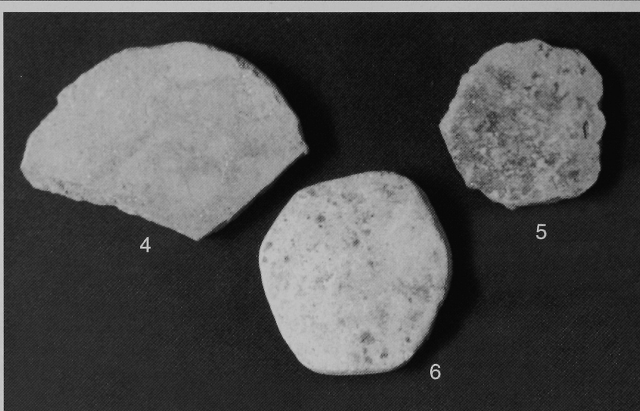
*1. Clay scraper, Type 2b, clay, D: 9.0*cm (cf. Fig. 15.6: 1).*
2. Clay scraper, Type 2a, potsherd, W: 9.7cm (cf. Fig. 15.5: 4).
3. Clay scraper, Type 2a, clay, W: 10.5cm (cf. Fig. 15.5: 2).
4. Clay scraper, Type 2a, clay, W: 9.1cm (cf. Fig. 15.5: 3).
5. Jar containing two Type 2a clay scrapers (nos. 3 and 4) inside, discovered from the passage of Rooms 10A01 to 10A02, Level 10 of Sector A (cf. Nishiaki et al. 2001: Pl. 3.8: 3).
*6. Clay scraper, Type 2b, clay, D: 9.0*cm (cf. Fig. 15.6: 6).*
*7. Clay scraper, Type 2b, clay, D: 10.6*cm (cf. Fig. 15.6: 4).*
8. Clay scraper, Type 2b, clay, W: 6.0+cm (cf. Fig. 15.6: 3).
9. Clay scraper, Type 2b, clay, W: 6.4+cm (cf. Fig. 15.6: 2).



5



6 7 8 9



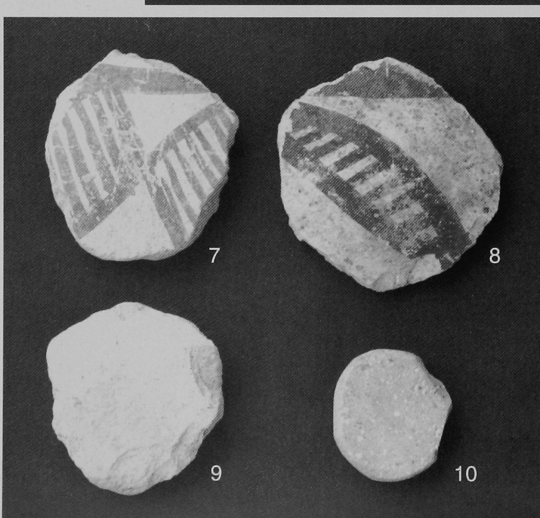
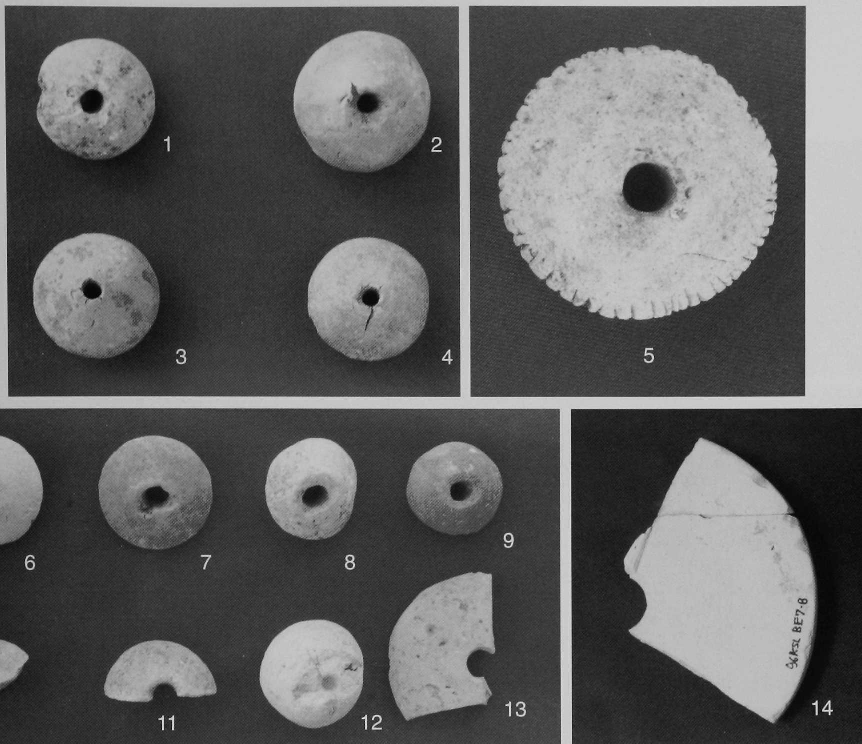


Plate 15.5 Chalcolithic clay disks from Tell Kosak Shamali.
1. Clay disk, Type 1, potsherd, L: 7.4cm (cf. Fig. 15.10: 4).
2. Clay disk, Type 1, potsherd, light yellow surface, bright yellowish brown core, L: 8.0cm, T: 1.5cm (96KSL-AD6-6; Floor/Fill of 201; Level 2 of Sector A).
3. Clay disk, Type 1, potsherd, bright yellowish brown surface, grayish yellow brown core, L: 7.5cm, T: 1.0cm (95KSL-AF6-5; Fill of 1308; Level 13 of Sector A).
4. Clay disk, Type 1, potsherd, orange, W: 6.2cm, T: 1.4cm (95KSL-AF6-4; Fill of 1306/08; Level 13 of Sector A).
5. Clay disk, Type 1, potsherd, L: 3.7cm (cf. Fig. 15.10: 5).
6. Clay disk, Type 2, potsherd, L: 4.3cm (cf. Fig. 15.10: 11).
7. Clay disk, Type 1, potsherd, L: 4.8cm (cf. Fig. 15.10: 8).
8. Clay disk, Type 1, potsherd, L: 5.4cm (cf. Fig. 15.10: 1).
9. Clay disk, Type 1, potsherd, L: 4.2cm (cf. Fig. 15.10: 2).
10. Clay disk, Type 2, potsherd, L: 3.0cm (cf. Fig. 15.10: 10).



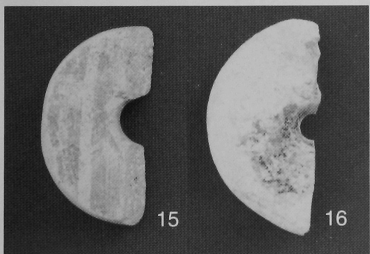
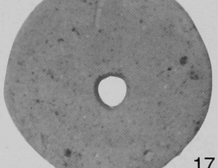


Plate 15.6 Chalcolithic spindle whorls, clay disks of Type 3, and clay figurines from Tell Kosak Shamali.

1. Spindle whorl, clay, D: 3.3cm (cf. Fig. 15.12: 15).
2. Spindle whorl, clay, D: 3.9cm (cf. Fig. 15.12: 6).
3. Spindle whorl, clay, D: 3.5cm (cf. Fig. 15.12: 12).
4. Spindle whorl, clay, D: 3.3cm (cf. Fig. 15.12: 13).
5. Spindle whorl, clay, nail incisions, D: 4.7cm (cf. Fig. 15.12: 4).
6. Spindle whorl, clay, D: 3.7cm (cf. Fig. 15.12: 8).
7. Spindle whorl, clay, D: 3.8cm (cf. Fig. 15.12: 9).
8. Spindle whorl, clay, D: 3.3cm (cf. Fig. 15.12: 10).
9. Spindle whorl, clay, D: 3.1cm (cf. Fig. 15.12: 16).
*10. Spindle whorl, clay, D: 3.9*cm (cf. Fig. 15.12: 2).*
11. Spindle whorl, clay, D: 3.7cm (cf. Fig. 15.12: 11).
12. Spindle whorl, clay, D: 3.4cm (cf. Fig. 15.12: 19).
*13. Clay disk, Type 3 (spindle whorl), potsherd, D: 6.0*cm (cf. Fig. 15.11: 3).*
*14. Clay disk, Type 3 (spindle whorl), potsherd, D: 12.2*cm (cf. Fig. 15.11: 8).*
15. Clay disk, Type 3 (spindle whorl), potsherd, D: 4.0cm (cf. Fig. 15.11: 4).
16. Spindle whorl, stone, D: 4.5cm (cf. Fig. 15.12: 7).
17. Clay disk, Type 3 (spindle whorl), potsherd, D: 5.3cm (cf. Fig. 15.11:1).
18. Clay figurine, zoomorphic, clay, L: 4.6+cm (cf. Fig. 15.14: 3).
19. Clay figurine, zoomorphic, clay, L: 4.8+cm (cf. Fig. 15.14: 5).
20. Clay figurine, boat-shaped, clay, L: 5.5+cm (cf. Fig. 15.14: 6).
21. Clay figurine, human being, probably squatting female, clay, L: 4.1+cm (cf. Fig. 15.14: 1).



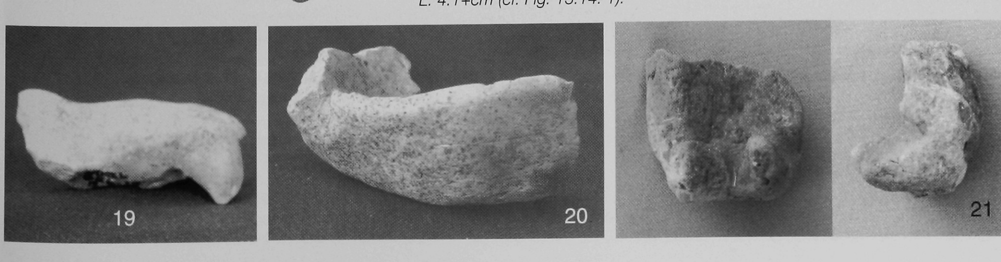


Plate 15.7 Chalcolithic miscellaneous objects of Group 1 from Tell Kosak Shamali.

1. Miscellaneous object, Group 1, shoe-shaped, clay, W: 10.2+cm (cf. Fig. 15.14: 9).
2. Pendant, Type 2, limestone, L: 6.4cm (cf. Fig. 15.17: 6).
3. Miscellaneous object, Group 1, pestle-like, clay, L: 12.3+cm (cf. Fig. 15.14: 7).
4. Miscellaneous object, Group 1, fragment of conical object, clay, L: 5.8+cm, W: 5.0cm (96KSL-BE7-19; Fill of B505; Level 5 of Sector B).
5. Miscellaneous object, Group 1, curved board, clay, L: 7.0+cm, W: 5.0cm (97KSL-BE7-38; Fill of B701; Level 7 of Sector B).
6. Miscellaneous object, Group 1, wavy plaques, clay, dull orange, H: 1.7-2.6cm, T: 0.6-1.5cm (95KSL-BE7-6; Foundation; Level 3 of Sector B).

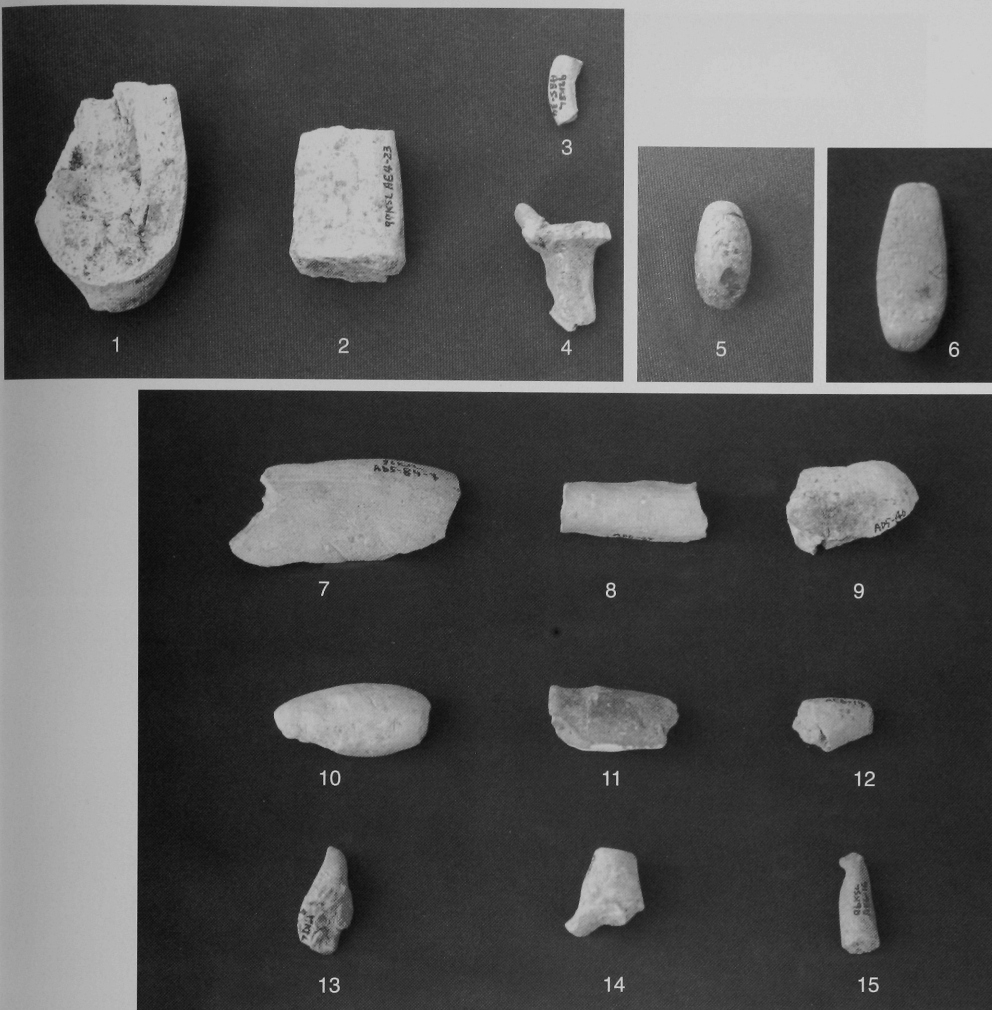


Plate 15.8 Chalcolithic miscellaneous objects of Groups 1 and 2 from Tell Kosak Shamali.

1. Miscellaneous object, Group 1, hollowed cone, clay, L: 4.5+cm (cf. Fig. 15.14: 8).
2. Miscellaneous object, Group 2, cone, clay, L: 3.6+cm (cf. Fig. 15.15: 2).
3. Miscellaneous object, Group 2, finger ring?, clay, L: 1.7+cm (cf. Fig. 15.15: 11).
4. Miscellaneous object, Group 2, cone, clay, L: 3.1+cm (cf. Fig. 15.15: 5).
5. Miscellaneous object, Group 2, token?, clay, L: 2.7cm (cf. Fig. 15.15: 9).
6. Miscellaneous object, Group 2, clay, L: 4.4cm (cf. Fig. 15.15: 7).
7. Miscellaneous object, Group 2, fragment, clay, dull orange, L: 6.0+cm, W: 2.8+cm, T: 1.2cm (96KSL-AD5-84; Floor of 901; Level 9 of Sector A).
8. Miscellaneous object, Group 2, fragment, clay, dull orange, L: 3.8+cm, W: 1.5+cm (96KSL-AD6-25; Fill; Level 8 of Sector A).
9. Miscellaneous object, Group 2, fragment, clay, dull orange, L: 3.5+cm, W: 2.1+cm (95KSL-AD5-46; Floor of 402; Level 4 of Sector A).
10. Miscellaneous object, Group 2, clay lump, clay, dull yellow orange, L: 4.1cm, W: 2.0cm (95KSL-AD5-49; Floor of 402; Level 4 of Sector A).
11 Miscellaneous object, Group 2, cone, clay, dark grayish yellow, L: 3.4+cm, W: 1.8+cm (96KSL-AD6-34; Fill; Level 10 of Sector A).
12. Miscellaneous object, Group 2, cone, clay, dull yellow orange, L: 2.1+cm, W: 1.5+cm (96KSL-AE6-14; Fill of 10A03; Level 10 of Sector A).
13. Miscellaneous object, Group 2, cone, clay, L: 2.9+cm (cf. Fig. 15.15: 3).
14. Miscellaneous object, Group 2, cone, clay, L: 2.4+cm (cf. Fig. 15.15: 4).
15. Miscellaneous object, Group 2, cone, clay, dull yellow, L: 2.7+cm, W: 1.0cm (96KSL-AE6-16; Floor of 10A03; Level 10 of Sector A).

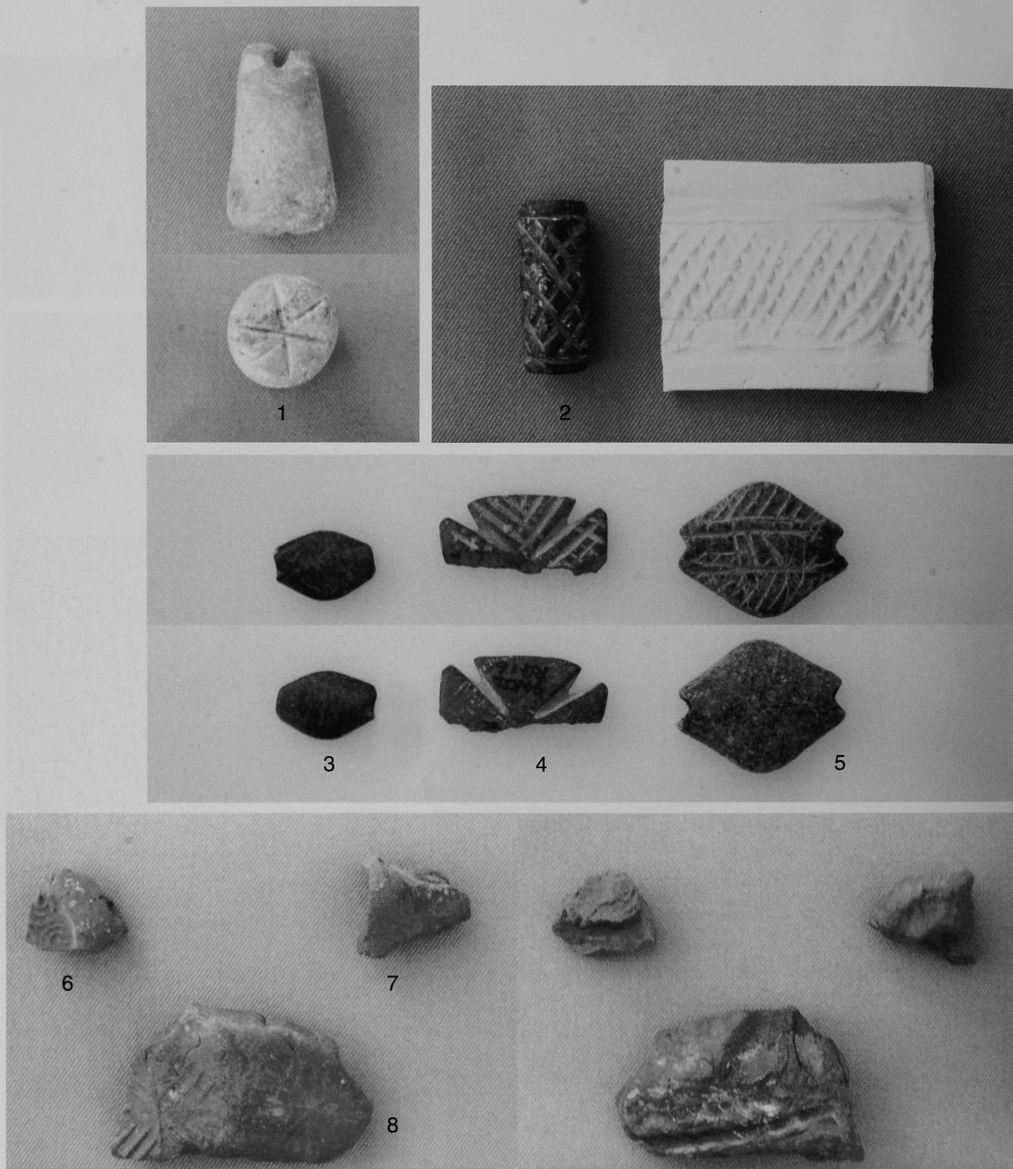


Plate 15.9 Chalcolithic seals and sealings from Tell Kosak Shamali.
1. Stamp seal, stone, L: 3.3cm (cf. Fig. 15.16: 1).
2. Cylinder seal, stone, L: 3.0cm (cf. Fig. 15.16: 8).
3. Bead, Type 4, stone, L: 1.9cm (cf. Fig. 15.16: 14).
4. Stamp seal, stone, L: 3.0cm (cf. Fig. 15.16: 10).
5. Stamp seal, stone, L: 3.0cm (cf. Fig. 15.16: 9).
6. Sealing, clay, L: 1.5+cm (cf. Fig. 15.16: 4).
7. Sealing, clay, W: 2.1+cm (cf. Fig. 15.16: 7).
8. Sealing, clay, W: 4.6+cm (cf. Fig. 15.16: 11).

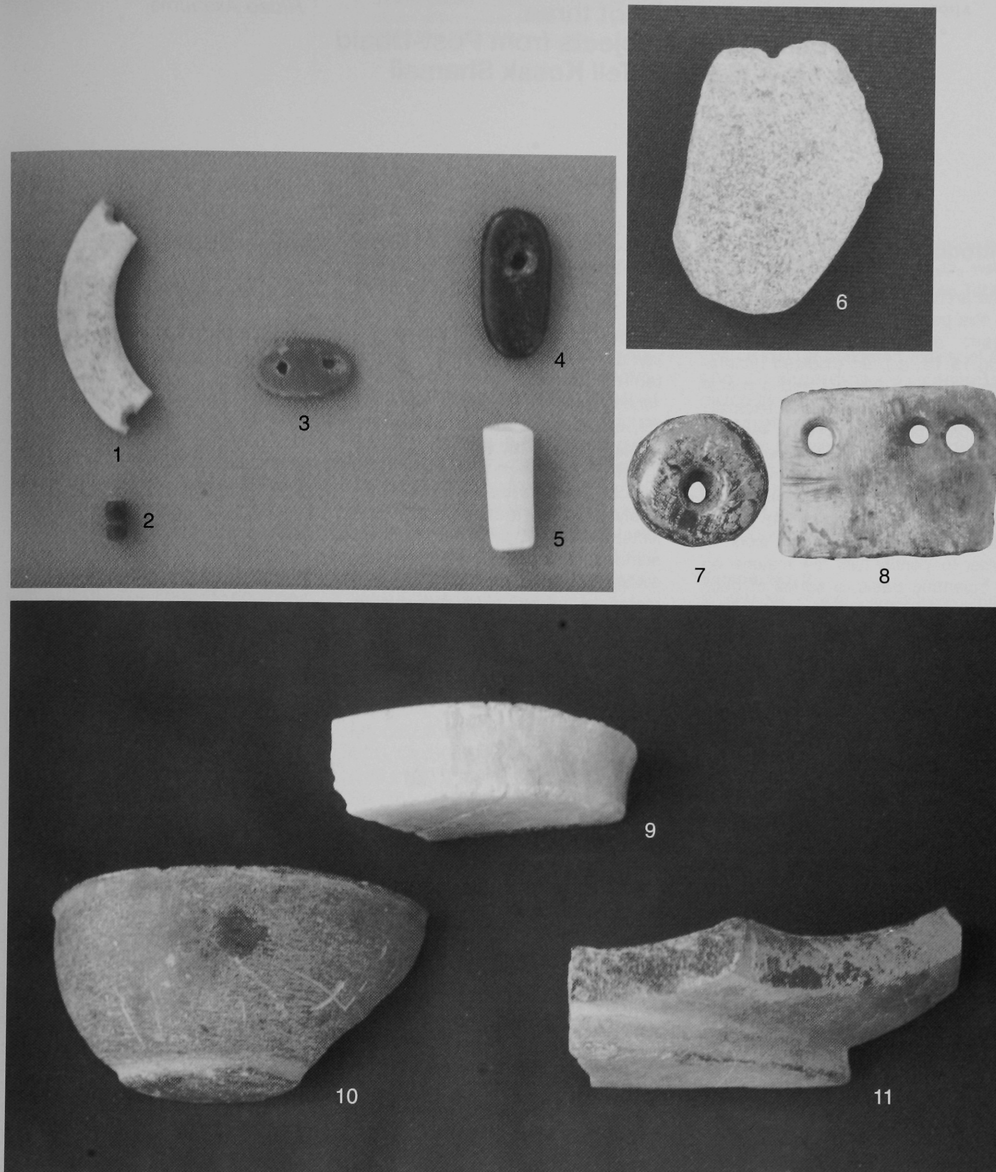


Plate 15.10 Chalcolithic beads/pendants and stone vessels from Tell Kosak Shamali.

*1. Bead, Type 3, stone, D: 5.0*cm (cf. Fig. 15.17: 9).*
2. Bead, Type 4, unidentified material, L: 0.6cm (cf. Fig. 15.17: 13).
3. Bead, Type 3, flint flake, W: 1.5cm (cf. Fig. 15.17: 10).
4. Pendant, Type 2, stone, L: 2.3cm (cf. Fig. 15.17: 5).
5. Bead, Type 4, shell ?, L: 1.9cm (cf. Fig. 15.17: 12).
6. Pendant, Type 2, basalt, reused fragment of stone vessel, L: 4.0+cm (cf. Fig. 15.17: 4).
7. Bead, Type 1, stone, D: 1.8cm (cf. Fig. 15.17: 1).
8. Bead, Type 3, bone, with three holes, W: 2.7cm (cf. Fig. 15.17: 8).
*9. Stone vessel, stone, D: 9.2*cm (cf. Fig. 15.17: 15).*
*10. Stone vessel, basalt, D: 8.3*cm (cf. Fig. 15.17: 17).*
*11. Stone vessel, basalt, D: 11.2*cm (at base) (cf. Fig. 15.17: 18).*

APPENDIX

Analytical results of three archaeological objects from Post-Ubaid to Uruk levels of Tell Kosak Shamali

Hideo Akanuma

Introduction

The archaeological objects reported in this paper consist of a small fragment of polished stone slab (Fig.15.18: a_1), an oxidized mineral lump (Fig.15.20: a_1) and a metal fragment (Fig.15.22: a_1), all excavated from Post-Ubaid to Uruk levels of Sector B at Tell Kosak Shamali. While these can be generally referred to as small finds, their poor preservation prevented the excavators from proper identification during the field work. In order to identify their raw material on a scientific basis, a series of geochemical and archaeometallurgical analyses was conducted at the author's laboratory. The analysis revealed that the objects are composed of chalcedony or a mixture of chalcedony and opal, a small lump of hematite, and a fragment made of copper, respectively.

Based on the distribution of mineral resources found in and around the site, and the persistent presence of obsidian imported from Anatolian sources (Chapter 12, this volume), we can assume that the distribution system of raw materials that enabled various tools to be used for everyday life, or of manufactured objects had already been established. Through further examination of the archaeological excavations and scientific analysis of the archaeological objects, we can obtain a better understanding of the actual conditions of circulation and utilization of both raw materials and manufactured objects during the end of the 5th to the late 4th millennium BC at Tell Kosak Shamali. In this paper, the analytical results of those three archaeological objects are interpreted.

Archaeological objects

The three archaeological objects (Nos. 1 to 3) subjected to scientific analysis were excavated between 1995 and 1996 by the University of Tokyo team. Table 15.2 lists the archaeological provenience data for each archaeological object (cf. Koizumi and Sudo 2001).

Samples from the objects were taken in the Iwate Prefectural Museum laboratory by the author in 1999.

Experimental

Sample preparation

Samples weighing approximately one hundred milligrams were taken from the three archaeological objects by using a portable drill equipped with a diamond-coated wheel. Close attention was paid to avoiding damage to their intact forms.

Each sample was divided into two parts: the larger part was used for structural analysis. The smaller part of sample No. 2 was subjected to both X-ray diffraction (XRD, powder method) and chemical analysis. The smaller part of sample No. 1 was subjected only to XRD, and that of sample No. 3 only to chemical analysis. Samples used for chemical analysis or XRD had their external soil layers removed with a diamond coated wheel, to avoid contamination from burial deposits, and were then washed in an ultrasonic bath with methyl alcohol and acetone, rinsed

Table 15.2 Examined archaeological objects from Sector B, Tell Kosak Shamali.

No.	Object	Description of Excavation			
		Year	Context	Level	Period
1	fragment	1995	BD7-7	2	Uruk
2	lump	1996	BD7-20	3	Uruk
3	fragment	1996	BD7-46	5	Post-Ubaid

Table 15.3 Analytical results of samples No. 1 and No. 2 by EPMA.

No.	L*	chemical components (mass %)											total
		Na_2O	K_2O	CaO	Al_2O_3	MgO	FeO	MnO	SiO_2	P_2O_5	TiO_2	V_2O_5	
1	Gl	0.43	4.36	0.17	5.83	0.31	0.68	<0.01	82.1	<0.01	0.15	<0.01	94.03
2	Q	<0.01	<0.01	<0.01	<0.01	<0.01	1.29	0.03	96.9	<0.01	0.01	<0.01	98.23

* L corresponds to the locations in Figs. 15.18 and 15.20.

1) A phenomenon characteristic of the inter diffusion of two soluble salts through a gel (Carl and Amstutz 1958; Muller et al. 1982).

with acetone, and dried at 130°C for 2 hours. The dried pieces of samples Nos. 1-3 were ground to fine powders using agate mortars, and then subjected to the previously mentioned analysis.

Analytical method
Samples to be used for observation of microstructure were sectioned, mounted with epoxy resin, ground with emery paper and then polished using diamond paste. The prepared samples were then examined under an optical microscope. Electron microprobe analyses were performed with a JEOL JXA 8800-R, equipped with three wavelength-dispersive X-ray spectrometers, in order to identify the mineral phase compositions of the samples. XRD was recorded by a JEOL JDX-3532 diffractometer, with Cu-Kα source in an angular range of 5-80° 2θ.

Inductively coupled plasma optical emission spectroscopy (ICP-OES), using a PERKIN ELMER Optima 4300DU, was employed for chemical analysis of twelve elements of sample No. 2 and six elements of sample No. 3 (see Tables 15.4 and 15.5). Forty milligrams of powdered sample No. 2 was weighed in a TMF vessel; 1.56ml of HCl (30wt%), 0.4ml HNO_3 (65wt%), 3.3ml of HF (40wt%), and 3ml of twice-distilled water was then added. The closed vessel was put into a PERKIN ELMER MUTIWAVE B30MCO3A microwave oven, operating at a frequency of 2450 MHz, and a three stage program was started (first stage: 100-400W, time 5min; second stage: 600W, 5min; third stage: 1000W, 15min). After cooling, 2.8ml of boric acid (4wt%) was added to the sample, and a second cycle was carried out (1000W, 10min). After cooling again, the solution was transferred into polypropylene bottles and made up to a total volume of 26ml with twice-distilled water. Thirty milligrams of dried sample No. 3 (composed of both metal and metal corrosion) was dissolved in 0.46ml of HNO_3 (65wt%) at room temperature in a small sealed Teflon vessel overnight. 3.7ml of HCl (30wt%) was added to the sample solution, and it was then transferred into polypropylene bottles and made into 26ml total volume solutions with twice-distilled water. All the reagents used were Merk Suprapur chemicals.

The elements determined, and the analytical lines selected (nm), were as follows: Fe (239.562), Cu (327.393), Ni (231.604), Co (228.616), P (213,617), Mn (257,610), Ti (334.940), Si (251.611), Ca (396.847), Al (396.153), Mg (285.213), V (309.310), Sn (235.485), Pb (261.418), As (228.812), Sb (231.146). Incident power used was 1.3Kw. Plasma argon gas flow rate was 15 l/min, auxiliary plasma argon gas flow rate was 0.2 l/min, and aerosol carrier gas flow rate was 0.8 l/min.

Analytical Results

Sample No. 1
The greater part of the macrostructure of sample No.1 (Fig. 15.18: a_1) was in an amorphous state (Fig. 15.18: b_1). Fig. 15.18: c_1 and c_2 show an electron probe microanalyzer (EPMA) compositional image (COMP) of the marked areas in Fig. 15.18: b_1 and c_1, respectively, where finely spaced, concentric Liesegang rings[1] with a large number of fine minute crystals (Qz) were observed. The Liesegang rings were mainly composed of SiO_2, in addition to 4.36% K_2O and 5.83% Al_2O_3 was also present in those rings (see Table 15.3).

The crystal Qz consisted mainly of Si and O according to elemental distribution analysis of EPMA. XRD-pattern showed quartz (Qz) was contained in that sample (Fig. 15.19). On the basis of these analytical results, sample No. 1 is believed to be a piece of chalcedony or a mixture of chalcedony and opal.

Sample No. 2
Sample No. 2 was a small lump, 2cm in diameter, weighing approximately 12g with a red brown crust (Fig. 15.20: a_1). Gray areas were distributed over the entire macrostructure and many cavities were also found in the structure (Fig. 15.20: b_1). The EPMA compositional image (marked location in Fig. 15.20: b_1) consisted almost entirely of iron oxide grains and the dark areas (Q), composed mainly of SiO_2, were also present in that image (Fig. 15.20: c_1 and c_2; Table 15.3).

Table 15.4 presents the data by ICP-OES analysis. The T.Fe content is 60.37% and the Si content is 2.02%. The other ten element contents are less than 0.3%, indicating that sample No. 2 consists primarily of iron oxide.

XRD analysis indicates that hematite (α-Fe_2O_3) is the major constituent of sample No. 2 and a small amount of goethite (α-FeOOH) is also contained in that sample (Fig. 15.21). According to these analytical results, sample No. 2 is identified as a lump of hematite.

Sample No. 3
The surface of sample No. 3 (Fig. 15.22: a_1) was covered in a green layer of corrosion, but metallic areas remain in the internal portions (Fig. 15.22: b_1). In the EPMA compositional image (the marked "R_1" in Fig. 15.22: b_1), there are a lot of particles whose

***Table 15.4 Chemical composition of sample No. 2 by ICP-OES** (mass %).*

T.Fe	Cu	Ni	Co	Mn	P	Ti	Si	Ca	Al	Mg	V
60.37	0.009	0.058	0.009	0.007	0.11	0.003	2.02	0.265	0.138	0.256	0.098

2) A small amount of O, Cl, and Si was estimated, derived from the presence of corrosion.

main component was Cu, or else contained a small amount of O, Cl, and Si (Fig. 15.22: c_1 and c_2)[2]. The dark gray inclusions (Gs) consisted of glass, mainly composed of CaO, Al_2O_3, and SiO_2 (Fig. 15.22: d_1 and d_2), which is estimated to have remained in the metal during the process of copper refining.

Sample No. 3 contains 67.4% Cu and the concentrations of five other elements (Sn, Pb, As, Sb, and Fe) are below 0.1% (see Table 15.5). These results indicate that sample No. 3 is a fragment made primarily of copper.

Discussion

Sample No. 1 is believed to be a piece of chalcedony or a mixture of chalcedony and opal, sample No. 2 is believed to be a lump of hematite, and sample No. 3 is believed to be a fragment of copper, according to the above-mentioned analytical results. The source of sample No. 1, chalcedony, is yet unknown because the geomorphological survey in the vicinity of Tell Kosak Shamali did not incorporate identifying specific outcrops or availability of this mineral (Oguchi 2001). On the other hand, it is fairly certain that there are neither copper nor iron ore deposits at Tell Kosak Shamali or near the site. Therefore, samples Nos. 2 and 3 were most likely brought to Tell Kosak Shamali from other regions by human efforts, unless brought by the massive Euphrates river system.

Sample No. 2 was derived from Level 3 of Sector B, the Middle Uruk period. The pottery assemblages of this period contained a small number of painted vessels, whose main color was red or brown (Koizumi and Sudo 2001). There is a possibility that hematite powders were used as raw material of those colors. The use of hematite for pottery decoration apparently had a long tradition at Tell Kosak Shamali starting from the earlier Ubaid period, for lumps of hematite, together with manganeze lumps, were recovered from the Early Northern Ubaid levels of Sector A as well (Chapter 13, this volume). This matter should be clarified by further research, however, including ascertaining the composition of the pigments used in those vessels.

Regarding the acquisition of sample No. 3, we can surmise that four possibilities exit. First, that the sample was produced at the site by smelting copper ore brought from other regions. Second, that the sample was made using raw copper material supplied from other regions. Third, that the sample was brought as a completed product to the site. Finally, that the utilization of scrap metal in order to make new artifacts was carried out at the site. Considering the fact that archaeological objects relating with copper smelting or refining activities (furnaces, tuyeres, slag, and so on) were not found at the site, it is probable that sample No. 3 was brought there as a completed product.

On the basis of the analytical results of these archaeological objects from Tell Kosak Shamali, it seems that the various tools necessary for everyday life, were produced by using raw materials obtained through trade with other regions, or were supplied from other regions. Further research, which includes the hypothesis that manufacturing activities depended on an interchangeable economy, will provide us with a better understanding of the actual condition of everyday life at Tell Kosak Shamali during the Late Chalcolithic period.

Table 15.5 Chemical composition of sample No. 3 by ICP-OES *(mass %).*

Cu	Sn	Pb	As	Sb	Fe
67.4	<0.005	<0.005	0.10	<0.005	0.025

Acknowledgements

I am very grateful to Professor Yoshihiro Nishiaki, the University of Tokyo Museum, for giving me this research opportunity. I also appreciate Dr. Tatsundo Koizumi and Dr. Nobutaka Tsuchiya for their helpful comments.

References

Carl, J.D. and G.C. Amstutz (1958) Three-dimensional liesegang rings by diffusion in a colloidal matrix, and their significance for the interpretation of geological phenomena. *Geological Society of America Bulletin* 69: 1467-1468.

Koizumi, T. and H. Sudo (2001) The stratigraphy and architectures of Sector B of Tell Kosak Shamali. In: *Tell Kosak Shamali: The Archaeological Investigations on the Upper Euphrates, Syria. Vol. I: Chalcolithic Architecture and the Earlier Prehistoric Remains*, edited by Y. Nishiaki and T. Matsutani, pp. 115-152. UMUT Monograph 1. Tokyo: The University Museum, The University of Tokyo / Oxford: Oxbow Books.

Muller, S.C., S. Kai, and J. Ross (1982) Curiosities in periodic precipitation patterns. *Science* 216: 635-637.

Oguchi, T. (2001) Geomorphological and environmental settings of Tell Kosak Shamali, Syria. In: *Tell Kosak Shamali: The Archaeological Investigations on the Upper Euphrates, Syria. Vol. I: Chalcolithic Architecture and the Earlier Prehistoric Remains*, edited by Y. Nishiaki and T. Matsutani, pp. 19-38. UMUT Monograph 1. Tokyo: The University Museum, The University of Tokyo / Oxford: Oxbow Books.

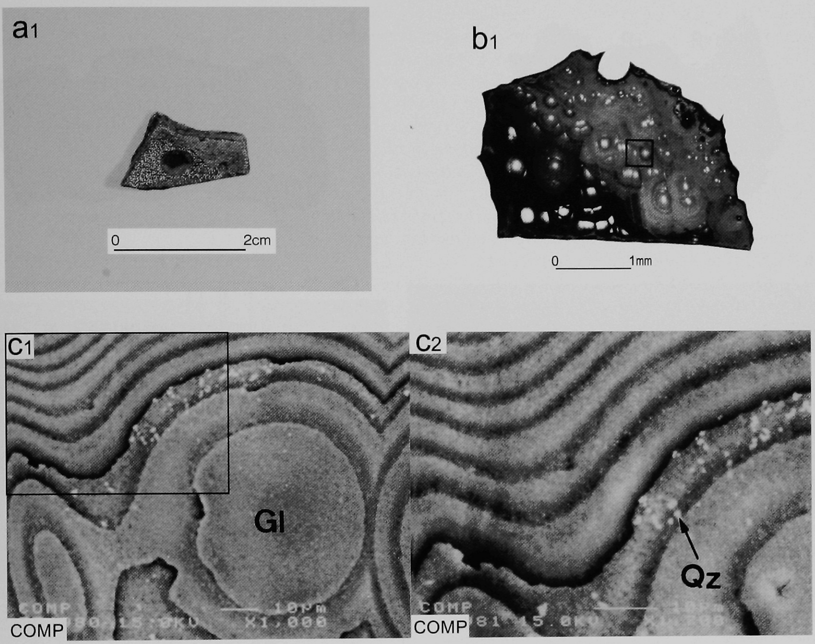


Fig. 15.18 External appearance of No. 1 and the results of structural analysis.
a_1: External appearance. The sample was extracted from the marked location in a_1.
b_1: Macrostructure. c_1 and c_2: Compositional images by EPMA. The analytical locations of c_1 and c_2 by EPMA are shown in b_1 and c_1, respectively.

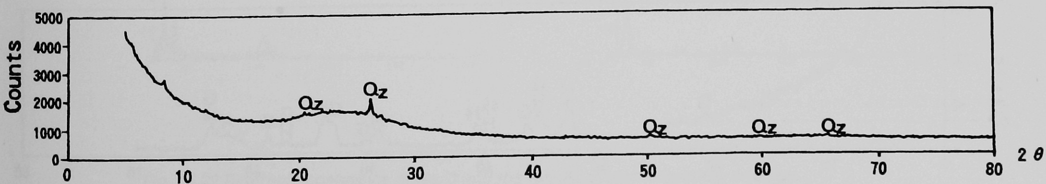


Fig. 15.19 XRD pattern of No. 1 *(Qz: quartz).*

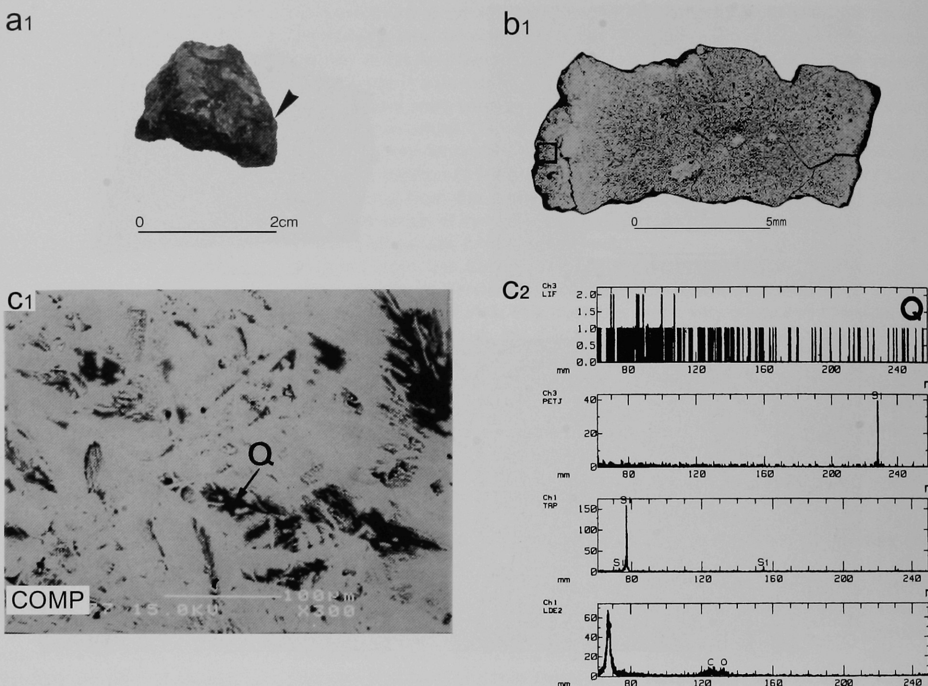


Fig. 15.20 External appearance of No. 2 and the results of the metallographic analysis.
a_1: External appearance. The sample was extracted from the marked location in a_1.
b_1: Macrostructure. c_1: Compositional image by EPMA.
c_2: The result of the qualitative analysis of the Q area in c_1.

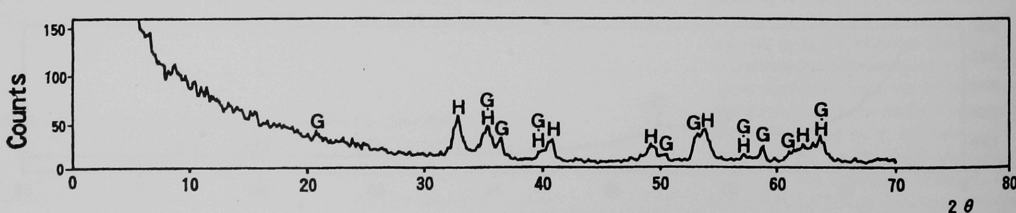


Fig. 15.21 XRD pattern of No. 2 *(H: hematite, G: goethite)*.

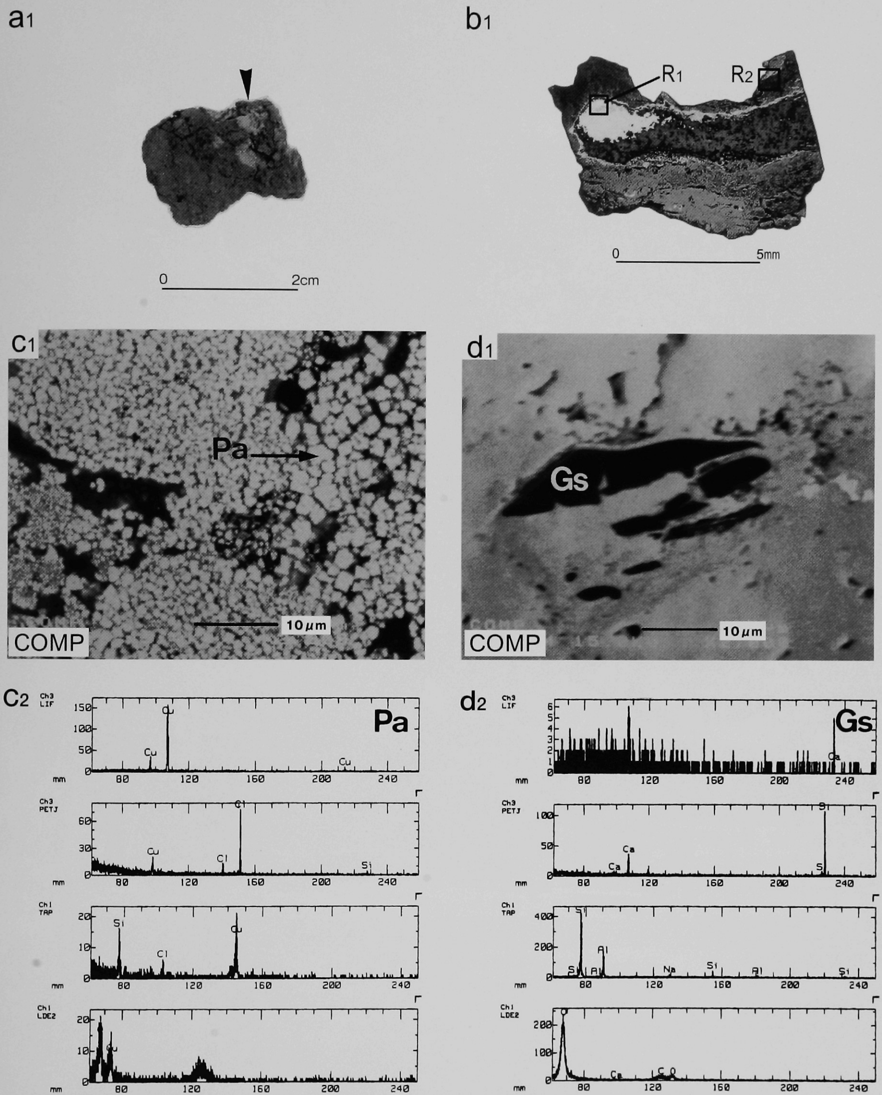


Fig. 15.22 External appearance of No. 3 and the results of metallographic analysis.
a_1: External appearance. The sample was extracted from the marked location in a_1.
b_1: Macrostructure. c_1 and d_1: Compositional images by EPMA of R_1 in b_1 and of R_2 in b_1, respectively.
c_2 and d_2: The results of the qualitative analysis by EPMA in the Pa area in c_1 and in the Gs area in d_1, respectively.

CHAPTER 16

Chalcolithic carbonised cereals from Ubaid burnt storage structures at Kosak Shamali

George Willcox

16.1 Introduction

Archaeobotanical samples collected manually during the excavation at Kosak Shamali were sent to me for analysis. I would like to thank Prof. Nishiaki for allowing me to work on the samples. Flotation was not carried out on the site. Four of the samples from Kosak Shamali Sector A, Level 10, contained large quantities of carbonised cereals. They came from what appear to be storage structures which had been destroyed by fire (Nishiaki *et al.* 2001). These structures were small square rooms approximately 1.8 by 1.8 metres. Two other samples containing carbonised wood from the same sector (10A03) were also analysed and these are treated separately. Four ash samples from sediments associated with pottery kilns were also examined. Finally a sample containing nineteen pea seeds (*Pisum sativum*) was also examined.

16.2 Description of samples

(see also Table 16.1)

Sample 1 was a sub-sample consisting of about 1.2 litres of pure grain which contained a mixture of emmer and einkorn (see Figs. 16.1 - 16.3). This grain was probably stored in the hulled state prior to threshing as indicated by the abundant presence of spikelet bases and glume fragments. The two species appear to be present in approximately equal proportions. The einkorn is of particular interest because it represents a domestic form of the two-seeded variety. Two-seeded einkorn is characterised by a flat ventral surface, which is produced be-

Table 16.1 Carbonised plant remains from Kosak Shamali.

Sample number	1	2	3	4	5	6	7
StoStr = storage structure	StoStr	StoStr	StoStr	StoStr			
Context	AE5-18	AE6-17	AE6-20	AE6-33	AD5-99	BD7-27	BE6-18
Date	970926	960903	971008	971025	960828	950908	960905
Level*	A-10	A-10	A-10	A-10	A-10	B-5	B-6
Feature	10A05	10A04	10A24	10A03	10A02	B501	B601
Volume (ml)	1200	900	800	2000			
emmer *(Triticum dicoccum)* grains	>1000	>1000					
spikelet forks	p	p					
einkorn *(Triticum* sp.*)* grains, 2 seeded	>1000	>1000					
spikelet forks	p	p					
awns, glume fragments	p	p				p	p
barley *(Hordeum sativum)*			>1000	>1000			
lentil *(Lens culinaris)*	1						
pea *(Pisum sativum)*					19		
flax *(Linum usitatissmum)*				1			

*A = Sector A; B = Sector B

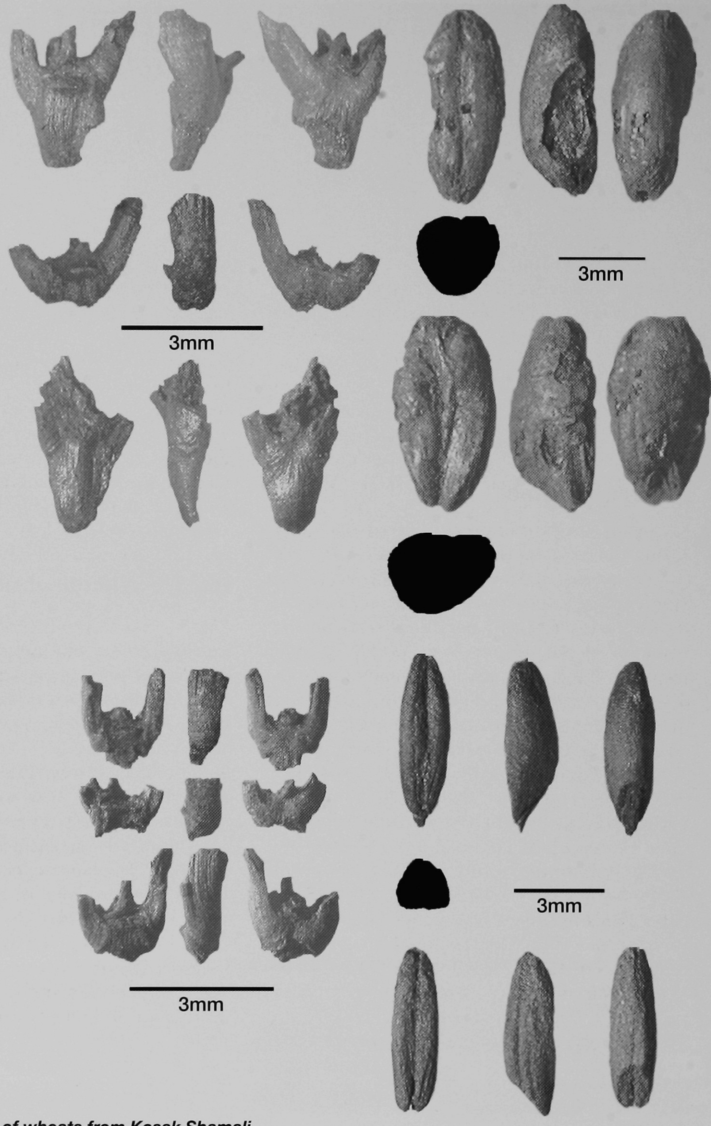


Fig. 16.1 Digital images of wheats from Kosak Shamali.
Above left, spikelet bases of emmer; above right, grains of emmer. Below left, spikelet bases of einkorn; below right, grains characteristic of two-seeded einkorn.

cause the two grains abut in the ventral plain. The measurements of both taxa are given in Figs. 16.2 and 16.3. Grains resembling those of the single-seeded form with a convex ventral face were extremely rare. The abscission scare surface of the spikelet forks associated with the two-seeded einkorn showed clearly that the rachis was semisolid as in domestic einkorn. The majority of emmer grains were easily distinguished from the einkorn on the basis of their morphology. However the spikelet bases were more difficult to distinguish. Examples which were clearly identifiable are given in Fig. 16.1.

Domesticated two-seeded einkorn is little known archaeobotanically and to my knowledge does not exist today in the Near East. It was first identified in the Near East by W. van Zeist and Waterbolk-van Rooijen (1996) from the late Neolithic settlement at Tell Sabi Abyad situated about 100kms north-east of Kosak Shamali, and it would appear that these two finds represent the same cultivar, which appears to be characteristic of these two sites for this period in northern Syria. It is perhaps significant that two-seeded wild einkorn was found on Epipalaeolithic sites in the area at Mureybet and at Abu Hureyra, and for the PPNA and early PPNB small quantities were found at Jerf el-Ahmar and at Dja'de (Willcox 1999) where barley was dominant. Two-seeded wild einkorn, *Triticum boeoticum thaoudar*, occurs today along the Turkish/Syrian border (Valkoun *et al.* 1998). Farther north, emmer and single-seeded einkorn was found at early PPNB Nevalı Çori. On the Euphrates not far from Kosak Shamali, for the middle PPNB, emmer and naked wheat were found at the site of Halula. Bronze age sites in the area have produced mainly emmer and some naked wheat. Thus the domestic two-seeded einkorn found at Kosak Shamali and Tell Sabi Abyad appears to represents a local isolated cultivar which may have developed from local wild populations of *Triticum boeoticum thaoudar* (as already mentioned by van Zeist and Waterbolk-van Rooijen 1996: 527). These populations may have occurred as weeds in the fields of late Neolithic farmers. Two-grained einkorn continued to be used during the Chalcolithic as we have seen at Kosak Shamali, however it did not apparently survive into the Bronze Age, perhaps due to the introduction of irrigation on sites in the Euphrates valley. A single seed of lentil was also recovered from sample 1.

Sample 2 (see Table 16.1) consisted of about 0.9 litres of pure grain and contained essentially the same wheats however the kernels were less well developed and perhaps more affected by the conditions and process of charring. Here too, the presence of spikelet forks, glumes and awns strongly suggest that the crops were stored together and in the hulled state. Like sample 1 this was also a sub-sample taken from a layer of carbonised grain.

Samples 3 and 4 (see Table 16.1) were made up of about 2.8 litres of hulled barley with no chaff remains, which indicates that they were threshed prior to storage. One flax seed (*Linum usitatissmim*) was also found in sample 4.

Samples 6 and 7 (see Table 16.1) were ash samples from kilns. These contained fragments of glumes, stems and awns of cereals. This indicates that chaff and straw were used as fuel in the kilns. In contrast, two other samples, also from kilns but from an earlier period and not shown in Table 16.1, did not contain chaff or any other identifiable carbonised plant remains. The reason for this difference could be due to different factors such as kiln temperature, availability and type of combustible used for the firing.

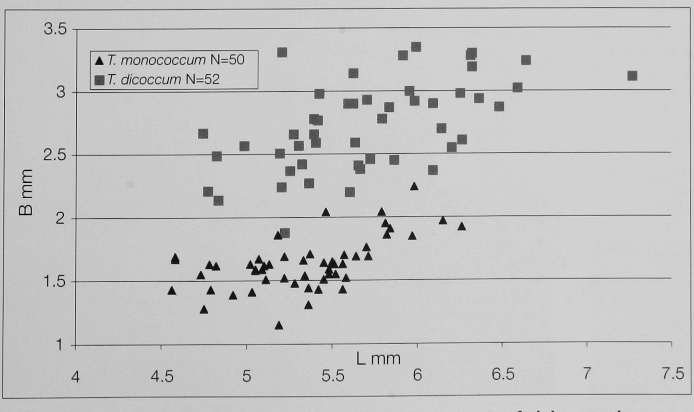


Fig.16.2 Scatter diagram giving length/breadth measurements of einkorn and emmer.

16.3 Conclusions

The finds from Kosak Shamali indicate that two species of wheat were stored together and may have been cultivated as part of the same crop. One of these wheats is a rare and little known form of domestic einkorn which is two-seeded, and appears to be evidence of a local and independent domestication event during the late Neolithic. The resulting cultivar continued to be used during the Chalcolithic period but from present evidence did not survive into the Bronze Age. If this is the case, then it appears that crop plants in this area were biologically isolated from other areas at this time. All four samples (1 to 4) which contained large quantities of pure grain represent sub-samples taken from the residue of stored grain which had been burnt. No weed seeds were recovered from the samples indicating that these crops were cleaned prior to storage.

The size and number of storage structures would appear to indicate that cereals made up an important part of the local plant economy. These conclusions are for the moment based on a small number of samples and so remain somewhat hypothetical and would be more secure if confirmed by comparing the results of analyses from other sites of the same periods in this region.

References

Nishiaki, Y., M. Tao, S. Kadowaki, M. Abe and H. Tano (2001) Excavations in Sector A of Tell Kosak Shamali: The stratigraphy and architectures. In: *Tell Kosak Shamali: The Archaeological Investigations on the Upper Euphrates, Syria. Vol. I: Chalcolithic Architecture and the Earlier Prehistoric Remains*, edited by Y. Nishiaki and T. Matsutani, pp.49-113. UMUT Monograph 1. Tokyo: The University Museum, The University of Tokyo / Oxford: Oxbow Books.

van Zeist, W. and W. Waterbolk-van Rooijen (1996) Cultivated and wild plants. In: *Tell Sabi Abyad: the Later Neolithic Settlement,* edited by P.M.M.G. Akkermans, pp. 521-550. Istanbul: Nederlands Historisch-Achaeologisch Instituut te Istanbul.

Valkoun, J., G. Waines and J. Konopka (1998) Current geographical distribution and habitat of wild wheats and barley. In: *The Origins of Agriculture and Crop Domestication*, edited by A. Damania, J. Valkoun, G. Willcox and C. Qualet, pp. 293-299. Aleppo: ICARDA.

Willcox, G. (1999) Agrarian change and the beginnings of cultivation in the Near East: Evidence from wild progenitors, experimental cultivation and archaeobotanical data. In: *Prehistory of Food,* edited by C. Gosden and J. Hather, pp. 479-500. London: Routledge.

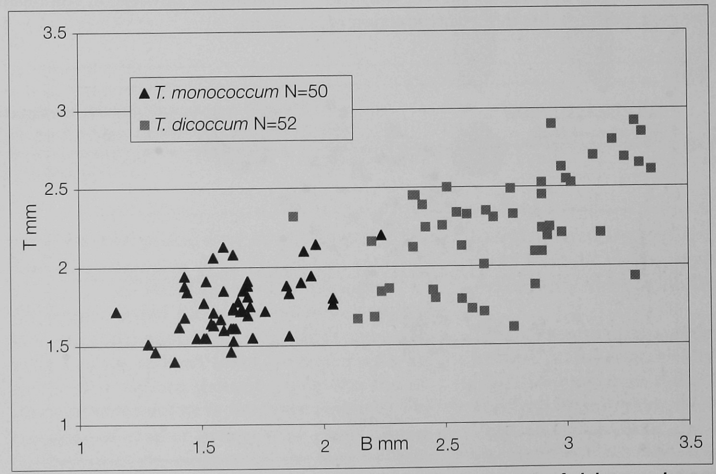


Fig.16.3 Scatter diagram giving breadth/thickness measurements of einkorn and emmer.

APPENDIX

Charcoal analysis from Tell Kosak Shamali

Hughes Pessin

Analysis was carried out on wood charcoal from two samples (AE6-32 and AE6-33) which came from Level 10, Sector A, feature 10A03. These samples originated from a floor of a small room (AE6-31). Sample AE6-32 was described as coming from burnt beams (Figs. 16.4 and 16.5) and sample AE6-33 from a sample with carbonised grains.

Fig. 16.4 Large wood beam discovered in Room 10A03, Level 10 of Sector A (AE6-32). *Also see Pl. 3.9: 3 in Nishiaki* et al. *(2001).*

Fig. 16.5 Section of the beam in Fig. 16.4.

357 charcoal fragments were identified, 324 from AE6-32 and 33 from AE6-33. Six taxa were thus identified. The results are given below (Table 16.2) as absolute (AF) and relative frequencies (RF).

All taxa encountered come from the ancient gallery forest of the Euphrates which is not surprising since the site is situated just above the flood plain. *Populus euphratica* (Euphrates poplar), *Populus* (poplar), *Salix* (willow) and *Tamarix* (tamarisk) occur as part of the present day vegetation in the area. However *Alnus* (alder) is of interest because this species is absent from the region today.

Samples came from a room which had been destroyed by fire and therefore represent building material such as roof beams. Thus poplar, willow and alder which came from fragments with a large diameter could have been used for roof beams while tamarisk which was found only in the form of young branches with a small diameter was probably used to cover the spaces between the beams which is a common practice today.

Results from the site of Tell Shiukh Fawqani, a Late Bronze settlement (1300 - 1200 BC) where several burnt buildings show that the same taxa were used in the architecture, but here in addition other taxa such as *Fraxinus* (ash), *Quercus* (deciduous oak) and *Pinus* (pine) were also used, however the sample size was much bigger.

Table 16.2 Charcoal remains from Room 10A03 of Level 10, Sector A.

Taxa	AF	RF
Populus euphratica	136	38.1
Populus sp.	10	2.8
Salix sp.	8	2.2
Salicaeae	80	22.4
Tamarix sp.	50	14
Alnus sp.	73	20.4
Total	357	100

CHAPTER 17

Preliminary analysis of the faunal remains from Tell Kosak Shamali (Syria): Squares AD5, AE5, AF5, BD6 and BE6

Lionel Gourichon and Daniel Helmer

17.1 Introduction

The faunal remains from Tell Kosak Shamali studied in this paper came from the Squares AD5, AE5, AF5, BD6 and BE6. The samples cover a good part of the chronological sequence of the human occupation: Early Northern Ubaid, Late Northern Ubaid, Terminal Northern Ubaid, Post-Ubaid and Uruk.

Considering the small number of identified specimens for each period (Table 17.1), archaeozoological problems such as taphonomic processes or procurement techniques of wild and domestic resources (hunting, husbandry) have not been fully undertaken. So preliminary results are given here with some comments, in order to provide the main lines of evidence which will be developed by the further analysis of larger samples.

Table 17.1 Summary of faunal remains from Tell Kosak Shamali.

	Early Northern Ubaid (late)		Late Northern Ubaid		Terminal Northern Ubaid		Post-Ubaid		Uruk		Total
	N	%	N	%	N	%	N	%	N	%	N
Mammals											
Canis sp.	1	0.4	4	1.2		0.0		0.0		0.0	5
Vulpes sp.	1	0.4	9	2.7	1	4.8	1	0.3		0.0	12
Equus hemionus/africanus	7	2.9	11	3.3	1	4.8	10	3.5		0.0	29
Sus domesticus/scrofa	7	2.9	31	9.2	1	4.8	9	3.1	4	2.6	52
Bos taurus/primigenius	31	12.9	20	5.9	2	9.5	25	8.7	8	5.2	86
Medium-sized ruminants	193	80.1	262	77.7	16	76.2	243	84.1	142	92.2	856
Ovis + Capra	111	63.5	165	60.2	12	65.3	113	57.2	105	85.7	506
Ovis aries	23	39.5	24	42.5	2	32.7	14	36.4	20	46.3	83
Capra hircus	14	24.0	10	17.7	2	32.7	8	20.8	17	39.4	51
Dama mesopotamica	5	2.9		0.0		0.0	3	1.5	2	1.6	10
Gazella subgutturosa	24	13.7	48	17.5	2	10.9	50	25.3	6	4.9	130
Lepus capensis	1	0.4		0.0		0.0	1	0.3		0.0	2
Nb of mammalian remains	**241**	100.0	**337**	100.0	**21**	100.0	**289**	100.0	**154**	100.0	**1042**
Birds											
Francolinus francolinus			3								3
Coturnix coturnix			1								1
Porzana porzana			15								15
Otis tarda			1								1
Reptiles											
Turtles	2		3		1		6		1		13
Fishes											
Unidentified	1		2								3
Arthropods											
Crab claws	1		2				1				4
Molluscs											
Snail shells	1		6		1						8
Nb of non-mamm. remains	**5**		**33**		**2**		**7**		**1**		**48**
Nb of non identified sp.	**649**		**1167**		**194**		**1037**		**286**		**3333**
TOTAL REMAINS	**895**		**1537**		**217**		**1333**		**441**		**4423**

17.2 Taphonomic observations

The faunal remains were on the whole well preserved at Tell Kosak Shamali: anatomical characters and butchery marks were clearly recognisable on the bone surface. This results from a rapid burial of the animal bones, though some evidence of weathering damage in consequence of long-time exposure to the air was visible for the Early Northern Ubaid, Late Northern Ubaid and Post-Ubaid periods. Study of the differential preservation of skeletal parts was not carried out but, as a rule in the Neolithic sites where food resources are mainly based on domestic animals, intentional breakage of the bones seems to be minor in comparison to the earlier PPNA sites.

The burnt bones provided little information because it is difficult to separate those which came from the hearths (possibly used as fuel or as a result of cooking) from those carbonised during fires which destroyed the buildings. However certain culinary practices were observable: for example roasting of heads was indicated by traces of burning on teeth extremities.

Scavenger tooth marks, probably from dogs, were present in all periods except the Terminal Ubaid (where the number of identified specimens was very low). Chewed bones represent only 2 % of the total remains and partially digested bones only 1 %.

17.3 Taxa identified in the faunal assemblage

17.3.1 Species description

Carnivores

The dog (*Canis familiaris*) was identified but, as in most archaeological sites, was poorly represented (0.5 %). A proximal metatarsus indicates an animal of average size (Bp = 8 mm). Although no bone remains of dog were recognised for the Post-Ubaid and Uruk periods, its occurrence is suggested by finds of chewed and partially digested bones.

The red fox (*Vulpes vulpes*) is the carnivore the most frequently hunted at Kosak Shamali. The small-sized fox which is present in the area today, the Blanford's fox (*Vulpes cana*), could also have been hunted but the small number of remains (mostly distal metapodials) are not sufficient to confirm this identification.

Perissodactyls

Bones and teeth of equids were found in almost all the occupation layers. Unfortunately, these rare elements can not be used to make reliably the diagnosis between the Asiatic (*Equus hemionus*) and the African wild ass (*E. africanus*).

Artiodactyls

The suids (*Sus scrofa* and *Sus domesticus*) were well represented (from 3 to 9 % according to periods). The high fragmentation of the remains and the high proportion of juveniles did not provide a large sample of measurements. So only the pig was identified with certainty and the presence of the wild boar is still in question.

The genus *Bos* is mainly represented by domestic cattle (*Bos taurus*). The wild cattle (*Bos primigenius*) occurred in the region at least until the Bronze Age period (Vila 1998), and some remains of large size suggest that it could have been hunted at Kosak Shamali. For example, one first proximal phalanx appears to belong to a wild bull, and its morphology does not show the characteristic pattern of muscle impressions which is sometimes observed on castrated cattle used as plough animals. Nevertheless, the small number of these remains does not allow the clear distinction between the two species.

In general the few measurements which we have of cattle from Kosak Shamali indicate that they were smaller[1)] than the PPNA aurochs of this region (Fig. 17.1).

From the sample analysed the wild sheep (*Ovis orientalis*) does not appear to have been hunted. Only the domestic sheep (*Ovis aries*) was identified. The small number of measurements could suggest that the mean size of the sheep from Kosak Shamali (Fig. 17.2) increased with time (which is to be expected for this period).

[1)] The statistical parameter used here is the log size index method exposed in Meadow (1999).

Yet for the moment the results are not statistically viable and confirmation must await the study of a larger sample.

The goats (*Capra hircus*) were of small size (Fig. 17.3) and it is known that this species, unlike the sheep, did not evolve a lot after the PPNB period. The animals of Kosak Shamali appear to fall around the average size of the goat populations from the Uruk levels of Sheikh Hassan (Vila 1998) and from the Late PPNB levels of Halula (Saña Seguí 1999).

According to the morphological features of the horn cores, gazelle remains belong to the Persian gazelle (*Gazella subgutturosa*). Its average size was identical to that of the gazelles from the Halaf levels of Shams ed-Din Tannira (Uerpmann 1982) and from the Uruk levels of Sheikh Hassan (Vila 1998).

The Mesopotamian fallow deer (*Dama mesopotamica*) was attested by post-cranial elements and by shed antlers. The latter were not included in the bone counts since they do not represent slaughtered animals and some of them show clear evidence of tool manufacturing.

Lagomorphs
The hare (*Lepus capensis*) was only represented by two pelvian bones. The measurements of these pieces (LAR = 11.2 and 10.0 mm respectively) are closed to those of the subspecies *L. c. syriacus*.

Birds
The black francolin (*Francolinus francolinus*), often mistaken osteologically with the chukar partridge (*Alectoris chukar*), was identified by three bones. This game bird lives in densely scrub-covered lowlands and wadis, generally not far from water. The riverside of the Euphrates at the vicinity of Kosak Shamali is its common habitat.

The quail (*Coturnix coturnix*) is a summer visitor in the Near East. A single bone in the Late Northern Ubaid attests its presence at Kosak Shamali.

Today, the spotted crake (*Porzana porzana*) can be sometimes observed in Syria during its migration. The fifteen bones identified at Kosak Shamali appear to belong to the same individual and suggest that this species could have inhabited (at least in the breeding season) the marsh areas near the Euphrates river.

One fragment of distal femur indicates the occurrence of the great bustard (*Otis tarda*) in the faunal remains. At present in winter, the Turkey populations of this typically steppic bird used to migrate to northern Syria, but in the past it could have been year-round resident in the area.

Other taxa
Even with the bird bones, the non-mammalian remains represent a small part of the faunal assemblage. The study of carapace fragments of turtles is still in progress and one of them appears to be from *Trionyx*. Fish vertebrae are not numerous, and crab and snail remains could be of non-anthropogenic origin.

17.3.2 Species frequencies

As shown by the frequencies of the wild mammals (Table 17.1), especially of the gazelles, hunting was a food procurement still relatively important for the inhabitants of Kosak Shamali: from 6.5 % for the latest occupation (Uruk) to 31 % for the Post-Ubaid period, and with *ca.* 20 % for the remaining periods. Most of these resources could have been exploited in the surroundings of the site, which lies on a strategic crossing point of different ecological zones, but in addition trades could also have played a role in the subsistence economy.

Caprines (*Ovis aries* and *Capra hircus*) are the main taxa identified in the faunal assemblage with more than 50 % of the total of identified specimens for each period. They predominated in the husbandry livestock in terms of number of heads, with almost more sheep than goats: 1 goat for 1.6 sheep for the Early Northern Ubaid period, 1 for 2.4 for the Late Northern Ubaid, 1 for 1.8 for the Post-Ubaid and 1 for 1.2 for the Early Uruk. Concerning to the Ubaid and the following periods, these ratios were slightly higher than those of distant sites such as Ras Shamra IIIB or Khirbet Derak (respectively 1 for 1 and 1 for 1.1, Helmer unpublished). A similarity was found with the Uruk levels of El Kowm where the ratio is of 1 goat for 1.2 sheep, while it is of 1 for 2.8 at Sheikh Hassan (Vila 1998).

Low frequencies characterise the cattle and the pigs and no substantial change could be noted between the different periods of occupation. Even so, it does not imply that these domestic animals were not of economic importance.

17.4 Caprine husbandry

As pointed above, the number of teeth is generally not sufficient to make consistent statements about the age profiles of slaughtered caprines for each period[2]. However, some hypotheses concerning the main trends of the husbandry system are proposed here, keeping in mind that they should be validated by the analysis of new material (Fig. 17.4).

In the Early Northern Ubaid period, where the sample of teeth is the smallest, the cull seems to have been oriented towards the exploitation of the tender meat (animals younger than two years) and of some secondary products, probably milk, in the same manner which is observed in the Late PPNB of the area.

The histograms for the Late Northern Ubaid and the Post-Ubaid periods are quite similar to each other. The exploitation of milk appears evident here, with a slaughtering of the older females.

In the Uruk period, in addition to the exploitation of some tender meat, the husbandry practices seem to be focused on the exploitation of milk and wool. Moreover, when sheep and goats are distinguished on the age profile[3], the high proportion of goats is correlated with the preferential exploitation of milk, while the sheep tend to provide the greater part of the meat supply. This economic pattern was the reverse of that observed in the Uruk occupation of Sheikh Hassan and El Kowm, where the major product was tender meat and where milk was less significant (Fig. 17.5). This pattern of caprine exploitation could be an indication of a different status of the Kosak Shamali locality in comparison with both other sites, one being a fortified village and the second a temporary settlement in an oasis. For varied reasons, therefore, those are rather "consumer" sites, whereas at that time Kosak Shamali could have been a small peasant village carrying on a "multicomponent" economy.

17.5 Conclusions

The interpretations based on the limited results exposed above are rather research orientations than assertions. The number of faunal remains found in the trenches AD5, AE5, AF5, BD6 and BE6 of Tell Kosak Shamali is relatively low and one must await further analysis to make more precise statements. However, the main conclusions are as follows:

1) During all the occupations studied, goats and sheep took the greatest part in the husbandry system in terms of number of heads, while hunting remained as a minor but steady practice. In the same time, the domestic cattle and in a lesser extent the pigs also represented a livestock fairly important.
2) The mortality profiles of the caprines indicate the exploitation of dairy products from the Ubaid to the Post-Ubaid period. There could exist a close relationship between the presence of pottery workshops at Kosak Shamali and the exploitation of milk, and this hypothesis should be explored in the future.
3) The Uruk caprine husbandry reflects a village economy which is different from that of other contemporaneous sites in Syria.

The analysis of the faunal assemblage of Tell al-'Abr, an Ubaid and Post-Ubaid settlement near Aleppo (Hammade and Yamazaki 1995), has not yet been published. We hope the future archaeozoological results from this site and from Kosak Shamali will give us new perspectives on their past subsistence economy for the northern Syria.

Acknowledgements
We are grateful to Prof. Yoshihiro Nishiaki for

[2] See Helmer (1996, 2000a) for the method of age estimation, and Payne (1973) for the interpretation of the mortality profiles.
[3] See Payne (1985) and Helmer (2000b) for the distinction between *Capra* and *Ovis* from the teeth.

his invitation to participate in the study of the archaeological material of Kosak Shamali, and also to the Direction of Antiquities and Museums of Damascus (Syria) who allowed a part of the faunal remains to be analysed in France. We thank George Willcox for translating the French version.

References

Hammade, H. and Y. Yamazaki (1995) A preliminary report on the excavations at Tell al-'Abr on the Upper Euphrates, 1992. *Akkadica* 93: 4-10

Helmer, D. (1996) Biometria i arqueozoologia a partir d'alguns exemples del Proxim Orient. *Cota Zero* 11: 51-60

Helmer, D. (2000a) Etude de la faune mammalienne d'El Kowm 2. In: *El Kowm 2: Une île dans le désert (La fin du Néolithique précéramique dans la steppe syrienne),* edited by D. Stordeur, pp. 233-264. Paris: CNRS Editions.

Helmer, D. (2000b) Discrimination des genres *Ovis* et *Capra* à l'aide des prémolaires inférieures 3 et 4 et interprétation des âges d'abattage: L'exemple de Dikili Tash (Grèce). In: *Animal Management and Demography through the Ages*, International Conference of Torino (Italy), 16-18 September 1998, edited by G. Giacobini and V. Peracino, pp. 29-38. *Anthropozoologica* 31 / *IBEX Journal of Mountain Ecology* 5.

Meadow, R.H. (1999) The use of size index scaling techniques for research on archaeozoological collections from the Middle East. In: *Historia Animalium ex Ossibus,* edited by C. Becker, H. Manhart, J. Peters and J. Schibler, pp. 285-300. *Festschrift für Angela von den Driesch zum* 65.

Payne, S. (1973) Kill-off patterns in sheep and goats: The mandibles from Ašvan Kale. *Anatolian Studies* 23: 281-303.

Payne. S. (1985) Morphological distinctions between the mandibular teeth of young sheep, *Ovis,* and goat, *Capra. Journal of Archaeological Science* 12: 139-147.

Saña Seguí, M. (1999) *Arqueología de la Domesticación Animal: La Gestion de los Recursos Animales en Tell Halula (Valle del Eufrates – Siria) del 8.800 al 7.000 BP.* Treballs d'Archeologia del Proxim Orient 1. Barcelona: Universitat Autonoma de Barcelona.

Uerpmann, H.-P. (1982) Faunal remains from Shams ed-Din Tannira: A Halafian site in Northern Syria. *Berytus* 30: 3-52.

Vila, E. (1998) *L'Exploitation des Animaux en Mésopotamie aus IV^{ème} et III^{ème} Millénaires avant J.-C.* Monographies du CRA 21. Paris: CNRS éditions.

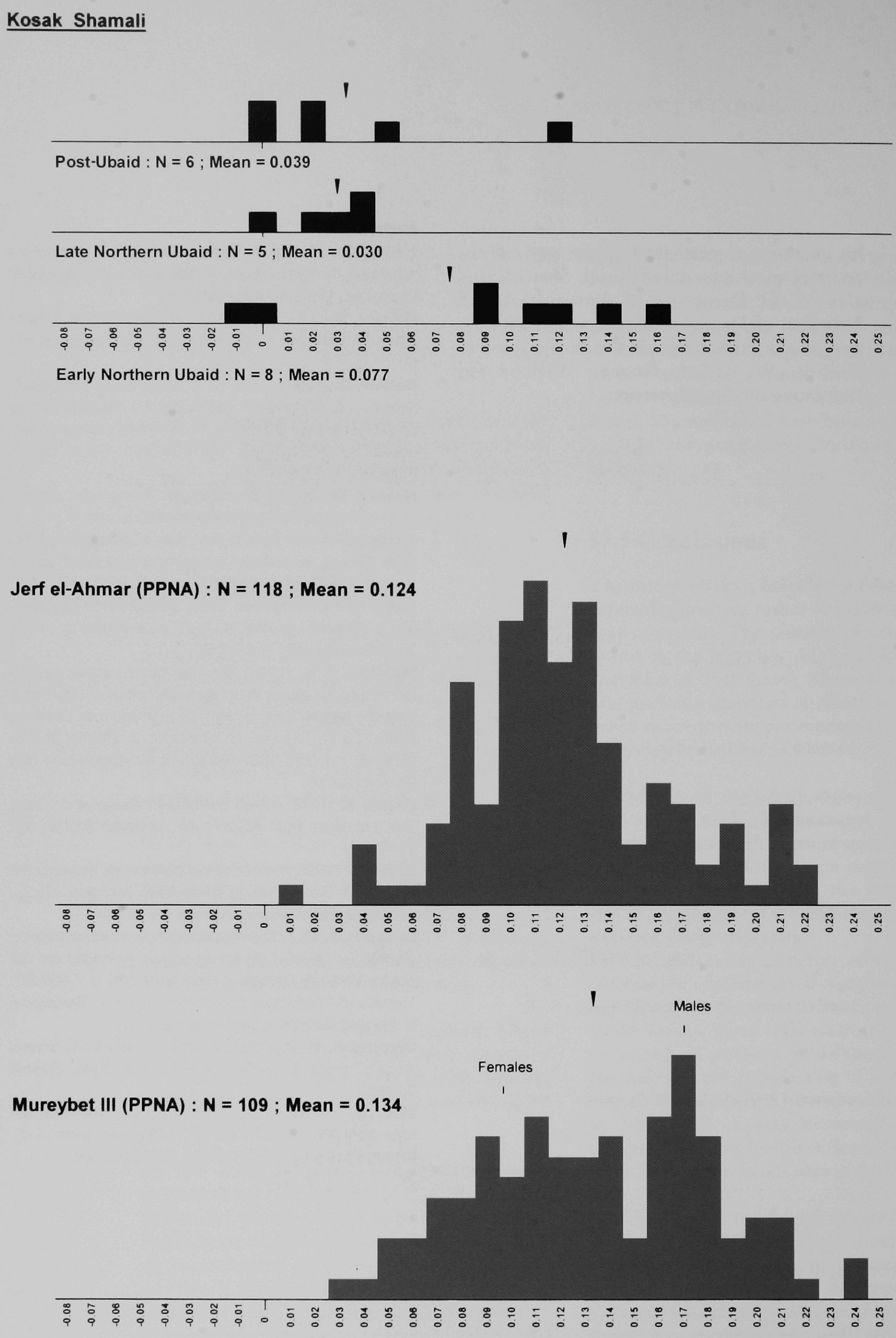


***Fig. 17.1** Diagrams of log ratio showing the differences in size between the cattle from Kosak Shamali and the aurochs (*Bos primigenius*) from Jerf el-Ahmar and Mureybet III (PPNA).*

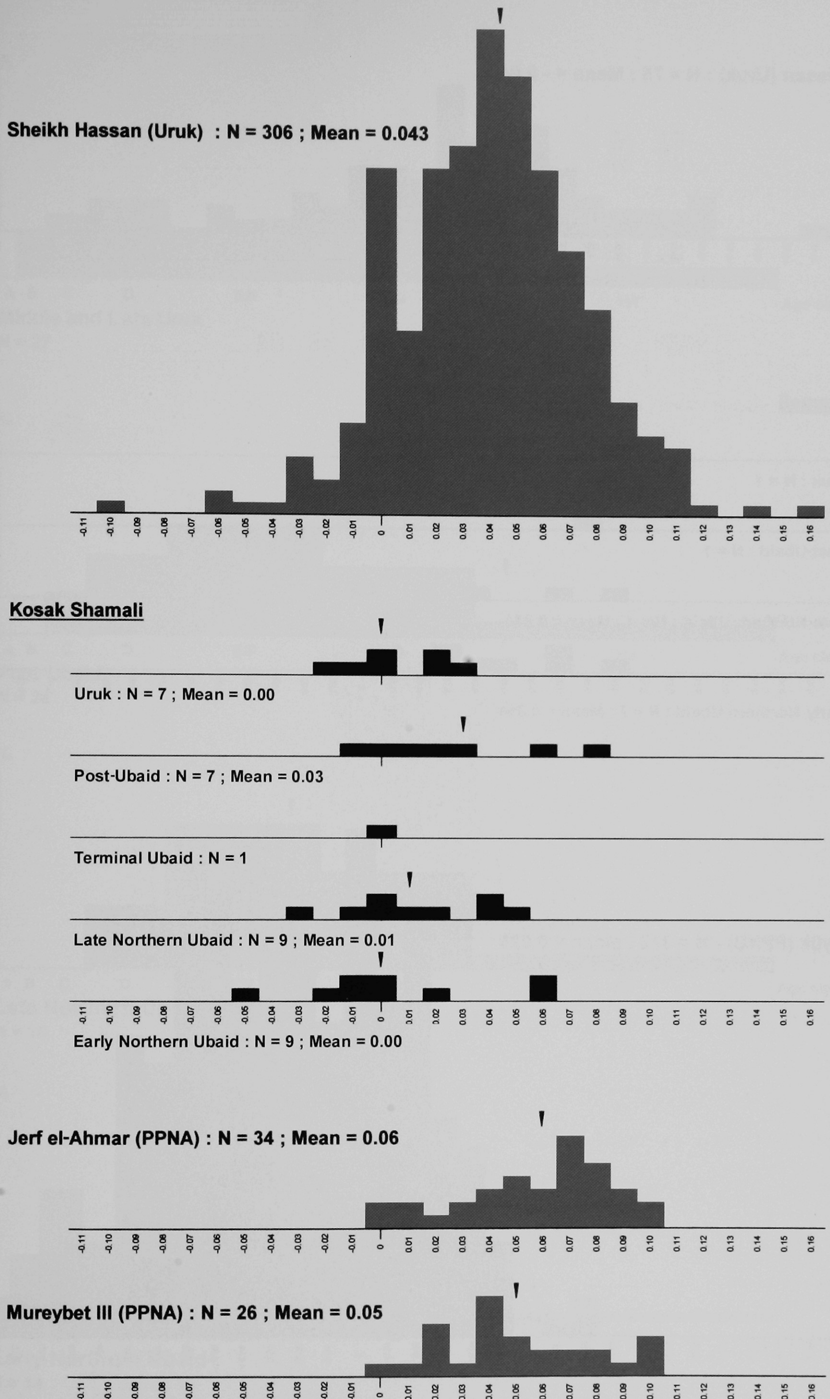


Fig. 17.2 Diagrams of log ratio showing the differences in size between the domestic sheep from Kosak Shamali and the wild sheep (Ovis orientalis) from Jerf el-Ahmar and Mureybet III (PPNA).

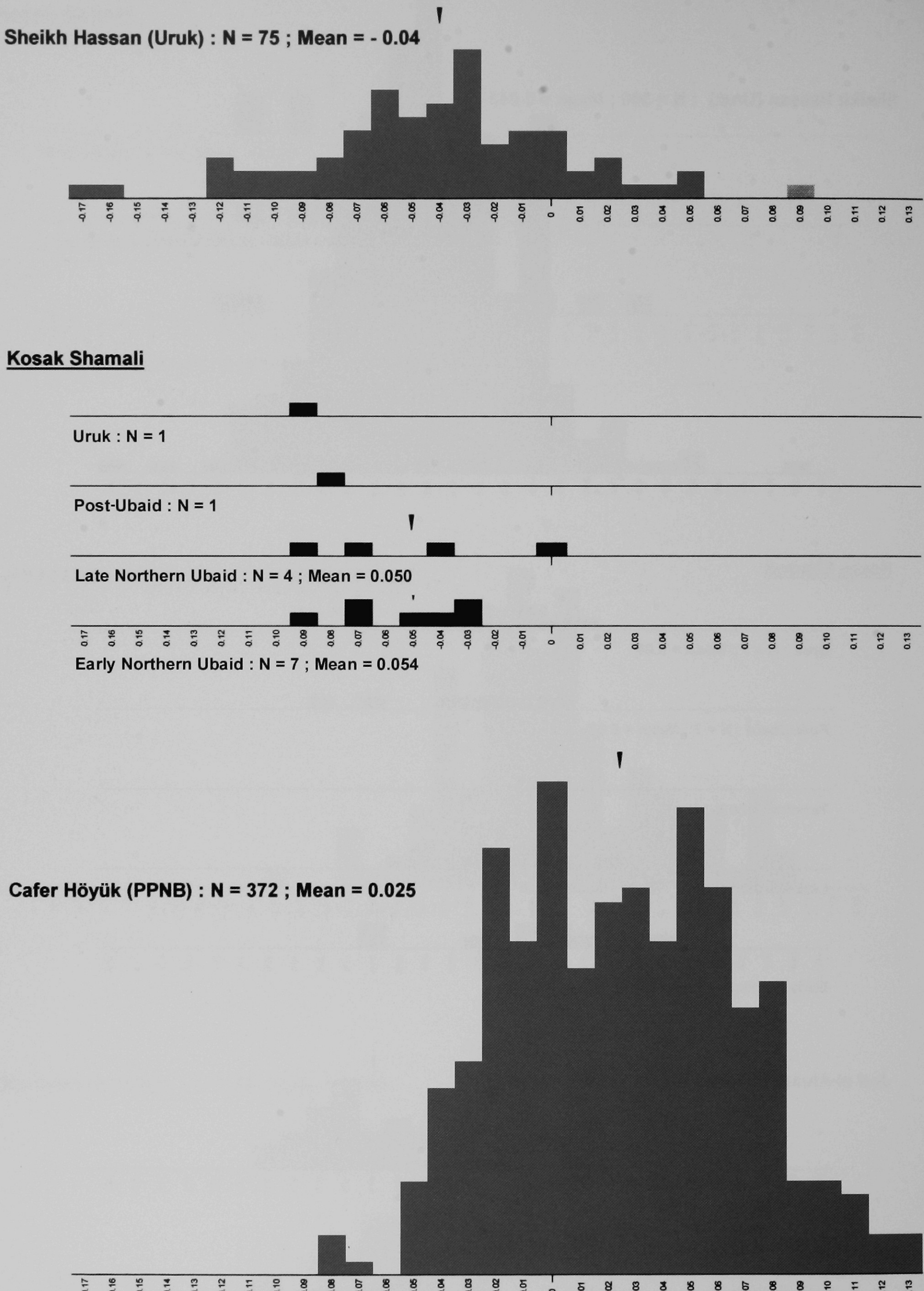


Fig. 17.3 Diagrams of log ratio showing the differences in size between the domestic goats (Capra hircus) *from Kosak Shamali and from Sheikh Hassan and the wild goats* (Capra aegagrus) *from Cafer Höyük.*

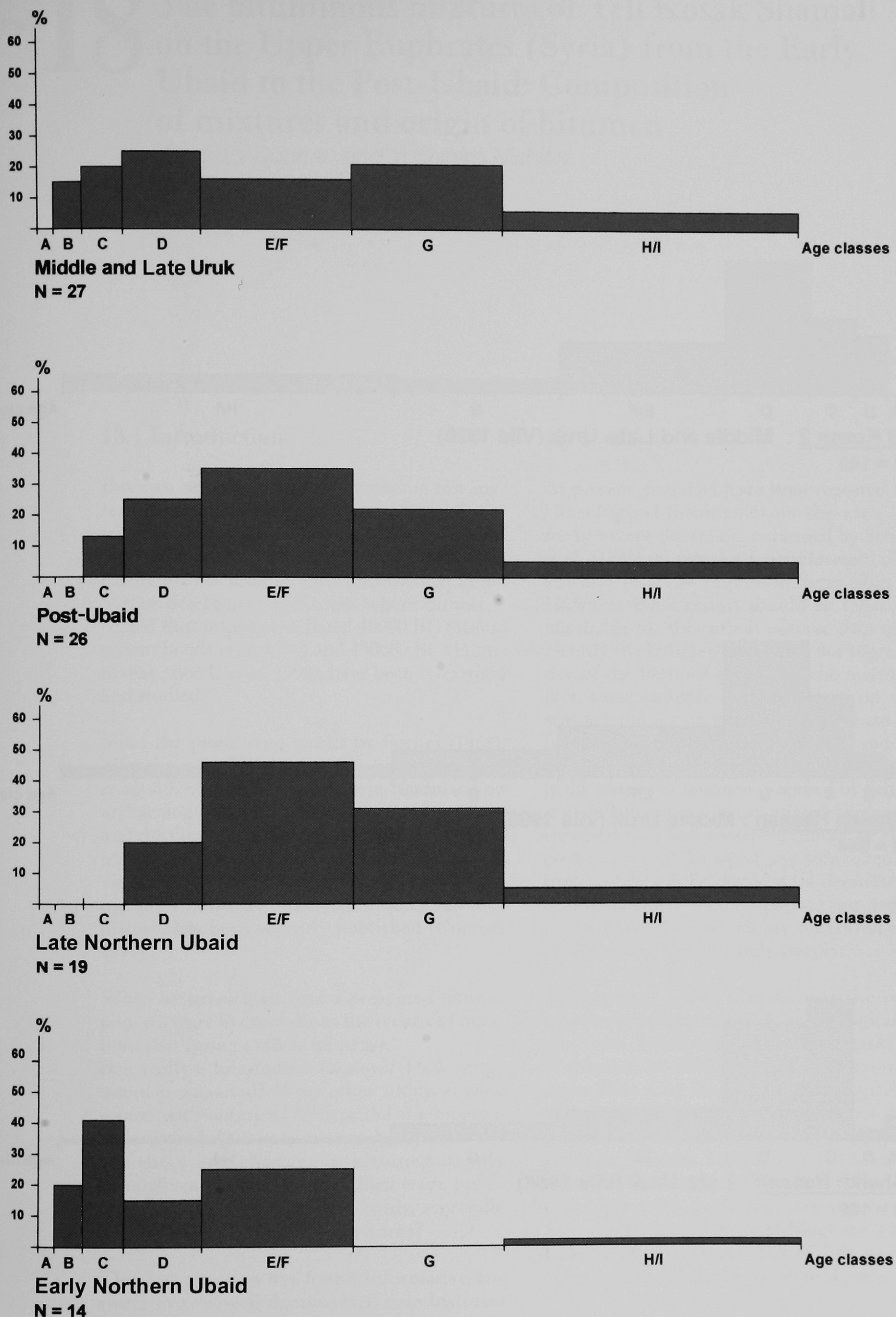


Fig. 17.4 Mortality profiles of sheep and goats of Kosak Shamali.

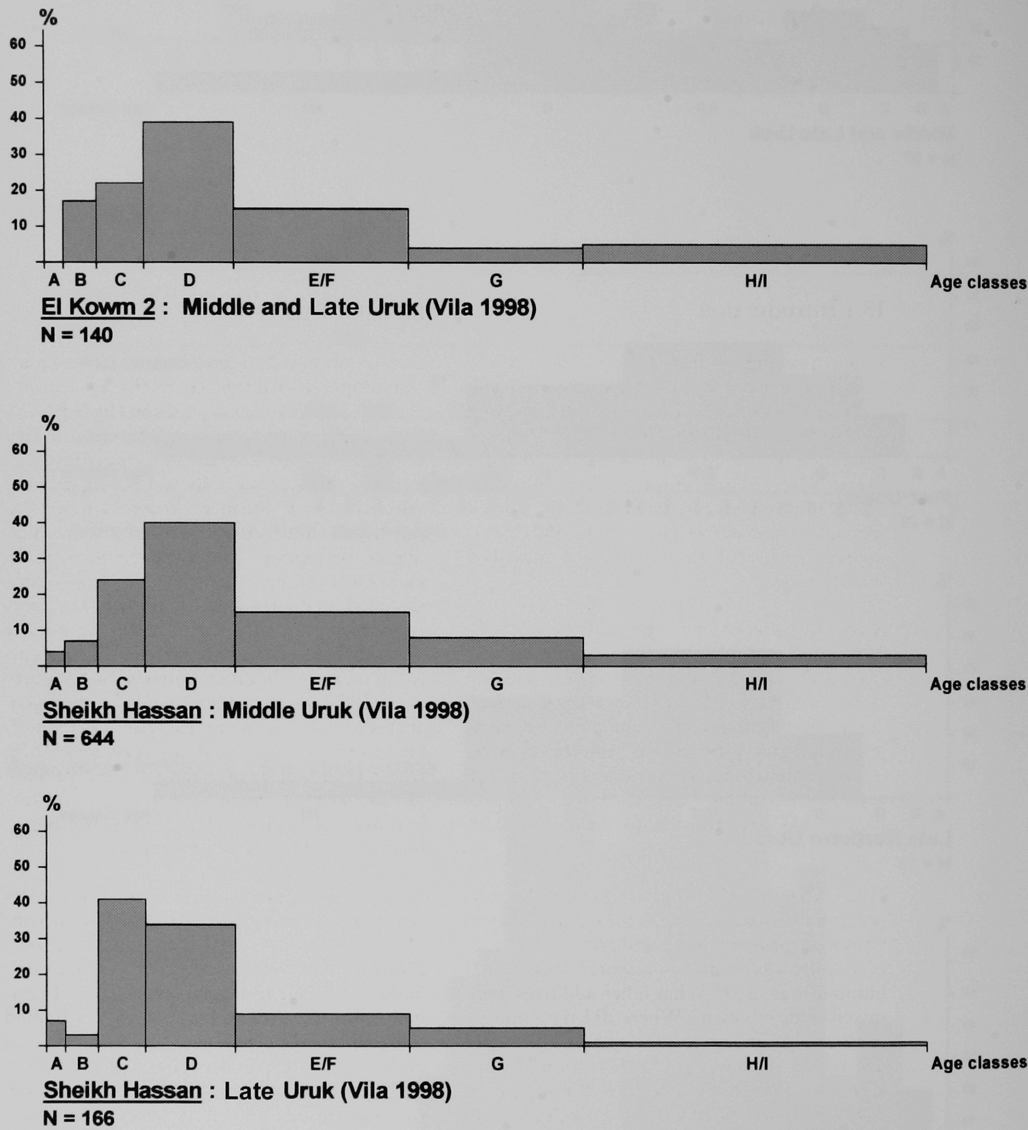


Fig. 17.5 Mortality profiles of sheep and goats for the Uruk levels of El Kowm 2 and Sheikh Hassan.

CHAPTER 18

The bituminous mixtures of Tell Kosak Shamali on the Upper Euphrates (Syria) from the Early Ubaid to the Post-Ubaid: Composition of mixtures and origin of bitumen

Jacques Connan and Yoshihiro Nishiaki

18.1 Introduction

Bitumen belongs to the list of common raw materials which has been extensively used and trade in Mesopotamia, Elam and the Gulf until the Neolithic time (7000-6000 BC). Evidence of earlier use has been recently documented in the Syrian desert near el-Kowm where bitumen-coated flint implement, dated 40000 BC (Mousterian; Boëda *et al.* 1996) and 150000 BC (Hummalian; Boëda *et al.* 1998), have been unearthed and studied.

Since the pioneering works by Forbes (1964), Marschner and Wright (1978), and Marschner *et al.* (1978), several studies were conducted on archaeological sites from present day Iraq, Iran and the Gulf using modern and efficient analytical techniques of petroleum exploration. A review, summarising the various aspects of the use and trade of bitumen in antiquity and prehistory, has been recently published (Connan 1999).

When archaeologists find a presumed bituminous mixture in excavations the recurrent questions that spring to their mind are:
Is it really a bituminous mixture? How much bitumen was used? What other additives were mixed with bitumen? Where did the bitumen come from? At a particular archaeological site are there any changes in bitumen supply through time? Do these identified trade routes agree with other historical records, especially geopolitical and cultural frameworks?

This last question has found informative answers in two well documented case histories covering a wide time scale namely in Tell el-'Oueili village (southern Iraq; Connan *et al.* 1996) and in Bahrain settlements (Connan *et al.* 1998). Another case history, not synthesised yet, exists in Kuwait between the 5th millennium BC and 700 AD.

At present, few data have been reported on archaeological bitumen from the area under study, except the results published by Schwartz *et al.* (1999) on samples from Hacınebi in Turkey and Jerablus Tahtani in Syria (Fig. 18.1). However these results should be regarded as unreliable for the carbon isotopic data used to identify the bitumen source are not representative of the bitumen present in the mixture. In fact, these isotopic data, acquired on whole samples and not on isolated bitumen, are largely obscured by the mineral matrix and more precisely by the carbonate content. Consequently the sources of bitumen proposed by Schwartz *et al.* (1999), are not substantiated by their geochemical data and therefore cannot be considered as proved. To avoid any subsequent controversy we will be providing a demonstration of this statement when reporting our own carbon isotopic data which are measured on asphaltenes and not on whole samples.

The present paper summarises the results which were obtained on 13 archaeological samples from Tell Kosak Shamali (Nishiaki 2000; Nishiaki *et al.* 1999, 2000, 2001; Koizumi and Sudo 2001). Our results on archaeological bitumen from this geographic area are not limited to Tell Kosak Shamali, for many samples from Hacınebi, Jerablus Tathani and Tell Sheik Hassan were also analysed (Fig. 18.1). In addition, to complete this prevailing series of bitumen, few samples from Dja'de el-Mughara, Habuba Kabira, Tell Banat and Tell Halula were also examined by the same geochemical tools.

This paper is however the first one to report our results in that geographic area. Some other papers on other sites from Syria are presently submitted for publication. They concerned Mari (Connan and Deschesne 2003) along the

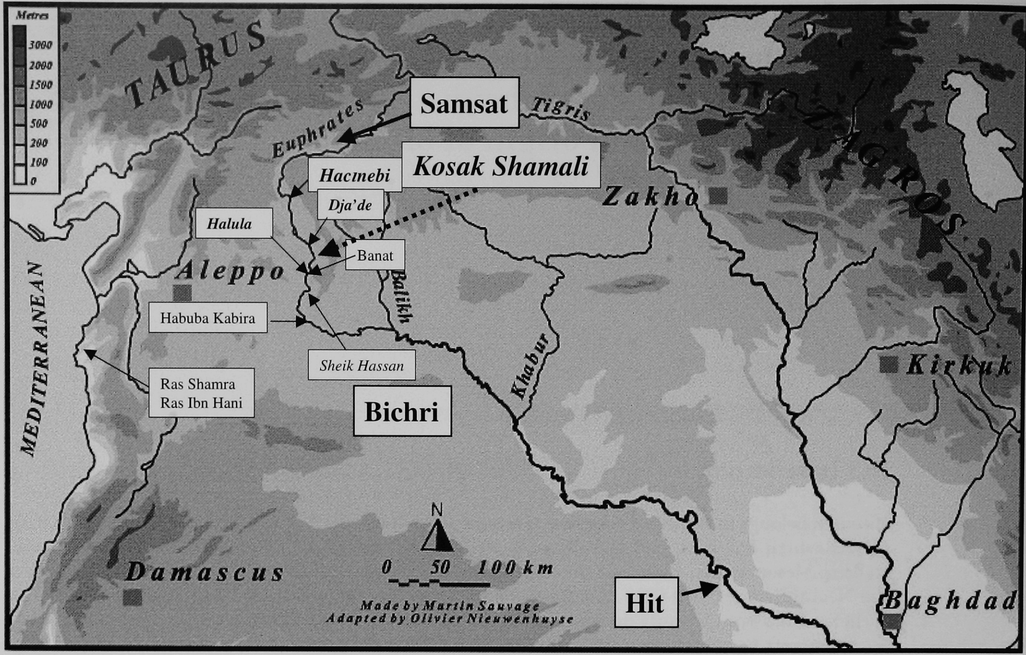


Fig. 18.1 Location map of bitumen from archaeological sites studied in North-West Syria along the Euphrates and location of the main potential oil seeps in the area.

Euphrates, Tell Brak (Connan and Oates 2003) in the Khabur valley and Sabi Abyad I (Connan *et al.* 2003) along the Balikh river.

18.2 Archaeological samples

Bituminous mixtures were encountered in all the levels of Tell Kosak Shamali throughout the Chalcolithic sequence, indicating that this exotic type of material continued to have been widely used from the earliest stage of the Northern Ubaid. The mixtures occur in a variety of forms, as either residues on stone, pottery and bone tools, or isolated finds. Particularly common are those seen on flint blades, almost undoubtedly used for sickle manufacturing with bone/wood handles (see Chapter 11). Bituminous mixtures on pottery are far less common. Only a few dozens specimens among the nearly 20000 sherds examined retain such traces. They were all noted in the interior of the sherds (Koizumi, next volume), and are likely residues of mixtures that were prepared using pottery vessels. Intentional application of bituminous mixtures to the outside of pottery, as recently demonstrated for painted decoration on Late Neolithic sherds at Tell Sabi Abyad along the Balikh river (Connan *et al.* 2003), has not been attested with the naked eye. Bitumen traces on bone tools are even rarer. They are restricted to unmodified gazelle horn cores alone, which may have been used for bitumen preparation (see Chapter 14). Grinding stone tools shaped like gazelle horns, with black residues at the tips, were also recovered in association with other stones smeared black. They included objects comparable to those reported as "stirrers" of boiled bitumen at Tell Abada (Jasim 1985), but the possibility that they were in fact tools for the preparation of painting pigment also remains (see Chapter 13).

In addition to these examples identified on tools, bituminous mixtures occur in isolated forms as well. Small lumps or fragments of unknown use were frequently found during the excavations. Worth mentioning among these was a group of relatively large fragments discovered in fill deposits of a mud-brick walled room of the Late Northern Ubaid period (Room 602; Level 6 of Sector A; see Nishiaki *et al.* 2001). The samples from this concentration weigh over 600g in total. They are flat slab fragments 9mm to 13mm thick, with a large imprint of reeds (or wood?) running parallel on one side. The other side shows a rather smooth surface occasionally with irregular imprints of chopped straw or other vegetable and mineral materials. Fragments with a nearly identical form were also recovered from the Post-Ubaid buildings of Sector B (Koizumi and Sudo 2001: 135-136). These may have been derived from water-proofed mats, or even reed boats. The possible use of these slabs for reed boats deserves intensive examination, which is in progress, for they could represent one of the oldest evidence of river boats in this region. Similar slabs of bituminous mixtures have been in fact identified as such in Oman (Cleuziou and Tosi 1990, 1994; Vosmer 2000) and in Kuwait (Carter and Crawford 2001). Whatever the case the amount of the recovered samples is relatively small to reconstruct the probably large items coated with those bituminous mixtures. This implies that bitumen was carefully curated or reused by the Chalcolithic inhabitants due to its precious nature; a similar suggestion has also been made at Hacınebi by Schwartz and Hollander (2001).

In short, the collection of Tell Kosak Shamali represents typical examples of what is currently unearthed from other excavations of the Near East and the Gulf. From this, thirteen samples, presumed to contain bituminous mixtures, were selected for geochemical analyses. The sample set spans from the Early Ubaid to the Post Ubaid period and comprises various types of archaeological artifacts.

The basic information on samples (date range, sample provenance, macroscopic description, and sample type) is listed in Table 18.1. The sample set covers a variety of bituminous samples which are currently encountered in excavations of the Near East, namely bitumen crusts coating the interior of potsherds (type 1a: n° 1382, 1384, 1379, and 1375; Fig. 18.2), black and hard bituminous mixtures with macro-imprints on the surface interpreted as traces of dissolved reeds or twigs (type 5: n° 1381, 1378, and 1385; Fig. 18.2), black and hard bituminous material with straw-like vegetal remains inside the mixture (type 3b: n° 1383 and 1380), soft and brown bituminous material with numerous straw-like vegetal pieces inside the mixture (type 3a = typical mortar used in building construction: n° 1386), and flint implements alone or attached to a sickle with traces of bituminous mixtures (type 9: n° 1395, 1376, and 1377; Fig. 18.3).

The type classification, adopted in the database, refers to either objects (flint implement, coffin, spindle whorl, mat, basket, etc.) or materials of unknown use (black and hard, soft and brown mixtures, pure solid bitumen, etc.). Consequently some samples are defined by two types. For instance a bituminous mixture on a flint implement (Fig. 18.3) or a sickle may be determined as type 9 (flint implement) and type 3b (bituminous black mixture with recognisable vegetal debris as seen in Mari; Connan and Deschesne 2003). Uncertainties, raised by the macroscopic observation, may also lead to two possible types: sample n° 1383, for instance, which shows rare vegetal remains, was originally classified as a pure oil seep. At that preliminary stage of observation, the most likely pre-diagnostic is reported and generally more accurate answers to the raised questions are brought up at subsequent steps of the geochemical study.

18. 3 Experimental

The archaeological bituminous materials were studied using the same analytical scheme applied in previous studies (Connan and Deschesne 1996; Connan 1999). A detailed up-to-date flowchart with a description of each analytical technique has been presented with some examples in Connan (2002) and analytical details may also be found in a recent paper on the petroleum geochemistry of crude oils and source rocks from Kuwait (Abdullah and Connan 2002).

A binocular description of each sample was carried out prior to the detailed chemical analysis. In the present study a petrographical analysis was not undertaken for the samples appeared to be quite classical in regard of our past experience. After the sampling procedure, which leaves pieces as references for possible further cross-checking, chemical analyses including screening techniques and detailed chemical and isotopic investigations were conducted. Several molecular biomarker ratios on terpanes and some isotopic criteria on asphaltenes ($\delta^{13}C$, $\delta^{34}S$, and $\delta^{15}N$) were used to establish bitumen-to-bitumen and bitumen-to-oil seep correlations.

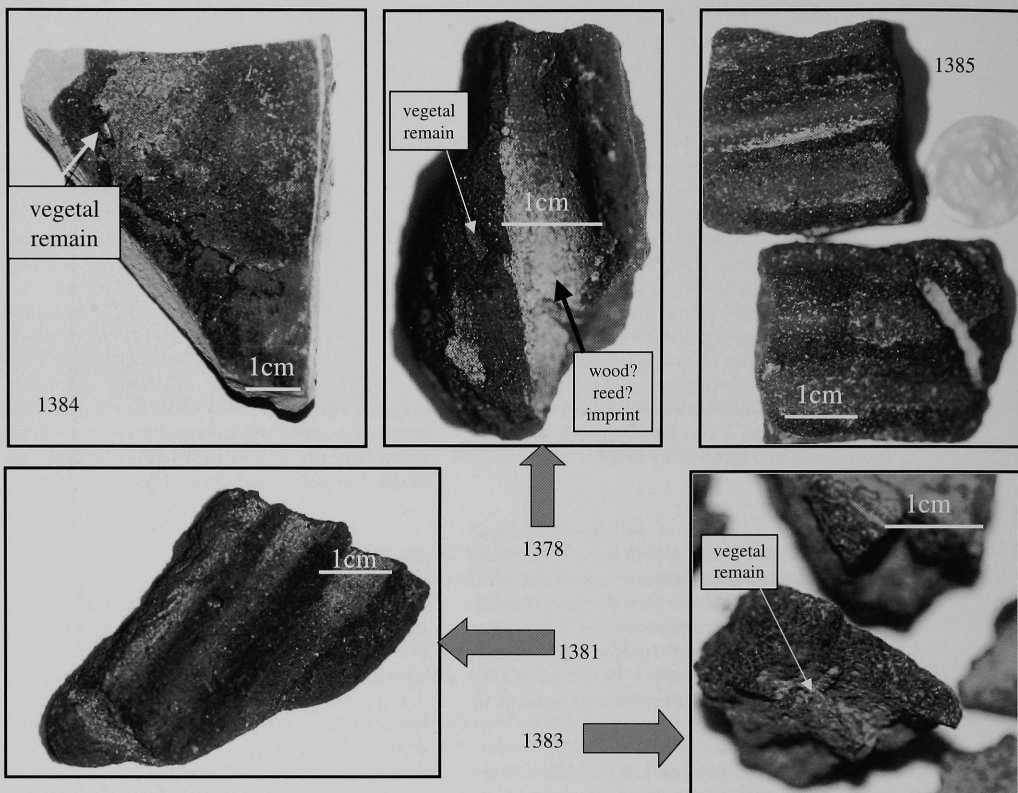


Fig. 18.2 Photograph of some bituminous samples of Tell Kosak Shamali.
N° 1384: interior of a potsherd showing a bituminous crust in which vegetal remains are clearly visible. N° 1378, 1381 and 1385 = hard bituminous mixtures with large vegetal imprints which are thought to be reeds. N° 1383 = lumps with rare recognisable vegetal remains, partly covered by some excavation soil.

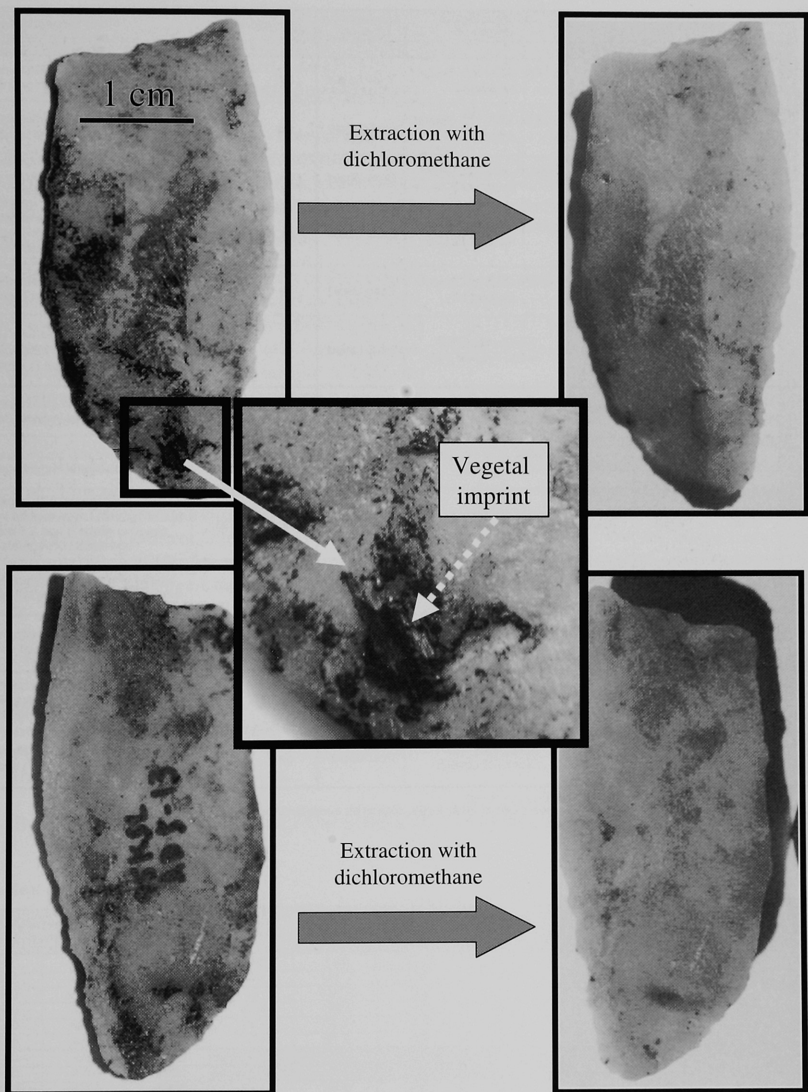


Fig. 18.3 Photograph of a flint implement (recto and verso) before and after treatment with dichloromethane in an ultrasonic bath.
The ink labels, providing the provenance of the flint, are scrapped prior to the chemical extraction. The rather efficient treatment allows to isolate the bitumen and clean the flint. Vegetal remains may be identified in the mixture when the remains are thick enough.

Table 18.1 Provenance, date and type of the bituminous samples from Tell Kosak Shamali.

sample number	date (cal.BC)*			archaeological reference	comment on period	sample type		Macroscopic description
	Max	Min	average					
1382	-5300	-4900	-5100	97KSL-AD5-105: Sector A-Level 12	Early Ubaid	1a	13?	Interior of a potsherd. Bituminous mixture with quartz grains
1383	-5300	-4900	-5100	97KSL-AD5-117: Sector A-Level 13	Early Ubaid	3b	10?	Black, hard bituminous mixture with rare vegetal remains but no quartz grains
1384	-5300	-4900	-5100	95KSL-AF6-10: Sector A-Level 16	Early Ubaid	1a	3b?	Interior of a potsherd. Bituminous mixture with some quartz grains and rare vegetal remains (straw?)
1395	-5300	-4900	-5100	97KSL-AD5-116: Sector A-Level 13	Early Ubaid	9	3b	Black grains with some vegetal remains. Well preserved sikkle of 30 cm length found in place in 1997
1380	-5190	-4800	-4995	97KSL-AE5-25: Sector A-Level 10	Early Ubaid	3b		Mixture of numerous vegetal debris with bitumen and quartz(?) grains
1381	-5190	-4800	-4995	97KSL-AE5-22-9: Sector A-Level 10A	Early Ubaid	5	3b	Hard bituminous mixture with vegetal debris and quartz grains. Large vegetal imprints (wood? reed?) and holes due to vegetal dissolution
1376	-5100	-4700	-4900	96KSL-AD6-10: Sector A-Level 4	Late Ubaid	9	3b	Flint implement with bituminous traces containing vegetal imprints (straw?)
1377	-5100	-4700	-4900	95KSL-AD5-13: Sector A-Level 4	Late Ubaid	9	3b	Flint implement with bituminous traces containing vegetal imprints (straw?)
1378	-5100	-4700	-4900	95KSL-AD4-11: Sector A- Level 6	Late Ubaid	5	3b	Black, hard sample with vegetal remains and quartz? grains. Large vegetal imprints at surface (wood or reeds?) and 2.5 mm holes due to dissolution of vegetals (stems?)
1379	-5100	-4700	-4900	96KSL-AE6-2: Sector A-Level 7	Late Ubaid	1a	13?	Interior of a potsherd. Bituminous mixture with numerous quartz? grains but no vegetal remains
1375	-4940	-4550	-4745	Level 1	Terminal Ubaid	1a	4b	Interior of a potsherd. Black hard mixture with rare vegetal imprints and few minerals.
1385	-4550	-4260	-4405	97KSL-BE7-34: Sector B-Level 6	Post Ubaid	5	13	Hard black mixture with quartz grains but no vegetal debris. Large vegetal imprint (reed? wood?) with a diameter of 0.7cm.
1386	-4550	-4260	-4405	96KSL-BD7-46-11: Sector B-Level 5	Post Ubaid	3a		Soft brown bituminous mixture with numerous vegetal remains (straw?) and quartz grains.

* All the dates, including those estimated from radiocarbon dates of other levels, should be considered provisional.

18.4 Results

18.4.1 Rock-Eval screening analysis: identification of bituminous mixtures

The Rock-Eval pyrolysis on whole samples was carried out on all bituminous mixtures except on the remains coating flint implements where the amount of available material was too low to allow the Rock-Eval analysis.

The most important parameters, deduced from the Rock-Eval analysis, are listed in Table 18.2. Tmax values of most samples fall within the range of typical archaeological bitumen, i.e. between 420 and 430°C. The sample n°1382, recovered by scraping the interior of a potsherd, contrasts with others by its much higher Tmax value equal to 446°C. This high value suggests that this black-grey coating is a carbonised residue. This assumption is fully confirmed by considering its corresponding Hydrogen (HI) and Oxygen (OI) Indexes. This carbon-rich material (almost 20 % TOC by weight / sample) is indeed a very hydrogen-depleted material (HI = 9; Table 18.2 and Fig. 18.4) as expected for a carbonised residue. This residue is very likely a carbonised bituminous mixture for in the diagram HI vs. TOC (Fig. 18.4) this particular sample still belongs to the bituminous family defined with other potsherds. This thermally degraded sample has been discarded from further geochemical investigations.

By reviewing in much detailed the results of other samples it appears the following features:

1- the bitumen content is related to sample type. In that respect bituminous mixtures coating the interior of pottery are richer in bitumen than the hard black mixtures with large macro-vegetal imprints. These potsherd mixtures are devoid of vegetal remains but show quartz grains. The potsherd material n°1382, identified as a carbonised residue, still belongs to the potsherd family;

2- the bitumen mixtures n°1395 and 1383 in which quartz grains are lacking, are the richest in TOC. Quartz grains act as a diluting agent when present;

3- the Kosak Shamali bituminous samples exhibit HI and OI values in agreement with most archaeological bitumen already analysed. As example of representative population we have reproduced the area defined by the archaeological bitumen of Bahrain. Consequently all samples analysed herein are not pristine geological bitumen but are anthropogenic materials, prepared by mixing various components: quartz grains, bitumen, vegetal debris, etc. In that respect, the sample set reveals several recipes for the preparation of mixtures: bitumen + quartz grains without vegetal debris + clays (?), bitumen + vegetal debris without quartz grains + clays (?), bitumen + quartz grains + vegetal debris + clays (?);

4- the bitumen content of samples tends to be lowered through increasing time (Fig. 18.5).

Table 18.2 Rock-Eval data.

sample number	date range		date (average)	S1	S2	S3	TOC	Tmax	HI	IP	OI
		Min	average								
1382	-5300	-4900	-5100	0.45	1.81	12.27	19.9	446	9	0.2	61
1383	-5300	-4900	-5100	17.7	127.7	14	35	433	365	0.12	39
1384	-5300	-4900	-5100	15	126.2	9.4	27.3	430	462	0.11	34
1395	-5300	-4900	-5100	27.4	162.2	14	34.9	427	464	0.14	40
1380	-5190	-4800	-4995	15.1	75.2	7.7	18.9	427	398	0.17	41
1381	-5190	-4800	-4995	17.9	81.6	9.3	22.2	427	366	0.18	41
1376	-5100	-4700	-4900								
1377	-5100	-4700	-4900								
1378	-5100	-4700	-4900	13.1	59.3	4.6	13.3	429	446	0.18	34
1379	-5100	-4700	-4900	7.9	67.9	10.4	19.3	431	351	0.1	53
1375	-4940	-4550	-4745	11.1	107.2	13.3	31.2	433	343	0.09	42
1385	-4550	-4260	-4405	9.8	41.8	4.33	9.5	431	441	0.19	45
1386	-4550	-4260	-4405	13.4	62.2	6	15.5	430	401	0.18	38

Significance of abbreviations: S1 =Thermovaporized Hydrocarbons (in mg HC / g sample); S2 = pyrolyzed hydrocarbons (in mg HC / g sample); S3 = CO_2 (in mg CO_2 / g sample; TOC = Total Organic Carbon (in % / sample); Tmax = temperature of the S2 peak (in °C); HI = Hydrogen Index = S2 / TOC; OI = Oxygen index = S3 / TOC; IP = S1 / S1 + S2.

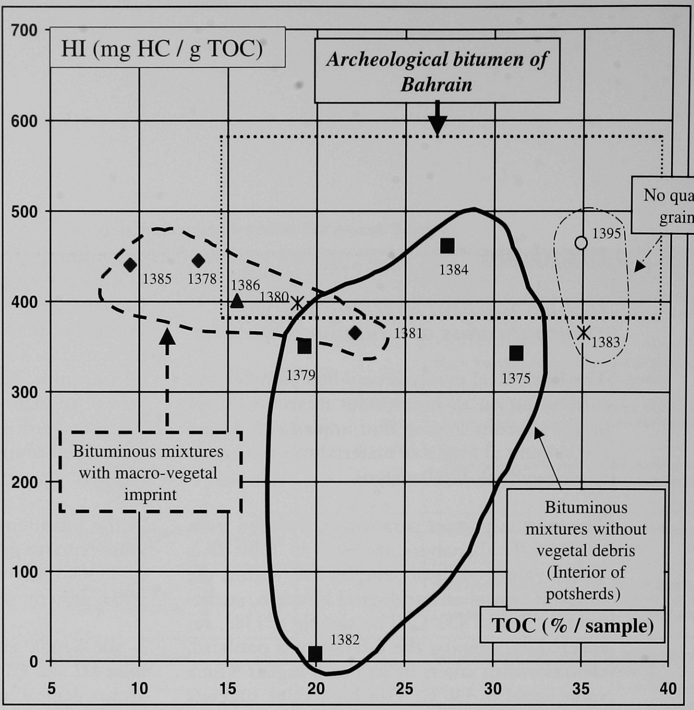


Fig. 18.4 Identification of bituminous mixtures by Rock-Eval screening techniques:
HI (Hydrogen Index in mg HC / g TOC) vs. TOC (Total Organic Carbon in % by weight / whole sample).

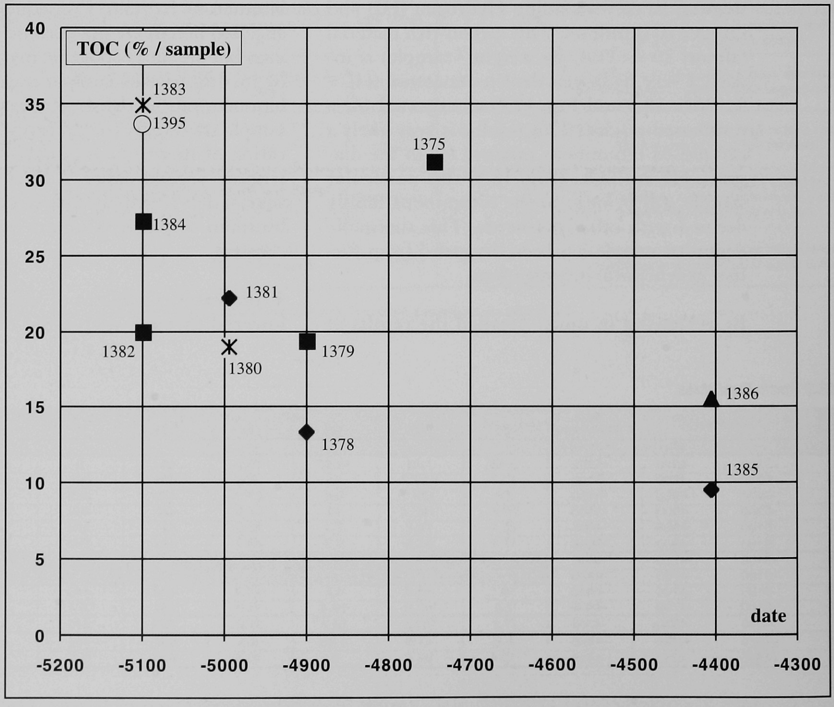


Fig. 18.5 Variation of TOC (Total Organic Carbon in % by weight / whole sample) of bituminous mixtures through time.

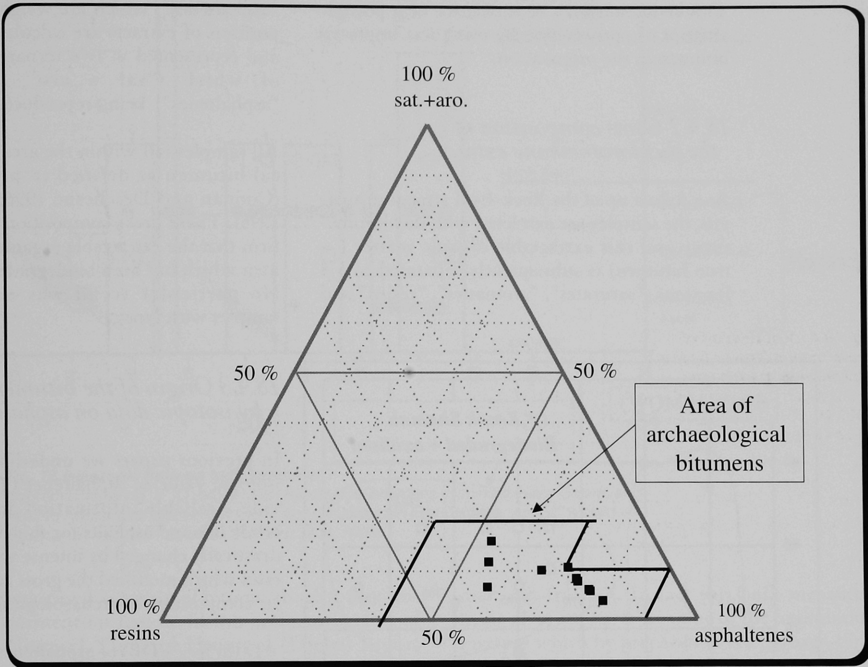


***Fig. 18.6** Ternary diagram ("saturates + aromatics" - "resins" - " asphaltenes") showing the gross composition of the dichloromethane extracts of the Kosak Shamali archaeological bitumens.*

***Table 18.3** Content and composition of the dichloromethane extract.*

					Gross composition (Iatroscan)			Gross composition (MPLC100 + precipitation of asp)				isotopic data on asphaltenes		
sample number	date			EO (%/sample)	"sat"	"aro"	"pol"	"sat"	"aro"	"res"	"asp"	$\delta^{13}C$	δD	$\delta^{34}S$
	Max	Min	Average											
1382	-5300	-4900	-4800	0.51	3.6	6.1	90.3							
1383	-5300	-4900	-4800	13.04	7.5	7.8	84.7	7.4	8.4	30.7	53.5	-27.7	-54	-5.6
1384	-5300	-4900	-4800	23.9	2	5.8	92.2	4.4	6.1	19.1	70.4	-27.8	-54	-6.2
1395	-5300	-4900	-4800	34.5	4	4.3	91.7	1.8	2.1	15.9	80.2	-27.9	-58	-5.8
1380	-5190	-4800	-4800	12.46	5	7	88	3.9	3.8	18.7	73.6	-28.1	-58	-0.9
1381	-5190	-4800	-4800	11.65	6.5	7.3	86.2	5.2	5	24.2	65.6	-28	-67	-0.9
1376	-5100	-4700	-4350	0.25	2.8	5.6	91.6							
1377	-5100	-4700	-4350	0.09	2.5	5.9	91.6					-28.3	-63	
1378	-5100	-4700	-4350	14.23	4.7	5.4	89.9	3.2	3	17.3	76.5	-28.3	-63	3.7
1379	-5100	-4700	-4350	7.36	2.6	9.2	88.2	1.2	5.5	36	57.3	-28.2	-58	4.9
1375	-4940	-4550	-4050	12.65	3.4	10.2	86.4	4	7.8	33.2	55	-27.7	-65	-5.9
1385	-4550	-4260	-3550	9.01	4.4	5.7	89.9	4.1	4.2	18.6	73.1	-28.2	-65	3.6
1386	-4550	-4260	-3550	14.47	5.1	5	89.9	2.3	3.5	17.3	76.9	-28	-63	-2.3

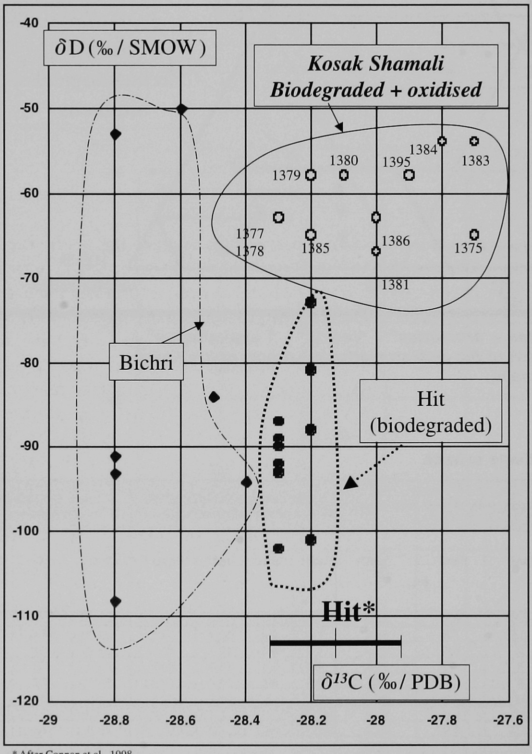
Significance of abbreviations: EO = Extractable Organic Matter by dichloromethane (in % by weight / bulk sample); "sat" = "saturated hydrocarbons" in % EO; "aro." = "aromatic hydrocarbons" in % EO; "pol." = "polars" or "resins + asphaltenes" in % EO; "res." = " resins" in % EO; "asp" = "asphaltenes" in % EO; $\delta^{13}C$ = $\delta^{13}C$ in ‰ / PDB; δD = δD in ‰ / SMOW = $\delta^{34}S$ = $\delta^{34}S$ in ‰ / CDT.

This reduction may be indicative of a possible attempt of optimisation by using less imported bitumen in the preparation.

18.4.2 Gross composition of the dichloromethane extract

As a follow up of the Rock-Eval screening analysis, the samples are extracted with dichloromethane and this extractable organic matter (= true bitumen) is subsequently separated into 4 fractions ("saturates", "aromatics", "resins" and "asphaltenes") which are weighed. Gross composition of extracts are calculated (Table 18.3) and represented in two ternary diagrams, one of which ("sat + aro", "resins", and "asphaltenes") being reproduced in Fig. 18.6.

All samples fall within the area of archaeological bitumen as defined in previous studies (Connan and Deschesne 1996; Connan *et al.* 1998). These gross composition properties confirm that the extractable organic matter is bitumen which has been biodegraded and oxidised. No particular trend was noticed among samples with types.



* After Connan et al., 1998

Fig. 18.7 Isotopic data on asphaltenes:
diagram of δD against $\delta^{13}C$ of archaeological samples from Kosak Shamali compared to natural asphalts from Bichri and Hit area.

18.4.3 Origin of the bitumen assumed by isotopic data on asphaltenes

In previous papers we underlined that carbon isotopic value of asphaltenes (Table 18.3) provide a reliable information on the origin of crude oils and asphalts for this parameter is not drastically changed by intense weathering processes which modified the gross and the molecular composition of archaeological bitumens.

δD (in ‰ / PDB) of asphaltenes is not a source parameter for this parameter is highly sensitive to weathering processes which affected the bitumen all along their history. This alteration entails a major shift of δD towards heavier values which means an enrichment in deuterium as seen in Kosak Shamali samples ($-54 < \delta D < -67$ ‰ / SMOW; Fig. 18.7). The occurrence of these heavy values agree with what was previously found in archaeological bitumen from other areas and very recently in samples from Bahrain (Connan *et al.* 1998). Unbiodegraded crude oils accumulated in reservoirs at depth and natural asphalts, tar sands and oil seeps (Djebel Bichri and Hit; Fig. 18.7) do generally show much lighter values ($-75 < \delta D < -120$ ‰ / SMOW). Consequently heavy values recorded in bitumen from this data set confirms that these archaeological bitumens are also deeply weathered oils, i.e. evaporated, biodegraded and oxidised.

The plot of $\delta^{13}C$ (in ‰ / PDB) vs. δD (in ‰ / SMOW) of asphaltenes (Fig. 18.7) does show that natural asphalts from Djebel Bichri, which

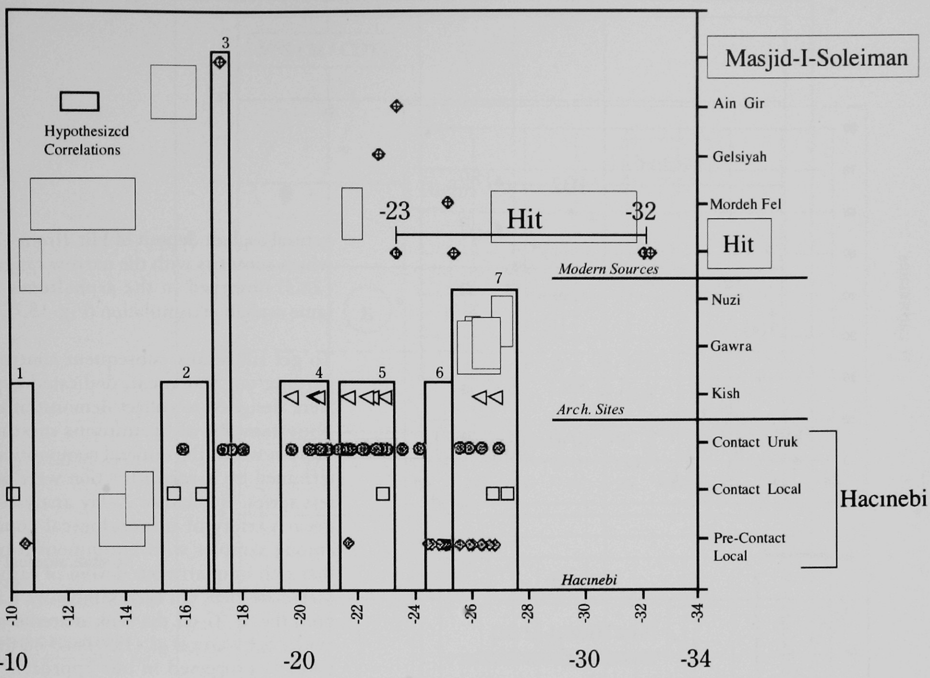
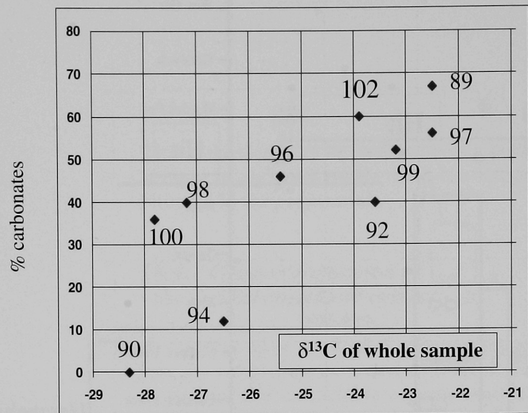


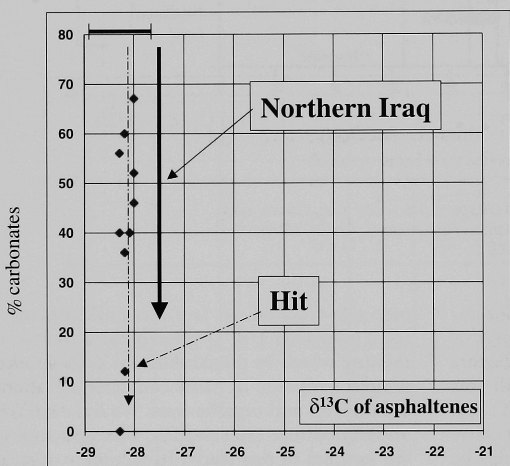
Fig. 18.8 Isotopic data on bulk samples:
diagram comparing $\delta^{13}C$ values of archaeological bitumens (Hacınebi, Kish, Gawra, and Nuzi) to natural asphalts and oil seeps from Hit, Mordeh Fel, Gelsiyah, Ain Gir, Masjid –I-Soleiman in Iran and Iraq (after Schwartz et al. *1999)*

were used as source of bitumen to glue flint implement on handle in the prehistoric sites of Umm el-Tlel and Hummal (Djebel Bichri area), were not exported to Kosak Shamali area between the V and IVth millennium BC. On the contrary the famous Hit source, particularly traded within the Uruk period may possibly be present in the samples analysed.

One should notice that the $\delta^{13}C$ values of asphaltenes recorded in both archaeological and geological samples vary between –28.8 and –27.7 ‰ / PDB, i.e. within a very narrow range of less than 1.5 ‰ / PDB. These results are fully consistent with what we reported in our previous papers (Connan 1988; Connan and Deschesne 1996; Connan 1999; Connan et al. 1998) but contrasts with what was recently published by Schwartz *et al.* (1999). These authors report $\delta^{13}C$ values of bitumen samples between –10 and –28 ‰ / PDB (Fig. 18.8) and consider these values as those of the bitumen itself. This assumption is fully wrong for the bulk isotope composition, carried out on whole archaeological bitumen samples as done by Schwartz *et al.* (1999), does not provide $\delta^{13}C$ values of the total organic carbon and more precisely of its bitumen sub-fraction. In fact this bulk measurement gives only a $\delta^{13}C$ value of the bituminous mixture which by preparation is a garbage-type sample composed of many components including mineral and organic ones. We have already underlined that critical point when presenting the samples of this study. In fact their organic matter is currently a mixture of bitumen and vegetal debris (reed and straw) which often even contains carbonised matter introduced with ashes. In that respect, the bulk $\delta^{13}C$ values, measured on whole samples, cannot be representative of the bitumen alone. In addition bulk values are largely influenced by the mineral matrix present and significant shift should be expected when carbonates are abundant. Marine carbonates possess $\delta^{13}C$ values around 0 (Karhu 1999) whereas petroleum (crude oils, bitumen, and natural asphalts) values cover the –20 / -33 ‰ / PDB range (Clark 1999). Occurrences of various mixtures of bitumen and minerals, especially carbonates, are obviously explaining the wide range of $\delta^{13}C$ values published by Schwartz *et al.* (1999) in their archaeological samples of Hacınebi, Kish, Gawra, and Nuzi (Fig. 18.8). Of particular significance is the wide range of $\delta^{13}C$ values found in the



a



b

Fig. 18.9 Carbon isotopic data from Mari:
comparison of $\delta^{13}C$ values measured on whole samples and asphaltenes: influence of the carbonate content on the data acquired on bulk samples.

natural asphalt deposit of Hit (from –23 to –32) which contrasts with the narrow range (-27.9 to –28.3) observed in the asphaltenes from the same asphalt accumulation (Fig. 18.7).

To get rid of any subsequent controversy regarding our statement, dedicated experiences were designed to collect demonstrative proofs. Nine samples of bituminous mixtures from Mari in which the mineral composition was determined by X-ray diffraction were selected as test series. By chance X-ray analyses reveal a great variety of mineralogical composition among samples with bituminous mixtures either rich in quartz but devoid of carbonates or carbonate-rich. On each sample we have measured the $\delta^{13}C$ on the bulk material as carried out by Schwartz *et al.* (1999) and on the asphaltenes as processed in our approach. The obtained data, gathered in Table 18.4, are presented in Fig. 18.9. These results fully confirm what was expected. First of all the $\delta^{13}C$ values measured on bulk samples are directly related to the amount of carbonate end especially of calcite in the present case history (Fig. 18.9). Occurrence of large percentages of calcite ($\delta^{13}C$ around 0?) should be shifting the bulk values towards heavier ones. This trend is indeed recorded herein for values move from –29 to –21 ‰ / PDB when the % of carbonates or calcite (not shown) increases (Fig. 18.9a). On the contrary $\delta^{13}C$ values of asphaltenes (Fig. 18.9b) are independent of the mineral composition and cluster within a narrow range which clearly indicates that the bitumen of Mari is likely originating from Hit. This pre-conclusion has indeed been corroborated by taking into account molecular data on biomarkers (Connan and Deschesne 2003).

Table 18.4 Bituminous mixtures from Mari (Syria):
Isotopic data (δD and $\delta^{13}C$) on whole samples and their asphaltenes and mineralogical composition of bulk samples.

archaeological number	Archaeological Campaign	Average date	asphaltenes		whole sample		mineralogical composition (X-Ray diffraction analysis)				
			$\delta^{13}C$	δD	%carbon	$\delta^{13}C$	quartz %	calcite %	dolomite %	gypsum %	felspars %
92	Mari 87	-2400	-28.3	-62	38	-27.2	8	38	2	1	2
97	Mari 87	-2330	-28.3	-56	25	-22.5	11	46	10	1	5
102	Mari 87	-2330	-28.2	-49	32	-23.9	5	57	3	1	1
89	Mari 87	-2100	-28.0	-60	24	-22.5	6	60	7	1	1
90	Mari 87	-2100	-28.3	-67	20	-28.3	96	0	0	0	1
99	Mari 87	-2100	-28.0	-71	27	-23.2	9	44	8	1	1
100	Mari 87	-2050	-28.2	-78	44	-27.8	7	35	1	4	1
94	Mari 87	-1750	-28.2	-59	23	-26.5	56	11	1	0	3
96	Mari 87	-1750	-28.0	-69	40	-25.4	9	41	5	1	1
98	Mari 87	-1750	-28.1	-47	25	-23.6	6	36	4	0	3

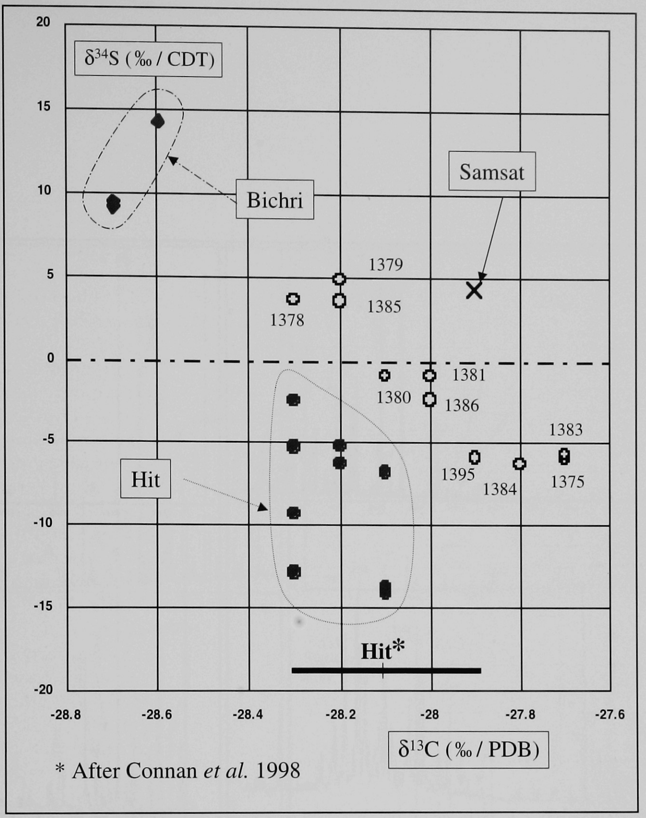


Fig. 18.10 Isotopic data on asphaltenes:
diagram of δ^{13}C against δ^{34}S of archaeological samples from Kosak Shamali compared to natural asphalts from Bichri, Hit and Samsat.
Significance of abbreviations: black circle = Hit natural asphalts; white circle = Kosak Shamali bituminous mixtures; black cross = Samsat solid bitumen.

To complete the series of genetic parameters, isotopic data on sulfur (δ^{34}S in ‰ / CDT) has been collected on asphaltenes. The results are presented in Fig. 18.10 by comparison to regional references on Hit and Bichri. As previously noticed, the Kosak Shamali samples are not showing any correlation with the Bichri bitumen but many samples display δ^{34}S values which falls within the Hit range. Some samples (n°1378, 1379 and 1385) occupy an intermediate position between Bichri and Hit. Obviously at least two main families are occurring among the bitumen of Kosak Shamali. They will be more precisely delineated by discussing the molecular chemistry in the next paragraph.

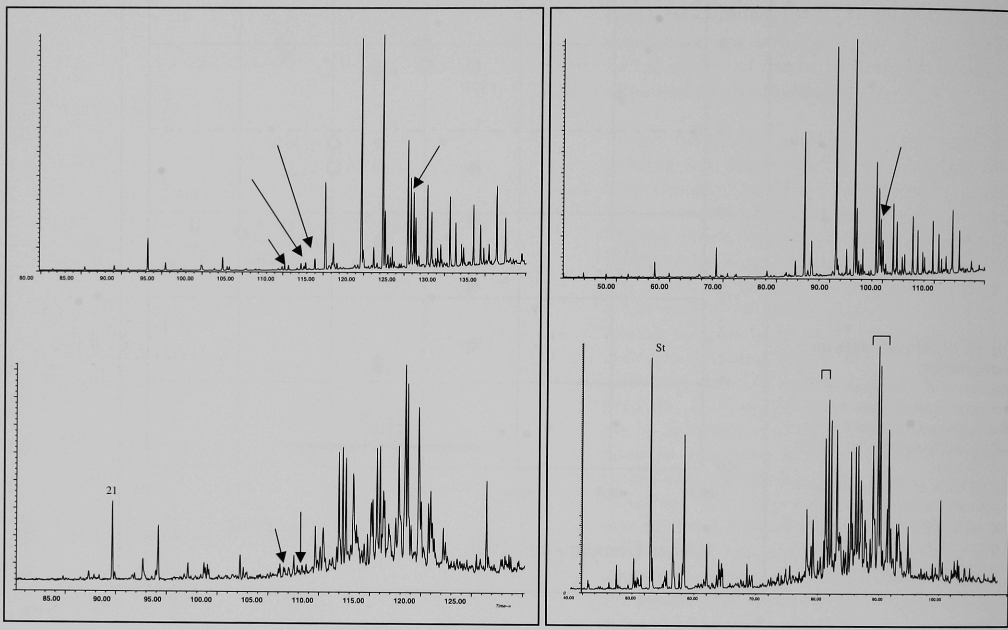
18.4.4 Origin of bitumen based on sterane and terpane biomarkers

"Saturates" were analyzed by GC-MS in order to examine sterane (m/z 217) and terpane (m/z 191) patterns which are currently used to elaborate genetic parameters allowing it to differentiate various bitumen origins.

As usual in archaeological bitumen, biomarker fingerprints display various degrees of alteration from almost unaltered patterns (state 3) to the most affected one which is ranked state 16 in our alteration scale. At this highest level of alteration, both steranes and terpanes are significantly altered but between state 1 and 15, terpanes are preserved and may be used to define genetic parameters reliable to identify the origin of the associated bitumen. Among the samples analysed, the sample 1385 is the only one that reached the highest degree of alteration, namely 16 (Table 18.5). Most samples exhibits states of alteration between 3 and 9 which correspond to a moderate biodegradation of C27steranes without alteration of terpanes (Table 18.5).

Review of steranes and terpanes reveals two main classes of bitumen, which are presented in Figs. 18.11 and 18.12.

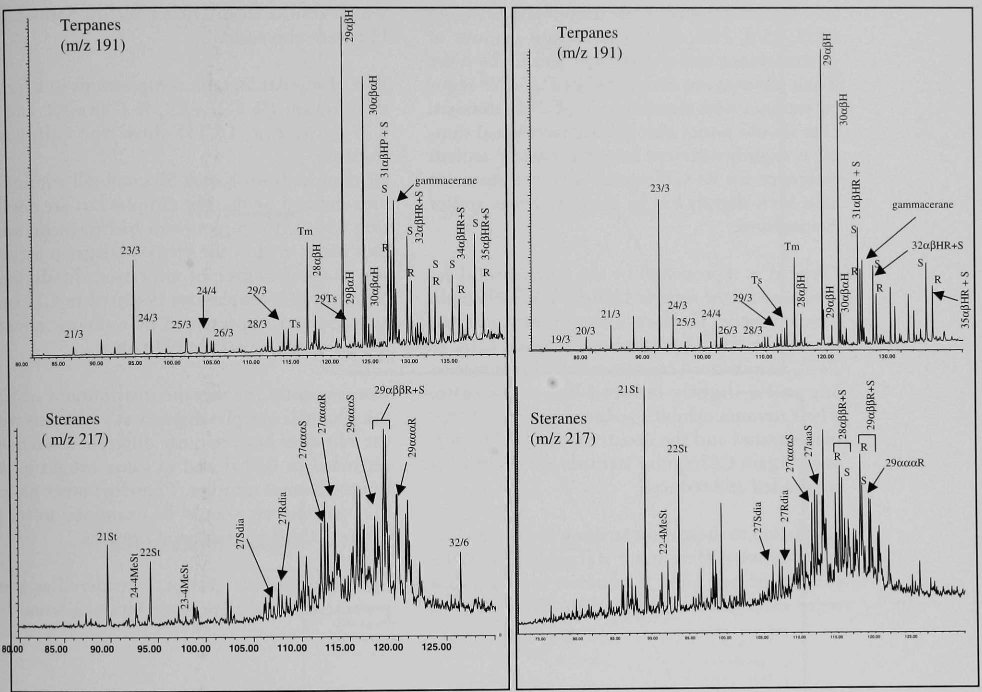
-Type I is exemplified by the famous natural asphalts of Hit in Iraq and by the sample 1380 of Kosak Shamali. Their terpanes are character-



1380-Kosak Shamali

231-Hit: natural asphalt

Fig. 18.11 Sterane (m/z 217) and terpane (m/z 191) patterns:
comparison of a sample from Kosak Shamali (n°1380) to a natural asphalt from Hit (n°231). Significance of abbreviations in steranes : C21St = 5 α (H), 14 β (H), 17 β (H)-pregnane; C22St = 5 α (H), 14 β (H), 17 β (H)-methyl-20-pregnane; C22-4MeSt =C22-4methylsterane; C27Sdiast = C27S-diasterane; C27 $\alpha\alpha\alpha$ R = 5α (H), 14α (H), 17α (H)-20R-cholestane; C28 $\alpha\beta\beta$ R = 5 α (H), 14 β (H), 17 β (H)-20R-24methylcholestane; C29 $\alpha\alpha\alpha$ R = 5 α (H), 14 α (H), 17 α (H)-20R-24ethylcholestane; 32/6 C32hexahydrobenzohopanes.
Significance of abbreviations in terpanes: 21/3 = C21tricyclopolyprenane; 23/3 = C23tricyclopolyprenane; 24/4 = C24 17, 21-secohopane; Ts = 18 α (H)-22, 29, 30-trisneonor; Tm = 17 α (H)-22, 29, 30-trisnorhopane; 28 $\alpha\beta$H = 17 α (H), 21 β (H)-30-dinorhopane; 29 $\alpha\beta$H = 17 α (H), 21 β (H)-norhopane; 29 $\beta\alpha$H = 17 β (H), 21 α (H)-norhopane; 30 $\beta\alpha$H = 17β(H), 21 α (H)-hopane; 30$\alpha\beta$H = 17α (H), 21β (H)-hopane; 31$\alpha\beta$HR+S = 17α (H), 21β (H)-homohopane 22R and 22S; 35 $\alpha\beta$HR+S = 17α (H), 21β (H)-pentakisnorhomohopane 22R and 22S.



1378- Kosak Shamali

1680-Samsat: natural asphalt

Fig. 18.12 Sterane (m/z 217) and terpane (m/z 191) patterns:
comparison of a sample from Kosak Shamali (n°1378) to a natural asphalt from Samsat (n°1680). Abbreviations in Fig. 18.11.

ized by low amount of the tricyclopolyprenanes (21/3, 23/3, 24/3, etc.), a moderate amount of gammacerane and a very high Tm to Ts ratio. Their steranes are dominated by C27-C29 regular steranes with almost no C27-C29diasteranes. One should notice that the archaeological sample is slightly different from the natural asphalt reference for its C27regular steranes seems to have been slightly lost by biodegradation and/or evaporation;

-Type II is represented by the Samsat solid asphalt and by the sample 1378 of Kosak Shamali. Their terpanes do show a significant contribution of the tricyclopolyprenanes family (21/1 to 29/3), an enhanced concentration of gammacerane and a slightly reduced Tm to Ts ratio. Their steranes exhibit a reduced amount of regular steranes and the occurrence of C27diasteranes. Again C27regular steranes are slightly biodegraded and reduced.

In relation to these most striking molecular features which differentiate sterane and terpane patterns of type I and II bitumen, specific ratios were calculated and listed in Table 18.6 in which results from Djebel Bichri, Samsat and Hit were also added.

Plot of regular sterane compositions in a ternary diagram (% C27 $\alpha\beta\beta$, % C28 $\alpha\beta\beta$, and % C29 $\alpha\beta\beta$; Fig. 18.13) show the following features:
all samples from Kosak Shamali fall within the area defined by the Hit samples but are not fitting with any samples from Bichri. Bichri samples move within the ternary diagram according to their degree of alteration. Moderately biodegraded samples are depleted in C27 steranes. Samsat, represented by a unique sample, is close to the Kosak and Hit area.

Consequently the sterane distributions of Kosak Shamali samples appears as consistent with the Hit ones but are quite different from those recorded in Bichri and to some extend in the unique Samsat samples. Therefore other molecular parameters should be examined to try to refine the differentiation of samples.

Specific molecular ratios, considered as good parameters to differentiate bitumen from dif-

Table 18.5 Summary of the characteristic properties of steranes and terpanes: *evaluation of the degree of alteration.*

sample number	steranes			diasteranes	terpanes		degree of alteration
	C21-C22	C27-C29	C29 $\alpha\alpha\alpha$ R	C27-C29diast	tricyclopolypr.	C27-C35Hop.	
1375	present-altered	slightly altered, less C27	unaltered	absent	present-trace	unaltered	9
1376	slightly altered	unaltered?	unaltered	absent	trace-slightly altered?	unaltered	3
1377	slightly altered	unaltered	unaltered	absent	trace-slightly altered?	unaltered	3
1378	slightly altered	unaltered?	unaltered	present	abundant-slightly altered?	unaltered	3
1379	slightly altered	slightly altered, less C27	unaltered	present but low	present-altered	unaltered	9
1380	slightly altered	unaltered?	unaltered	trace	present-slightly altered?	unaltered	3
1381	slightly altered	slightly altered, less C27	unaltered	trace	present-slightly altered?	unaltered	9
1383	slightly altered	unaltered	unaltered	trace	present-trace	unaltered	3
1384	slightly altered	unaltered	unaltered	trace	present-trace	unaltered	3
1385	absent	altered- no regular steranes	unaltered	extremely abundant	abundant -altered	altered?	15 or 16
1386	slightly altered	slightly altered, less C27	unaltered	trace	present	unaltered	9
1395	slightly altered	unaltered?	unaltered	trace	trace-slightly altered?	unaltered	3

Significance of abbreviations: C21= C21Sterane = 5 α (H), 14 β (H), 17 β (H)-pregnane; C22 = C22sterane = 5 α (H), 14 β (H), 17 β (H)-methyl-20-pregnane; C27-C29 = C27-C29steranes; C29 $\alpha\alpha\alpha$ R = 5 α (H), 14 α (H), 17 α (H)-20R-24 ethylcholestane; C27-C29diast = C27-C29diasteranes; tricyclopolypr. = tricyclopolyprenanes; C27-C35Hop. = C27-C35Hopanes.

Hit

Samsat-Bichri

Kosak Shamali

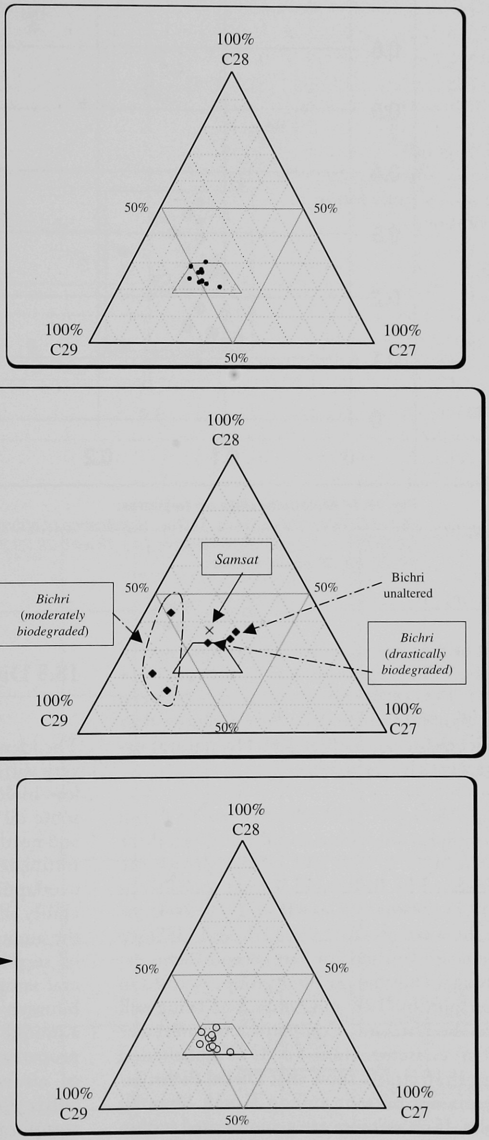


Fig. 18.13 Gross composition of regular steranes expressed in a triangular diagram (% C27 αββ R+S- % C28 αββ R+S, % C29 αββ R+S):
comparison of Hit natural asphalts, Samsat-Bichri natural asphalts and Kosak Shamali archaeological bitumens.

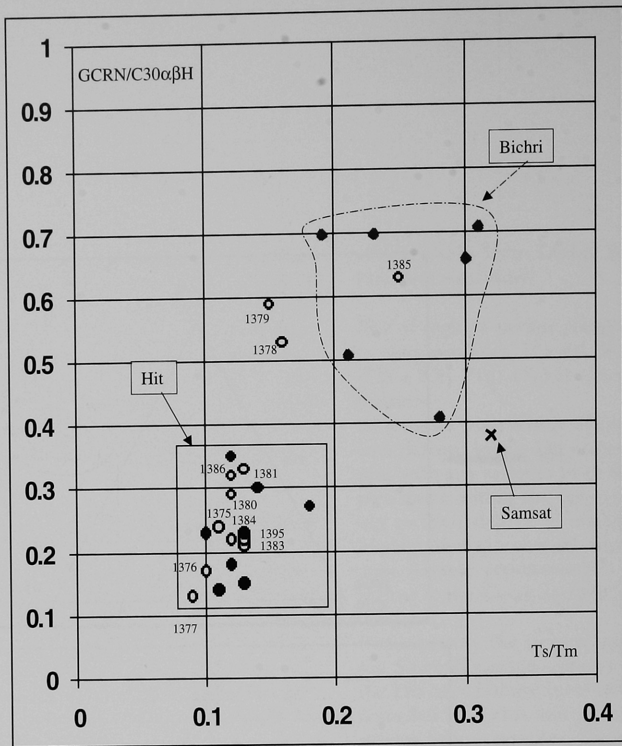


Fig. 18.14 Molecular data on terpanes:
plot of GCRN / C30 $\alpha\beta$H vs. Ts/Tm . Significance of abbreviations: GCRN = Gammacerane; C30 $\alpha\beta$H = 17 α(H)21 β(H)-hopane; Ts = 18 α(H)-22,29,30-trisneonorhopane; Tm = 17 α (H)-22, 29, 30-trisnorhopane.

ferent origins were selected for a comparison of samples. They are reproduced in Figs. 18.14 and 15. Fig. 18.16 offers a cross plot between molecular and isotope data. As references, data on Djebel Bichri, Samsat and Hit natural asphalts were also included.

In Fig. 18.14 (GCRN/C30 $\alpha\beta$H vs. Ts /Tm), most samples fall within the Hit area but three of them (n°1378, 1379 and 1385) approach the area defined by Bichri and Samsat asphalts. In Fig. 18.15 (27Sdia / 29 $\alpha\alpha\alpha$R vs. 23/3 / 24/4) the same three samples (n°1379, 1378, and 1385) are in the neighbourhood of Samsat and Bichri asphalts again but the previous group, ascribed to Hit, is split into two subgroups, one being still within the Hit zone. Comparison of molecular (Ts/Tm) vs. isotopic ratio (δ^{13}C of asphaltenes) in Fig. 18.16 clearly show that Djebel Bichri bitumen is not present among Kosak Shamali samples. If six samples are again located within the Hit area some others (n°1384, 1383, and 1375) are appearing in the northern Iraq zone.

18.5 Discussion

The identification of the source of bitumen is a very difficult task in this part of the world for low molecular contrasts are observed between some oil seeps and natural asphalts from Hit and northern Iraq. Isotopic data on asphaltenes, fortunately, help to draw some conclusions but overlapping may also exist. In addition the reliability of the classification still depends upon the amount of references analysed. Within one oil seep location one should have access to several samples for it should be underlined that a bitumen occurrence at surface is not defined by a unique set of properties but by a spectrum of properties which is largely related to the degree of alteration of various bitumens at the collection site. The problem became more complicated when this geological bitumen is manufactured and incorporated in bituminous mixtures and submitted to weathering processes during its historical life. In particular we are aware of the limited data available on

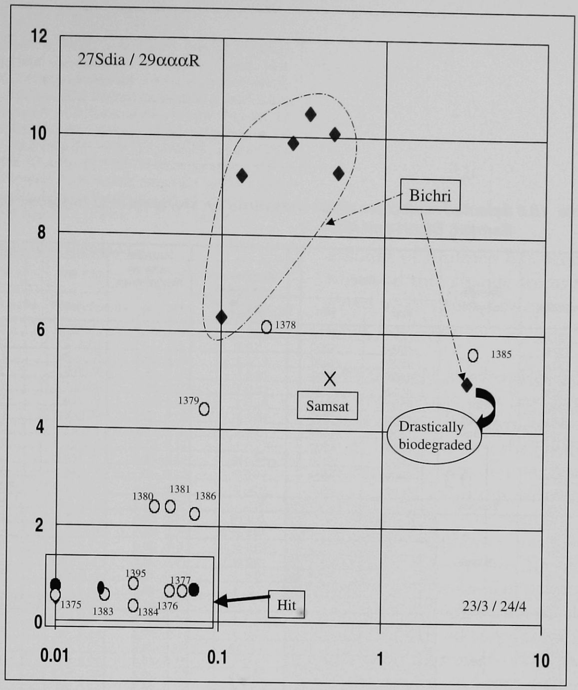


Fig. 18.15 Molecular data on steranes and terpanes:
plot of 27Sdia/29αααR vs. 23/3 / 24/4.
Significance of abbreviations: C27Sdiast = C27S-diasterane; C29 αααR = 5 α(H), 14 α(H), 17 α (H)-20R-24ethylcholestane; 23/3 = C23tricyclopolyprenane; 24/4 = C24 17,21-secohopane.

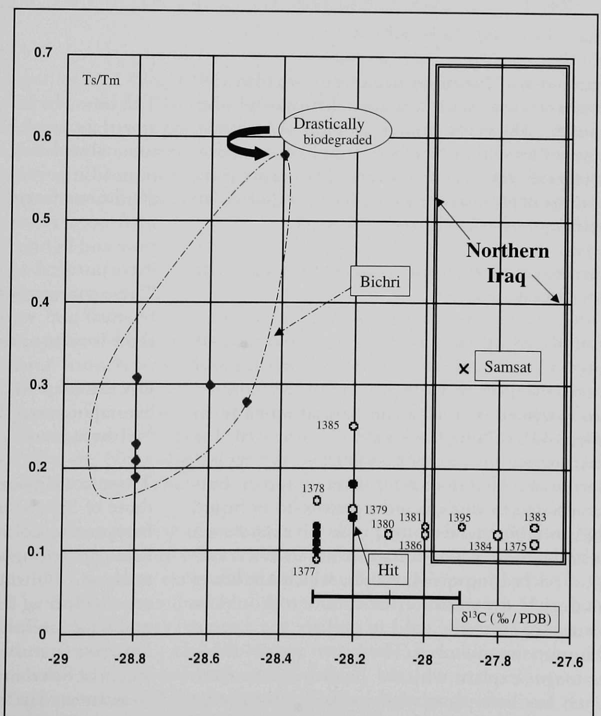


Fig. 18.16 Molecular data on terpanes vs. carbon isotopic data on asphaltenes.

Table 18.6 Selected molecular ratios measured on steranes and terpanes of bitumen from Kosak Shamali, Samsat, Bichri and Hit.

number	Sample location	date		steranes and terpanes	Isotopic data on asphaltenes	S63	S64	S65	S57
		Max	Min	degree of alteration	$\delta^{13}C$	%C27	%C28	%C29	27SDia/29 $\alpha\alpha\alpha$ R
1375	Tell Kosak Shamali	-4200	-3900	2	-27.7	27.9	23	49.2	0.01
1376		-4500	-4200	1		30	22	48	0.05
1377		-4500	-4200	1	-28.3	35	21	44	0.06
1378		-4500	-4200	1	-28.3	25.6	30.2	44.2	0.19
1379		-4500	-4200	7	-28.2	21.2	28.4	50.3	0.08
1380		-5100	-4500	1	-28.1	26.1	26.3	47.6	0.04
1381		-5100	-4500	2	-28	26.2	26.5	47.3	0.05
1383		-5100	-4500	2	-27.7	27.1	22.6	50.2	0.02
1384		-5100	-4500	1	-27.8	27.8	23.1	49.1	0.03
1385		-3900	-3200	16	-28.2	24.8	26.3	48.9	3.59
1386		-3900	-3200	2	-28	25.5	27.4	47.2	0.07
1395		-5100	-4500	2	-27.9	22.9	24.1	53	0.03
1680	Samsat				-27.9	24	37	39	0.47
170	Bichri			16	-28.4	25.9	32.3	41.8	3.3
364				11 or 15	-28.5	21.1	15.3	63.6	0.51
365				13 or 15	-28.6	8.5	43.2	48.3	0.13
374				13 or 15	-28.8	13.3	21.6	65	0.1
425				1	-28.8	32.9	36.4	30.7	0.48
429				1	-28.8	32.3	33.9	33.8	0.27
268				15	-28.8				0.34
16	Hit			1	-28.2	29.3	24.5	46.2	0.07
231				1	-28.3	32	24.1	44	0.01
233				15	-28.2	25.6	29.9	44.5	0.01
232				1	-28.3	30.6	24.3	45.1	0.01
234				15	-28.3	24.2	26	49.8	0.01
236				1	-28.3	33	23.7	43.3	0.01
135-1				1	-28.3	35	20	45	0.01
135-2				1	-28.3	36	21	43	0.02

the natural bitumen occurrences from the Samsat area, which is only known by one sample. Moreover numerous natural bitumen sources known in Northern Iraq have not been analysed yet. These present-day constraints lead to be critical about the data set and to let some question mark when necessary.

According to what was presented it seems that we can say that:
- the bitumen from Djebel Bichri has not been found among the Kosak Shamali bituminous mixtures. This feature is not surprising and may be explained by the nature of the bitumen occurrences. The huge accumulation of bitumen, outcropping in Djebel Bichri, occurs as impregnations of quartz sand and are typical tar sands. Therefore the pristine bitumen outcropping at surface is not a pure solid or liquid bitumen but an oil-stained rock. To export such a bitumen over long distance, one should transport oil-bearing quartz sands, which are heavy materials. In addition the bitumen should be extracted from the sand to prepare the various bituminous mixtures. These two major disadvantages explain why the Djebel Bichri bitumen has been discarded in Antiquity except during the Palaeolithic where the quantity used was very limited.

The bitumen from Hit and northern Iraq flow at surface as oil shows. At Samsat the bitumen we analysed was occurring as a pure solid bitumen filling veins. These adequate geological conditions favour the gathering of these bitumen occurrences for export. The material is pure and lighter than a rock and could be easily incorporated to prepare required mixtures. These sources of bitumen are present at Kosak Shamali and we have split the samples among three sources as follows:

Hit: sample 1380, 1381, 1376, 1377, and 1386,
Samsat?: sample 1378, 1379, and 1385
Northern Iraq? : 1383, 1384, 1395, and 1375

These conclusions are not in agreement with those of Schwartz *et al.* (1999), which stemmed from analysis of slightly later materials at Hacınebi. According to our experience based on the analysis of bitumen from several sites in the area including Hacınebi, Tell Sheikh Hassan, and Jerablus Tahtani, we have never seen so far bitumen from Iran (Gel Siyah and Sar-I Pol in Fig. 5 of Schwartz *et al.*) or even from the Mediterranean Lattakia source imported to this geographic area. The Mediterranean bitumen from Lattakia exhibits very specific geochemical

Significance of abbreviations: %C27 = % 5α(H), 14α(H), 17α(H)-20R+20S-cholestane / total $\alpha\alpha\alpha$steranes; % C28 = % 5α(H), 14α(H), 17α(H)-20R+20S-24methylcholestane / total $\alpha\alpha\alpha$steranes; % 5α(H), 14α(H), 17α(H)-20R+20S-24ethyl cholestane / total $\alpha\alpha\alpha$ steranes; 27Sdia / 29$\alpha\alpha\alpha$R = C27Sdiasterane / 5α(H), 14α(H), 17α(H)-20R-24 ethylcholestane; 23:3 /24:4 = C23polyprenane / C24 17; 21-secohopane, 29:5/29$\alpha\beta$H = 29Ts / 17α(H), 21β(H)-30-norhopane; 28$\alpha\beta$H = 17α(H); 21β(H)-30-dinorhopane; Tricyl / penta = tricyclopolyprenanes / pentacyclic terpanes; Ts/Tm = 18α(H)-22, 29, 30-trisneonorhopane / 17α(H)-22, 29, 30-trisnorhopane; GCR / 30$\alpha\beta$H = gammacerane / 17α(H), 21β(H)-hopane.

Tricyclopolyprenanes and terpanes					
Tt26	**Tp2**	**Tp5**	**T32**	**Tp1**	**Tp35**
23:3/24:4	**29:5/29$\alpha\beta$H**	**28$\alpha\beta$H/Tm+Ts**	**Tricycl/penta**	**Ts/Tm**	**GCR/30$\alpha\beta$H**
0.46	0.06	0.25	0.01	0.11	0.24
0.66	0.04	0.21	0.02	0.1	0.17
0.65	0.05	0.19	0.02	0.09	0.13
6.1	0.09	0.1	0.18	0.16	0.53
4.4	0.11	0.13	0.08	0.15	0.59
2.4	0.08	0.2	0.08	0.12	0.29
2.4	0.09	0.16	0.09	0.13	0.33
0.55	0.07	0.23	0.02	0.13	0.21
0.35	0.06	0.23	0.02	0.12	0.22
5.6	0.15	0.01	0.41	0.25	0.63
2.26	0.1	0.23	0.08	0.12	0.32
0.8	0.1	0.29	0.03	0.13	0.22
5.1	0.13	0.24	0.19	0.32	0.38
5	0.5	0.08	2.01	0.58	2.6
9.3	0.12	0.14	0.34	0.28	0.41
9.2	0.14	0.19	0.19	0.3	0.66
6.3	0.15	0.27	0.1	0.31	0.71
10.1	0.1	0.01	0.29	0.21	0.51
9.9	0.1	0.01	0.38	0.19	0.7
10.5	0.1	0.16	0.4	0.23	0.7
0.68	0.12	0.26	0.05	0.18	0.27
0.5	0.08	0.21	0.03	0.1	0.23
0.74	0.08	0.25	0.05	0.14	0.3
0.75	0.06	0.22	0.04	0.13	0.23
0.75	0.07	0.24	0.05	0.12	0.35
0.73	0.06	0.2	0.04	0.12	0.18
0.53	0.05	0.18	0.02	0.11	0.14
0.57	0.05	0.2	0.03	0.13	0.15

properties (Connan *et al.* 1990a, 1990b) which was not encountered yet in the Hacınebi-Kosak Shamali area. According to our present knowledge, the use of this bitumen source has been restricted to Mediterranean local sites, i.e. in Ras-Shamra-Ougarit and its harbour: Ras Ibn Hani.

18.6 Conclusions

The geochemical study of 13 archaeological bituminous mixtures from Kosak Shamali has shown that all samples are true archaeological samples which were prepared by mixing bitumen with other materials: vegetal debris (straw?), quartz, clay, etc. No geological sample was present among the samples analyzed.

Analysis of the bitumen quantity reveals that the mixtures are quite typical of what is currently seen elsewhere in other excavations of the Near East. The detailed examination of the sample set indicates that several recipes were used namely: bitumen + quartz + clay (?), bitumen + vegetal debris + clay (?), and bitumen + vegetal debris + quartz + clay (?). In the interior of potsherds, the mixture identified is bitumen + quartz + clay (?). It seems that the amount of bitumen has been reduced through time and that change seems to have been instigated in an attempt to optimize the mixture by using less bitumen.

The detailed geochemical study using molecular and isotopic data has suggested three possible sources of bitumen used in Kosak Shamali (Fig. 18.17). At first the molecular chemistry of steranes and terpanes suggested that two main sources of bitumen were present at Kosak Shamali. These two sources, both famous ones along the Euphrates, are Hit on one side and possibly Samsat on the other side. Cross-checking of molecular parameters with carbon isotope data suggested a third possibility, which is the asphalt oil seeps from northern Iraq. No bitumens from the Djebel Bichri or Ras Shamra-Ougarit areas were found among the samples of Kosak Shamali.

Assuming that our results based on the small sample size are representative, the source distribution appears to show a chronological pattern. Samples of the lower levels all indicate derivation from northern Iraq, while the upper levels rather point to Hit and Samsat sources with an exception of a single piece from Level 1 (n° 1383). This would open an array of discussions on the social relationship of Tell Kosak Shamali with other regions and its change through time, which will be discussed in the next volume.

Acknowledgements
The authors would like to thank Professor Dr. M. Namik Yalcin, Istanbul University, Turkey, for providing us with the solid bitumen reference from the Samsat area. Thanks are also due to Elf Aquitaine Production for their technical support. We are indebted to the technical staff from the CSTJF of Elf Aquitaine Production in Pau (France) and in particular to Daniel Dessort, Jean-Bernard Berrut, Béatrice Ruiz and Nadine Loubère who have carried out many analyses. We would also like to acknowledge Daniel Jarvie, from Humble Instruments & Services Inc., Texas, USA, and Armelle Charrie-Duhaut, Laboratoire de Chimie Bioorganique, Louis Pasteur University, Strasbourg, France, who performed the analyses of the Samsat reference.

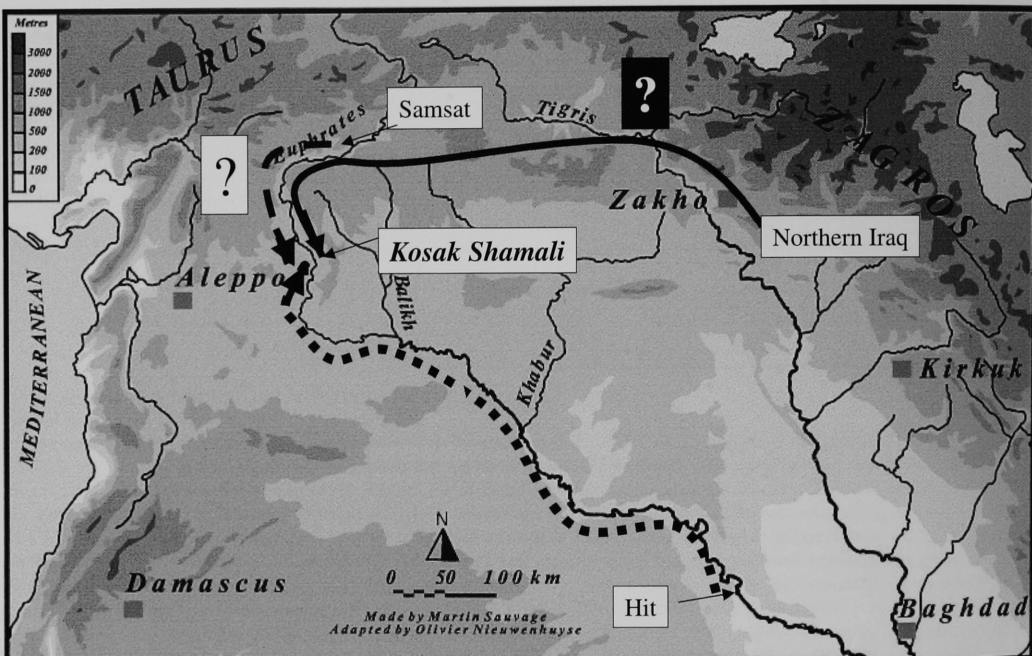


Fig. 18.17 Map of the Near East showing the presumed source of bitumen and their associated trade routes to Kosak Shamali.

References

Abdullah, F.H. and J. Connan (2002) Geochemical study of some Cretaceous rocks from Kuwait: Comparison with oils from Cretaceous and Jurassic reservoirs. *Organic Geochemistry* 33: 125-148.

Boëda, E., J. Connan, D. Dessort, S. Muhesen, N. Mercier, H. Valladas and N. Tisnerat (1996) Bitumen as hafting material on Middle Palaeolithic artefacts. *Nature* 380: 336-338.

Boëda, E., J. Connan and S. Muhesen (1998) Bitumen as hafting material on Middle Palaeolithic artefacts from the El Kowm Basin, Syria. In: *Neandertals and Modern Humans in Western Asia*, edited by T. Akazawa, K. Aoki and O. Bar-Yosef, pp.181-204. New York: Plenum.

Carter, R. and H. Crawford (2001) The Kuwait-British Archaeological Expedition to As-Sabiyah: report on the second season's work. *Iraq* LXIII: 1-20.

Clark, I.D. (1999) Stable isotopes. In: *Encyclopaedia of Geochemistry*, edited by C. P. Marshall and R. W. Fairbride, pp. 588-592. Dordrecht: Kluwer Academic Publishers.

Cleuziou, S. and M. Tosi (1990) The Third campaign at RJ-2: A preliminary report. In: *The Joint Hadd Project: Summary Report of the Third Season*, edited by J. E. Reade and M. Tosi, pp.11-21. Paris and Rome.

Cleuziou, S. and M. Tosi (1994) Black boats of Magan: some thoughts on Bronze Age water transport in Oman and beyond from the impressed bitumen slabs of Ra's al-Junayz. In: *South Asian Archaeology 1993, Volume II*, edited by A. Parpola and P. Koskikallio, pp. 745-761. Helsinki.

Connan, J. (1988) Quelques secrets des bitumes archéologiques de Mésopotamie révélés par les analyses de géochimie organique pétrolière. *Bulletin, Centres Recherches Exploration, Elf Aquitaine* 12(2): 759-787.

Connan, J. (1999) Use and trade of bitumen in antiquity and prehistory: molecular archaeology reveals secrets of past civilizations. *Philosophical Transactions of the Royal Society of London* B 353: 33-50.

Connan, J. (2002) L'archéologie moléculaire et isotopique: étude géochimique des bitumes, brais et goudrons de bois. In: *Géologie de la Préhistoire*, edited by J.C. Miskovsky, pp. 1045-1056. Paris: Association pour l'Étude de l'Environnement Géologique de la Préhistoire, Maison de la Géologie.

Connan, J., C. Breniquet and J.-L. Huot (1996) Les objets bituminés de Tell el'Oueili: des témoins de la diversité des réseaux d'échanges commerciaux de l'Obeid 0 à l'Uruk récent. In: *Oueili, Travaux de 1987 à 1989*, edited by J.-L. Huot, pp. 413-453. Paris: ERC.

Connan, J., O. Deschesne and D. Dessort (1990a) L'origine des bitumes archéologiques de Ras Shamra (Syrie). *Bulletin, Centres Recherches Exploration, Elf Aquitaine* 14(2): 521-539.

Connan, J., O. Deschesne and D. Dessort (1990b) L'origine des bitumes archéologiques de Ras Shamra (Syrie). In: *Ras Shamra-Ougarit VI: Arts et Industries de la Pierre*, edited by M. Yon, pp. 101-105. Paris: ADPF.

Connan, J. and O. Deschesne (1996) *Le Bitume à Suse*. Collection du Musée du Louvre. Coédition Elf Aquitaine-réunion des Musées Nationaux-Collection Monographie, Paris.

Connan, J. and O. Deschesne (2003) Le Bitume à Mari. *Ah Purattim* 1, in press.

Connan, J., P. Lombard, R. Killick, F. Højlund, J.-F. Salles and A. Khalaf (1998) The archaeological bitumen of Bahrain from the Early Dilmun period (c.2200 BC) to the sixteenth century AD: A problem of sources and trade. *Arabian Archaeology and Epigraphy* 9: 141-181.

Connan, J., O. Nieuwenhuyse, A. van As and L. Jacobs (2003) Bitumen in early ceramic art: bitumen-painted ceramics from Late Neolithic Tell Sabi Abyad (Syria). *Archaeometry*, in press.

Connan, J. and J. Oates (2003) The bitumen from Tell Brak from the Middle Uruk (c.3500 BC) to Late Bronze age (c.1280 BC): Origin and trade routes. In: *Excavations at Tell Brak, Volume 3. The Prehistoric Periods*, edited by J. Oates, D. Oates, G. Emberling and H. McDonald. Cambridge: McDonald Institute Monograph, in press.

Forbes, R.J. (1964) Bitumen and petroleum in antiquity. In: *Studies in Ancient Technology*, 2nd edition, pp. 1-123. Leiden: E. J. Brill .

Jasim, A.A. (1985) *The Ubaid Period in Iraq: Recent Excavations in the Hamrin Region*. BAR International Series 267. Oxford: Archaeopress.

Karhu, J. (1999) Carbon isotope. In: *Encyclopaedia of Geochemistry*, edited by C. P. Marshall and R. W. Fairbridge, pp. 67-73. Dordrecht: Kluwer Academic Publishers.

Koizumi, T. and H. Sudo (2001) The stratigraphy and architectures of Sector B of Tell Kosak Shamali. In: *Tell Kosak Shamali, The Archaeological Investigations of the Upper Euphrates, Syria, Vol. I*, edited by Y. Nishiaki and T. Matsutani, pp. 115-152. UMUT Monograph 1. Oxford: Oxbow Books.

Marschner, R.F. and H.T. Wright (1978) Asphalts from middle eastern archaeological sites. *Archaeological Chemistry* 2: 150-171.

Marschner, R.F., L.J. Dufy and H.T. Wright (1978) Asphalt from ancient town sites in Southwestern Iran. *Paléorient* 4: 97-112.

Matsutani, T. and Y. Nishiaki (1995) Preliminary report on the archaeological investigations at Tell Kosak Shamali, The Upper Euphrates, Syria: The 1994 season. *Akkadica* 93: 11-20.

Nishiaki, Y. (2000) An Ubaidian burnt building from Tell Kosak Shamali, North Syria. *Proceedings of the First International Congress on the Archaeology of the Ancient Near East*, edited by P. Matthiae, A. Enea, L. Peyronel and F. Pinnock, pp. 1213-1223. Rome: University of Rome.

Nishiaki, Y., T. Koizumi, M. Le Mière and T. Oguchi (1999) Prehistoric occupations at Tell Kosak Shamali, the Upper Euprates, Syria. *Akkadica* 113: 13-68.

Nishiaki, Y., M. Tao, S. Kadowaki, M. Abe and H. Tano (2001) Excavations in Sector A of Tell Kosak Shamali: The stratigraphy and architectures. In: *Tell Kosak Shamali, The Archaeological Investigations of the Upper Euphrates, Syria, Vol. I*, edited by Y. Nishiaki and T. Matsutani, pp. 49-97. UMUT Monograph 1. Oxford: Oxbow Books.

Schwartz, M. and D. Hollander (2001) Annealing, distilling, reheating and recycling: bitumen processing in the Ancient Near East. *Paléorient* 26(2): 83-91.

Schwartz, M., D. Hollander and G. Stein (1999) Reconstructing Mesopotamian Exchange Networks in the 4th Millennium BC: Geochemical and archaeological analyses of bitumen artifacts from Hacınebi Tepe, Turkey. *Paléorient* 25(1): 67-82.

Vosmer, T. (2000) Model of a third Millennium BC reed boat based on evidence from Ra's al-Jinz. *The Journal of Oman Studies* 11: 149-152.

CHAPTER 19

Summary of the papers in Volume II

Yoshihiro Nishiaki

This is the second volume of the research reports of Tell Kosak Shamali, the prehistoric site that the University of Tokyo team excavated in the Tishreen Dam Flood Zone of the upper Euphrates valley, Syria, between 1994 and 1997. The volume comprises eight papers concerning the technology and subsistence of the societies of the earliest Northern Ubaid to the Middle Uruk, accompanied with detailed documentation of archaeological finds. Accounts of the flaked stone artifacts (Chapter 11), grinding and ground stones (Chapter 13), bone artifacts (Chapter 14), and other small finds like ornamental and administration pieces (Chapter 15) are given, together with results of the analysis of botanical (Chapter 16) and faunal remains (Chapter 17), and source identification of obsidian (Chapter 12) and bitumen imports (Chapter 18). The following is the editor's summary of these chapters. A few comments are also made when appropriate. These papers cover nearly all the major finds except pottery. The latter and related objects will be presented in the next volume with general conclusions to be drawn from all the available data.

Chapter 11

Flaked stone artifacts represent one of the important tools for the Chalcolithic communities. This chapter examined about 33000 specimens level by level to explore the chronological changes of the flaked stone industries in the Chalcolithic sequence. As a result, it revealed several elements of change. In the raw material exploitation, the predominant use of flint over obsidian characterizes the industries. The vast proportion of tools from all the levels were manufactured on locally available flint. Obsidian was utilized only sparsely, but it was more common in the earliest Northern Ubaid levels and it diminished in relative importance over the sequence. In addition, the pattern of obsidian imports also displayed a diachronic change. In most of the levels of the Northern Ubaid period, obsidian was basically imported in the form of finished products, but from the Post-Ubaid onwards, it was brought in as cores and large flakes as well.

Noteworthy changes of the flint industries were observed in blank production technology. Elongated blade blanks were more commonly produced in the earlier Ubaid levels, with a technology similar to the Halafian, but they were increasingly replaced by shorter flake blanks in the later levels. On the other hand, in the Post-Ubaid levels a small number of blades with a distinct form were introduced. These blades, generally known as Canaanean blades, were considered specialist products, indicating the emergence of a more complicated system of lithic production in this late stage of the Chalcolithic sequence. Typologically, the most characteristic tools of Tell Kosak Shamali are sickle elements that were attached to a handle with bitumen. They constituted up to half of the total flaked stone tools in the earlier Northern Ubaid levels, but their proportion steadily decreased as time went on for unknown reasons. Dominant tool forms in the latest occupations (Middle Uruk) were thus non-formalized flake tools such as retouched flakes, denticulates and notches. Similarly the morphological features of the sickle elements also exhibited temporal changes. The manufacture of blade-based elongated elements in the earliest Ubaid became less common in the later Ubaid period when shorter elements with crescent or one-corner pointed shapes made on flakes took their place, and again blade elements came into common use during the Post-Ubaid and Uruk stages.

From these observations and others, this chapter suggests that the long sequence of Tell Kosak Shamali can be divided into seven phases.

The periodization, solely based on a lithic perspective, seems to well correspond to that defined by the stratigraphy as well as the architectural evidence (Chapters 3 and 4 of Volume I). The changes in lithic assemblages were interpreted as a complex phenomenon of changes in the social system, reflecting both indigenous industrial evolution and cultural interaction with contemporaneous communities mainly in the south.

Chapter 12

The amount of obsidian introduced to the settlement was small, as noted above, comprising less than a few percent in all the levels. In Chapter 12, a trace element analysis using the ICP-AES method was carried out on nine samples, with a result showing that most of the obsidian was imported from either the Bingöl or the Nemrut Dağ areas in southeast Anatolia. While these sources are ones which have been commonly identified at other related Chalcolithic settlements in inland North Syria, the existence of one sample from Cappadocia, Central Anatolia calls for our particular attention. The sample was from the earliest stage of the Ubaid occupations at Tell Kosak Shamali, Level 14 of Sector A. The associated lithic assemblages and architectural evidence from this stage contained elements probably surviving from the earlier Halafian entity in this region (Chapter 11; also see Chapter 3 of Volume I). In that respect it is interesting to recall that, as recent analyses at Tell Halula and Dja'de Mughara show, the obsidian sources in Central Anatolia were equally important on the Upper Euphrates during the Neolithic and Halafian periods. The social relations for obsidian supply in the earliest Northern Ubaid may also have differed from that of the later periods, although the small sample size so far analyzed precludes a final conclusion.

Chapter 13

The Chalcolithic inhabitants of Tell Kosak Shamali widely exploited rich stone sources in the Euphrates valley. They manufactured a large variety of grinding and ground stone tools from sandstone, basalt, limestone and so on, all readily available nearby the settlement, leaving a large collection over 3000 specimens that outnumbers most of the collections obtained to date from other Chalcolithic sites in North Syria. Chapter 13 documented the inventory of these tools from morphological and functional points of view.

Grinding and ground stone tools were obviously produced for various purposes. Besides grain processing tools well known at numerous other Chalcolithic sites, craft working and even hunting tools were also manufactured. Perhaps most intriguing among these were tools considered to have served for pottery production. Their common occurrence is not surprising, however, for pottery workshops were repeatedly identified in several Chalcolithic levels of the excavated squares (Chapters 3 and 4 of Volume I). The possible pottery production tools included those for surface treatment (polishers, grinders and smoothers), pigment preparation (pounders, pestles, smearers, mortars and palettes), and securing/painting pottery (anvils and "turning tables"). While tools made of other materials like wood and clay must have been utilized for similar purposes, this chapter demonstrates that particular kinds of stone tools made up an important part of the potters' tool kit in the Chalcolithic period. The frequency and typological variation of these tools likely reflect technological changes in pottery production. For example, the relative occurrence of pigment preparation tools closely correlates to that of painted pottery; it sharply dropped in the Post-Ubaid period, when painting became rarely applied in pottery decoration. This led to a suggestion that further analysis of these tools in combination with data from the pottery itself, as well as their spatial distribution pattern, would contribute to an understanding of Chalcolithic pottery manufacturing technology from a unique point of view.

Chapter 14

The Chalcolithic bone industry was described in Chapter 14. Tools made of bones including horn-cores were relatively rare in the Tell Kosak Shamali collection. Only 90 specimens were recovered. Most predominant were awls, followed by a much smaller number of needles, knives, spatulas, splintered pieces, a flesher, bone plates, tubes, debitage, a sickle handle, and an unidentifiable fragment. Several unmodified horns and antlers were also utilized as tools, as indicated by use-wear at their tips. From a functional point of view, which is not based on experimental or use-wear analysis, these bone tools appear to have served mostly for domestic work. Indications of other purposes like ornamental (plates and tubes) and craft use (horns) are only sparsely present. No hunting tools such as bone points are included in the present collection.

The analysis in this chapter shows that bone tools from the earlier Northern Ubaid period display larger variations both in form and manufacturing techniques, many of which have close parallels at earlier settlements, even at those of the Neolithic period. The implication of the emergence of a more simplified industry in the Terminal Northern Ubaid period has not been explained well, but interestingly it seems to be a comparable phenomenon to what was observed above for the flaked and ground stone industries.

Chapter 15

Artifacts collectively described as small finds in Chapter 15 are composed of 180 specimens. They included spindle whorls of stone and clay, clay scrapers, clay disks, clay figurines, miscellaneous clay objects, seals and sealings, stone vessels, and ornamental pieces made on stone and bone. These objects represent sources of information concerning various facets of the daily life of the Chalcolithic village communities, from which insight into fiber spinning technology, pottery production, goods control practices, ritual activities and so on was obtained. They provided an idea even about riverine transportation, through a clay model of a boat discovered in Level 10 of Sector A.

The description in this chapter incorporates discussions on two artifact classes, the spindle whorls and seals/sealings. The metric analysis revealed the increasingly more common use of lighter spindle whorls from the later phase of the Late Northern Ubaid, which was interpreted as evidence demonstrating the onset of substantial production of wool that probably required spinning of a finer yarn. This interpretation is apparently in accord with the results of the faunal analysis (see below), which also points out the increase of wool production from the same period.

Four seals and seven sealings were discovered at Tell Kosak Shamali, mostly in two particular contexts: the burnt building of the Early Northern Ubaid (Level 10 of Sector A), and the Post-Ubaid workshop (Level 5 of Sector B). Examples from the Ubaid burnt building consisted of one stamp seal and five sealings, all situated close to the entrance of the storage building complex. The sealings, with traces of coil baskets, did not show an impression from the associated seal. A consequent suggestion of this is that the circulation of the sealed material was directed out of the settlement or at least out of this building complex. The seals from the Post-Ubaid workshop, dating to the end of the 5th millennium BC, unexpectedly included a stone cylinder seal with a geometric design. Although the excavators claim its discovery in a primary context (Chapter 4 of Volume I) and this chapter sought a proper time-space position in the Mesopotamian chronology for this very early "cylinder seal", the possibility of its intrusion from an upper layer cannot be ruled out. The remaining pieces are two flat bead-like stamp seals and one sealing. A comparison with the Ubaid specimens disclosed an interesting contrast. The existence of two seals in a restricted context as opposed to one in the burnt building, may hint at the involvement of more than one person in managing the circulation of goods. The sealing, bearing two impressions of a stamp, retains evidence of use of a shoulder of a jar, instead of the coil basket noted for the Ubaid. According to the author of this chapter, these differences could be an indication of the emergence of a new administrative system in the Post-Ubaid period, when a well-organized pottery workshop that has no parallels in the earlier period came into use for the first time at Tell Kosak Shamali.

The paper appended to this chapter reports on scientific analyses of three specimens from the Post-Ubaid and Uruk levels of Sector B: a small, highly polished stone slab (Level 2, Middle/Late Uruk), an oxidized stone lump (Level 3, Middle Uruk) and a metal fragment (Level 5, Post-Ubaid). Through geochemical and archaeometallurgical analyses, these were identified as a piece of chalcedony, a hematite lump, and a fragment of copper, respectively. The chalcedony piece seems an unfinished bead, and the hematite lump is likely to have been a pigment for pottery decoration. The original form of the copper fragment is unknown because of its poor preservation.

Chapter 16

Chapters 16 and 17 dealt with organic remains from the Chalcolithic levels of Tell Kosak Shamali. Although water floatation was not employed for the excavations, thanks to fire a relatively large collection of botanical samples was recovered from Level 10 of Sector A. The remarkable architecture of Level 10 was a large burnt building, in which plenty of tools and daily commodities were preserved *in situ*. Botanical remains were abundantly present in a series of small, square rooms without recognizable doorways, best interpreted as storage rooms. Rooms 10A03 to 10A05 were rich with carbonized grain, which was stored either in pottery jars or clay structures. The analysis in Chapter 16 showed that the Northern Ubaid community handled wheat and barley separately but not emmer and einkorn: grain of emmer and einkorn was stored together in Rooms 10A04 and 10A05, while in Room 10A03 barley was stored without mixing with other species. In addition, the wheat was in the hulled state prior to threshing, while the barley was fully hulled and threshed before storage.

Another contribution from the botanical study was the identification of two-seeded domestic einkorn in the samples, a cultivar thought to have been domesticated locally in this region during the late Neolithic but abandoned sometime before the Bronze Age. The Tell Kosak Shamali example filled a gap within this biological reconstruction, demonstrating its continuous cultivation as late as the Early Northern Ubaid period.

The burnt building produced plenty of charcoal remains as well. Those from Room 10A03, believed to represent collapsed roof material, gave us an opportunity to reconstruct the building techniques of the Early Northern Ubaid period. Large poplar, willow and alder were used for roof beams while narrower tamarisk that was found only in the form of young branches was probably put to use to cover the spaces between the beams. Worth mentioning was the use of a certain amount of alder as well. Alder, not growing wild in the region today, may have had a different habitat in the Ubaid period, or have been exploited from driftwood on the Euphrates.

Two groups of ash samples were also subjected to botanical analysis to investigate fuels for kilns in different periods. One was taken from a pottery kiln of the Early Northern Ubaid period in Level 13 of Sector A (Feature 1306; see Chapter 3 of Volume I), and the other one from Post-Ubaid pottery kilns from Levels 6 and 5 of Sector B. Whereas the former yielded no identifiable plant remains, the latter both contained fragments of glumes, stems and awns of cereals, indicating that chaff and straw were used as fuel in those kilns. The contrast, admittedly insufficient to be generalized, may have resulted from different ways of firing between these periods.

Chapter 17

Faunal remains studied in Chapter 17 came from Squares AD5, AE5, AF5, BD6 and BE7. These squares were selected so as to examine all the chronological phases of the Chalcolithic sequence, but unfortunately they contained too few materials from the lowest levels of the Ubaid period. Nevertheless the analysis provided important information as to the animal use in the late Early Northern Ubaid to the Middle Uruk periods.

A large diversity of animal species was identified, consisting of not only domestic sheep, goat, cattle and pig, but also wild species such as gazelle, fallow deer, dog, red fox, equid, hare, bird, and possibly wild cattle and pig. Hunting of wild mammals, particularly gazelles, remained a steady practice throughout the periods represented, in addition to the husbandry that was more economically important. As no stone or bone arrows were recovered, stone sling missiles may have played an important role in hunting.

Predominant in the husbandry system were sheep and goats, the former being more common. According to the preliminary analysis of the age profiles, secondary products, probably milk, were already exploited in the late Early Northern Ubaid period along with the tender meat. Secondary products appear to have increased in economic importance during the Late Northern Ubaid to Post-Ubaid periods. In the Uruk period the trend became even more conspicuous, when exploitation of milk and wool took the preferential status. The preliminary interpretation of the authors of this chapter, that Tell Kosak Shamali was not a simple "consumer" settlement at that time is one to be tested through further analysis of other related evidence.

Chapter 18

Turning back to material studies, the final chapter of this volume referred to the use and the sources of bitumen, an exotic raw material for the society of Tell Kosak Shamali. Microscopic observation revealed that bitumen was mixed with quartz, clay, and vegetal debris prior to use, a common procedure already known at other Chalcolithic sites in Mesopotamia. Pottery vessels were used for the preparation by heating, as evidenced by residues on the interior of some bowls. The resultant bituminous mixtures were then put to use either as a glue or waterproof agency for tools and other daily utensils. Most common was their use for manufacturing sickles with flint blades and handles made of organic materials. Bituminous mixtures were also used to fix or waterproof mats/riverboats made of reeds. The discovery of a cache in Level 6 of Sector A indicates that old bituminous mixtures were carefully collected and stored for reuse, due to their precious nature for the Ubaid communities of Tell Kosak Shamali.

Like obsidian, bitumen was imported to the settlement from restricted sources. The analysis of carbon isotopic data extracted from thirteen archaeological samples attested that bitumen from sources at Djebel Bichri, the closest to the settlement, was not brought in, but it identified three possible sources in remote regions: Samsat on the upper Euphrates in modern Turkey, Hit on the middle Euphrates of Iraq, and an as yet unspecified source in northern Iraq. The nearest one among these to Tell Kosak Shamali is Samsat, over 200km up the Euphrates watercourse to the northeast. Such long distance trade may have been facilitated by boat technology. The chronological distribution of the small set of data point to a trend that bitumen from the source of northern Iraq was more commonly introduced than the others in the earliest levels of the early Northern Ubaid. Further study is required to see whether or not this trend has archaeologically meaningful implications.

مصادر محتملة في مناطق بعيدة: سامسات في منطقة الفرات الأعلى في تركيا، حيت في منطقة الفرات الأوسط في العراق، ومصدر غير محدد في منطقة العراق الشمالي.

أقربها إلى موقع تل قصق هو سامسات، يبعد 200 كم على مجرى الفرات باتجاه الشمال الشرقي.
استخدام القوارب ساعد في تسهيل التجارة لمسافات بعيدة. التوزع الزمني للمعلومات القليلة التي تمكنا من الحصول عليها، يدل على أن مصدر القار في شمالي العراق ظهر بشكل أكبر في السويات المبكرة التي ترجع الى فترة العبيد الشمالي. ونحتاج إلى دراسة أعمق لكي نعرف إن كان هذا الاتجاه يحمل مضمون أثري أو لا.

النص بقلم: يوشيهيرو نيشياكي

ترجمة: لبنى عمر

السوية 13 القطاع A (المعلم 1306، راجع الفصل 3 من الجزء I) والعينة الأخرى من أفران شي الفخار التي ترجع إلى مرحلة ما بعد العبيد من السويات 6 و 5 من القطاع B. لم يعثر في العينة الأولى على بقايا نباتية، أما الأخرى احتوت على بقايا سنابل الحبوب مثل الساق وحسكة السنابل وقصعة السنابل، وهذا يدل أن القصب والتبن قد تم استخدامه كوقود لهذه الأفران. وهذا التباين، يجب الاعتراف أنه غير كافي لتعميم هذه النتيجة، ربما كان نتيجة استخدام عدة تقنيات شي خلال هذه الفترات الزمنية.

الفصل: 17

بقايا العظام التي درست في الفصل 17 أتت من المربع AD5، AE5، AF5، BD5 و BE5 وتم اختيار هذه المربعات لكي تتم دراسة كافة المراحل الزمنية للعصر الحجري النحاسي، ولكن لسوء الحظ لم نعثر في هذه المربعات على العديد من العينات من السويات الأكثر انخفاضاً التي ترجع إلى فترة العبيد. على أية حال قدم تحليل البقايا العظمية معلومات هامة حول كيفية استثمار الحيوانات من فترة العبيد الشمالي المبكر وحتى فترة أوروك الوسطى.

تم التعرف على أجناس حيوانية كبيرة ومتنوعة، لم تتألف فقط من الحيوانات المدجنة الخراف و الماعز، الأبقار والخنازير، بل أيضاً عثر على أنواع برية مثل الغزال، الأيل، الكلب، الثعلب الأحمر، الحمار البري، الأرنب، والطيور، ومن المحتمل الأبقار والخنازير البرية. استمرت عملية صيد الثدييات، وبشكل خاص صيد الغزلان، خلال الفترات الزمنية التي تمت دراستها، هذا بالإضافة إلى تدجين الحيوانات التي كانت أكثر أهمية من الناحية الاقتصادية. لم يتم العثور على رؤوس سهام حجرية أو عظمية، لذلك من المحتمل أن قذائف المقلاع قد لعبت دوراً هاماً في عملية الصيد.

في نظام التدجين كانت الخراف والماعز هي الحيوانات السائدة، والخراف كانت أكثر شيوعاً. ومن خلال الدراسة الأولية لمقاطع الأعمار، اكتشفنا أن المنتجات الثانوية وعلى الأغلب الحليب تم استثمارها خلال فترة العبيد الشمالي المبكر هذا بالإضافة إلى اللحوم. ازدادت أهمية المنتجات الثانوية خلال فترات العبيد الشمالي المتأخر حتى فترة ما بعد العبيد. خلال فترة أوروك أصبح هذا الاتجاه أكثر وضوحاً، حين أصبح استثمار الحليب والصوف أمراً محبذاً أو مفضلاً. والتفسير الأولي الذي وضعه مؤلفي هذا الفصل، هو أن تل قصق الشمالي لم يكن عبارة عن مستوطنة «استهلاكية» بسيطة، وهنا يجب التأكد من هذا الأمر من خلال دراسة أدلة أخرى متعلقة به.

الفصل: 18

نعود إلى دراسة المواد، هذا الفصل من هذا الجزء يشير إلى وظيفة ومصدر مادة القار، التي كانت مادة خام مميزة لدى مجتمع قصق الشمالي. كشفت الدراسة المجهرية أنه تم مزج القار مع الكوارتز، الطين، والبقايا النباتية قبل أن يتم استخدامه، وهذه العملية كانت معروفة سابقاً في مواقع العصر الحجري النحاسي في منطقة بلاد الرافدين. تم الاعتماد على الأواني الفخارية في عملية التحضير، حيث استخدمت في التسخين، والدليل على ذلك بقايا القار التي عثر عليها في جوف بعض الطاسات، وبعد ذلك يبدأ استخدام مزيج القار إما كمادة لاصقة أو مادة مقاومة للماء لأجل الأدوات أو الآلات التي تستخدم يومياً. الاستخدام الأكثر شيوعاً لهذه المادة كان في صناعة المناجل ذات الشفرات الصوانية ذات المقابض المصنوعة من مواد عضوية. استخدمت أيضاً للتثبيت أو للحصائر المقاومة للماء أو الزوارق النهرية المصنوعة من القصب. اكتشاف مخبأ سري في السوية 6 القطاع A يدل على أن مزيج القار كان يتم جمعه بعناية و تخزينه لأجل إعادة استخدامه، هذا بسبب طبيعته الثمينة بالنسبة الى جماعات العبيد البشرية في تل قصق الشمالي.

ومثل الأوبسيديان، تم استيراد القار من مناطق محددة. ويدل تحليل نظائر الكربون التي أخذت من ثلاثة عشرة عينة أثرية أن مصدر القار لم يكن من منطقة جبل بشري، الأكثر قرباً إلى المستوطنة، فقد تم تحديد ثلاثة

لم تحمل أي تصميم يرجع للختم الذي عثر عليه.

و مما سبق ذكره يمكن أن تقترح أن المواد التي تم ختمها كان يتم تداولها خارج المستعمرة أو على الأقل خارج مجمع الأبنية التي عثر عليها فيه. الأختام التي عثر عليها في مشغل مرحلة ما بعد العبيد، الذي يعود الى نهاية الألف الخامس قبل الميلاد، كانت تضم بشكل غير متوقع ختم أسطواني حجري يحمل تصميم هندسي. بالرغم من أن المنقب يرجع اكتشافه هذا إلى سوية مبكرة (الفصل 4 من الجزء I) وهذا الفصل يسعى إلى وضع هذا «الختم الأسطواني» المبكر جداً في فترة زمنية ملائمة بالنسبة الى تاريخ بلاد الرافدين، ولا يمكننا الجزم إن كان هذا الختم ينتمي إلى طبقة أعلى ولاحقاً توضع في هذه الطبقة. القطع التي تبقت عبارة عن ختمين مسطحين بشكل خرزة وطبعة ختم. المقارنة بين لقى فترة العبيد يكشف عن تباين مثير للاهتمام. العثور على ختمين في منطقة محصورة من البناء المحروق كل منهما موضوع بجانب الآخر، هذا الأمر يلمح إلى الاعتماد على اكثر من شخص للقيام بمهمة مراقبة تبادل البضائع. طبعة الختم التي تحمل تصميمين، تدل على استخدام كتف الجرة، عوضاً عن آثار السلال التي تمت ملاحظتها خلال فترة العبيد. تبعاً لرأي المؤلف في هذا الفصل، هذه الاختلافات قد تعتبر مؤشر على ظهور نظام إداري جديد خلال فترة ما بعد العبيد، حيث بدأ استخدام مشغل فخار منظم في موقع تل قصق الشمالي لم نشاهد مثيلاً له في الفترة السابقة.

الفصل: 16

الفصل 15 و الفصل 16 يختصان بالبقايا العضوية خلال العصر الحجري النحاسي في تل قصق الشمالي. بالرغم من أن عملية التطويف بالماء لم يتم استخدامها أثناء التنقيب، لكن بفضل الحريق تم اكتشاف كمية ضخمة نسبياً من العينات النباتية ترجع للسوية 10 القطاع A.

البقايا المعمارية الرائعة في السوية 10 عبارة عن بناء ضخم محروق، عثر فيه على العديد من الأدوات والمواد المستخدمة يومياً التي حفظت في مكانها الأصلي. ظهرت البقايا النباتية بكثرة في مجموعة من الغرف الصغيرة، مربعة الشكل لم يتم تحديد موضع أبوابها، وأفضل تفسير لوظيفة هذه الغرف هو اعتبارها كغرف تخزين. الغرف من 10A03 حتى الغرفة 10A05 كانت غنية ببقايا الحبوب المتفحمة، التي تم تخزينها داخل جرار فخارية أو منشآت من الطين. وتظهر الدراسة في هذا الفصل أن المجتمعات البشرية خلال فترة العبيد الشمالي كانت تفصل القمح والشعير دون الخلط بينهما، ولكن لم تفصل الحنطة والقمح البري: تم تخزين حبوب الحنطة والقمح البري كلاهما في الغرف 10A04 و 10A05 في حين تم تخزين الشعير في الغرفة 10A03 دون مزجه مع أي نوع آخر من الحبوب. وبالإضافة الى ذلك عثر على القمح المقشور قبل البدء بعملية درسه، في حين كان الشعير مقشور بشكل كامل وتمت عملية درسه قبل تخزينه.

والنتيجة الأخرى التي حصلنا عليها من دراسة البقايا النباتية، هي العثور على عينتين لبذور القمح البري تمت زراعتها من قبل الإنسان، ويعتقد أن هذه الزراعة تم استخدامها محلياً خلال فترة النيوليت المتأخر ولكن قبل فترة البرونزي تم تركها.
نموذج تل قصق الشمالي يسد الفراغ في عملية إعادة بناء البيولوجيا، ويدل على استمرار عملية الزراعة حتى فترة العبيد الشمالي المتأخرة.

وأيضاً حصلنا على العديد من البقايا المتفحمة من البناء المحترق. والعينات من الغرفة 10A03 يعتقد أنها تمثل المواد التي بني منها سقف الغرفة، مما مكننا من تصور تقنيات البناء خلال فترة العبيد الشمالي المبكر. حيث استخدم شجر الحور والصفصاف وجار الماء كدعامات للسقف في حين استخدمت شجرة الطرفاء الصغيرة التي عثر على بقاياها بشكل أغصان يافعة فقط، ربما لأنها استخدمت لتغطية المسافات بين الدعامات، مثل تقنية البناء في يومنا هذا.

تمت دراسة البقايا النباتية في مجموعتين من عينات الرماد لأجل اكتشاف أنواع وقود خلال الفترات الزمنية المختلفة. إحدى هذه العينات تم أخذها من فرن شي الفخار يرجع الى فترة العبيد الشمالي المبكر في

تحضير الأصبغة بشكل قليل نسبياً، المرتبطة بشكل مباشر بعملية تلوين الفخار، هذا الأمر يقودنا إلى مرحلة ما بعد العبيد، حيث أصبح من النادر خلال هذه الفترة استخدام طريقة التلوين في زخرفة الفخار. لذلك نقترح إجراء المزيد من الدراسات والتحاليل لهذه الأدوات وربطها بالمعلومات التي حصلنا عليها من الفخار نفسه، بالإضافة إلى نموذج التوزع المكاني، كل هذا سيساهم على فهم تقنيات تصنيع الفخار خلال العصر الحجري النحاسي من وجهة نظر أخرى متميزة.

الفصل: 14

تم وصف صناعة الأدوات من العظام خلال العصر الحجري النحاسي في الفصل 14. كان عدد الأدوات التي تم صنعها من عظام وقرون الحيوانات قليلاً نسبياً في مجموعة تل قصق الشمالي. تم اكتشاف 90 قطعة عظم فقط. وكانت غالبية الأدوات عبارة عن مخارز. ثم يليها عدد أقل من الإبر العظمية، سكاكين، مبسّطات، قطع مكسرة، سكين خاص بإزالة اللحم، صفائح من العظم، أنابيب... يد منجل، وكسر من الصعب تحديد ماهيتها. عثر على عدة قرون لم يتم تغيير شكلها، استخدمت أيضاً كأدوات، والدليل على ذلك تأكل أطرافها العلوية نتيجة استخدامها كأدوات. ومن وجهة نظر وظيفية، دون الاعتماد على التجارب أو تحليل التآكل الناتج عن الاستخدام، يبدو أن هذه الأدوات العظمية استخدمت بشكل كبير للقيام بالأعمال المنزلية. ولدينا أدلة على وظائف أخرى مثل التزيين (الأنابيب و الصفائح) أو في الحرف (القرون) ولكن كان ظهورها نادراً. وفي مجموعة العظام الحالية لم نعثر على أدوات خاصة بالصيد مثل رؤوس سهام من العظم.
ودراسة العظام التي ذكرت في هذا الفصل تدل على تنوع الأدوات العظمية من حيث الشكل وتقنيات التصنيع خلال فترة العبيد الشمالي المبكر، والعديد منها تشبه أخرى عثر عليها في مستوطنات أكثر قدماً، حتى في المواقع التي تعود الى فترة النيوليت. حتى الآن لم يتم تفسير سبب ظهور صناعة اكثر بساطة خلال المرحلة الأخيرة من فترة العبيد الشمالي، ولكن الأمر الذي يستدعي الانتباه أن هذه الظاهرة مشابهة لما سلف ذكره في حالة صناعة الأدوات الحجرية وحجارة الطحن.

الفصل: 15

جميع المواد المصنعة التي أطلق عليها اسم اللقى الصغيرة في الفصل 15 تتألف من 150 قطعة تعود الى مواد مصنعة متنوعة. وتضم فلكات مغزل من الحجر والطين، مكاشط من الطين، أقراص من الطين، مجسمات طينية، مواد طينية متنوعة، أختام و طبعات أختام، أواني حجرية، وقطع استخدمت لأغراض تزينية مصنوعة من الحجارة أو الطين. تقدم لنا هذه اللقى مصدر للمعلومات يهتم بعدة أوجه للحياة اليومية لمجتمعات قرى العصر الحجري النحاسي، وعن طريقها تعرفنا على تقنية غزل النسيج، صناعة الفخار، طرق التحكم بالبضائع، والنشاطات الشعائرية .. الخ. هذه اللقى زودتنا بمعلومات حول النقل النهري، من خلال نموذج لقارب مصنوع من الطين عثر عليه في السوية 10القطاع A.

وصف اللقى الصغيرة في هذا الفصل يتضمن دراسات تهتم بنوعين من اللقى، فلكات المغزل، الأختام/ طبعات الأختام. أظهرت دراسة المقاييس تزايد استخدام فلكات مغازل أخف وزناً من الفلكات التي استخدمت خلال المرحلة اللاحقة مرحلة العبيد المتأخر، ويمكن تفسير هذا الأمر على أنه دليل نشوء عملية تصنيع حقيقية للصوف، وربما تطلب هذا الأمر غزل خيوط أرق. وهذا التفسير يبدو أنه يتوافق مع نتائج دراسة البقايا العظمية (راجع الأسفل)، حيث تدل على ازدياد إنتاج الصوف في نفس هذه الفترة.

عثر في تل قصق الشمالي على أربعة أختام و سبع طبعات أختام، وبشكل خاص في منطقتين محددتين: البناء المحروق الذي يرجع الى فترة العبيد الشمالي المبكر (السوية 10 القطاع A)، والمشغل الذي يرجع الى فترة ما بعد العبيد (السوية 5 القطاع B). تتألف الأمثلة من بناء فترة العبيد المحروق من ختم وخمسة طبعات أختام، عثر عليها قرب مدخل مجمع بناء التخزين. طبعات الأختام، التي تظهر عليها آثار طبعات السلال،

على الأدلة الناتجة عن دراسة الأدوات الحجرية ويبدو أنه يتوافق مع التقسيم الزمني المأخوذ من الاسترتغرافيا (توضع الطبقات) بالإضافة إلى الأدلة المعمارية الفصل 3و4 الجزء I). تم تفسير التغيرات التي ظهرت على مجموعات الأدوات الحجرية، على أنها ظاهرة تغيرات معقدة في النظام الاجتماعي تعكس تطور محلي في تقنيات الصناعة و تفاعل ثقافي مع الجماعات المعاصرة وبشكل رئيسي في الجنوب.

الفصل: 12

كما ذكر سابقا، كمية الأوبسديان التي تم العثور عليها في الموقع كانت صغيرة، تتألف من نسبة مئوية صغيرة في كافة السويات. في الفصل 12، أظهرت نتائج تحليل تتبع المصدر الذي نفذ على تسع عينات باستخدام طريقة ICP-AES، أن معظم حجارة الاوبسديان تم استيرادها إما من بنجول أو مناطق نمرود داغ جنوب شرق الأناضول. في حين تم التعرف على هذه المصادر مسبقاً في مستوطنات ترجع إلى العصر الحجري النحاسي كشف عنها ضمن أراضي سوريا الشمالية، ولكن إحدى هذه العينات تعود لمنطقة كابادوكيا وسط منطقة الأناضول وهذا الأمر يستدعي الاهتمام بهذه العينة، التي عثر عليها في الجزء الأقدم من مستوطنة فترة العبيد، السوية 14 القطاع A. مجموعات الأدوات الحجرية والأدلة المعمارية المرتبطة بهذه المرحلة كانت تحتوي على مواد من المحتمل أنها من العناصر التي بقيت من الوجود الحلفي السابق في هذه المنطقة (الفصل 11، أيضاً الفصل 3 من الجزء I). في هذه الحالة لا بد من ذكر، كما أظهرت الدراسات المؤخرة في تل حالولة و جعدة اهغارة، أهمية مصادر الأوبسديان في وسط منطقة الأناضول بالنسبة لمنطقة الفرات الأعلى خلال فترة النيوليت و خلال فترة حلف.

من المحتمل أن الصلات الاجتماعية بغرض الحصول على الاوبسديان خلال فترة العبيد الشمالي المبكر ربما اختلفت عما كانت عليه في الفترات اللاحقة، مع أن العينة صغيرة الحجم التي تمت دراستها حتى الآن تحول عملية الوصول إلى نتيجة نهائية.

الفصل: 13

استثمر سكان تل قصق الشمالي خلال العصر الحجري النحاسي مصادر الحجارة المتوفرة بكثرة في منطقة وادي الفرات بشكل كبير. قاموا بتصنيع أصناف متعددة من الرحى وأدوات الطحن الحجرية من الحجر الرملي والبازلت والحجر الكلسي، الخ. كان يسهل الوصول إليها ومتوفرة قرب المستوطنة، وبالتالي حصلنا على مجموعة تضم اكثر من 3000 عينة وهذه المجموعة تفوق من حيث العدد غالبية مجموعات أدوات الطحن الحجرية التي كشف عنها في مواقع العصر الحجري النحاسي شمال سوريا. الفصل 13 يوثق هذه الأدوات المكتشفة من حيث الشكل والوظيفة.

يظهر بوضوح أنه قد تم صنع الرحى وأدوات الطحن الحجرية لتلبية عدة غايات. بالإضافة إلى الأدوات المرتبطة بمعالجة الحبوب والتي تعرفنا عليها بشكل جيد في مواقع أخرى ترجع الى فترة العصر الحجري النحاسي، تم تصنيع الأدوات المرتبطة بالحرف وأدوات الصيد. وربما اكثر هذه الأدوات إثارة للاهتمام هي الأدوات التي يبدو أنها استخدمت في صناعة الفخار. وظهور هذه الأدوات ليس بالأمر المفاجئ، على أي حال فقد تم التعرف على عدة مشاغل للفخار بشكل متكرر في عدة سويات تعود الى فترة العصر الحجري النحاسي في المربعات التي تم التنقيب فيها (الفصل 3 و4 الجزء I) ضمت الأدوات، التي من المحتمل تم استخدمها في تصنيع الفخار، أدوات خاصة بتسوية سطح الفخار (أدوات تلميع، أدوات طحن وأخرى للتنعيم)، وأدوات تحضير ألوان الأصبغة (مدقات، يد هاون، أدوات للتلوين، هاون، ولوح توضع عليه الألوان) وأدوات خاصة بالتثبيت والرسم على الفخار (سندان و «طاولة قابلة للدوران»). من المؤكد أن مواد أخرى مثل الطين والخشب استخدمت في عمليات مشابهة، ولكن هذا الفصل خاص بأدوات حجرية معينة كونت جزء هام من مجموعة أدوات الفاخوري خلال العصر الحجري النحاسي.

تنوع أشكال هذه الأدوات وتكرار ظهورها، هذا الأمر يعكس التغيرات التي طرأت على تقنيات صناعة الفخار. على سبيل المثال، ظهور الأدوات المرتبطة بعملية

هذا هو الجزء الثاني من تقارير البحث لتل قصق الشمالي، الموقع الذي يعود الى فترة عصور ما قبل التاريخ، وأجرى عمليات التنقيب في هذا الموقع فريق من جامعة طوكيو بين عامي 1994 و1997 في منطقة فيضان سد تشرين في وادي الفرات الأعلى، سوريا. هذا الفصل يتألف من ثمان صفحات تتعلق بالتقنيات وحياة الجماعات البشرية خلال فترة العبيد الشمالي المبكر وحتى مرحلة أوروك الوسطى، بالإضافة الى توثيق مفصل للقى الأثرية. تم ذكر أعداد رقائق الأدوات الحجرية (الفصل 11) الرحى وحجارة الطحن (الفصل 13) اللقى العظمية (الفصل 14) بالإضافة إلى لقى صغيرة أخرى مثل قطع صغيرة للزخرفة أو قطع لها علاقة بالعمليات الإدارية (الفصل 15) بالإضافة إلى نتائج تحليل البقايا النباتية والعظمية (الفصل17) والتعرف على مصدر الأوبسيديان واستيراد القار (الفصل 18).

فيما يلي تلخيص المؤلف لهذه الفصول. تم إضافة بعض التعليقات عند الضرورة. هذا البحث يغطي تقريباً كافة اللقى الهامة ما عدا الفخار والمواد المرتبطة به، حيث سيتم مناقشة هذا الموضوع في الجزء الثاني مع النتائج التي سنحصل عليها من المعلومات المتوفرة لدينا.

الفصل: 11

تعتبر اللقى الحجرية المصنعة من أهم أدوات مجتمعات العصر الحجري النحاسي. في هذا الفصل تمت دراسة حوالي 33000 عينة، سوية تلو سوية لكي يتم الكشف عن التغيرات التي طرأت على تصنيع الأدوات الحجرية خلال مراحل العصر الحجري النحاسي. وبالنتيجة، تم الكشف على عدة عوامل تغير في طريقة استثمار المواد الخام. نلاحظ الاعتماد على حجر الصوان بكثرة في تصنيع الأدوات الحجرية خلال هذه الفترة بالمقارنة مع حجر الأوبسيديان. نسبة كبيرة من الأدوات الحجرية في كافة السويات تم تصنيعها من حجارة الصوان المحلية. أما الأوبسيديان نادراً ما استخدم، ولكن في سويات العبيد الشمالي المبكر كان استخدامه أكثر شيوعاً، وانخفضت أهميته بشكل نسبي على طول تسلسل السويات الزمني .بالإضافة الى ذلك طريقة استيراد الأوبسيديان تدل على تغير هام. في معظم سويات فترة العبيد الشمالي، كان يتم استيراد الأوبسيديان كمنتجات في نهاية مرحلة تصنيعه، ولكن من مرحلة ما بعد العبيد وما يليها، تم استيراده بشكل نوى ورقائق كبيرة أيضاً.

و مما يجدر ذكره التغير الذي طرأ على تصنيع الأدوات الحجرية من الصوان التي من حيث تقنية تصنيع النصال الطويلة التي كانت اكثر شيوعاً في سويات العبيد المبكر وتقنية تصنيعها مشابهة بتقنيات التصنيع في فترة حلف. واستبدلت هذه النصال بشكل متزايد بنصال أقصر طولاً. ومن جهة أخرى ظهرت في السويات التي ترجع الى فترة ما بعد العبيد عدد قليل من النصال لها شكل مميز. وهذه النصال، والتي تعرف باسم بالنصال الكنعانية، والتي تعتبر أدوات لها استخدام خاص، تدل على نشوء نظام تصنيع أدوات حجرية أكثر تعقيداً خلال المرحلة الأخيرة من العصر الحجري النحاسي. أما من حيث الشكل، فإن الأدوات الأكثر تميزاً في تل قصق الشمالي هي أجزاء المنجل التي تم وصلها بيد المنجل عن طريق القار، والتي تؤلف ما يصل إلى نصف مجموع أجزاء الأدوات الحجرية التي عثر عليها في سويات العبيد الشمالي المبكر. لكن أعدادها أخذت تتناقص بشكل مستمر مع مرور الزمن لأسباب ما نزال نجهلها.

أما أشكال الأدوات الشائعة خلال فترة المستوطنات اللاحقة (مرحلة أوروك الوسطى) كان عبارة عن أدوات لا تتبع نموذج محدد مثل الرقائق المشذبة، المسننة أو المتثلمة. وبشكل مماثل ظهرت تغيرات مؤقتة على شكل المنجل. النصال المصنعة من قطع حجرية طويلة والتي ظهرت خلال فترة العبيد المبكر أصبحت أقل شيوعاً خلال فترة العبيد المتأخر حيث حلت محلها قطع أقصر من حيث الطول بشكل هلال أو بشكل زاوية مدببة. صنعت من الرقائق الحجرية، ومرة أخرى شاع استخدام النصال مرة أخرى خلال فترة ما بعد العبيد وفترة أوروك.

ومن خلال هذه الملاحظات ومن خلال دراسات أخرى. يقترح هذا الفصل أن تسلسل السويات في تل قصق يمكن تقسيمه إلى سبع مراحل. هذا التقسيم الذي يعتمد

تل قصق شمالي
بحوث أثرية في أعالي الفرات - سوريا

المجلد ٢ تنقيبات العصر الحجري النحاسي (الكالكوليتي) ووسيلة العيش

أصدرت من قبل
يوشيهيرو نيشياكي
و
توشيو ماتسوتاني

جامعة طوكيو
٢٠٠٣